Strategic Plan for Economic and Community Prosperity in the Wabash Heartland Region

June 2016

A Message from the Steering Committee

Nearly eighteen months ago, our Steering Committee was formed for the purpose of developing a long-term strategic plan that builds upon regional strengths by identifying opportunities and resources that support the enhancement to, development of, and implementation of innovative strategies that will augment the long-term prosperity of our 10-county region. Functionally, the Steering Committee was brought together to oversee and guide the strategic planning process catalyzed by a generous grant provided by the Lilly Endowment, to whom we owe a tremendous amount of gratitude. But also, the Steering Committee came together as individuals that love their communities and are passionate about the prosperous, shared future that the region has before it.

From Montgomery County in the south to Pulaski County in the north, and from Fountain, Warren and Benton Counties in the west to Cass County in the east, nearly 350,000 individuals call the 10 counties that comprise the Wabash Heartland Region home. Numerous reasons brought these residents to our region – many were born and raised here; many moved away and subsequently returned to take advantage of job opportunities within a diverse regional economy; and many are new residents, attracted by the region's high quality of life, mixture of rural and urban settings, and educational opportunities.

Our region is home to numerous assets that have historically benefitted its economy:

- High quality education, through its numerous school corporations, Ivy Tech Community College, Purdue University, Trine University, and Wabash College
- Diverse employment clusters, from vehicle manufacturers in Tippecanoe County, complemented by deep manufacturing capabilities throughout the region, to meat processing and packaging in Carroll and Cass Counties and ag bioscience businesses in Benton, Pulaski, and Warren Counties
- Local recognition for quality of life initiatives, such as Delphi and Crawfordsville being recognized as Indiana Stellar Communities
- Numerous natural resources that provide residents with the opportunity to live, work, and play, such as the twin lakes in White County, Prophetstown State Park in Tippecanoe County, and Tippecanoe River State Park in Pulaski County
- Home to an internationally-renowned, Tier 1 public research university in Purdue University, which serves as a center of innovation in the areas of engineering, agriculture, technology, entrepreneurship, and many others

In addition to being blessed by all of these assets and a rich cultural history that binds us together, the 10 counties within our region (Benton, Carroll, Cass, Clinton, Fountain, Montgomery, Pulaski, Tippecanoe, Warren, and White) are home to a great number of thought leaders that care deeply about the future of their communities.

Each member of the Steering Committee is deeply invested within the region, whether as a business leader, educator, or community partner, and collectively we approached this task with great enthusiasm. We undertook an intentional, deliberate process of studying the opportunities and challenges that are present within the region, and identifying strategies and actions that leverage the existing strengths and assets to enhance the region's prosperity. We worked under the premise that true long-term prosperity within the region would be found in the confluence of three interconnected spheres: economic development, education and workforce development, and quality of life and place; and we have come to understand that prosperity in the 21st Century will be accomplished regionally and not only on a local or county-by-county basis.

Over the course of the 18 months, we held numerous Steering Committee meetings, inviting regional thought leaders to present their ideas on key regional issues and potential solutions, and oversaw 15 gatherings of county-level leaders throughout the region. In addition, we identified regions throughout the nation to which the Wabash Heartland Region

could benchmark, and visited the Ames, Iowa; Greenville, S.C.; and Columbus, Ind. regions in best practice exchanges. Through the generosity of the Lilly Endowment Inc., we procured the services of the Battelle Technology Partnership Practice, an internationally-respected thought leader in economic development research and strategy, to provide research and analysis that assisted us in formulating the vision, strategies, and actions included in this document.

We owe our thanks and gratitude to the hundreds of individuals and organizations who took the time to participate in this effort. Community Foundations in each of the 10 counties have played an integral part in convening conversations with key stakeholders throughout the region. Local economic development organizations assisted us in connecting to, and receiving input from, numerous business leaders throughout the region, and both Purdue University and Ivy Tech Community College opened up their practices and strategies for our analysis. The Central Indiana Corporate Partnership shepherded the strategic planning process, provided thought leadership and identified innovative best practices to consider. Without the benefit of input from these numerous stakeholders and partners, the plan attached to this document might have looked very different.

The accompanying document defines key strategies and action steps that represent the foundational ideas we believe are essential to the success in the region. The four strategies are:

1. **Catalyze the growth of industrial clusters for which the region has a unique comparative advantage;**
2. **Advance systemic workforce development/talent initiatives aligned with industry cluster needs;**
3. **Leverage the region's long-standing research strength and recent investments to diversify the economy through innovation, entrepreneurship, and education; and**
4. **Foster a high-value quality of place.**

It is our hope that this plan will serve as the foundation for a transformative time in this region's history. We understand and embrace the notion that this plan represents the beginning of this important work, and that significant effort must continuously be given to outreach efforts that facilitate community support and buy-in for these regional strategies.

In order to stimulate the regional adoption and implementation of the strategies and actions outlined within this plan, we, as a Steering Committee, have established the Wabash Heartland Innovation Network (WHIN). Through numerous discussions, we have established a guiding vision, or True North, for the work of the Wabash Heartland Innovation Network, along with a number of values which will guide the direction of WHIN now and into the future.

Wabash Heartland Innovation Network True North Statement:

The Wabash Heartland Innovation Network exists to cultivate initiatives that empowers globally-competitive companies to plant and grow in the Wabash Heartland.

Wabash Heartland Innovation Network Guiding Values:

- Be Industry-Led
- Be Regionally-Focused
- Seek inclusive input and ownership
- Increase the global competitiveness of the region
- Be sustainable

It is our intention for these to be more than words on a page, but for them to be the principles that guide the Wabash Heartland to enhanced, long-term prosperity. As the development of this plan has neared completion, WHIN has already begun to move its work forward. Using this plan as a baseline, WHIN is working with numerous regional leaders to develop a series of white papers that refine the ideas within this plan into actionable steps and identify the resources and support needed for long-term sustainable success. Additionally, with the release of this plan, WHIN intends to launch a coordinated effort to share the contents of the plan and receive additional input and feedback from the many partners throughout the Wabash Heartland.

Indeed, for this plan to succeed, many partners will need to take a seat at the table. We believe that the strategies and actions defined within the plan may take many years to implement, with some having more immediate impacts and others

being achieved incrementally over the long-term. We, as a Steering Committee, have spent countless hours discussing, debating, and thoughtfully considering the ideas of others and our peers. Together, we offer the accompanying plan as the foundation of a long-term plan for growth and regional prosperity.

This plan is intended to provide a vision for the development of regional prosperity, and we hope this vision will be embraced and reflected in the many initiatives that will organically arise from within the region. We believe that with the right leadership, support, funding, and champions, this plan will allow us to ensure long-term prosperity for the residents and businesses within the Wabash Heartland Region.

Respectfully Submitted on behalf of the Wabash Heartland Innovation Network Steering Committee,

Gary Henriott, Chair

Steering Committee Members:
David Bathe*, Chancellor, Ivy Tech Community College of Indiana, Lafayette and Kokomo Regions*
JoAnn Brouillette, *Owner, Demeter LP*
Ron Dickerson*, Retired, Vice President, Nucor Steel*
Dick Giromini, *President and CEO, Wabash National*
Gary Lehman, *Trustee, Purdue University*
Stephanie Long, *President and CEO, North Central Health Services*
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Todd Miller, *President and CEO, Myers Spring*
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Marianne Rose, *President and CEO, Community Foundation of Greater Lafayette*
Steve Schultz, *Chief Legal Counsel, Purdue University*

Strategic Plan for Economic and Community Prosperity in the Wabash Heartland Region

PREPARED BY:
Battelle Technology Partnership Practice (TPP)

PREPARED FOR:
CICP Foundation

FUNDED BY:
Lilly Endowment, Inc.

July 2016

*In the fourth quarter of 2015, TEConomy Partners, LLC was formed as an independent company, transitioning the complete staff and capabilities of the Technology Partnership Practice (TPP) from Battelle Memorial Institute.

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Executive Summary

Economic regions are not defined by arbitrary municipal or county boundaries, but instead by the interconnectedness of the industrial base, as well as how that industrial base is served by a particular labor shed. To effectively compete economically, it is well understood that each region has specific industry clusters through which it is uniquely positioned for growth due to factors of comparative advantage. The National Governors Association's advice to states across the nation (which holds true for regions as well) with regard to best practices for global competitiveness includes the opinion that:

> *"Each state [region] must exploit the unique advantages it has relative to other states [regions] and build on the strengths found in its local 'clusters of innovation'— distinct groups of competing and cooperating companies, suppliers, service providers, and research institutions."*[1]

Clusters offer regions the opportunity to specialize by gaining specific core competencies and knowledge that allow the region to compete effectively, and by allowing public investment and other resources to be focused where they will provide the most economic benefit. The value of cluster development is found both in advancing a region's economic competitiveness and broad community prosperity and in helping to organize its economic development efforts.

The bottom line is that regions must understand and position their industrial clusters to be a key driver of regional economic growth. Michael Porter, one of the nation's leading experts in business and regional competitiveness, explains:

> *"Clusters are a striking feature of virtually every national, regional, state, and even metropolitan economy, especially in more economically advanced nations… Clusters are not unique, however; they are highly typical—and herein lies a paradox: the enduring competitive advantages in a global economy lie increasingly in local things—knowledge, relationships, motivation—that distant rivals cannot match."*[2]

In analyzing the ten-county Wabash Heartland Region[3], significant evidence points to a unique group of interconnected industrial clusters with strong supply chain networks across the defined region. Based upon this analysis, eight Wabash Heartland Region industry clusters were identified as offering unique and important opportunities upon which strategic development efforts can be established (Table ES-1). Each cluster is categorized into one of three strategic areas: 1) Life- and Agri-Sciences; 2) Value-Added Metals Processing; and 3) Key Support Clusters.

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[1] National Governor's Association, "A Governor's Guide to Trade and Global Competitiveness," 2002.

[2] Michael Porter, Harvard Business School Professor, "Clusters and the New Economics of Competition," Harvard Business Review, November-December 1998.

[3] The Wabash Heartland Region is defined as the ten-county region comprised of Benton, Carroll, Cass, Clinton, Fountain, Montgomery, Pulaski, Tippecanoe, Warren, and White counties.

Table ES-1. Wabash Heartland Region's Industry Clusters

Strategic Area	Key Targeted Clusters	Decision Tree Assessment
Life- and Agri-Sciences	Agbiosciences	Current Opportunity
	Food Processing and Manufacturing	Current Opportunity
	Biomedical Sciences	Emerging Strength
Value-Added Metals Processing	Automotive/Heavy Vehicle Equipment	Current Strength
	Metals Production and Related Manufacturing	Current Strength
	Precision Metalworking	Current Opportunity
Key Support Clusters	Engineering, Technical, and Design Services	Emerging Strength
	Packaging Products	Current Strength

Furthermore, when the industry clusters are examined by county, it is quickly apparent the strength of each county in at least one or more cluster (Table ES-2), thereby indicating the truly regional nature of this industrial base.

Table ES-2. Industry Clusters by County Strengths

Greater Lafayette Industry Clusters	Benton	Carroll	Cass	Clinton	Fountain	Montgomery	Pulaski	Tippecanoe	Warren	White
Target Industry Clusters										
Ag Biosciences	237	171	245	205	85	379	160	704	156	176
Automotive/Heavy Vehicle Equipment	18	22	844	865	647	246	751	8,880	283	951
Biomedical Sciences	12	2	10	-	95	346	-	1,437	-	34
Engineering, Technical, and Design Services	-	2	41	26	1	16	21	385	2	6
Food Processing and Manufacturing	19	1,991	1,928	1,564	18	401	2	180	-	76
Metals Production & Related Manufacturing	-	8	65	-	816	803	131	1,416	54	295
Packaging Products	124	6	126	176	19	750	6	213	0	355
Precision Metalworking	-	30	551	444	-	238	25	270	137	77
Total, Eight Cluster Employment	409	2,231	3,811	3,279	1,681	3,178	1,095	13,485	633	1,971
Total, All Private Sector Employment	1,646	4,435	11,215	8,976	4,207	12,732	3,485	61,004	1,532	7,478

Note: Clusters highlighted in green by country represent a location quotient (LQ) greater than 5.0.

Finally, when commuting patterns are analyzed to better understand the labor shed workforce patterns of the region, it quickly becomes apparent once again the regional nature of the ten counties. The analysis indicates that 77 percent of the labor force within the ten counties lives within the region—of the nearly 132,000 workers that are employed within the region, nearly 101,000 live within the ten-county region. A more detailed, county-level assessment of the Wabash Heartland commuting patterns is presented in Table ES-3. Like most regions, county-based, live-in and work-in employment is for many the "norm" (see green diagonal). For seven counties, most of the employees that work in that county also live in that county. However, for three counties (Benton, Carroll, and Warren) more of their residents work in Tippecanoe County than in their home county.

Table ES-3. Wabash Heartland Employment Commuting Patterns

		Work in Greater Lafayette (GL) Region											
		County											
	County	Benton	Carroll	Cass	Clinton	Fountain	Montgomery	Pulaski	Tippecanoe	Warren	White	**Work in Non-GL Region County**	**Workers Live in (Row) Totals**
Live in Greater Lafayette (GL) Region	Benton	892	9	21	27	72	45	14	1,094	82	99	1,155	3,510
	Carroll	31	1,968	375	496	17	55	40	2,568	6	628	2,656	8,840
	Cass	17	696	7,787	101	2	39	294	328	0	205	5,649	15,118
	Clinton	28	276	141	4,983	24	174	15	2,475	4	74	3,709	11,903
	Fountain	22	14	23	35	2,295	566	19	922	413	66	3,744	8,119
	Montgomery	60	48	80	145	359	6,867	74	1,708	96	162	5,320	14,919
	Pulaski	29	41	184	24	8	22	2,048	279	13	221	2,634	5,503
	Tippecanoe	350	782	238	1,097	274	786	48	43,582	182	788	29,827	77,954
	Warren	136	10	13	24	579	97	9	917	756	33	1,190	3,764
	White	47	318	337	115	45	104	226	2,442	21	3,507	2,846	10,008
Live in Non-GL County		481	1,346	4,817	3,780	1,043	4,955	1,859	9,842	471	2,224		
Workers Work in (Column) Totals		2,093	5,508	14,016	10,827	4,718	13,710	4,646	66,157	2,044	8,007		

Source: U.S. Census Bureau, 2013 Longitudinal Employer-Household Dynamics Data, Battelle Calculations.

The bottom line is that the Wabash Heartland Region has the opportunity to build upon its economic foundation by focusing on key regional opportunities that, if seized, will enable the region to become a leading job- and wealth-generating economy.

Recognizing this opportunity, in early 2015, a steering committee consisting of Wabash Heartland leaders assembled to identify assets and resources that can be better utilized and coordinated to provide economic opportunities for its residents and communities. The strategic planning effort was funded by a Lilly Endowment grant that was awarded to the Central Indiana Corporate Partnership Foundation, and managed by Central Indiana Corporate Partnership (CICP). To assist in this effort, the Battelle Technology Partnership Practice (TPP) was selected to aid in the development of an economic strategy. Battelle TPP is the economic development consulting arm of the world's largest independent non-profit research and development organization. Battelle TPP 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 development programs in the United States.

This economic development strategic plan was developed with input from the Steering Committee, the Community Foundations in all ten counties in the region, as well as business, academic, and civic leaders throughout the region to gain an understanding of the Wabash Heartland Region's existing strengths and capabilities and to gather input on the types of activities needed to position the region as an economic leader in the future.

The Wabash Heartland Region Strategic Economic Development Plan

The desire by the Wabash Heartland Region's leaders to strategically focus significant time, effort, and investment in an effort to catalyze economic growth and community prosperity is understandable. The growth of a number of the region's key industry clusters, coupled with the potential to leverage the significant research assets of both a Tier 1 Land-Grant Research University and a base of innovative industries, potentially positions the region for strong economic growth.

In order to experience this growth, however, the mandate is quite simple— the Wabash Heartland Region needs to focus its economic development efforts to ensure that not only can its existing industry drivers raise their level of competitiveness and added value, but that it can also identify new drivers of innovation to improve the region's economic prospects. This strategy is designed to address the most pressing needs of the region and identify the elements and ingredients to successfully position the region to build on its strengths, seize its opportunities, and put into action a set of strategies that catalyze economic and community prosperity.

The analysis suggests that to truly transform the region's economy will require taking advantage of the following opportunities:

- Regional industrial clusters that can be positioned to promote further economic growth.
- An existing industrial base that seeks a skilled workforce, thereby providing employment opportunities for the region's citizens.
- A world-class research base that provides opportunities to diversify the region's economy through innovation and entrepreneurship.
- A growing understanding that quality of life issues are a critical component of a region's ability to foster economic growth.

The identified opportunities stand as strategic priorities which, if effectively leveraged, will enable the region to ignite the growth of the economy, leading to community prosperity. It is proposed that the Wabash Heartland Region initiate a set of four strategies and an associated set of 16 actions as summarized in Table ES-4 to focus its efforts on fostering synergies between the region's industrial clusters and its academic assets so that their combined effect is greater than the sum of their individual efforts. The strategies and actions have been designed to be driven by industry and capitalize on the region's comparative innovation assets.

Table ES-4. Summary of Proposed Strategies and Actions

Strategy	Actions
Strategy 1: Catalyze the growth of industrial clusters for which the region has a unique comparative advantage	• Expand the footprint of targeted industry clusters and their related supply chains to create greater economic opportunities throughout the region. • Develop a regional branding/marketing campaign for a greater sense of regional identity. • Achieve a 21st Century digital and transportation infrastructure to enhance access to and adoption of digital connectivity and innovative multimodal methods of transporting goods, services and people.
Strategy 2: Advance systemic workforce development/talent initiatives aligned with industry cluster needs	• Annually develop a projected occupational needs assessment of the targeted industry clusters. • Actively inform and educate students, parents, and educators on career opportunities that exist in the identified industry clusters and the educational requirements and career pathways needed to access them. • Improve Science, Technology, Engineering, and Math (STEM) education at the K-12 level, including soft skills, leveraging current best practices, industry partnerships, and experiential learning to scale a systemic workforce/talent initiative that reaches across the region. • Working with industry, create career pathways that include experiential learning experiences for high demand careers within the region. • Launch a campaign to attract skilled technical and managerial talent, including efforts to engage veterans and other targeted groups, to near-term employment opportunities within the region.
Strategy 3: Leverage the region's long-standing research strengths and recent investments to diversify the economy through innovation and entrepreneurship	• Leverage the recent increase in National Institute of Standards and Technology (NIST) Manufacturing Extension Partnership (MEP) funding for Purdue's Technical Assistance Program (TAP) Manufacturing Program. • Leverage the recent Purdue investments in the Research Park Aerospace District to develop a targeted industry cluster in aircraft manufacturing. • Leverage the recent Purdue investments and Ivy Tech's existing Ag-biosciences programs, as well as Purdue's extension office network, to position the region for growth in multiple segments of food and agriculture, including plant science, livestock, and precision agriculture technological advancements. • Leverage commercialization and entrepreneurial investments to diversify the region's economic base. • Leverage the recent investment in the Purdue Polytechnic Institute by linking the regional industrial workforce demands to the curriculum and experiential learning opportunities.
Strategy 4: Foster a high-value quality of place	• Foster an environment that is welcoming, inclusive, and collaborative in nature for all people. • Support localities' efforts to undertake strategic planning efforts to improve the quality of life for its citizens and strategize how best to leverage regional strengths. • Jointly develop solutions to common quality of life problems being faced across the region.

A Call to Action

The Wabash Heartland Region is at a unique economic development crossroads. The region's industrial base has weathered the Great Recession remarkably well, and specific growth opportunities are presenting themselves, such as the General Electric Aviation facility now open and assembling engines and in the recently announced expansion at Subaru of Indiana. Through state and institutional investments, Purdue University is further positioning itself as both a global research university and a key source for tomorrow's workforce via its traditional and polytechnic educational programs.

The challenge for the Wabash Heartland Region is to foster economic growth and broad community prosperity by focusing its efforts on building synergies between the region's industrial clusters and its academic assets so that their combined effect is greater than the sum of their individual efforts.

The Wabash Heartland Region has the opportunity to build upon its economic foundation by focusing on key regional opportunities that if seized will enable the region to "leap forward" and become a leading job- and wealth-generating economy over the next decade. In today's global knowledge-based economy, the recipe for economic success is quite simple— the Wabash Heartland Region needs to focus its economic development efforts to ensure that not only can its existing industry drivers raise their level of competitiveness and added value, but that it can also identify new drivers of innovation to improve the region's economic prospects.

Taking advantage of these opportunities requires a comprehensive, systematic effort that will require the broad support of the entire ten-county region. Consensus around the vision developed in this strategy and the specific actions outlined must be viewed as a top economic priority by all.

By working together, the opportunity for the Wabash Heartland Region to grow its economic base and increase community prosperity is substantial. If successful, it is expected that what will emerge is a public-private partnership that will advance the region for decades.

Section 1: Introduction

The Economic Development Ecosystem

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. The large majority of these nations is engaged in global trade and is seeking to advance their economies and living standards via economic development activities. The United States remains the single largest economy in the world, but other nations are catching up fast as their pace of development and economic growth outstrips that of the United States. While the United States has driven economic development forward on a robust ecosystem of innovation and commercialization of new ideas and technologies, other countries have now built similar systems that enable them to compete not only with lower labor and input costs, but also with skilled human capital, inventiveness, and entrepreneurship. Many developed and developing nations watched and learned from the American economic growth model, and have now successfully emulated the model and are significant economic competitors.

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, others failing to adapt and experiencing economic decline. The harsh reality of the modern 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?*

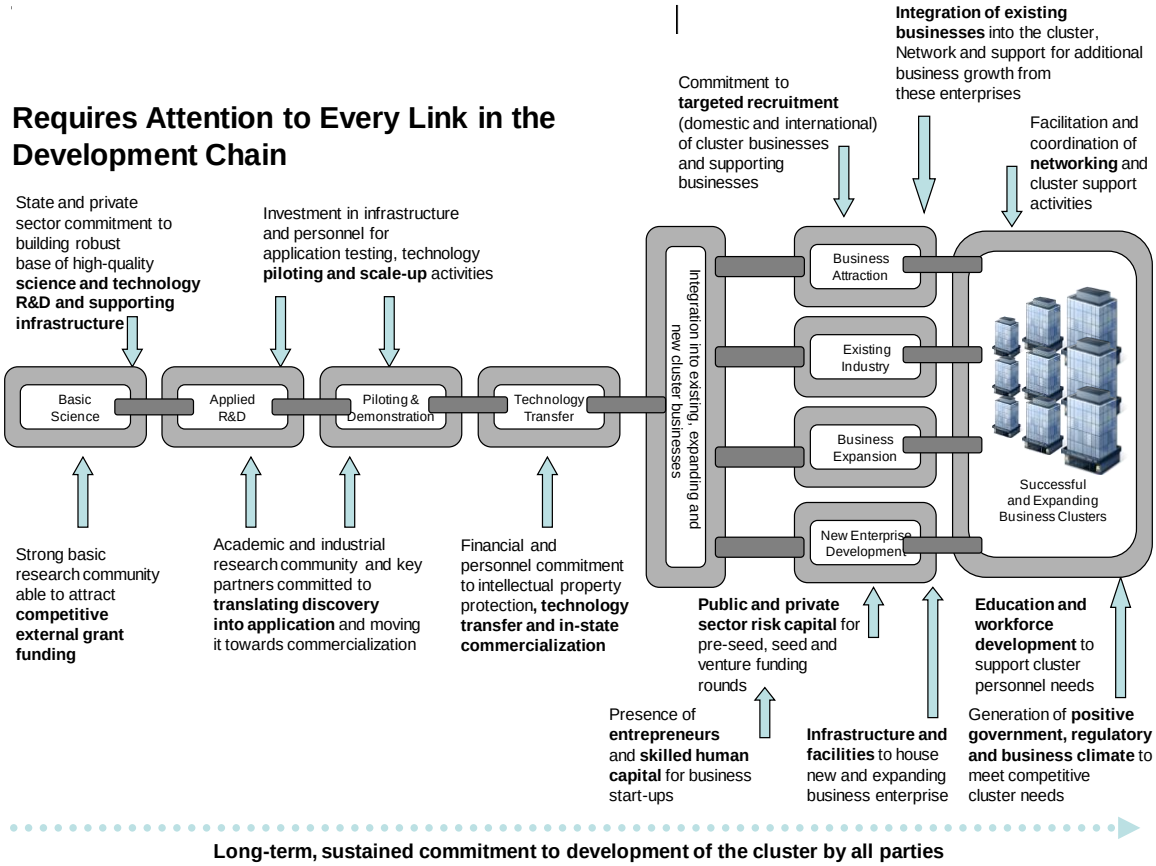
Best practice in economic development recognizes that for economic growth leading to community prosperity to occur within a region, an entire interconnected sequence of positive factors, or what Battelle terms the economic development ecosystem, has to be in place that connects and strengthens the drivers of industrial development. If components in the ecosystem either inadequately address economic needs or are missing, a sustainable value-added economic base able to generate quality jobs is unlikely to develop (Figure 1).

The value of developing a robust economic development 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:

- 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 start-ups with high-growth business potential
- Stronger supplier networks, increasing the economic multiplier impact of the value-chain for the region
- 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 in the region
- Increased quality of life for the region's citizens

Regions that have strategically focused on creating a holistic, well-functioning, economic development ecosystem are prospering in the 21st Century.

Figure 1. Economic Development Ecosystem



Best practices in economic development also recognizes that each region has a set of target industry sectors or "industry clusters" in which it can differentiate itself, thereby building comparative advantage within competitive global markets. Increasingly, emphasis is being placed on innovation as the key driver of 21st Century economic development. The ability of a region to excel at innovation and deployment in particular areas of industry (including both existing and emerging industries) is becoming a critical and defining driver of economic competitiveness. As the National Governor's Association set out in advising states and regions across the nation on best practices for global competitiveness:

> *"Each state must exploit the unique advantages it has relative to other states and build on the strengths found in its local 'clusters of innovation'— distinct groups of competing and cooperating companies, suppliers, service providers, and research institutions."*[4]

[4] National Governor's Association, "A Governor's Guide to Trade and Global Competitiveness," 2002.

The Wabash Heartland Region[5] is at a unique economic development crossroads. The region's industrial base has weathered the Great Recession remarkably well, and specific growth opportunities are presenting themselves, such as the General Electric Aviation facility now open and assembling engines and in the recently announced expansion at Subaru of Indiana. Through state and institutional investments, Purdue University is further positioning itself as both a global research university and a key source for tomorrow's workforce via its traditional and polytechnic educational programs.

Yet, the challenge for the Wabash Heartland Region is to foster economic growth and broad community prosperity by focusing its efforts on building synergies between the region's industrial clusters and its academic assets so that their combined effect is greater than the sum of their individual efforts.

The Wabash Heartland Region has the opportunity to build upon its economic foundation by focusing on key regional opportunities that if seized will enable the region to "leap forward" and become a leading job- and wealth-generating economy over the next decade. In today's global knowledge-based economy, the recipe for economic success is quite simple— the Wabash Heartland Region needs to focus its economic development efforts to ensure that not only can its existing industry drivers raise their level of competitiveness and added value, but that it can also identify new drivers of innovation to improve the region's economic prospects. This strategy is designed to address these challenges and identify the elements and ingredients to successfully position the region to build on its strengths, seize its opportunities, and put into action a set of strategies that catalyze economic and community prosperity.

Background and Report Purpose

In early 2015, a steering committee consisting of Wabash Heartland Region leaders assembled to identify opportunities, assets, and resources that can be better utilized and coordinated to provide economic opportunities for its residents and communities. The strategic planning effort was funded by a Lilly Endowment grant that was awarded to and managed by the Central Indiana Corporate Partnership (CICP) Foundation. To assist in this effort, the Battelle Technology Partnership Practice (TPP) was selected to aid in the development of an economic strategy. Battelle TPP is the economic development consulting arm of the world's largest independent non-profit research and development organization. Battelle TPP 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 development programs in the United States.

This economic development strategic plan was developed with input from the Steering Committee, the Community Foundations in all ten counties in the region, as well as business, academic, and civic leaders throughout the region to gain an understanding of the Wabash Heartland Region's existing strengths and capabilities and to gather input on the types of activities needed to position the region as an economic leader in the future. The following strategy is the collective result of the input received.

[5] The Wabash Heartland Region is defined as the ten county region comprised of Benton, Carroll, Cass, Clinton, Fountain, Montgomery, Pulaski, Tippecanoe, Warren, and White counties.

This report is organized into the following sections:

- Section 2 sets the overall economic context of the region by providing broad socio-economic information regarding the region and comparing it to the State of Indiana and to the nation.
- Section 3 provides an assessment of industry clusters in the Wabash Heartland Region, as well as an examination of cluster occupational patterns found within the clusters.
- Section 4 seeks to describe and understand the research and innovation assets of the Wabash Heartland Region, primarily driven by Purdue University. This section also explores how these assets can be leveraged to serve as an economic engine for the region.
- Section 5 considers strategies and actions that the Wabash Heartland Region should pursue to advance the region's economy, thereby providing economic opportunities for its residents and communities.

Section 2: Setting the Economic Context

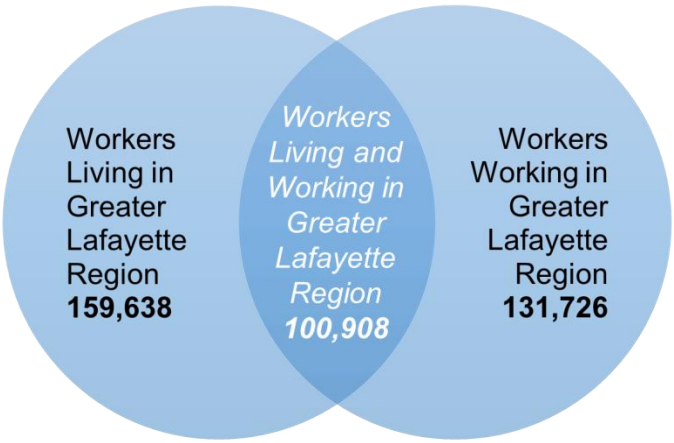
This section attempts to set the overall economic context by providing broad socio-economic information by first analyzing whether or not the ten counties actually comprise a "region," and then analyzing how the ten counties compare to the State of Indiana and to the nation on key population and economic dynamics. For some metrics, differences *within* the Wabash Heartland Region that may impact or shape strategic development initiatives are also examined.

Do the Ten Counties Represent a Region?

Economic regions are not defined by arbitrary municipal or county boundaries, but instead by the interconnectedness of the industrial base, as well as how that industrial base is served by a particular labor shed. Section 3 provides significant evidence of unique industrial clusters across the ten-county region with strong supply chain networks. This evidence alone indicates the presence of an economic region; the question is whether the industrial base is being supported by a regional labor shed.

To answer that question, Battelle undertook a detailed commuting pattern analysis to better understand the labor shed workforce patterns of the region. The analysis indicates that 77 percent of the labor force within the ten counties lives within the region. Figure 2 illustrates that of the nearly 132,000 workers that are employed within the region, nearly 101,000 live within the ten-county region.

Figure 2. Living and Working in the Wabash Heartland Region



Source: U.S. Census Bureau, 2013 Longitudinal Employer-Household Dynamics Data, Battelle Calculations.

A more detailed, county-level assessment of the Wabash Heartland Region commuting patterns is presented in Table 1. Like most regions, county-based, live-in and work-in employment is for many the "norm" (see green diagonal). For seven counties, most of the workers that work in that county also live in that county. However, for three counties (Benton, Carroll, and Warren) more of their residents work in Tippecanoe County than in their home county.

Table 1. Wabash Heartland Region Employment Commuting Patterns

		Work in Greater Lafayette (GL) Region											
		County											
	County	Benton	Carroll	Cass	Clinton	Fountain	Montgomery	Pulaski	Tippecanoe	Warren	White	Work in Non-GL Region County	Workers Live in (Row) Totals
Live in Greater Lafayette (GL) Region	Benton	892	9	21	27	72	45	14	1,094	82	99	1,155	3,510
	Carroll	31	1,968	375	496	17	55	40	2,568	6	628	2,656	8,840
	Cass	17	696	7,787	101	2	39	294	328	0	205	5,649	15,118
	Clinton	28	276	141	4,983	24	174	15	2,475	4	74	3,709	11,903
	Fountain	22	14	23	35	2,295	566	19	922	413	66	3,744	8,119
	Montgomery	60	48	80	145	359	6,867	74	1,708	96	162	5,320	14,919
	Pulaski	29	41	184	24	8	22	2,048	279	13	221	2,634	5,503
	Tippecanoe	350	782	238	1,097	274	786	48	43,582	182	788	29,827	77,954
	Warren	136	10	13	24	579	97	9	917	756	33	1,190	3,764
	White	47	318	337	115	45	104	226	2,442	21	3,507	2,846	10,008
Live in Non-GL County		481	1,346	4,817	3,780	1,043	4,955	1,859	9,842	471	2,224		
Workers Work in (Column) Totals		2,093	5,508	14,016	10,827	4,718	13,710	4,646	66,157	2,044	8,007		

Source: U.S. Census Bureau, 2013 Longitudinal Employer-Household Dynamics Data, Battelle Calculations.

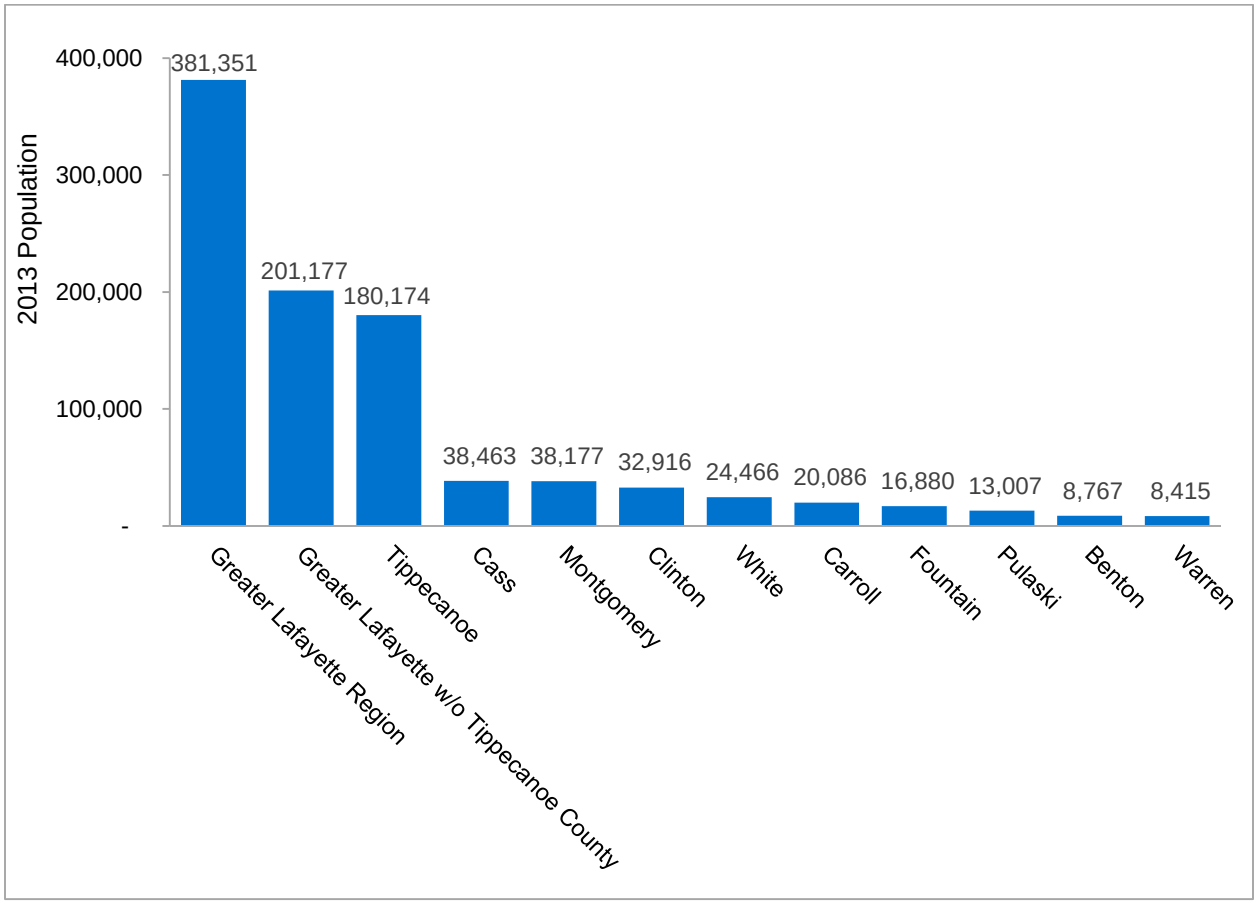
The overall "regionalization" of Wabash Heartland Region as characterized by commuting patterns is centered on Tippecanoe County due to its size both in terms of population and jobs. Of the nearly 101,000 workers that both live and work in the Wabash Heartland Region, over 43,500 live and work in Tippecanoe County. Not surprisingly, among the non-Wabash Heartland Region counties, Marion County is the most connected external county to the Wabash Heartland Region, with slightly more than 10,000 regional residents commuting to Marion County for work and more than 2,300 Marion County residents commuting to the Wabash Heartland Region for employment.

Regional Population Dynamics

General Population Trends

Analyzing recent population data and trends further supports the fact that the ten counties comprise a region centered around Tippecanoe County. Figure 3 illustrates the population of the overall region in 2013, as well as for each of the ten counties. The combined Wabash Heartland Region has more than 380,000 residents. Tippecanoe County alone, however, accounts for just over 180,000 residents or 47 percent of the region's total. The next largest counties, in terms of population include Cass and Montgomery counties, each with just over 38,000 residents. The rural fabric of the region includes two counties (Benton and Warren) each with fewer than 10,000 residents.

Figure 3. Total Population in Region and by County, 2013

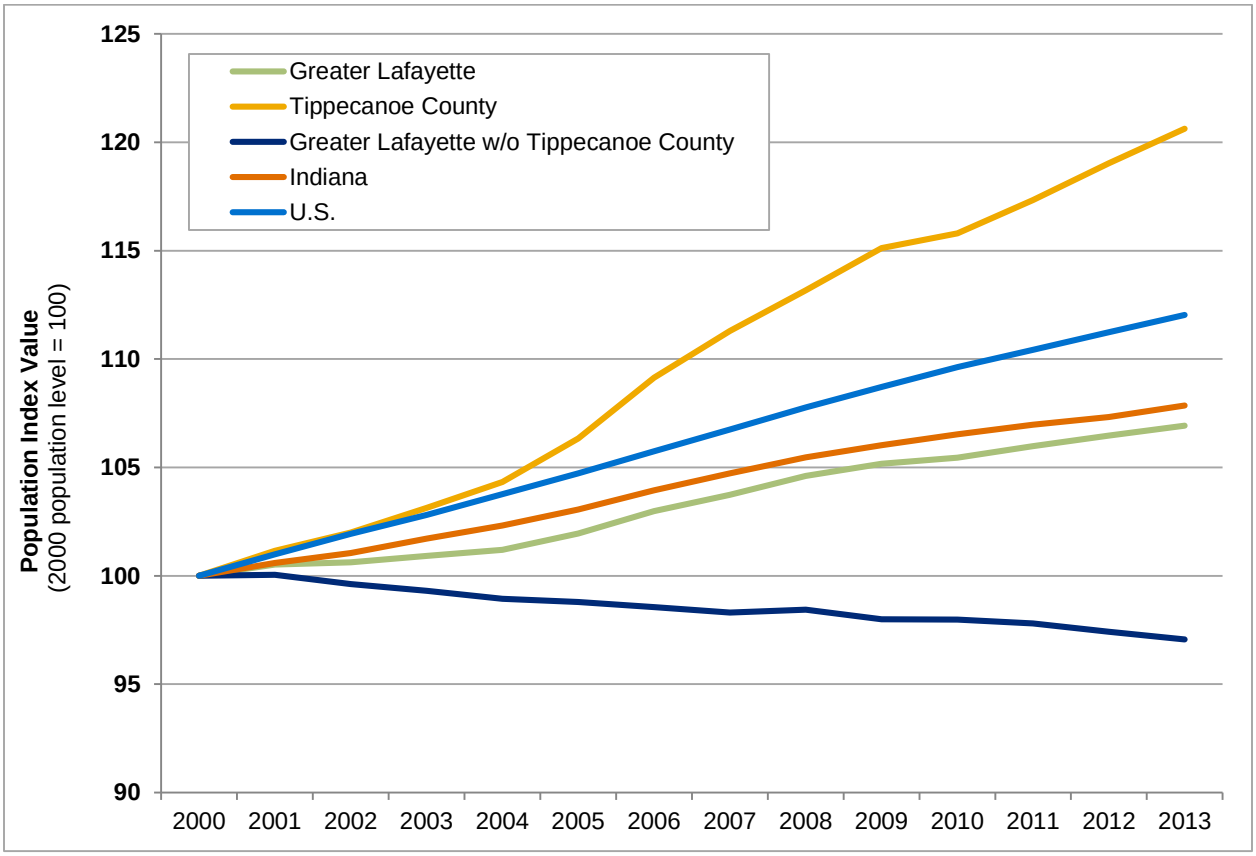


Source: U.S. Census Estimates, Battelle Calculations.

The population size of Tippecanoe County has the potential to mask a number of trends in population growth and structure that are important to the development potential and future of the Wabash Heartland Region. To overcome this issue, the following analysis provides a summary index (i.e., year 2000 population = 100, with the subsequent years measured as a share of the year 2000 population) for the Wabash Heartland Region—including the total region, Tippecanoe County only, and a total for the remaining nine counties—and for the State of Indiana and the United States.

Figure 4 illustrates that while the Wabash Heartland Region has grown on par with the State of Indiana, Tippecanoe County has realized extensive growth and is significantly outpacing both Indiana and the United States. It also indicates that outside of Tippecanoe County the remaining regional counties combined have lost about 3 percent of their population since 2000. It is important to recognize that at least some of this growth in Tippecanoe County may be due to an increasing number of students, especially graduate students, attending Purdue University and establishing West Lafayette or a surrounding community as their official residence.

Figure 4. Comparison of Growth for Total Population, 2000-2013



Source: U.S. Census Estimates, Battelle Calculations.

Younger Working Age Population Trends

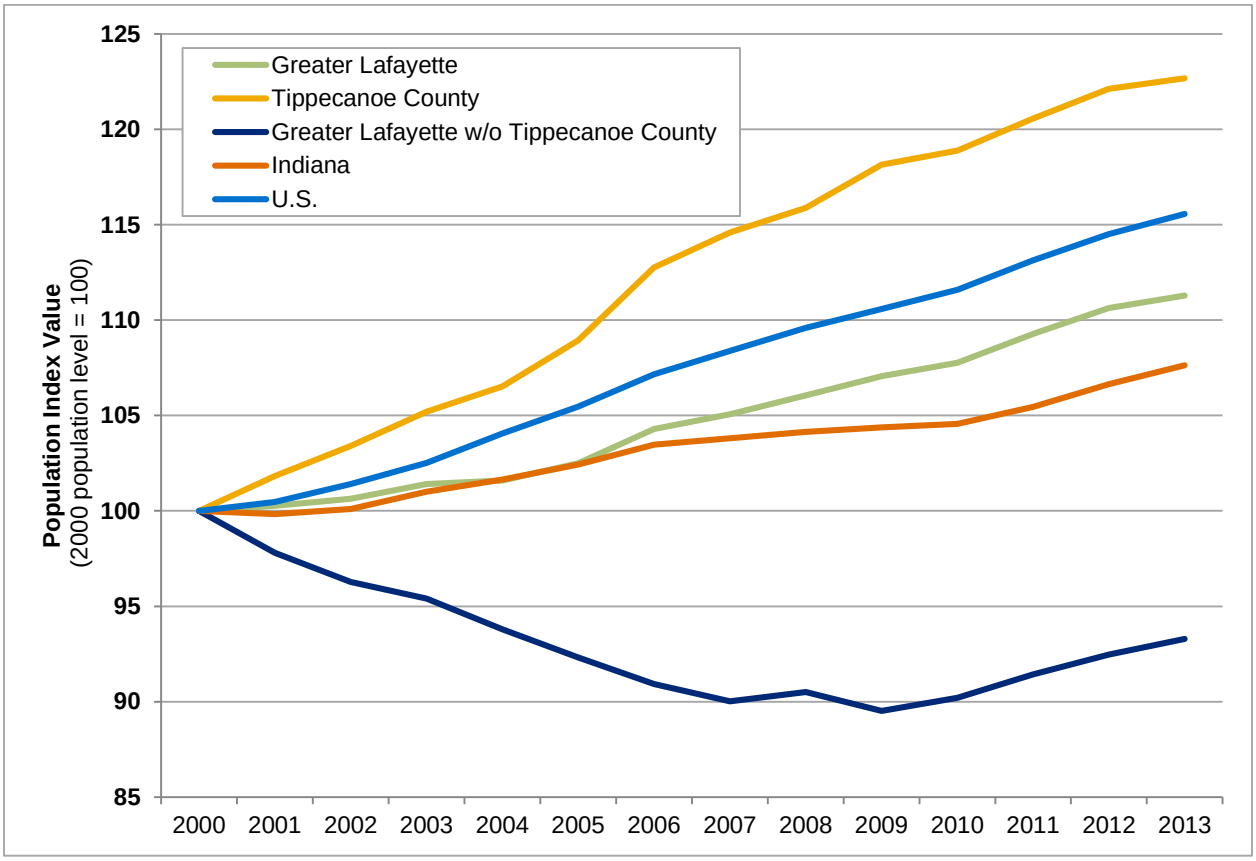
Figure 5 illustrates specifically the trends for the age 20-29 population cohort. Tippecanoe County's growth in younger working age population outpaces the nation and the State of Indiana, and is a significant impetus for the growth realized in the region. As mentioned previously, an influx of students to Purdue University likely accounts for some, though definitely not all, of the population growth in Tippecanoe County and, hence, the region overall in this age cohort. Growth in student numbers includes:[6]

- The number of graduate students (fall enrollment) from 2000 to 2013 increased by more than 3,000, with over 9,300 graduate students enrolled in Fall 2013 with 3,700 of these students being foreign citizens.
- The total number of foreign students attending Purdue University has nearly doubled since 2000 (from 4,627 to 8,703 in 2013).

[6] Most recently available data from the National Center for Educational Statistics' Integrated Postsecondary Education Data System.

While these international students are considered part of the region's demographic fabric, unless they are presented with career opportunities that entice them to remain in the region after graduation, these additional "residents" are simply regional economic consumers that are moving in and out every four to six years upon graduation, and not necessarily a core demographic asset on which to build.

Figure 5. Comparison of Growth of 20-29 Year Old Population, 2000-2013



Source: U.S. Census Estimates, Battelle Calculations.

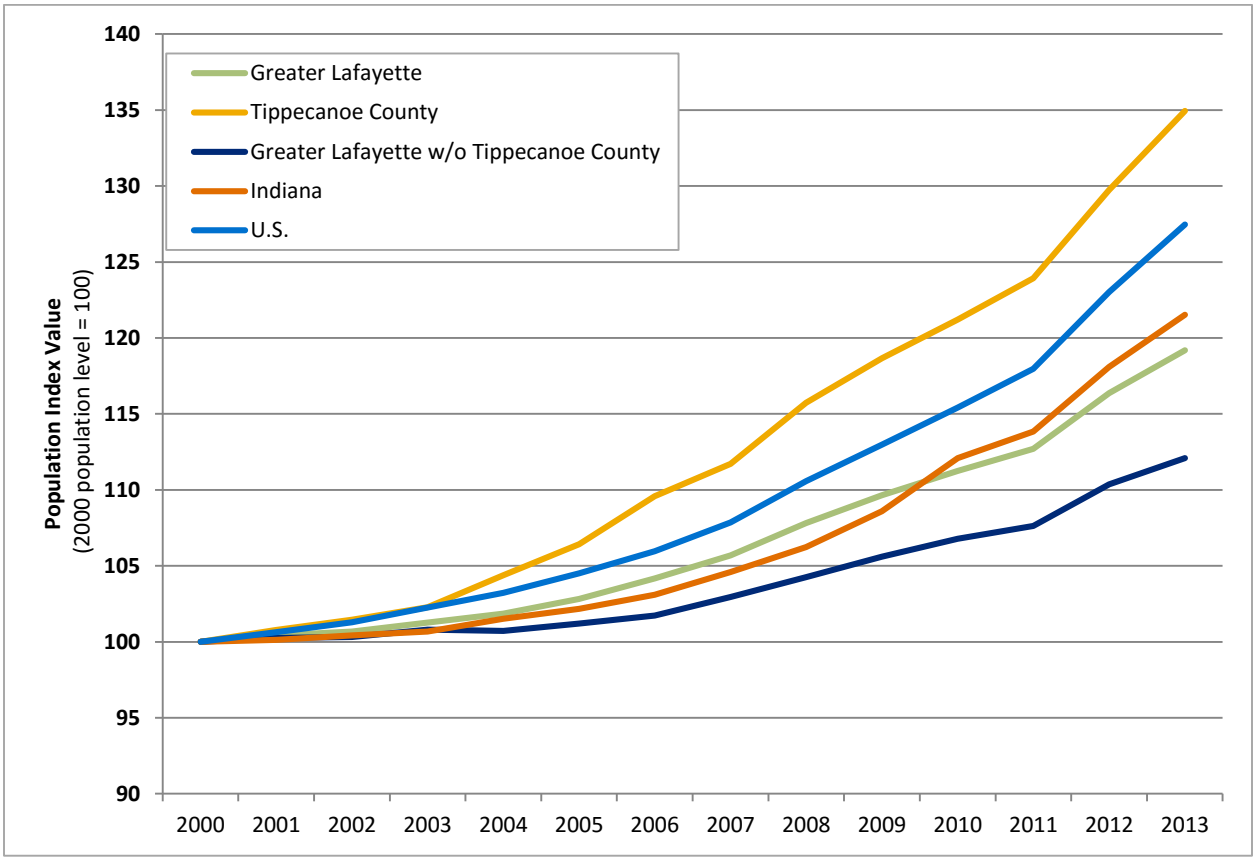
It is important to note the sharp decline in this age cohort's population from 2000 through the Great Recession for the nine counties in the region beyond Tippecanoe. It is a positive sign for these counties that this trend is reversing from 2009-2013—likely as the major employers began to recover post-recession so that employment for individuals was more available throughout the region.

Older Population Trends

In a similar fashion, Figure 6 examines the age 65+ population cohort, and as expected given the aging of the U.S. population, all regions are realizing increases in this population cohort. A key finding is that Tippecanoe County is realizing a more dramatic increase (35 percent) in its ages 65 and older population. This growth rate exceeds that of the remaining counties of the Wabash Heartland Region, the State of Indiana as a whole, and even the United States. This growth is likely due to a wide variety of reasons including the aging of a generational workforce, attraction to the "central cities" for various amenities ranging from lifestyle opportunities provided by a university town, easier transportation access, or the

availability of retirement/senior living options that are not available elsewhere in the region (or even the state). It will be important for the Wabash Heartland Region's economic development leadership to further examine this issue to more fully understand its context and what it could mean for both quality-of-life development as well as overall economic development.

Figure 6. Comparison of Growth of 65+ Year Old Population, 2000-2013



Source: U.S. Census Estimates, Battelle Calculations.

Urban and Rural Context

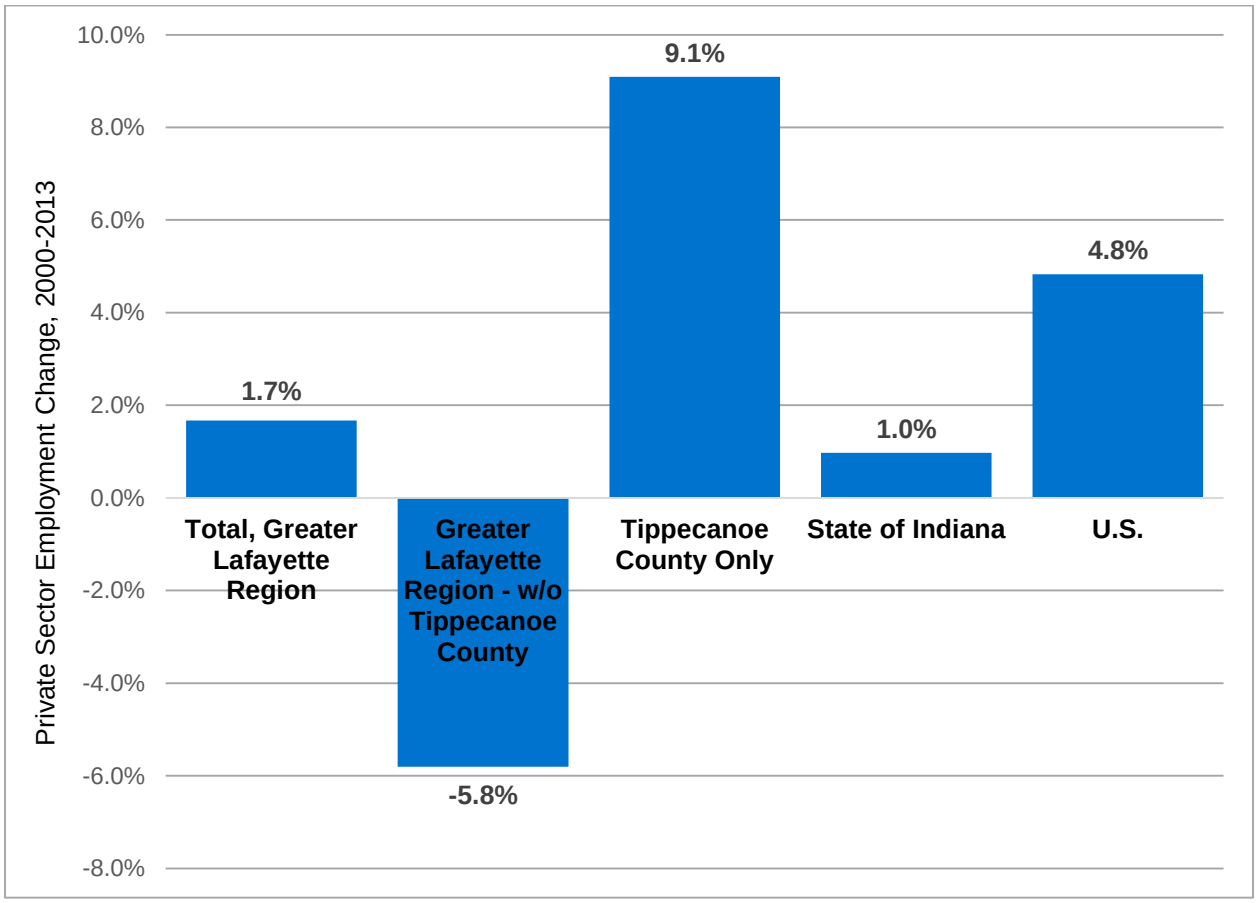
The "central place" context within the Wabash Heartland Region is also reflected in official U.S. Census defined urban and rural populations. Based on the U.S. 2010 Census, 60 percent of the Wabash Heartland Region's population is considered to be living in an urbanized area, compared to 73 percent for the State of Indiana, and 79 percent for the United States. The "central place" of Tippecanoe County (Lafayette and West Lafayette) is considered to be 86 percent urbanized while the remainder of the region on average is 39 percent urbanized. Only two other counties in the region, Cass and Clinton, have half or more of their population living in urban areas (55 percent urban and 50 percent urban, respectively). One county, Benton, is considered to be 100 percent rural as of the 2010 Census.

Regional Economic Dynamics

Broad Employment Trends

While key industry cluster trends are considered in Section 3, in assessing the current economic situation it is also important to understand the broad employment trends of the Wabash Heartland Region. Figure 7 illustrates that regional private sector employment growth over the last decade slightly outpaces the State of Indiana as a whole but lags the United States by more than 3 percent. Similar to the population dynamics of the region, Tippecanoe County drives the private sector employment growth of the Wabash Heartland Region, and in fact on its own outpaces both Indiana and the nation, while the remaining nine counties have experienced a private sector employment decline of 5.8 percent.

Figure 7. Private Sector Employment Change, 2003-2013

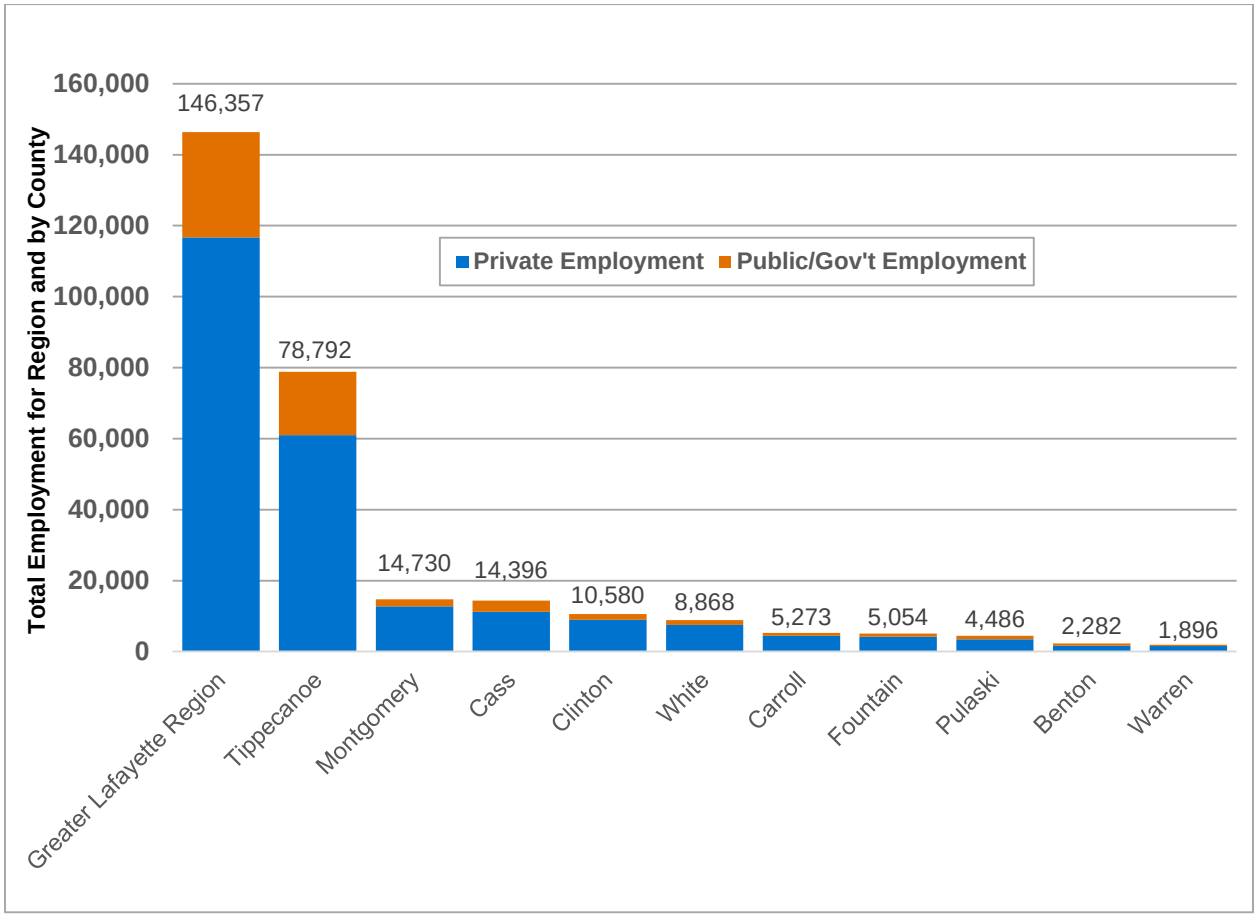


Source: U.S. Bureau of Labor Statistics, Quarterly Census of Employment and Wages (QCEW) data.

Figure 8 expands on this analysis and looks at both private and public sector employment for the Wabash Heartland Region as a whole and for each of the ten counties. The additional public sector employment (including Purdue University in Tippecanoe and local education and governments throughout the region) brings current (2013) regional employment to more than 146,000. Given the size of Purdue University's employment, Tippecanoe County has more public sector employees than all of the remaining nine

counties combined and accounts for 60 percent of the public sector workforce and 54 percent of the region's total workforce.

Figure 8. Wabash Heartland Region Private and Public Sector Employment by County, 2013

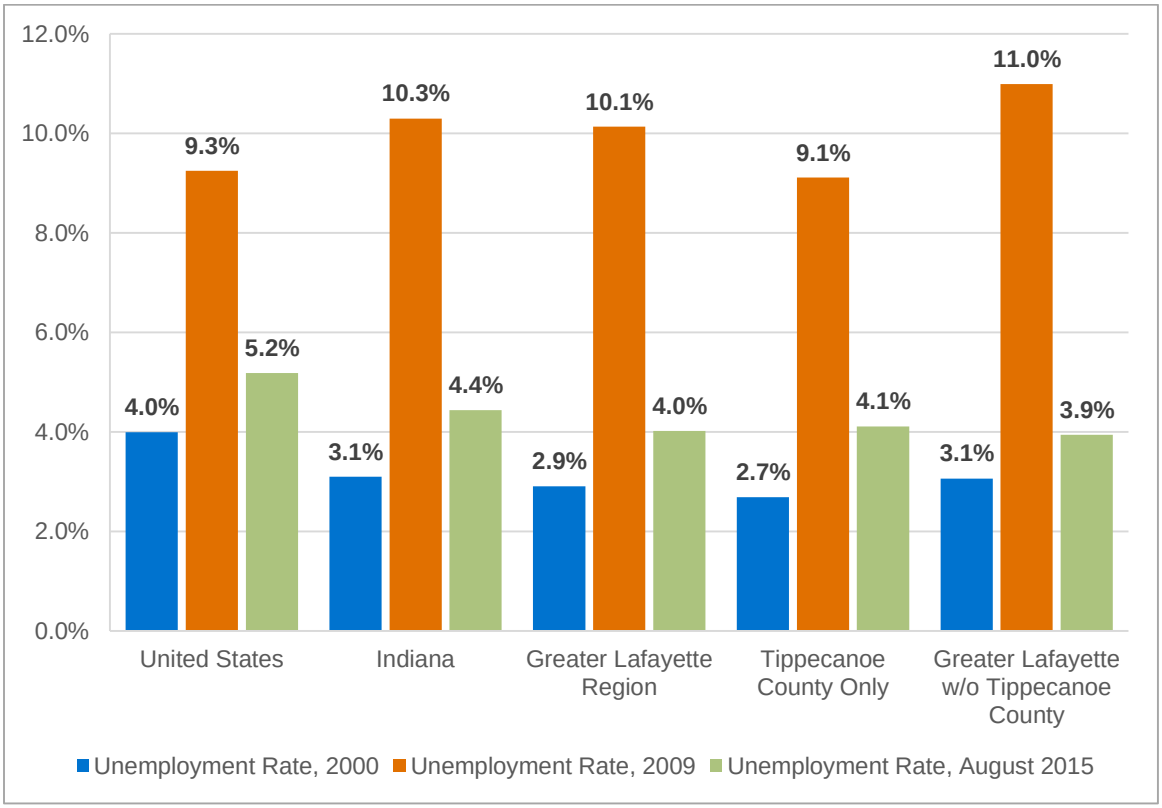


Source: U.S. Bureau of Labor Statistics, QCEW data.

Unemployment Rate

At the depths of the Great Recession in 2009, the Wabash Heartland Region's unemployment rate exceeded the U.S. rate. Its recovery, as evidenced by its most recent unemployment rate, has been better than both the United States and Indiana. However, an important level of new structural unemployment may exist in the region as the unemployment rate as of August 2015 is still 1.1 percentage points higher than it was in 2000 (Figure 9).

Figure 9. Unemployment Rate by Region, Select Years, and Current



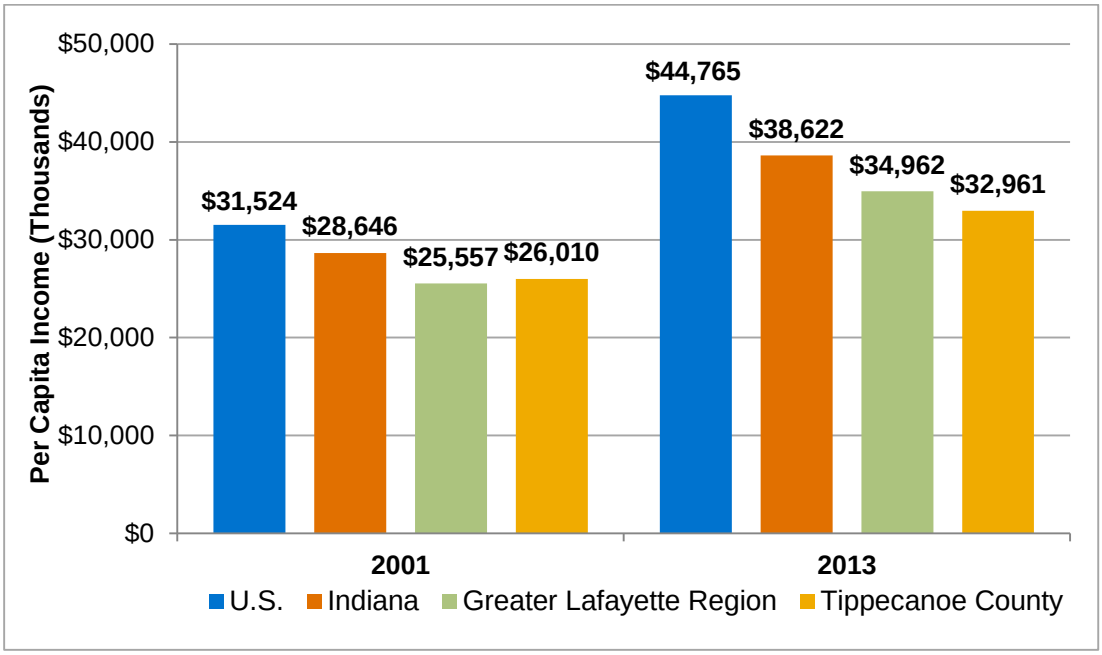
Source: U.S. Bureau of Labor Statistics, Local Area Unemployment Statistics (LAUS), Annual Averages 2000, 2009, and August 2015.

Income and Wage Trends

An examination of recent income and wage trends shows the role the size of the urban population in Tippecanoe County plays in skewing these measures. Figure 10 illustrates that while the Wabash Heartland Region's per capita income lags the nation both in terms of 2013 performance and the 2001-2013 growth, it is on par with the state. Figure 10 also illustrates that Tippecanoe County's growth in per capita income has not kept pace with the nation, Indiana, and is even outpaced by the Wabash Heartland Region as a whole.

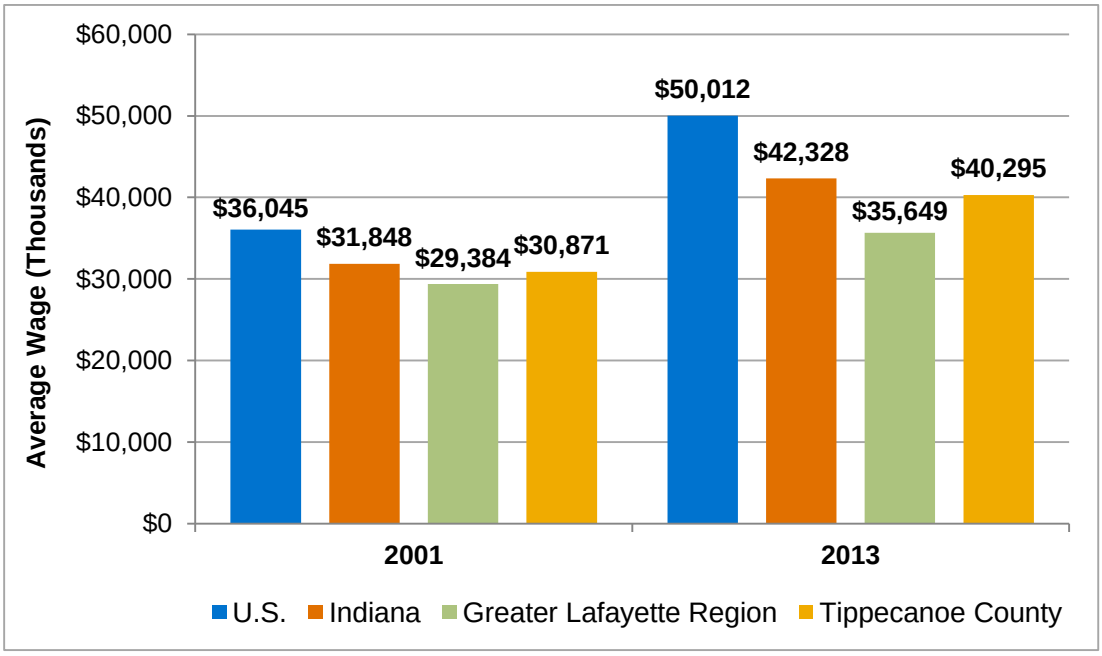
Average wages (i.e., total wages divided by total employment) follow a similar pattern as per capita income (Figure 11). Removing the population context (including low/no income earners across the socio-economic spectrum such as unemployed college students) improves the "performance" of Tippecanoe County, but both the county and the Wabash Heartland Region as a whole lag the state and nation in 2013 average wages and the 2001-2013 growth rate.

Figure 10. Per Capita Personal Income by Region, 2001 and 2013



Source: U.S. Bureau of Economic Analysis, Local Personal Income Data, Battelle Calculations.

Figure 11. Average Wages by Region, 2001 and 2013

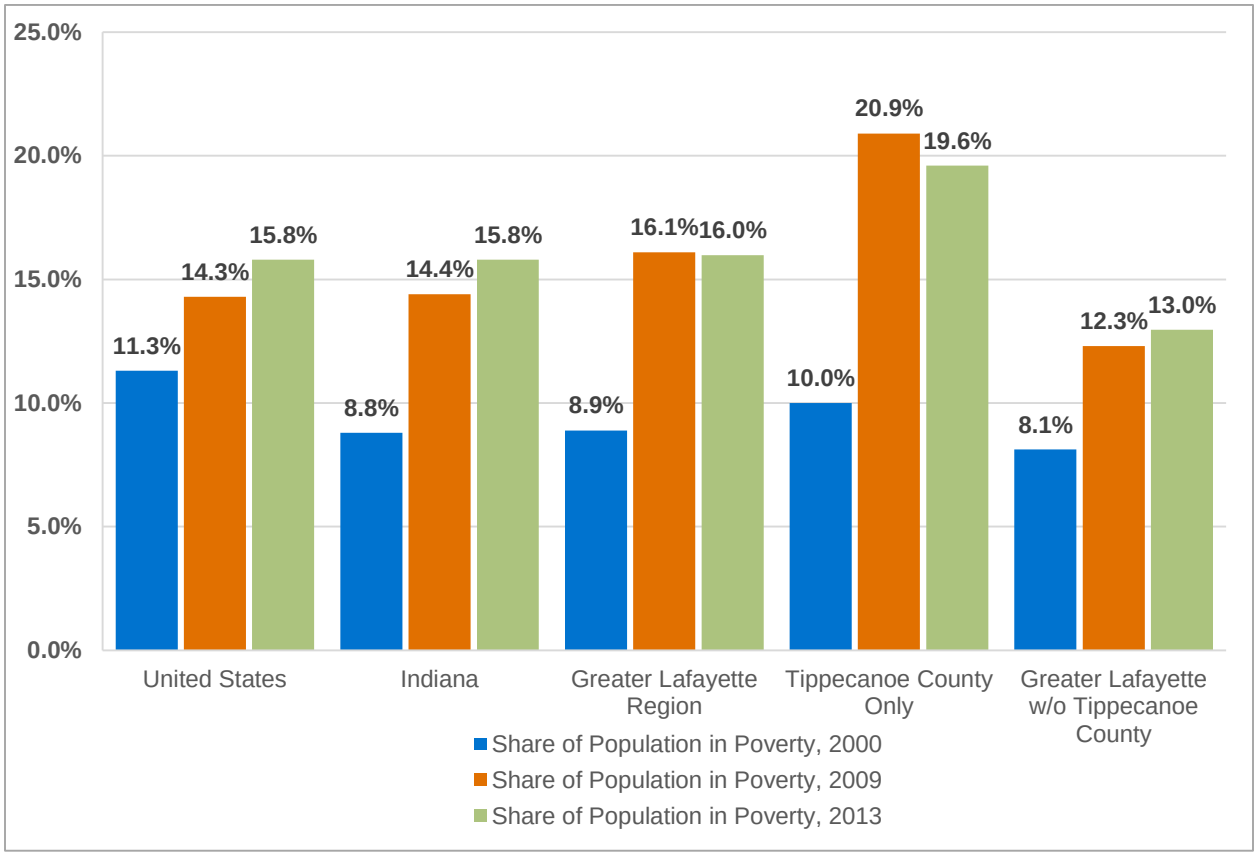


Source: U.S. Bureau of Economic Analysis, Local Personal Income Data, Battelle Calculations.

Poverty

Similar to national and state poverty levels, the Wabash Heartland Region's share of population in poverty is significantly higher in 2013 than it was in 2000, as illustrated in Figure 12. Unlike the United States and Indiana, the region's share of population in poverty has declined slightly from the depths of the Great Recession in 2009, with Tippecanoe County's poverty rate falling by 1.3 percent (though still higher than the regional average) and the rest of the region continuing to increase by 0.7 percent.

Figure 12. Share of Population Considered to be in Poverty



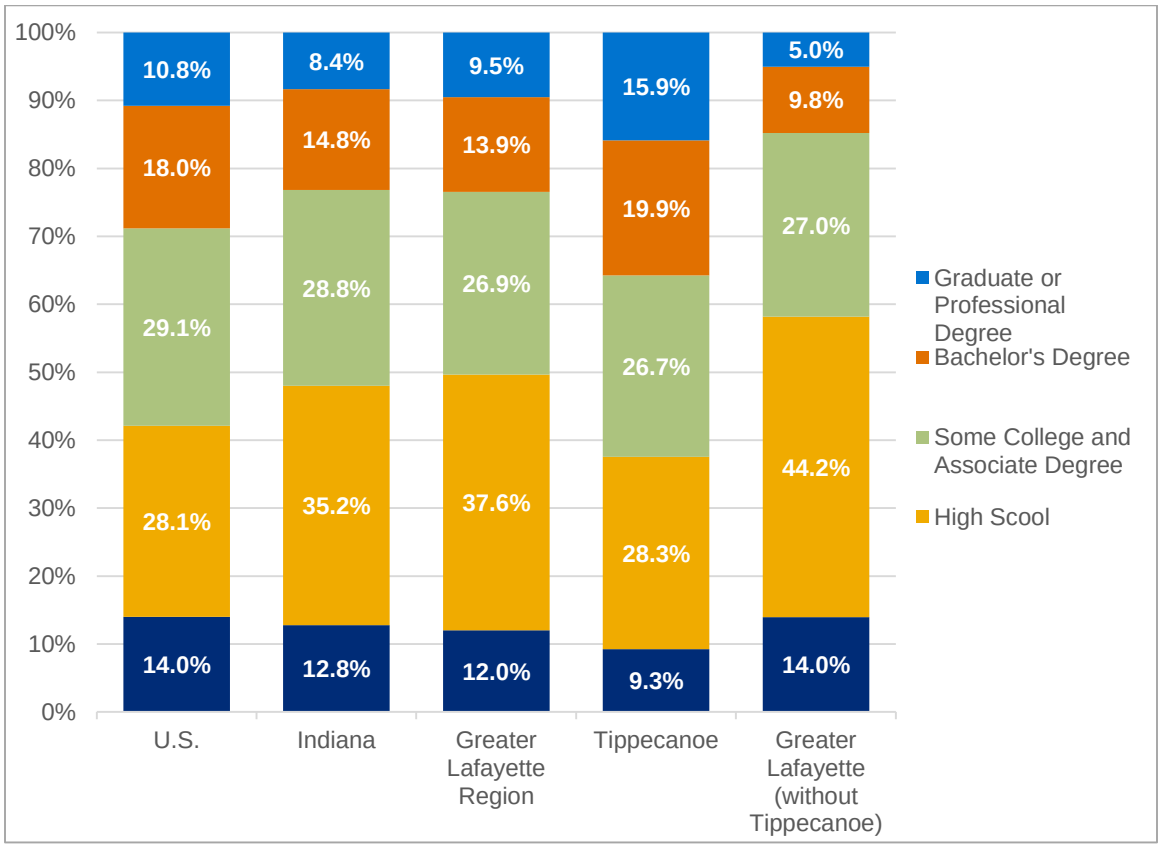
Source: U.S. Census, Small Area Income and Poverty Estimates (SAIPE), 2000, 2009, and 2013 (most recent available).

Regional Educational Attainment Dynamics

Finally, to further understand the broad economic context of the Wabash Heartland Region, overall educational attainment is examined (Figure 13). Similar to other measures, as a region the Wabash Heartland Region's educational attainment levels closely mirror the State of Indiana attainment, but this regional "average" misses geographic distinctions that are important from an economic development perspective. Tippecanoe County's population stands out as highly educated when compared to the region, state, and nation with nearly 36 percent of its population with a Bachelor's degree or higher. The rest of the region has nearly 60 percent of its population with a high school degree or less. However, given its overall population size, Tippecanoe County also has a sizeable population (approximately

36,000 residents) with a high school diploma or less.[7] These stark differences require economic development strategies that provide opportunities for the Wabash Heartland Region's residents regardless of their current educational background.

Figure 13. Educational Attainment by Region, 2013 (population age 25 and older)



Source: STATS Indiana Data, U.S. Census Estimates, Battelle Calculations.

[7] STATS Indiana data, U.S. Census Estimates, Battelle Calculations.

Summary

The labor shed, broad population, and economic data clearly indicates that Tippecanoe County is the major economic center in the Wabash Heartland Region both in terms of overall population size and employment opportunities. The ten-county Wabash Heartland Region represents a level of social, economic, and geographic diversification that represents both significant opportunities and significant challenges for the region's development. This diversified economic context includes:

- A strong central place "situation" (e.g., the cities of Lafayette and West Lafayette, Tippecanoe County)
- A varied urban-rural landscape
- Significant "heavy" industry operations
- A research-intensive Land-Grant University
- An extensive level of educational offerings by a community college system
- Infrastructure to support a developing entrepreneurial community
- Inclusion in the commuting-shed for Indianapolis, the 14th largest city in the United States
- Situated on a major transportation artery between Indianapolis and Chicago

Of particular challenge to the overall prosperity of the region is the fact that per capita income and average wages in the region lag state and national levels. The next section will begin to identify key regional industry clusters that represent opportunities to differentiate the region thereby generating greater community prosperity.

Section 3: Targeted Industry Cluster Analysis

In today's globally based economy, the key to success for regions is to identify those growth opportunities within its core industry sectors in which it is best positioned to differentiate itself and experience economic growth. While each of the eight industry clusters (refer to Table ES-1) identified in the Wabash Heartland Region is an important economic driver for the region, they vary considerably in how they are positioned for economic and employment growth. More importantly, even in clusters that were hit hard by the recession, key component industries or subsectors may offer important growth opportunities, even when the overall industry or cluster has limited overall growth potential based on national or international economic trends. As a result, it is important to analyze these Wabash Heartland Region industry clusters in more depth to examine how they are positioned for growth in the future.

Overview of Industry and Cluster Analysis Methodology

The concept of building economic development strategies and tactics around industry clusters is not a new concept, yet a "one-size-fits-all" approach to determining and assessing a region's industry clusters can lead to misunderstandings, confusion, and in some cases missed opportunities for regional economic development.

Defining Regional Industry Clusters

Identifying and defining a region's industry clusters must consider both quantitative and qualitative information and provide a comparative context to assess true possibilities. Potential clusters are determined by a variety of factors including employment size (critical mass), regional industry concentration, growth prospects, number of establishments, broad economic development context, and even relationships to other clusters.

Establishing the industry structure of a cluster (typically through the use and inclusion of specific industry classifications such as the North American Industrial Classification System (NAICS) codes) requires a thorough understanding inter-industry supply chain dynamics, a perspective on the region's uniqueness, and an eye on national comparative norms. Using a more general "national" defined industry cluster structure, while typically required to make "apples-to-apples regional" comparisons, can easily miss important regional dynamics and relationships. Finding regional "niches" for actionable economic development often requires a more localized cluster definition and analysis, while maintaining some consistent industry cluster concepts to avoid "gerrymandering" a regional cluster definition (i.e., including only industry codes that perform well in the region and removing poor performing or non-existent segments that will over influence in a positive manner any comparative metrics) or developing "cluster" definitions based upon what amounts to a single firm operation.

The process of identifying and defining local industry clusters begins with detailed analysis to discover unique components and strengths, integrating component industries around both regional and national industry supply chain "norms," and ultimately grouping subsectors to achieve both conceptual understanding and actionable "scale."

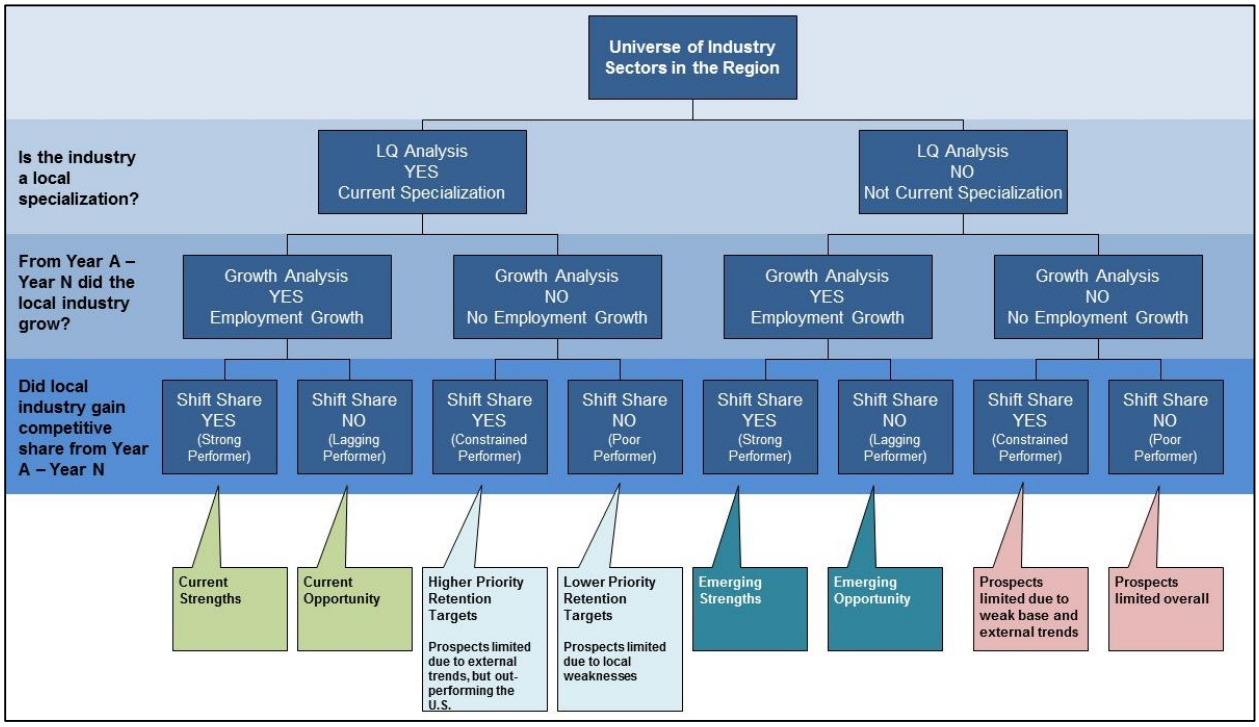
Throughout this process, a perspective on the actual industry context of the region is imperative as no cluster definition based solely upon aggregating NAICS codes is perfect, and economic development strategies built solely on simple NAICS aggregations can be misplaced or missed. Considerations need to

be made for instances where component pieces of companies can be counted within NAICS codes outside of the core cluster definition (e.g., headquarters, distribution) or where small firms or outlying sectors that are not “part of the definition” are integral to a region’s industry success (e.g., key small electronic components manufacturer, a metal wholesaler built around the unique needs of the region).

Cluster Analysis Assessment Methodology

From an economic development perspective, industry cluster analysis attempts to understand the interrelationships (both existing and potential) among firms and to what extent these industry clusters can be worked with, enhanced, and developed. While the ability to work with true industry clusters allows for significant economies of scale in the development process, it is important to recognize that not all establishments will be part of a group of similar firms and not all groups of firms are able to operate as an industry cluster. However, from an economic development and job opportunity perspective, these firms and groups of firms are often key economic assets in their own right. For this analysis, the term “industry cluster” and “industry group” are used interchangeably. Figure 14 portrays in a visual format, the Battelle industry and cluster targeting analysis decision tree structure.

Figure 14. Industry and Cluster Targeting Analysis: Decision Tree



The results of the industry cluster performance-based decision tree provide a place to start for the overall assessment of cluster opportunities. Beyond the results of the decision tree-based analysis, the Battelle team further examined these clusters and, to the extent possible many of the individual firms within these clusters, to better understand the regional context and dynamics of the cluster. This assessment includes understanding the overall size and makeup of the cluster (e.g., the extent a cluster’s employment is driven by a single large firm, is the cluster’s employment spread throughout the Wabash Heartland Region or primarily located in one county, is employment growth limited to a single county), the

establishment nature of the cluster (e.g., does the cluster consist of many individual firms, a number of establishments of the same firm, one key "customer" firm, or is the cluster based primarily on one or two key firms), and finally, are there key niches within any specific cluster that should be examined separately. Additionally, other information obtained through company and organization interviews and web-based research was used to help identify, understand, and provide context to the various industry clusters.

Through this decision tree analysis, eight Wabash Heartland Region industry clusters were identified.[8] A useful way to summarize and visualize the performance of these eight clusters is through the use of bubble charts that present in one graphic higher or lower employment concentration levels (vertical axis), job growth or decline (horizontal axis), and the 2013 employment size of the cluster (size of bubble for each cluster) (refer to Figure 15 and Figure 16). Concentration levels are measured through the use of location quotients (LQ) that provide a metric of the level of employment in a region relative to the United States. A baseline value of 1.00 in this metric indicates the Wabash Heartland Region is just as concentrated in an particular cluster as the United States overall, with values less than 1.00 indicating the region is less concentrated than the United States and values greater than 1.00 indicating that the region is more concentrated than the United States. Regional economic literature suggests that values exceeding 1.20 should be characterized as true regional specializations.

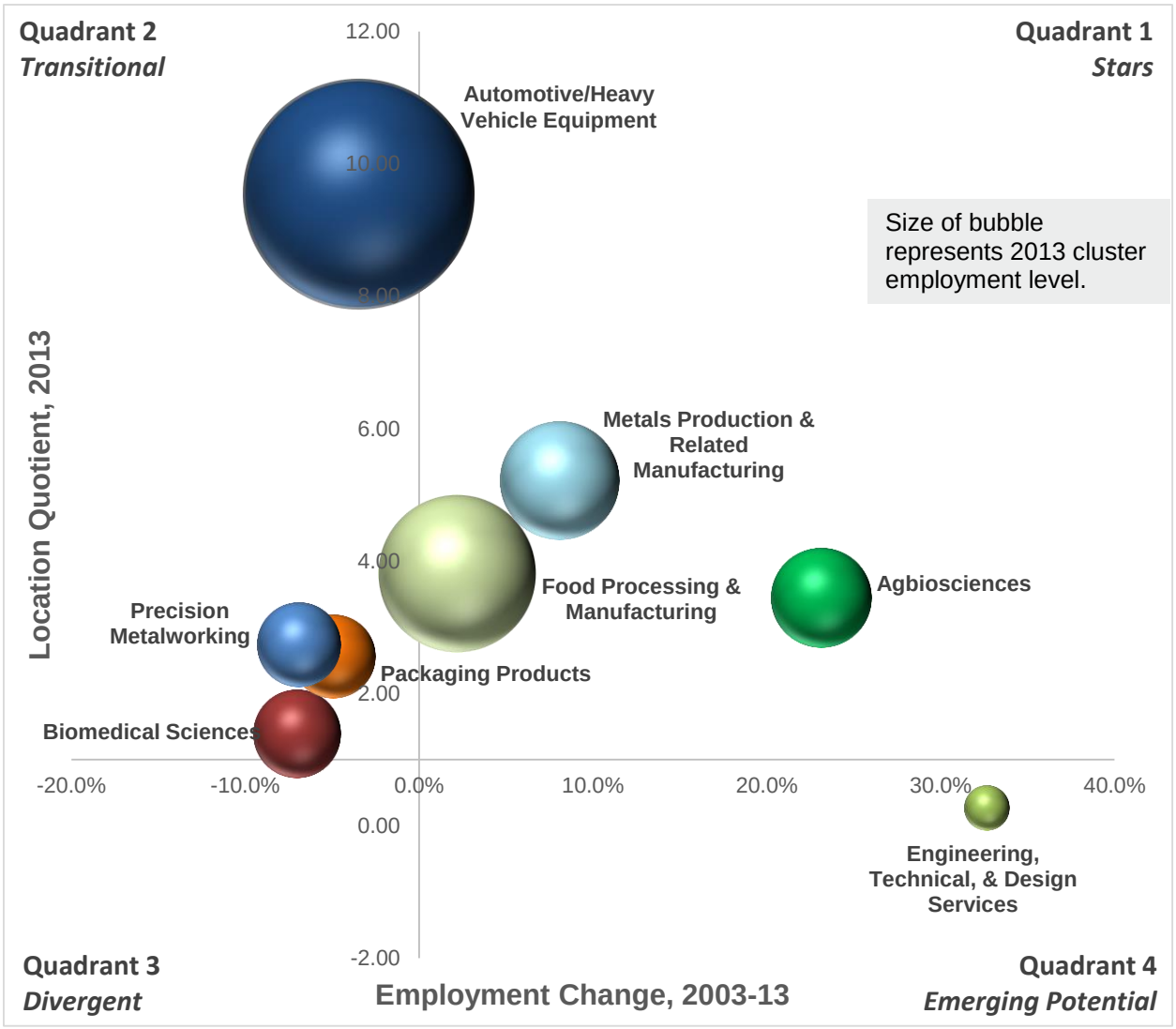
The bubble charts are divided into four quadrants based upon the axis values with the relative performance in these quadrants represented as:

- ***Stars*** – High performing clusters with above average concentrations (above 1.00) and positive growth rate over the period examined. These clusters represent strong regional strengths and opportunities for cluster growth.
- ***Transitional*** – Clusters that have an above average regional concentration, but have declined in employment over the period. These clusters typically revolve around mature industry segments. Often these clusters, while they have limited growth potential, provide significant regional employment and hence are key retention targets.
- ***Divergent*** – Clusters that have both below average regional concentrations and have declined over the period. These clusters have extremely limited prospects for future growth. It should be noted that the decision tree methodology limits the further examination of divergent clusters.
- ***Emerging Potential*** – Clusters that experience employment growth over the period being examined, but whose overall concentration in the region is currently below average. Often, through industry and economic development growth strategies, these emerging clusters can expand to levels that increase their regional concentrations to above average levels.

To better capture the historical and most recent industry dynamics, these Wabash Heartland Region clusters were examined for both the overall 2003-2013 period as well as for the post-recession 2009-2013 period.

[8] See Appendix A for the definition of each cluster at the six-digit NAICS level.

Figure 15. Wabash Heartland Region Cluster Dynamics, 2003-2013

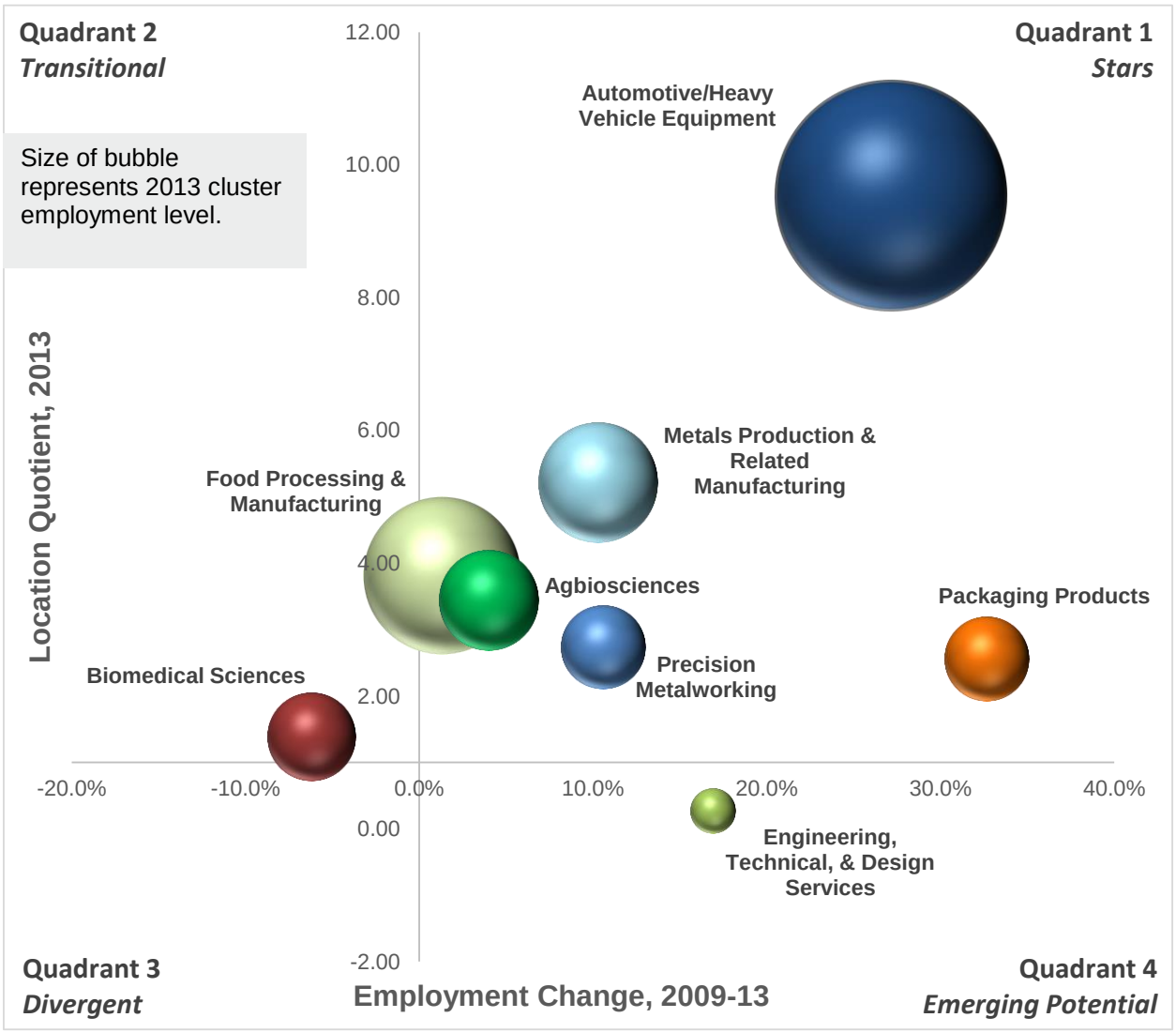


Source: Battelle analysis of IMPLAN QCEW data.

Figure 15 illustrates four clusters with employment growth over the decade during times of extreme cyclicality including Engineering, Technical, and Design Services; Agbiosciences; Metals Production and Related Manufacturing; and Food Processing and Manufacturing. Figure 15 also illustrates the region's most sizeable cluster, Automotive/Heavy Vehicle Equipment, is undergoing the same transition as the overall U.S. industry.

Figure 16, however, presents a significant post-recessionary rebound within the Automotive/Heavy Vehicle Equipment cluster, double digit growth in four additional clusters (including more than 30 percent growth in Packaging Products), and positive employment gains in two other clusters. The special circumstances of the Biomedical Sciences cluster will be discussed in detail later in this section.

Figure 16. Wabash Heartland Region Cluster Dynamics, 2009-2013



Source: Battelle analysis of IMPLAN QCEW data.

Based upon this analysis, eight Wabash Heartland Region industry clusters offer unique and important opportunities upon which strategic development efforts can be established (Table 2). Each cluster is categorized into one of three strategic areas: 1) Life- and Agri-Sciences; 2) Value-Added Metals Processing; and 3) Key Support Clusters.

Table 2. Decision Tree Assessment of Wabash Heartland Region Industry Clusters

Strategic Area	Key Targeted Clusters	Decision Tree Assessment
Life- and Agri-Sciences	Agbiosciences	Current Opportunity
	Food Processing and Manufacturing	Current Opportunity
	Biomedical Sciences	Emerging Strength*
Value-Added Metals Processing	Automotive/Heavy Vehicle Equipment	Current Strength
	Metals Production and Related Manufacturing	Current Strength
	Precision Metalworking	Current Opportunity
Key Support Clusters	Engineering, Technical, and Design Services	Emerging Strength
	Packaging Products	Current Strength

*Note: See Biomedical Industry Cluster section for further discussion.

The Life-and Agri-Sciences strategic area encompasses the breadth of the Biomedical Sciences cluster in the Wabash Heartland Region and the depth and size of the Agbiosciences and its integration and inter-relationships with Food Processing and Manufacturing. The Value-Added Metals Processing strategic area brings together the commonalities and further supply chain relationships and potential among the Automotive/Heavy Vehicle Equipment, Metals Production and Related Manufacturing, and Precision Metalworking clusters. Finally, the Key Support Clusters strategic area connect two areas, Packaging Products and Engineering, Technical, and Design Services that support other existing clusters in the region and provide potential opportunities for regional economic growth.

The following narrative provides details regarding the cluster development prospects within each strategic area. The sections begin with a brief overview of the strategic area, followed by a descriptive definition of each included cluster, a cluster economic performance summary, a discussion of the cluster's opportunities relative to its assets and connections to other clusters, as well as an overview of the market prospects for the particular cluster.[9]

[9] For the overview of market prospects, Battelle generally relies on market research intelligence from IBISWorld or BCC Research to identify faster growing market opportunities and specific market and technology challenges. The advantage of IBISWorld is that its industry research reports align well with the industry classification system and so focus on detailed industry product markets.

Life- and Agri-Sciences

The Wabash Heartland Region's Life- and Agri-Sciences strategic area consists of three industry cluster components, often with important interactions occurring among them: 1) Agbiosciences; 2) Food Processing and Manufacturing; and 3) Biomedical Sciences.

Agbiosciences

Overview

The Agbiosciences industry cluster includes a variety of agriculture-related services (including recent advancements in precision agriculture), agriculture-bio feedstock processing (e.g., wet corn milling, soybean processing), and ethanol production. Furthermore, this cluster includes agricultural-related wholesale operations and the substantial and integrated agricultural distribution operations of a number of global agribusinesses. The region is home to the significant employment of major firms such as Tate and Lyle, The Andersons, and Archer Daniels Midland (ADM) Company. *It is important to note that this definitional structure treats some establishments of global integrated agribusiness, such as ADM, as Agbiosciences entities, but establishments engaged in further downstream processing into direct food inputs or consumer-related food manufacturing as entities within the Food Processing and Manufacturing cluster.* A number of emerging companies are beginning to appear in the regional Agbiosciences landscape including Spensa Technologies and Spero Energy. One component of the fully defined Agbiosciences cluster that appears to have a limited presence in the region is the area of agricultural chemicals (e.g., fertilizers, pesticides).

Cluster Performance

Overall, the Agbiosciences industry accounts for more than 2,500 jobs in the Wabash Heartland Region (Table 3). It should be noted that the definition and employment assessment of the Agbioscience industry cluster does not include the nearly 6,800 farm proprietors and workers in the Wabash Heartland Region that underpin the strengths in this cluster. Given the importance of agriculture and farming to this region, it is not surprising that the Agbiosciences industry is nearly 3.5 times more concentrated in Wabash Heartland Region (LQ of 3.45) than the cluster is nationally. The growth and development of the major operations in the region has led the cluster to increase the number of jobs by nearly 500 over the decade, significantly outpacing the nation.

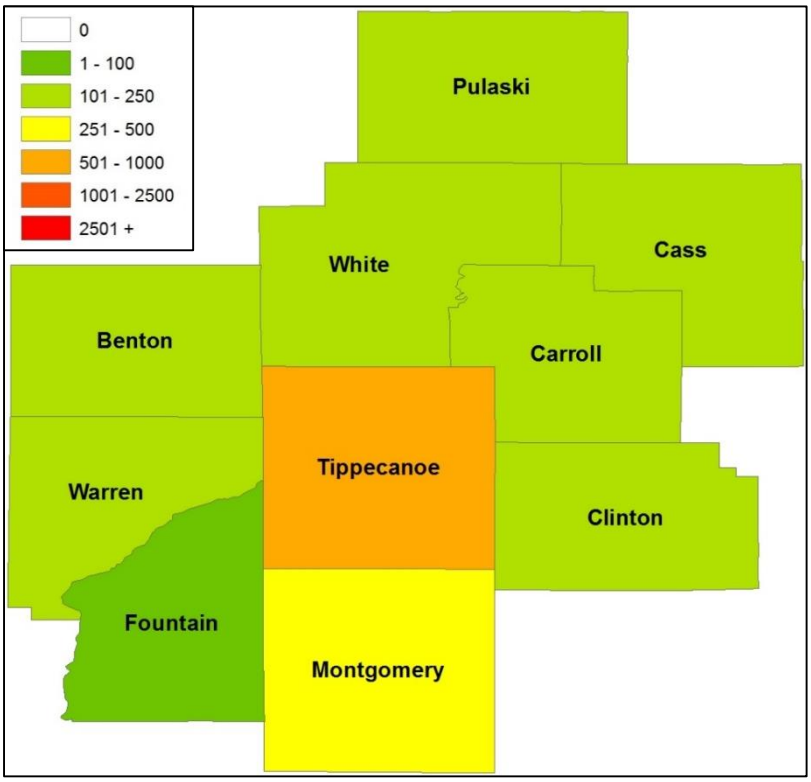
Table 3. Economic Summary for the Agbiosciences Cluster

Performance	2013 Metrics				Recent Employment Performance		
	Estabs.	Employment	Average Wage	Location Quotient	Change Through Recession, 2003-2009	Change Post-Recession, 2009-2013	Total Decade Change, 2003-2013
Regional Performance	167	2,518	$56,179	3.45	18.4%	4.0%	23.1%
U.S. Performance					1.7%	6.6%	8.4%

Source: Battelle analysis of IMPLAN QCEW data.

Figure 17 illustrates that the Agbiosciences cluster accounts for at least 100 jobs in every county of the Wabash Heartland Region, except Fountain County (with 85 Agbioscience jobs).

Figure 17. Agbiosciences – 2013 Cluster Employment by County



Cluster Opportunity

The region's Agbiosciences cluster employment levels are driven by major multi-national agribusinesses, and their growth and future success are important to the region. However, as new growth areas emerge in precision agriculture (and its related technologies) and new applications for agricultural feedstocks and agricultural biotechnology, the region has the potential to become a hub for such development. It will be critical to further integrate the agricultural R&D of Purdue University, with regional industry and entrepreneurial capacities to see these new areas flourish in the Wabash Heartland Region. Additionally, the state's food and agriculture innovation initiative, AgriNovus Indiana, recently received a grant from Lilly Endowment, Inc. to prepare an analysis of the state's agbiosciences workforce, including current and future talent needs. As such, the Wabash Heartland Region is in a position to gain a better understanding of its workforce needs with respect to this market's future trends, as well as leverage any actionable insights from the study.

Cluster Market Prospects

Market Outlook

This market is highly volatile due to its reliance on agricultural commodities. Those commodities have seen their share of ups and downs over the past five years due to, among other factors, the surplus of

U.S. crops on the market, which caused crop prices to fall and depressed farmer income. Over half of the market components listed below are expected to realize declines or extremely limited revenue growth over the five years leading to 2020. However, firms in the basic organic chemical manufacturing industry are expected to realize some of the highest growth rates over the 2015-2020 time period at an average annual rate of 3.2 percent.

Key Drivers

- Demand from crop production
- Demand from animal food production
- Demand from grocery wholesaling
- Demand from food manufacturing
- Price of animal feed and fertilizer

Specific Market Segment Growth Forecasts

Growth in specific market segments and technologies important to the Wabash Heartland Region are detailed as follows:

Corn, Soybean, and Oilseed Processing: Food and grocery wholesalers comprise the largest downstream market for this industry. Those wholesalers distribute to food manufacturers and grocery stores, so any change in consumer demand is felt by the industry. The recent shift in U.S. consumer demand from animal fats and traditional cooking oils to more vegetable-based oils has led to the industry supplying a greater amount of vegetable and edible oils. Over the five years leading to 2014, revenue is expected to increase to $68.0 billion at an average rate of 1.4 percent per year. This estimate includes an expected decrease in revenue of 1.6 percent in 2014. Over the 2014-2019 period revenue is expected to make minimal gains, with an annualized growth rate of 0.8 percent leading to $70.8 billion in revenues.[10]

Grain and Bean Wholesaling: As with other crop-based industries, 2015 was a volatile year for the U.S. grain and bean wholesaling industry. However, over the past five years the increasing demand for food and for crops used in renewable fuel manufacturing increased the demand for crops such as oilseeds and grains, which caused industry revenue to grow at an estimated 2.0 percent over the 2010-2015 period to $133.5 billion. The first part of the 2015-2020 period is expected to bring about a decline in demand due to the expected surplus of crops on the market, causing industry revenue to grow at an annualized 1.3 percent, reaching $142.4 billion.[11]

Crop Support Activities: Firms in this industry space cover a range of crops, with the industry's largest market sector being fruit and vegetable farming. There has been relatively slow revenue growth in the U.S. industry over the 2010-2015 period, with revenues reaching $13.7 billion at a growth rate of 0.7 percent per year. With an increasing global population needing to be fed, demand for crop support activities would be expected to increase. However, due to the surplus of certain U.S. crops in the market, crop prices have fallen, leading to decreases in revenue in the crop support activities industry. Industry

[10] IBISWorld, Margarine and Cooking Oil Processing in the U.S., 2014.
[11] IBISWorld, Corn, Wheat and Soybean Wholesaling in the U.S., 2015.

revenue is expected to fall by an annualized 0.3 percent over the 2015-2020 period, resulting in revenues of $13.5 billion.[12]

Animal Feed, Fertilizer, and Other Farm Supplies Wholesaling: In recent years, increasing amounts of fracking and a surplus of crops on the U.S. market has led to decreases in the prices of oil and animal feed. Seeing as the animal feed, fertilizer, and farm supplies wholesaling industry supplies manufactured goods to farmers, as farmers income decreases so does revenue in this industry. Over the 2010-2015 period, revenue is anticipated to have fallen at an average annual rate of 0.2 percent to $91.5 billion. Oil and feed prices are expected to fall over the first part of the 2015-2020 period, and stabilize toward the end, leading to an average annual fall in revenues of 0.3 percent over the period, with revenues falling to $90.1 billion.[13]

Farm and Garden Equipment Wholesaling: Demand in this industry is driven primarily by farmers that use their equipment, which has recently translated into unstable revenue growth for the US industry over the past five years. In the early parts of the 2010-2015 period, high crop prices meant higher demand for farm and garden equipment. However, in 2015, crop yields thus far have been extremely high, depressing crop prices and cutting into industry revenues. From 2010-2015, industry revenue grew at an annualized 5.2 percent, leading to 91.3 billion in revenue. In 2015, revenue is projected to drop 8.9 percent due to reduced farm income. This trend is expected to remain over the next five years, with revenue projected to decline by an annualized 0.6 percent over the 2015-2020 period, leading to $88.4 billion in revenues.[14]

Ethanol: According to the most recent U.S. Energy Information Administration's Short-Term Energy Outlook, U.S. ethanol production will exceed 950,000 barrels per day in 2015 and reach similar production levels in 2016.[15] This level of production amounts to an approximate 2 percent increase over 2014 production levels. U.S. production continues its slight increase led by ethanol facilities located in the Midwest corn belt. While falling gas prices have increased overall fuel consumption, which has in turn increased the amount of ethanol consumption as a component of blended gasoline, many of these facilities are still operating under capacity. The proposed Renewable Fuel Standard (RFS) issued by the U.S. Environmental Protection Agency (EPA) earlier this year is projected to only slightly increase total ethanol production as the largest effects of this RFS would be realized in increases in biodiesel consumption over corn-based ethanol.

Food Processing and Manufacturing

Overview

The Wabash Heartland Region Food Processing and Manufacturing cluster includes the breadth of food processing and manufacturing ranging from packaged food products, meat and dairy processing, and snack food manufacturing. However, nearly 60 percent of the cluster's employment is related to pork processing and production and includes major employers including Indiana Packers Corporation and

[12] IBISWorld, Crop Services in the U.S., 2015.

[13] IBISWorld, Farm Supplies Wholesaling in the US, 2015.

[14] IBISWorld, Farm, Lawn and Garden Equipment Wholesaling in the US, 2015.

[15] US Energy Information Administration, *Short Term Energy Outlook*, November 2015.

Tyson Fresh Meats. Snack foods production, including three Frito-Lay facilities, accounts for an additional 16 percent of the cluster's regional employment. Other significant employers include Pace Dairy Foods and Zachary Confections.

Cluster Performance

The Food Processing and Manufacturing cluster accounts for nearly 6,200 regional jobs (Table 4). The cluster's importance is 3.8 times more concentrated in the Wabash Heartland Region than overall national averages (LQ = 3.81). The cluster has realized steady, though limited, growth throughout the 2003-2013 period, exceeding national declines over the decade. Somewhat concerning is that post-recession growth, though positive, is slightly off of the national pace. This growth, however, could be somewhat attributable to the fact that the cluster in the Wabash Heartland Region did not experience the same recessionary decline, so did not require as large of a "bounce back."

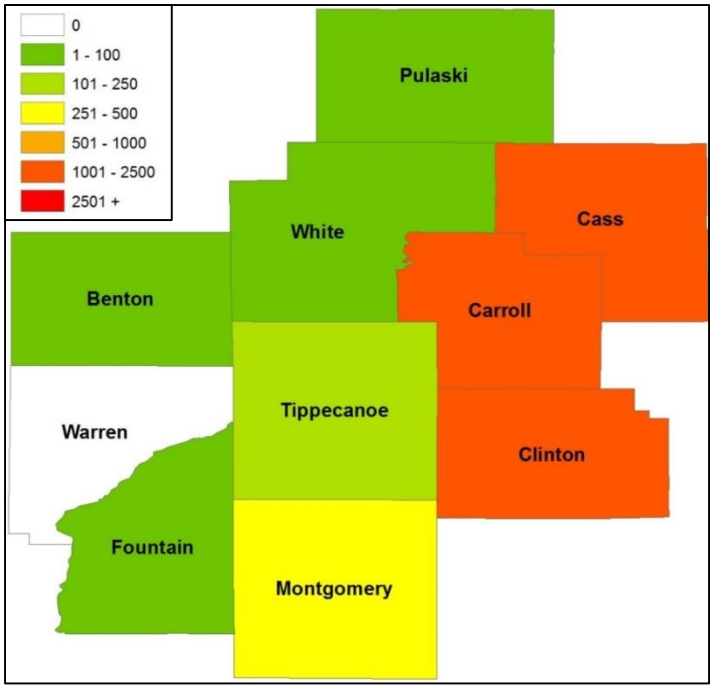
Table 4. Economic Summary for the Food Processing and Manufacturing Cluster

Performance	2013 Metrics				Recent Employment Performance		
	Estabs.	Employment	Average Wage	Location Quotient	Change Through Recession, 2003-2009	Change Post-Recession, 2009-2013	Total Decade Change, 2003-2013
Regional Performance	48	6,179	$37,791	3.81	0.9%	1.3%	2.2%
U.S. Performance					-3.5%	2.3%	-1.3%

Source: Battelle analysis of IMPLAN QCEW data.

Figure 18 illustrates the important regional diversity of the Food Processing and Manufacturing cluster, with three counties accounting for more than 1,000 jobs each.

Figure 18. Food Processing and Manufacturing – 2013 Cluster Employment by County



Cluster Opportunity

The Food Processing and Manufacturing cluster provides significant and geographically diversified employment to the Wabash Heartland Region. Developing out of the agricultural resources and heritage of the region, further development and product diversification is possible. Leveraging the agricultural, food, and nutrition-related research from Purdue University will be important if the region is to realize any emerging entrepreneurial growth within this cluster.

Cluster Market Prospects

Growth in specific market segments and technologies important to the Wabash Heartland Region are detailed as follows:

Market Outlook

This market, which includes the processing, packaging, and manufacturing of food products from meat to potato chips, is expected to realize increased revenue over the next five years as consumer's disposable income increases and the economy strengthens. The animal processing sector in particular tends to hold steady during economic fluctuations as consumers continue purchasing meat, albeit lower quality meats, during economic downturns. However, certain segments, such as cheese production, may realize increased competition from abroad as well as increasing costs of animal feed and other inputs, which could serve to temper revenues in this industry in the future.

Key Drivers

- Increasing prices for inputs and ingredients

- Increasing discretionary and disposable incomes, which change consumer purchasing behavior
- Changing demand dynamics from end purchasers ranging from wholesalers, to restaurants, to supermarkets and grocery stores
- Increasing demand for healthy food options
- Changes in per capita meat and dairy consumption

Specific Market Segment Growth Forecasts

Growth in specific market segments and technologies important to the Wabash Heartland Region are detailed as follows:

Meat Processing: This industry is engaged in the slaughtering of animals, along with the processing and packaging of meats, including poultry. However, slaughtered animal products (except poultry) is the largest segment of products in this industry at 45.1 percent. Even with rising meat prices over the past five years, due to fluctuating feed costs and other factors, the demand for meat products is projected to increase with industry revenue expected to reach $249.9 billion at an annualized rate of 5.1 percent over the 2010-2015 period. Expected increases in disposable income and consumer sentiment over the next five years will lead to continued growth in industry revenue, projected to reach at $257.8 billion over the 2015-2020 period at an annualized rate of 0.6 percent.[16]

Snack Food Manufacturing: The U.S. snack food manufacturing industry, with potato, tortilla, corn, and other chips making up a combined 63.2 percent of the market, has fared well over the past five years. Firms in this industry have adjusted to shifting consumer preferences toward snacks with reduced fat and sodium, and the prices of key inputs such as corn and wheat fell over the five years leading to 2015. These effects, among others, are expected to result in industry revenues of $37.6 billion over the 2010-2015 period with an annualized growth rate of 4.3 percent. Moderately low increases in input prices and a strengthening economy will serve to increase revenue in this industry over the next five years, with revenues projected to reach $44.9 billion at an annualized growth rate of 3.6 percent over the 2015-2020 period.[17]

Chocolate and Confectionary Production: This U.S. industry's products are considered discretionary goods, which typically realize increases in demand as discretionary income rises. Over the 2010-2015 period, discretionary income has increased, leading to growing demand in this industry, especially for organic, reduced fat, and dark varieties of chocolate goods. Factors such as the volatile cost of cocoa has tempered growth over the same period, leading to an estimated annualized revenue growth of 1.7 percent from 2010-2015, with revenue totaling $17.3 billion. Over the next five years, the price of cocoa is expected to stabilize and discretionary income is predicted to increase. Revenues in this industry are anticipated to reach $18.9 billion over the 2015-2020 period at an annualized growth rate of 1.8 percent.[18]

Cheese and Dairy Product Production: Cheese makes up the largest segment of products produced in this industry in the United States, followed by fluid milk and milk-based products, dry, evaporated, and

[16] IBISWorld, Meat, Beef and Poultry Processing in the U.S., 2015.

[17] IBISWorld, Snack Food Production in the U.S., 2015.

[18] IBISWorld, Chocolate Production in the U.S., 2015.

condensed milk products, and butter. The revenue of the US cheese and dairy production industry is largely dependent on the price of raw milk. As the price of raw milk increased over the past five years, so did industry revenue, which is expected to reach an annualized growth rate of 3.2 percent to $114.1 billion over the 2010-2015 period. Over the next five years, revenue growth is expected to be hampered by increased foreign competition and increased animal feed costs. However, increasing disposable income will help to buoy industry revenue, which is forecast to grow at an annualized rate of 0.4 percent to $116.6 billion over the five years leading to 2020.[19]

Biomedical Sciences

Overview

The Biomedical Sciences cluster includes the breadth of component industries including pharmaceutical manufacturing, medical devices, biotechnology, and medical laboratories. One unique aspect of the Wabash Heartland Region's Biomedical Sciences cluster is the significant employment in ophthalmic lens manufacturing. Major firms in the region include Evonik, Walmart Optical Manufacturing, Endocyte, Cook Biotech, SSCI, and Ash Access Technology. As one of the more entrepreneurial growth clusters, the biomedical sciences also include a number emerging companies such as Bioanalytical Systems, MED Institute, Akina, Nutrabiotix, Tymora Analytical, Perfinity Biosciences, Muffin, and Concordance Health Solutions.

Cluster Performance

The biomedical cluster accounts for more than 1,900 jobs in total with approximately a third of the employment contained within pharmaceutical manufacturing and another third within the biotechnology/biomedical R&D sector (Table 5). The sector overall is specialized in the region with 39 percent more employment in the region than would be expected if the region were at the US average. A key consideration of this cluster is the comparative growth rate and the influence of one key firm. Over the course of the transition and production changes from Eli Lilly to Evonik, a significant reduction in employment occurred in the facility. Given the size of this facility, it has a significant impact on the "performance" of the biomedical cluster as a whole. With this firm's performance included, the cluster declined by 7.0 percent over the decade. Removing this single firm, employment in the remaining Biomedical Sciences cluster firms more than doubled (growing by 135 percent) during the 2003-2013 period and dramatically outpacing the overall U.S. cluster.

[19] IBISWorld, Dairy Product Production in the U.S., 2015.

Table 5. Economic Summary for the Biomedical Sciences Cluster

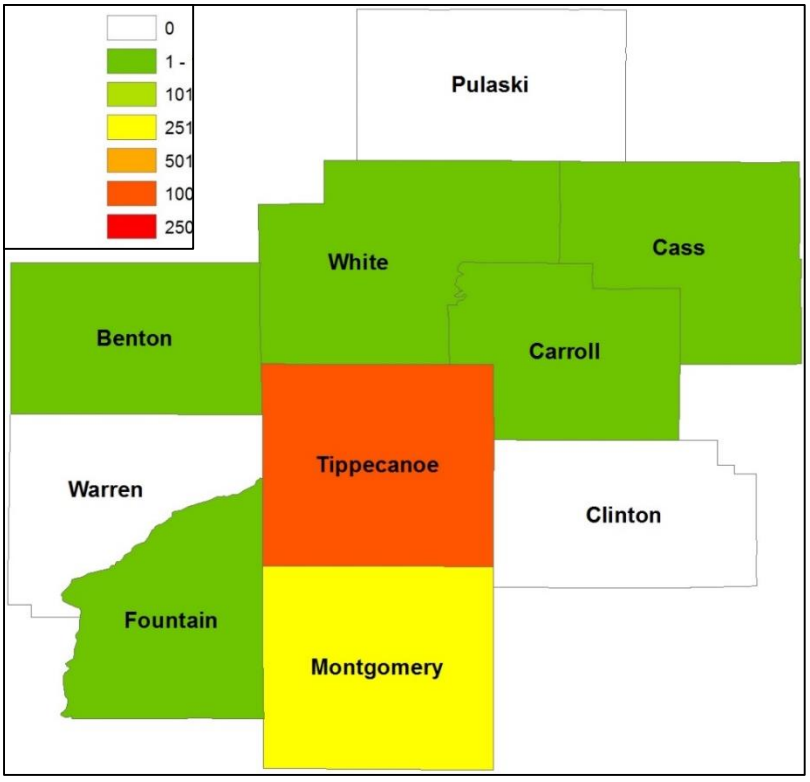
Performance	2013 Metrics				Recent Employment Performance		
	Estabs.	Employment	Average Wage	Location Quotient	Change Through Recession, 2003-2009	Change Post-Recession, 2009-2013	Total Decade Change, 2003-2013
Regional Performance*	51	1,936	$75,571	1.39	-0.9%	-6.2%	-7.0%
	50*	1,270	$67,138	1.08	135.4%	-0.1%	135.3%
US Performance					10.5%	2.8%	13.5%

Source: Battelle analysis of IMPLAN QCEW data.

* Blue-shaded row includes estimated values.

Figure 19 illustrates that most of the Biomedical Sciences cluster employment is located within Tippecanoe County, accounting for over 1,400 (nearly 75 percent) of the cluster's jobs in the region.

Figure 19. Biomedical Sciences – 2013 Cluster Employment by County



Cluster Opportunity

The Biomedical Sciences cluster consists of a number of existing and emerging firms driving important growth in the region. Continued growth of these firms, as well as future entrepreneurial ventures in this cluster, will be a key opportunity for the Wabash Heartland Region.

Cluster Market Prospects

Growth in specific market segments and technologies important to the Wabash Heartland Region are detailed as follows:

Market Outlook

Comprised of medical instruments, pharmaceuticals, ophthalmic goods, and biological R&D, this market has realized significant volatility over the past five years. However, recent investments from both federal and private parties into advanced biomedical technologies have proved to shore up demand. Looking toward the future, increasing domestic demand for biomedical products will help to further strengthen the market, as well as increased demand from emerging markets such as China and India. The high cost of medical products may lead to increased competition from abroad.

Key Drivers

- Aging and increasing life expectancy of the US population
- Increasing global population
- Demand from healthcare and social assistance
- Changing dynamics of private health insurance under the Affordable Care Act
- Federal funding for Medicare and Medicaid
- Process for Food and Drug Administration (FDA) approval and regulation of new and existing pharmaceuticals
- Biomedical research and development expenditures

Specific Market Segment Growth Forecasts

Growth in specific market segments and technologies important to the Wabash Heartland Region are detailed as follows:

Brand Name and Generic Pharmaceutical Manufacturing: These two sections of this US industry have had wildly different experiences over the past five years. As many drug patents expired over the 2010-2015 period, revenue for brand name pharmaceutical manufacturers dropped off sharply, while generic pharmaceutical manufacturers were able to start producing generic versions of high demand drugs. In the five years leading up to 2015, brand name pharmaceutical manufacturing revenue is expected to decline by an annualized 3.0 percent to $131.1 billion. Over the same period, generic

pharmaceutical manufacturing revenue is projected to grow at an annualized 4.5 percent reaching $61.0 billion.[20,21]

Over the next five years, revenue for brand name pharmaceutical manufacturing is expected to grow as manufacturers expand their portfolios to include products such as biologic drugs, leading to an expected annualized revenue growth of 2.9 percent and $151.0 billion in revenue. The high growth trend in generic pharmaceutical manufacturing is projected to hold during the same period, with revenue anticipated to reach $74.8 billion, growing at an annualized rate of 4.2 percent.[14,15]

Biotechnology and Other Biological Research: This US industry experienced significant volatility in the five years leading to 2015. Federal spending accounts for more than 50 percent of industry revenues, so the sequestration of 2013 and subsequent defense spending cuts had significant impact on revenues. However, recent federal spending on biotechnology research is expected to help the industry's revenue growth rate stay in the black. Revenue growth over the 2010-2015 period is expected to reach an average annual rate of 2.4 percent, leading to $140.2 billion in revenues. The next five years are projected to realize increased private investment as the economy strengthens, leading to expected industry revenues of $161.7 billion at an average annual rate of 2.9 percent.[22]

Glasses and Other Ophthalmic Goods Manufacturing: While technological advancements in contact lenses and other devices have helped to bolster revenues in this US industry, increasing competition from overseas has kept revenue from growing too quickly over the 2010-2015 period. Revenue is expected to reach $7.5 billion over this period at an annualized growth rate of 4.3 percent. The fastest growing downstream consumer in this industry is people aged 50 years and older. This consumer base is expected to grow in 2015, which, among other factors, will contribute to industry revenue increasing at an average annual rate of 2.8 percent over the 2015-2020 period to $8.7 billion.[23]

Medical Appliance and Instrument Manufacturing: New products, advances in technology, and increased demand have helped the US medical appliance and instrument manufacturing industry to achieve a revenue of $105.3 billion over the 2010-2015 period at an average annual growth rate of 2.9 percent. Revenues are expected to continue their upward climb, reaching $124.0 billion over the 2015-2020 time frame at annualized rate of 3.3 percent. As emerging markets expand their healthcare services, IBISWorld expects exports from this industry to increase over the 2015-2020 period to $30.3 billion at an annualized rate of 4.5 percent.[24]

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[20] IBISWorld, Brand Name Pharmaceutical Manufacturing in the U.S., 2015.
[21] IBISWorld, Generic Pharmaceutical Manufacturing in the U.S., 2015.
[22] IBISWorld, Scientific Research and Development in the U.S., 2015.
[23] IBISWorld, Glasses and Contact Lens Manufacturing in the U.S., 2015.
[24] IBISWorld, Medical Instrument and Supply Manufacturing in the U.S., 2015.

Value-Added Metals Processing

The Value-Added Metals Processing strategic area builds upon the commonality in inputs, processing, products, and supply chains among three specific industry clusters in the Wabash Heartland Region: 1) Automotive/Heavy Vehicle Equipment; 2) Metals Production and Related Manufacturing; and 3) Precision Metalworking.

Automotive/Heavy Vehicle Equipment

Overview

The cluster definition includes manufacturers and suppliers of automotive, trucks, heavy vehicles, and related parts and components (primarily within NAICS 3361-3363). It also includes some key fabricated metal components as 1st/2nd Tier suppliers. Major employers in the Wabash Heartland Region include Subaru of Indiana Automotive (SIA), Wabash National Corporation, TRW Automotive, NHK Seating, Caterpillar, Federal Mogul, Regal Beloit, and Oerlikon Fairfield.

Cluster Performance

Overall, the region's Automotive/Heavy Vehicle Equipment cluster has been impacted by the global restructuring of this industry, realizing a decline of 3.5 percent over the 2003-2013 period (Table 6). These declines, in part buoyed by steady growth within SIA earlier in the decade, have still significantly outpaced the industry cluster at the national level (declining by 18.2 percent). At more than 13,500 jobs, the Automotive/Heavy Vehicle Equipment cluster is the largest cluster in the Wabash Heartland Region.

Data reflecting post-recession growth, though significantly stronger than the overall U.S. industry, actually underrepresents the Wabash Heartland Region's Automotive/Heavy Vehicle Equipment cluster's true employment "rebound" after the Great Recession. Given the lead times and capital investment nature of the purchase of semi-trailers, the truck trailer manufacturing segment (NAICS 336212) actually lagged the overall recession by a couple years with its lowest employment numbers actually coming in 2011. Hence, employment in the region actually rebounded at an even higher level of approximately 4,000 jobs from the segment's recessionary trough.

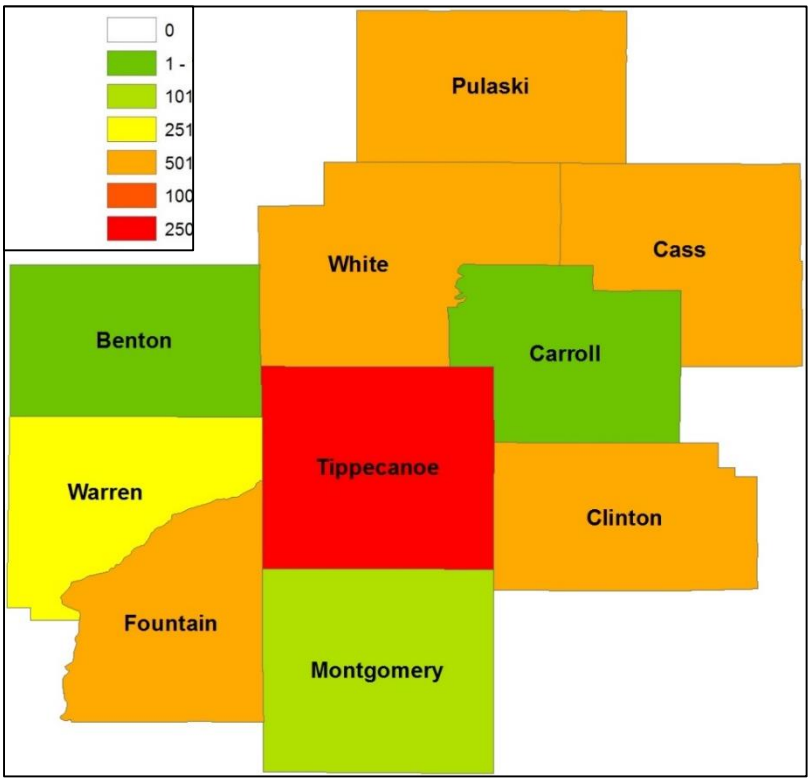
Table 6. Economic Summary for the Automotive/Heavy Vehicle Equipment Cluster

Performance	2013 Metrics				Recent Employment Performance		
	Estabs.	Employment	Average Wage	Location Quotient	Change Through Recession, 2003-2009	Change Post-Recession, 2009-2013	Total Decade Change, 2003-2013
Regional Performance	65	13,507	$54,976	9.54	-24.1%	27.2%	-3.5%
US Performance					-29.6%	16.1%	-18.2%

Source: Battelle analysis of IMPLAN QCEW data.

Figure 20 illustrates that Tippecanoe County accounts for a significant share of the Automotive/Heavy Vehicle Equipment cluster employment (more than 8,800 jobs). The cluster also provides significant employment throughout the region, accounting for more than 500 jobs in five additional counties.

Figure 20. Automotive/Heavy Vehicle Equipment – 2013 Cluster Employment by County



Cluster Opportunity

As the largest cluster in terms of total employment, the continued success and growth of the Automotive/Heavy Vehicle Equipment cluster is critical to the future of the Wabash Heartland Region. Though entrepreneurial activity is likely to be limited in such a mature industry cluster, opportunities exist for regional efforts to improve the supply chain and workforce for this cluster.

Cluster Market Prospects

Growth in specific market segments and technologies important to the Wabash Heartland Region are detailed as follows:

Market Outlook

The components of this market range from automobile electronics manufacturing to engines and motor home manufacturing. The economic downturn significantly hampered growth in this industry, however recent increases in consumer spending and exports have caused it to bounce back relatively well, with most sectors projected to realize strong revenue growth both over the 2010-2015 period and into the next five years. While exports are projected to decline due to the strengthening U.S. dollar, the industry is expected to remain strong.

Key Drivers

- World price of steel
- Demand for and from truck transportation
- Cost per gallon of gasoline and diesel fuel
- Demand from car and automobile manufacturing
- Regulation for the automotive sector

Specific Market Segment Growth Forecasts

Growth in specific market segments and technologies important to the Wabash Heartland Region are detailed as follows:

Automobile (Except Light Truck) Manufacturing: In the United States, historically low interest rates and increasing consumer sentiment over the 2010-2015 period lead to increased revenue in the automobile manufacturing industry. Industry revenue is expected to increase at an annualized rate of 9.0 percent, reaching $126.9 billion in the five years to 2015. Industry revenues are expected to keep their upward momentum over the next five years at an annualized growth rate of 1.9 percent leading to $139.4 billion in revenue over the 2015-2020 period. As the U.S. dollar grows stronger, exports are expected to slow. Exports from this industry are expected to grow at an annualized rate of 7.8 percent to a total of $22.2 billion over the years 2010-2015.[25]

[25] IBISWorld, Car and Automobile Manufacturing in the U.S., 2015.

Truck and Trailer Manufacturing: Because the U.S. truck and trailer manufacturing industry started from a low demand base due to the economic downturn, the expected revenue growth rates from 2010-2015 are quite strong, with revenue expected to reach $39.1 billion by 2015 with an annualized growth rate of 7.9 percent. IBISWorld expects industry revenue to increase at an annualized rate of 1.6 percent totaling $42.4 billion over the five years leading up to 2020, due in part to the potential growth in the recreational vehicle and motor home component of this industry sector.[26]

Demand for U.S. semi-truck trailer manufacturing was greatly depressed during the recession, but with the resurgence of trucking activity beginning in 2010, IBISWorld anticipates the trade value total in this section of the industry to reach $4.8 trillion over the 2010-2015 period at an annualized growth rate of 3.8 percent.[27]

Agricultural Equipment and Tractor Manufacturing: Thanks to the economic recovery and a strong agricultural sector over the past five years, the U.S. market for agricultural equipment and tractor manufacturing had an annual revenue growth of 3.3 percent over the 2010-2015 period. However, with crop prices declining in 2015, industry demand will slow, leading to an expected industry revenue decline of 5.0 percent to 44.5 billion in 2015. The projected annual revenue growth over the 2015-2020 period will be 3.4 percent, leading to revenue of $52.5 billion. Globally, emerging markets and innovations in technology will help to spur the demand for food as well as increase demand for agricultural equipment.[28]

Gear, Speed Changer, and Other Engine Component Manufacturing: Including both non-gasoline powered engines for large vehicles and power-generating equipment for utility plants, this industry's revenue growth depends primarily on the demand of diesel engines. Due to increased exports over the past five years, annualized industry revenue growth over the 2010-2015 period is expected to reach 9.9 percent, totaling $55.1 billion. In the United States, higher consumer spending will translate to increased investment in industrial equipment and diesel engines. Industry forecasts over the 2015-2020 period place revenue at $61.4 billion with an annualized growth rate of 2.2 percent.[29]

Miscellaneous Motor Vehicle Parts and Accessories Manufacturing: This industry suffered significant setbacks during the Great Recession due in large part to declining automobile sales. However, as U.S. demand for cars started to recover in 2010, the demand for auto parts increased as well. The trend is expected to continue, with industry revenue projected to increase to $58.9 billion over the 2010-2015 time frame, at an annualized growth rate of 4.6 percent. The recovery of the auto industry is expected to keep revenue growing in the auto parts manufacturing industry, with industry revenue expected to grow at an annualized rate of 2.3 percent reaching $66.1 billion in the five years leading up to 2020.[30]

Motor Vehicle Suspension and Steering System Manufacturing: During the recession, revenue in the U.S. motor vehicle suspension and steering system manufacturing industry fluctuated along with automobile demand. However, the aftermarket automotive parts section of this industry held strong during

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[26] IBISWorld, Truck, Trailer and Motor Home Manufacturing in the U.S., 2015.

[27] IBISWorld, Truck, Trailer and Motor Home Manufacturing in the U.S., 2015.

[28] IBISWorld, Tractors and Agricultural Machinery Manufacturing in the U.S., 2015.

[29] IBISWorld, Engine and Turbine Manufacturing in the U.S., 2015.

[30] IBISWorld, Auto Parts Manufacturing in the U.S., 2015.

the economic downturn as more people chose to fix their old cars rather than buy new ones. Toward the end of the 2010-2015 period, this industry realized increased revenues as disposable income increased, leading to an expected revenue of $14.0 billion over those five years at an annualized growth rate of 5.8 percent. With high consumer sentiment and automobile production on the rise, the next five years are expected to bring an annualized revenue growth of 1.8 percent to the industry, with revenues totaling $15.3 billion over the 2015-2020 period.[31]

Motor Vehicle Electric Equipment Manufacturing: Due to the recovery of the automobile manufacturing sector and advancements in technology, the U.S. motor vehicle electric equipment manufacturing industry is expected to realize revenues of $24.9 billion over the 2010-2015 period, with an annualized growth rate of 8.4 percent. Increasing domestic demand, as well as significant demand from Mexican automobile manufacturing operations, is expected to keep revenue growth strong, with an estimated annualized growth rate of 4.1 percent over the 2015-2020 period, leading to revenues of $30.5 billion.[32]

Metals Production and Related Manufacturing

Overview

The Wabash Heartland Region Metals Production and Related Manufacturing cluster consists of both primary metals production and related downstream and value-added fabrication. Specifically, the cluster is focused on steel production and fabrication, aluminum extrusion, and copper wire manufacturing. Major employers in the region include Nucor Steel, Alcoa, Nanshan America AAT, Harrison Steel Castings, Tube Fabrication Industries, and REA Magnet Wire Company.

Cluster Performance

Employment in the Metals Production and Related Manufacturing cluster reached nearly 3,600 in 2013 (Table 7). The cluster reflects an extremely specialized employment base at over five times more concentrated in the Wabash Heartland Region than nationally (LQ = 5.22). Though somewhat experiencing the national decline in “metals” leading into and through the recession, regional employers weathered the recession significantly better than national industry, with post-recession gains outpacing the nation.

[31] IBISWorld, Automobile Steering and Suspension Manufacturing in the U.S., 2015.

[32] IBISWorld, Automobile Electronics Manufacturing in the U.S., 2015.

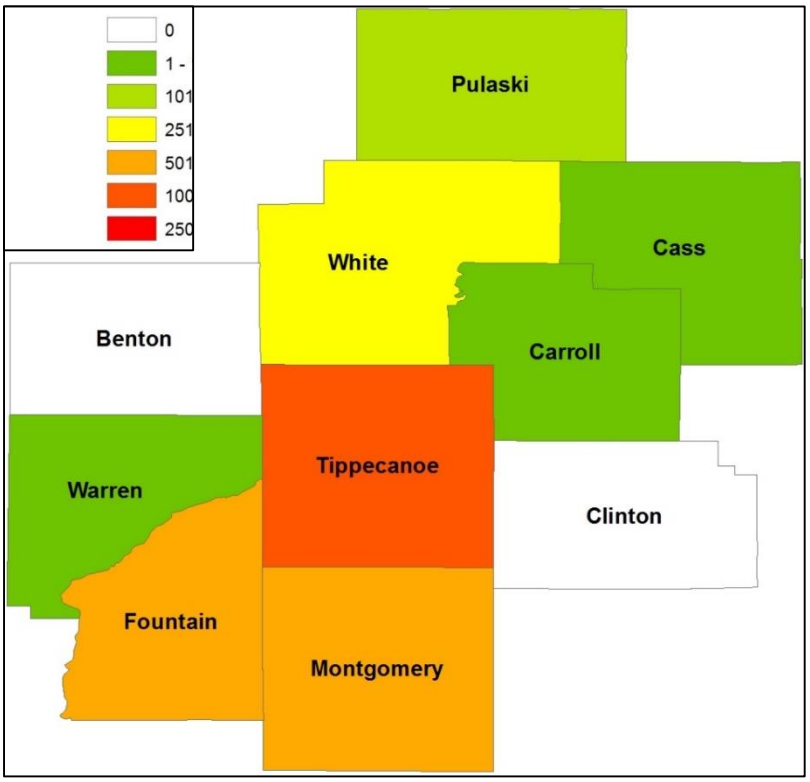
Table 7. Economic Summary for the Metals Production and Related Manufacturing Cluster

Performance	2013 Metrics				Recent Employment Performance		
	Estabs.	Employment	Average Wage	Location Quotient	Change Through Recession, 2003-2009	Change Post-Recession, 2009-2013	Total Decade Change, 2003-2013
Regional Performance	27	3,586	$62,985	5.22	-2.0%	10.3%	8.1%
US Performance					-16.5%	7.2%	-10.5%

Source: Battelle analysis of IMPLAN QCEW data.

As presented in Figure 21, over 1,000 jobs in the Metals Production and Related Manufacturing cluster are located in Tippecanoe County. Fountain and Montgomery counties each account for at least 500 cluster jobs.

Figure 21. Metals Production and Related Manufacturing – 2013 Cluster Employment by County



Cluster Opportunity

The investments in and the strong performance of the Wabash Heartland Region's Metals Production and Related Manufacturing cluster over the last ten years indicates a cluster that is poised to perform well into the future. The diversification in the types of metals involved in the cluster further stabilizes the region's cluster against raw material-oriented economic shocks. Similar to the Automotive/Heavy Vehicle Equipment cluster, opportunities exist to further grow the cluster via workforce development activities in the region.

Cluster Market Prospects

Growth in specific market segments and technologies important to the Wabash Heartland Region are detailed as follows:

Market Outlook

With the recession halting many construction efforts for a time, this market realized both significant dips then surges in demand for its products over the past five years leading to 2015. Since metals are the primary input for many segments of this market, the fluctuating world price of metals contributed to changes in revenue growth over the 2010-2015 period. The strengthening of the auto industry helped to grow revenues in this market, albeit not without its own set of "ups and downs" over the same period. This market also relies heavily on demand from the construction industry, which is poised to grow in the coming years, boding well for the U.S. materials production and related manufacturing market.

Key Drivers

- World price of steel, copper, aluminum, and iron ore
- Demand from automobile and truck manufacturing
- Government funding for highways and other infrastructure projects
- Housing starts and the value of non-residential construction
- Price of electric power

Specific Market Segment Growth Forecasts

Growth in specific market segments and technologies important to the Wabash Heartland Region are detailed as follows:

Aluminum Product Manufacturing: The U.S. aluminum product manufacturing industry was significantly impacted by the recession and the subsequent slow recovery over the past five years. Revenue increased sharply from 2010 to 2011, but fell in 2012 as economic stability issues emerged in domestic markets and emerging economies. The recent increase in industrial production is expected to help the industry reach the end of the 2010-2015 period on a high note, with industry revenues projected to grow at an annualized 3.5 percent to $43.4 billion. The next five years are expected to bring increased

demand from automakers and emerging markets, with industry revenues anticipated to reach $49.6 billion over the 2015-2020 period at an average annual rate of 2.7 percent.[33]

Iron and Steel Mills: The past five years have been quite volatile for the U.S. iron and steel milling industry. The economic recovery in 2010 brought increasing industry revenues as demand for steel products from the automobile and construction industries grew; however, this trend reversed in 2012 with increasing uncertainty about the health of the US economy and a global surplus in steel causing revenues to fall. IBISWorld expects industry revenues over the 2010-2015 period to reach $106.3 billion at an annualized rate of 0.5 percent. The next five years are just as uncertain for this industry. Projected increases in import competition will cut into industry profits, while an expected increase demand for steel products and the cost of steel may boost industry revenue. Over the 2015-2020 period industry revenue is expected to grow at an annualized rate of 0.8 percent to reach $110.8 billion.[34]

Steel and Ferrous Metal Foundry Products: With the recent recovery of the U.S. manufacturing industry, as well as the slow recovery of the US construction industry, revenue in the U.S. steel and ferrous metal foundry products industry has grown significantly compared to its recessionary levels. Industry revenue is projected to reach $20.8 billion over the 2010-2015 period at an average annual rate of 3.1 percent. It is expected that over the next five years the industry will face increased competition from abroad as well as from domestic non-ferrous material-casting producers. However, increased demand from the energy, mining, and manufacturing sectors are expected to boost industry revenues, which are projected to grow at an annualized rate of 3.8 percent to $25.1 billion over the 2015-2020 period.[35]

Fabricated Copper Production: The largest product segment in this U.S. industry is copper wire, sheets, and strips at 38.5 percent. Revenue in this industry closely follows construction and manufacturing activities. As such, the five years leading to 2014 realized industry revenues plummet and then rebound as domestic construction and manufacturing fluctuated as well as demand from emerging markets. Over the 2009-2014 period, industry revenue is expected to reach $23.2 billion at an annualized rate of 8.1 percent. With the anticipated growth in manufacturing, automotive, electronics, and appliance industries, revenue over the 2014-2019 time frame is expected to continue its upward trend to reach $25.3 billion at an annualized rate of 1.8 percent.[36]

Fabricated Structural Metal Products Manufacturing: Revenue in this U.S. industry is attached to demand from utility, infrastructure, and non-residential construction as well as the price of metals. Over the five years leading to 2015, non-residential construction activity grew, which increased demand for structural metal products. Demand from the infrastructure sector was volatile as a number of federal initiatives started and then stalled. Overall, industry revenue is predicted to reach $43.8 billion over the 2010-2015 period at an annualized rate of 3.1 percent. Increased demand from non-residential construction projects is expected to keep revenues growing in this industry, with revenues anticipated to grow at an annual average of 2.7 percent to $50.1 billion over the 2015-2020 period.[37]

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[33] IBISWorld, Aluminum Manufacturing in the U.S., 2015.

[34] IBISWorld, Iron and Steel Manufacturing in the U.S., 2015.

[35] IBISWorld, Ferrous Metal Foundry Products in the U.S., 2015.

[36] IBISWorld, Copper Rolling, Drawing and Extruding in the U.S., 2014.

[37] IBISWorld, Structural Metal Product Manufacturing in the U.S., 2015.

Precision Metalworking

Overview

As an integral supplier and typically limited volume producer, the Precision Metalworking cluster includes firms engaged in smaller scale metal stamping, spring manufacturing, precision machining, and machine tool components, tools, and dies. Key employers in the Wabash Heartland Region include Small Parts, Inc., LEP Special Fasteners, Lafayette Wire Products, Kirby Risk Precision Machining, Myers Springs, and Matthew Warren Spring.

Cluster Performance

The Wabash Heartland Region's Precision Metalworking cluster currently stands at just under 1,800 workers (Table 8). The Great Recession impacted the regional industry cluster somewhat harder than the industry nationally. Post-recession growth in the regional cluster, while strong, still lags the national industry growth by nearly 5 percent. Even with the employment declines over the last decade, the Precision Metalworking cluster is still highly concentrated in the region with a location quotient of 2.74, indicating it is approaching three times as concentrated as the cluster is nationally.

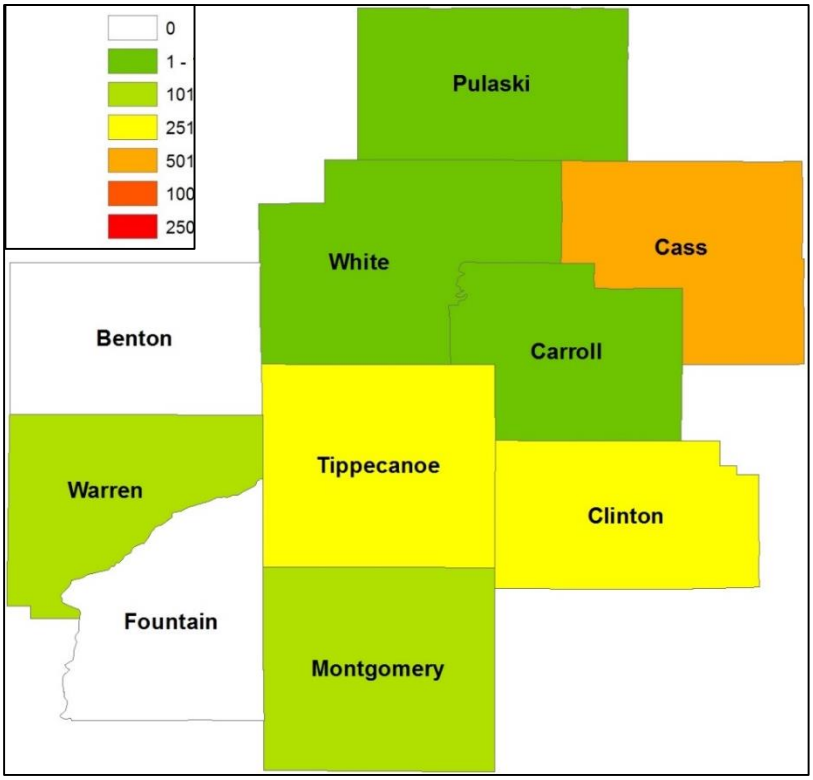
Table 8. Economic Summary for the Precision Metalworking Cluster

Performance	2013 Metrics				Recent Employment Performance		
	Estabs.	Employment	Average Wage	Location Quotient	Change Through Recession, 2003-2009	Change Post-Recession, 2009-2013	Total Decade Change, 2003-2013
Regional Performance	66	1,771	$43,643	2.74	-15.8%	10.6%	-6.9%
US Performance					-12.8%	15.4%	0.6%

Source: Battelle analysis of IMPLAN QCEW data.

Figure 22 illustrates a fairly diverse geographic footprint for the Wabash Heartland Region Precision Metalworking cluster as only one county, Cass County, has more than 500 jobs in the cluster and four other counties have between 100 and 500 workers.

Figure 22. Precision Metalworking – 2013 Cluster Employment by County



Cluster Opportunity

The Precision Metalworking cluster consists of a number of smaller firms providing metalworking products and services to customers within the region and beyond. These smaller firms typically rely on the local and regional support network much more than larger national and multinational firms. Providing support to these firms' growth needs in terms of capital, training, and workforce development, and market access represent key opportunities for cluster and regional intermediaries.

Cluster Market Prospects

Growth in specific market segments and technologies important to the Wabash Heartland Region are detailed as follows:

Market Outlook

The U.S. precision metalworking market produces goods that are in demand in a number of industries including the aerospace, automotive, defense, and construction industries. The economic recovery that started in 2010 has had a significant positive impact in this market as downstream consumers respond to increasing demand. Looking ahead, the anticipated increase in the cost of steel will allow for players in this market to further increase revenue by passing the cost to downstream consumers. Increased competition from imports will likely be an issue, while increased demand from primary consumers will help to buoy market revenue.

Key Drivers

- Upstream demand for cluster products and services (especially from other regional clusters)
- Aggregate private investment
- World price of steel and other material inputs

Specific Market Segment Growth Forecasts

Growth in specific market segments and technologies important to the Wabash Heartland Region are detailed as follows:

Machine Shops: Rebounding demand in the private aerospace, defense, and transportation manufacturing sectors has led to yearly revenue growth in the U.S. machine shops industry from 2010-2015. Even though defense spending dropped off in the last part of that period, it did so gradually, allowing the industry to adequately shift to other markets to keep positive growth. Industry revenue is expected to grow at an annualized rate of 5.5 percent over the five years leading to 2015, with revenue reaching $47.5 billion. Heavy machinery manufacturers and other manufacturing sectors are expected to grow in the five years to 2020. This increase in demand for machined products, along with similar increases in demand from the medical devices and satellite manufacturing sectors will serve to boost revenue growth over the 2015-2020 period. Industry revenue is expected to reach $57.3 billion over the next five years growing at an annualized rate of 3.8 percent.[38]

Metal Nut, Bolt, and Other Industrial Fastening Production: This U.S. industry generally manufactures two kinds of products: generic fasteners and precision-manufactured fasteners, with the latter making up the largest segment of products in this industry. Over the past five years heightened activity in the construction and automobile and other machinery manufacturing sectors has increased demand for industrial fasteners. However, revenue gains in this industry have originated primarily from precision manufactured products as product standardization has cut into revenues from more generic fasteners. IBISWorld estimates that industry revenue will reach $31.8 billion over the 2010-2015 period at an annualized rate of 5.8 percent. Over the next five years, imports from Taiwan and China are expected to increase, but will most likely impact generic fastener revenue the most. Increased demand from manufacturing and construction industries as well as the forecast increase in steel prices is estimated to lift industry revenue to $37.7 billion at an annualized 3.4 percent over the 2015-2020 period.[39]

Heavy/Light Gauge Spring and Wire Manufacturing: The recovery of the certain downstream consumers, especially the automotive industry, has spurred demand growth in the U.S. heavy and light gauge and wire manufacturing industry over the past five years. However, cheaper imports from competitors in China and Mexico have served to keep revenue growth low in this industry. IBISWorld expects industry revenue to reach $10.0 billion over the 2010-2015 period, growing at an annualized rate of 0.8 percent. Foreign competition and rising purchasing costs will continue to be an issue for this industry over the next five years, while demand from the automotive sector is expected to increase.

[38] IBISWorld, Machine Shop Services in the U.S., 2015.

[39] IBISWorld, Screw, Nut and Bolt Manufacturing in the U.S., 2015.

Industry revenue is projected to grow at an annualized rate of 1.4 percent over the 2015-2020 period, with revenue reaching $10.7 billion.[40]

Metal Closure Stamping and Forging: Firms in the defense equipment and aerospace industries (among others) demand the roll formed, forged, and stamped metal products that this U.S. industry provides. With the recovery of industrial manufacturing sector since 2010, industry revenue has increased at an annualized rate of 2.0 percent, reaching $38.5 billion over the 2010-2015 period. With an expected increase in metal prices as well as increased demand for value-added metal products from the private aerospace and other market sectors, this industry is anticipated to grow at an annualized rate of 4.8 percent to $48.7 billion over the 2015-2020 period.[41]

Key Support Clusters

The final strategic cluster development area for the Wabash Heartland Region includes two distinctive clusters (Engineering, Technical, and Design Services and Packaging Products) that provide products and services as inputs in support of the region's other key clusters.

Engineering, Technical, and Design Services

Overview

The Engineering, Technical, and Design Services cluster in the Wabash Heartland Region includes a broad array of engineering and related companies, many with connections to Purdue University, extending into architectural, design, and environmental consulting activities. Significant employers include Engineering Innovation, Inc. and P.C. Krause and Associates—both engineering service firms. Numerous smaller and/or emerging technology companies are also classified and included in this cluster including En'Urga, Omega Micro Technologies, and Indiana Microelectronics.

Cluster Performance

Unlike the other seven clusters included within the three strategic areas, the Engineering, Technical, and Design Services cluster is currently small (only 500 total employees) (Table 9). However, this cluster has shown important growth throughout the entire 2003-2013 period, with especially strong post-recession growth—growing 13 percent faster than the US cluster overall.

[40] IBISWorld, Wire and Spring Manufacturing in the U.S., 2015.
[41] IBISWorld, Metal Stamping and Forging in the U.S., 2015.

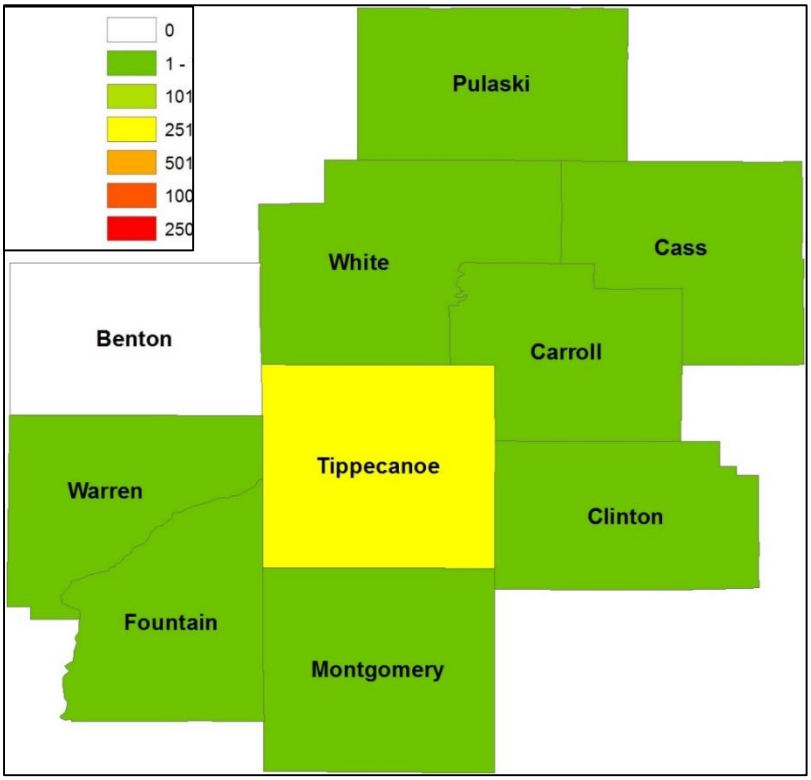
Table 9. Economic Summary for the Engineering, Technical, and Design Services Cluster

Performance	2013 Metrics				Recent Employment Performance		
	Estabs.	Employment	Average Wage	Location Quotient	Change Through Recession, 2003-2009	Change Post - Recession, 2009-2013	Total Decade Change, 2003-2013
Regional Performance	102	500	$55,311	0.28	13.5%	16.9%	32.7%
US Performance					13.5%	5.5%	19.7%

Source: Battelle analysis of IMPLAN QCEW data.

Though Tippecanoe County has a slightly higher share of this cluster, its geographic diversity provides employment opportunities throughout the region (Figure 23).

Figure 23. Engineering, Technical, and Design Services – 2013 Cluster Employment by County



Cluster Opportunity

The Engineering, Technical, and Design Services cluster provides both integral support services to regional manufacturers and other consumers. Furthermore, this cluster is most tied to non-biomedical engineering and technology start-ups in the Wabash Heartland Region. In this context, opportunities exist to grow the clusters existing firms as well as launch new entrepreneurial ventures, especially leveraging the engineering and technological strengths of Purdue University.

Cluster Market Prospects

Growth in specific market segments and technologies important to the Wabash Heartland Region are detailed as follows:

Market Outlook

This market, which includes architectural and engineering services as well as a number of consulting services, has been able to weather the past five years well. While engineering services slowed during the recession, increased demand for construction and easier access to credit has allowed this and other industry sectors to grow. Government investment, which is projected to increase in 2015, is an important driver in this market, especially in the scientific and consulting services sectors. With increased attention given to testing, feasibility studies, and ecological building practices, this industry is expected to realize strong growth in the future.

Key Drivers

- Demand from key industrial customers, especially those within regional clusters
- Construction spending will drive both architectural and some types of engineering services
- Consumer spending
- Overall R&D expenditures and demand
- Government consumption and investment

Specific Market Segment Growth Forecasts

Growth in specific market segments and technologies important to the Wabash Heartland Region are detailed as follows:

Engineering Design and Development Services: Due mostly to limited private investment over the 2010 to 2015 period, the U.S. engineering design and development services industry is expected to realize revenues decline by an average annual rate of 0.7 percent over this period, resulting in expected revenues of $189.9 billion. 2015 is projected to realize increases in the value of private non-residential construction, which is expected to increase industry revenue for that year by 4.5 percent. Looking ahead, the strengthening economy is expected to result in continued increased demand for non-residential

construction and “green” buildings over the next five years. Industry revenues are anticipated to grow at an average rate of 3.8 percent, leading to $229.2 billion over the 2015-2020 period.[42]

Architectural Design Services: The major drivers of revenue in this U.S. industry are commercial and institutional development, which is expected to increase in 2015. Industry revenue is projected to reach $36.3 billion over the 2010-2015 period, reaching an average annual growth rate of 2.9 percent. Downstream construction demand from both residential and non-residential markets are expected to increase as credit becomes more accessible, increasing demand in this industry over the five years leading to 2020. Revenue is anticipated to grow at an average annual rate of 4.0 percent, leading to revenues of $44.1 billion.[43]

Physical, Chemical, and Other Testing Services: The health and safety of consumer goods has become an increasingly important issue in the United States. As a result, the U.S. physical, chemical, and other testing services industry has grown over the past five years to meet the increased demand. Industry revenue is expected to reach $17.1 billion over the 2010-2015 period at an average annual rate of 2.3 percent. Public and private R&D spending is expected to increase over the next five years, leading to products that need to be thoroughly tested before reaching the market. Increased government regulations is also expected, which, along with increased R&D spending, is projected to increase industry revenue to $20.3 billion at an annualized rate of 3.5 percent.[44]

Scientific, Technical, and Other Consulting Services: Given the varied markets in which this industry is involved, the U.S. scientific, technical, and other consulting services industry was able to weather the recessionary period extremely well. Increased demand for feasibility and other studies from energy and mining firms aided the industry’s revenue growth, which is projected at an average annual rate of 5.0 percent over the 2010-2015 period, leading to $28.9 billion in revenue. The future for this industry is bright, as growth in mining, farming, and private businesses increase demand for this industry’s services, as well as increased federal spending. Industry revenue is anticipated to reach $34.8 billion over the 2015-2020 time frame, growing at an annualized rate of 3.8 percent.[45]

Packaging Products

Overview

The Packaging Products cluster is an “inter-related” industry cluster focused on manufacturing a variety of packaging solutions, including wood and corrugated cardboard containers, metal cans, plastic bottles, and closures (lids and bottle caps). Wabash Heartland Region firms in this cluster serve both regional and national customers. Major regional employers include Closure Systems International, Ball Corporation, DrugPlastics, American Fibertech Corporation, and a corrugated cardboard operation of International Paper.

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[42] IBISWorld, Engineering Services in the U.S., 2015.

[43] IBISWorld, Architects in the U.S., 2015.

[44] IBISWorld, Laboratory Testing Services in the U.S., 2015.

[45] IBISWorld, Scientific and Economic Consulting in the U.S., 2015.

Cluster Performance

The Wabash Heartland Region Packaging Products cluster accounted for nearly 1,800 workers in 2013 (Table 10). Heading into and through the Great Recession, the regional cluster had above average employment declines (declining by 28.4 percent). These declines have been largely offset by significant post-recession growth of nearly 33 percent, exceeding the U.S. cluster's recovery by 31 percent. Overall, the cluster experienced a net decline from 2003-2013, but its recent performance has it setup for future growth and success.

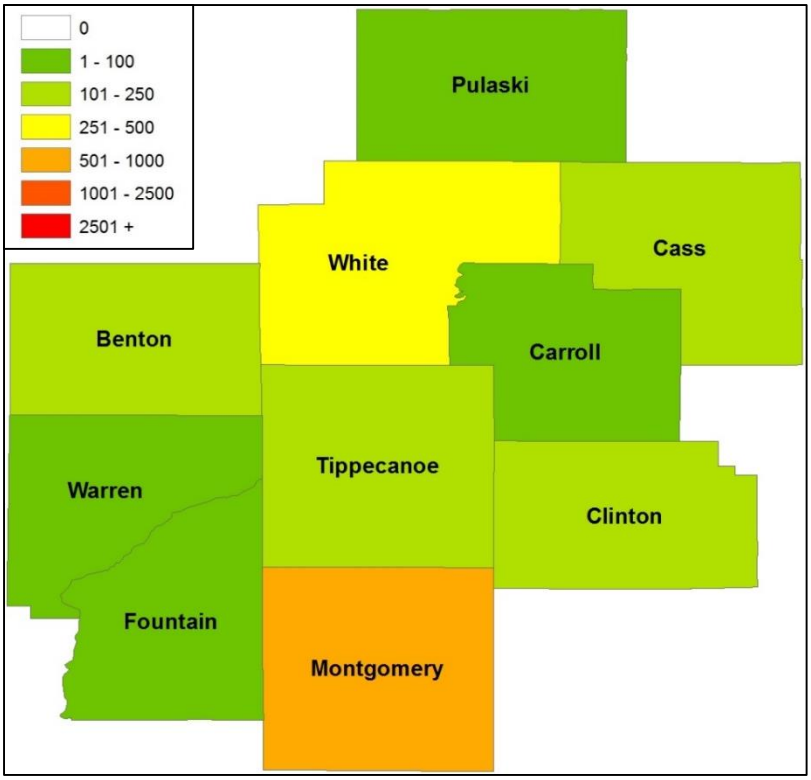
Table 10. Economic Summary for the Packaging Products Cluster

Performance	2013 Metrics				Recent Employment Performance		
	Estabs.	Employment	Average Wage	Location Quotient	Change Through Recession, 2003-2009	Change Post-Recession, 2009-2013	Total Decade Change, 2003-2013
Regional Performance	29	1,775	$43,849	2.56	-28.4%	32.7%	-5.0%
U.S. Performance					-20.2%	1.7%	-18.8%

Source: Battelle analysis of IMPLAN QCEW data.

Figure 24 illustrates the broad geographic diversity of the Packaging Products cluster in the Wabash Heartland Region.

Figure 24. Packaging Products – 2013 Cluster Employment by County



Cluster Opportunity

The diverse nature of the Wabash Heartland Region Packaging Products cluster, both in terms of the type and technologies of the actual packaging products as well as the industries and markets these firms serve, should serve the cluster well and provide for continued opportunities for growth.

Cluster Market Prospects

Growth in specific market segments and technologies important to the Wabash Heartland Region are detailed as follows:

Market Outlook

Since goods in this market are used by a multitude of different U.S. industries, demand from those downstream consumers drive revenue in the packaging products market. Because of the resurgence of manufacturing activities in the United States, many of the industry components in this market are expected to realize moderate to strong growth during the past five years and into the next. However, shifts in consumer demand in certain downstream markets can have significant impact on this market. Shifts away from sugary drinks will have impacts on the aluminum can manufacturing sector, as well as shifts towards moving goods in plastic containers as opposed to wood containers over health concerns.

Key Drivers

- Demand from key customer markets (e.g., food processing, various manufactured products, miscellaneous consumer products, wholesale and distribution activities)
- Consumer spending
- Level of foreign competition in component segments (e.g., corrugated cardboard boxes, pallets)
- Key input prices (e.g., price of plastics/resins, wood pulp, aluminum)

Specific Market Segment Growth Forecasts

Growth in specific market segments and technologies important to the Wabash Heartland Region are detailed as follows:

Plastic Bottle and Container Manufacturing: Driven by the end-use requirements of the markets served by companies in this industry, a variety of plastic compounds (e.g., high density polyethylene [HDPE], polyethylene terephthalate [PET], polyvinyl chloride [PVC]) are used to make plastic bottles and plastic containers for the food and beverage, consumer products, pharmaceutical, and the chemicals/additives industries. U.S. industry revenue is expected to reach $12.0 billion in 2015, down 6.9 percent from 2014. This revenue decline is somewhat deceiving in that substantial decline in raw material inputs during the period has lowered the cost of products from this industry. In fact, industry value-added figures, which remove the effect of input costs, show an increase of 4.5 percent from 2014-2015. Revenue forecasts for the industry show an annual 2.2 percent growth from 2015 to 2020.[46]

Wood Pallets, Skids, and Container Production: This U.S. industry produces wood pallets, boxes, and other containers that are used extensively in a number of industries to house and transport products, including the pharmaceutical, automobile, and fruit and vegetable industries. Manufacturing in these industries slowed significantly during the recession, but has recently rebounded toward the end of the 2009-2014 period. This increased demand for wood container and transport products is expected to increase industry revenue to $7.4 billion over this period, growing at an annualized 2.7 percent. With manufacturing anticipated to continue increasing over the five years to 2019, revenue in this industry is expected to grow at an annualized 1.9 percent to $8.1 billion. The industry could realize increased competition from plastic, paper, and metal skids and containers over this period as demand for more lightweight containers and pallets increases.[47]

Light Metal or Steel Can Manufacturing: Demand from the beverage industry, especially from soft drink and beer companies, made up over half of total revenue in this industry in 2015. However, as consumer's move away from sugary drinks, this change has reduced demand for aluminum cans. Conversely, there has been increased demand over the past five years from breweries and ice tea manufacturers. However, reduced demand from this industry's primary consumers during the 2010-2015 period is expected to cause revenue to decline by an annualized 0.4 percent to $19.7 billion. With declining demand for soft drinks and alcohol, as well as increased competition from plastic producers will

[46] IBISWorld, Plastic Bottle Manufacturing in the U.S., 2015.
[47] IBISWorld, Wood Pallets and Skids Production in the U.S., 2014.

serve to keep growth low over the next ten years. Revenue in this industry is projected to grow at an annualized 0.8 percent to $20.5 billion over the 2015-2020 time frame.[48]

Corrugated and Solid Cardboard Container Manufacturing: Cardboard is the most commonly used form of packaging in the United States. The nation's corrugated and solid cardboard container manufacturing industry experienced a decline in revenue growth in 2009, but with the post-recession resurgence of the food manufacturing and other sectors industry revenue is expected to grow moderately over the 2010-2015 period at an annual rate of 2.2 percent to $61.7 billion. Increased demand from certain downstream industries, as well as slow growth in the prices of key inputs over the next five years is expected to boost industry revenues to $66.7 billion at an annualized rate of 1.6 percent over the 2015-2020 period.[49]

Cluster-Focused Workforce Needs

Cluster Staffing Patterns

A requisite component of building upon and enhancing the regional economic opportunities presented by these key industry clusters is ensuring that the regional workforce is able to meet the various clusters' employment needs and requirements.

One approach to identifying key occupations and skill sets within an industry cluster is to examine cluster "staffing patterns," or the occupational employment and concentration found within the cluster. To perform this examination, Battelle utilized the National Industry-Occupational Employment Matrix (from the US Bureau of Labor Statistics) and aligned it with the eight key targeted clusters identified for the Wabash Heartland Region. Within these data, "key cluster occupations" were identified as those occupations that represent at least a 1.9 percent share of national cluster employment.[50] In total, 49 specific occupations meet this threshold for one or more of the Wabash Heartland Region clusters. While specific cluster activities and skill mix will differ at a regional vs. national level, this approach generally aligns extremely well and allows for key insights into the demand for talent within a region's clusters. Table 11 presents the three largest occupations for each cluster.

[48] IBISWorld, Metal Can and Container Manufacturing in the U.S., 2015.

[49] IBISWorld, Cardboard Box and Container Manufacturing in the U.S., 2015.

[50] Detailed occupational data is not available for detailed industry sector on a statewide or sub-state level. Therefore, detailed national level industry-occupational data are used to understand the occupational structure of the defined key clusters.

Table 11. Three Largest Occupational Shares by Key Targeted Cluster

Target Clusters	Largest Key Cluster Occupations (based upon National data)	Occ. Share of Employment
Agbiosciences	Sales Representatives, Except Technical and Scientific Products	10.3%
	Laborers and Freight, Stock, and Material Movers, Hand	5.1%
	General and Operations Managers	2.9%
Biomedical Sciences	Team Assemblers	3.0%
	Medical Scientists, Except Epidemiologists	2.7%
	Electrical and Electronic Equipment Assemblers	2.1%
Food Processing and Manufacturing	Packaging and Filling Machine Operators and Tenders	8.5%
	Food Batchmakers	6.1%
	Packers and Packagers, Hand	4.4%
Automotive/Heavy Vehicle Equipment	Team Assemblers	16.4%
	Welders, Cutters, Solderers, and Brazers	3.8%
	Machinists	3.6%
Metals Production and Related Manufacturing	Welders, Cutters, Solderers, and Brazers	7.1%
	First-Line Supervisors of Production and Operating Workers	4.3%
	Team Assemblers	4.3%
Precision Metalworking	Machinists	19.1%
	Computer-Controlled Machine Tool Operators, Metal and Plastic	6.7%
	First-Line Supervisors of Production and Operating Workers	4.2%
Engineering, Technical, and Design Services	Management Analysts	6.4%
	Civil Engineers	5.3%
	General and Operations Managers	3.4%
Packaging Products	Team Assemblers	7.2%
	Paper Goods Machine Setters, Operators, and Tenders	5.2%
	Molding, Coremaking, and Casting Machine Setters, Operators, and Tenders, Metal/Plastic	5.1%

Source: Battelle analysis of OES data from the Indiana Dept. of Workforce Development; data are those for IDWD Region 4.

There are no occupations considered “key” across all eight targeted clusters. Only one occupation, Inspectors, Testers, Sorters, Samplers, and Weighers is a key occupation in six clusters, with four additional occupations considered to be a key occupation within five clusters. Table 12 presents the 22 key cluster occupations playing an important role across more than one Wabash Heartland Region targeted cluster. Twenty-seven (27) occupations are considered to be a key cluster occupation within a single cluster.

Table 12. Metrics for Key Cluster Occupations Within Two or More Wabash Heartland Region Targeted Clusters

Key Cluster Occupations for Wabash Heartland Region	Major Occupational Grouping	# of Key Clusters	Occ. Specialized in Region	Occ. Growing in Region (2010-14)
Inspectors, Testers, Sorters, Samplers, and Weighers	Production	6	No	Yes
First-Line Supervisors of Production and Operating Workers	Production	5	Yes	Yes
General and Operations Managers	Management	5	No	Yes
Laborers and Freight, Stock, and Material Movers, Hand	Transportation and Material Moving	5	No	Yes
Team Assemblers	Production	5	Yes	Yes
Helpers – Production Workers	Production	4	Yes	No
Sales Representatives, Except Technical and Scientific Products	Sales	4	No	No
Cutting, Punching, and Press Machine Setters, Operators, and Tenders	Production	3	Yes	No
Industrial Machinery Mechanics	Installation and Maintenance	3	Yes	Yes
Machinists	Production	3	Yes	Yes
Maintenance and Repair Workers, General	Installation and Maintenance	3	No	No
Mechanical Engineers	Engineering	3	Yes	Yes
Office Clerks, General	Office and Administrative	3	No	No
Welders, Cutters, Solderers, and Brazers	Production	3	Yes	Yes
Computer-Controlled Machine Tool Operators, Metal and Plastic	Production	2	Yes	Yes
Customer Service Representatives	Office and Administrative	2	No	No
Extruding and Drawing Machine Setters, Operators, and Tenders	Production	2	Yes	Yes
Industrial Truck and Tractor Operators	Transportation and Material Moving	2	Yes	Yes
Molding/Casting Machine Setters, Operators, and Tenders, Metal and Plastic	Production	2	Yes	No
Packaging/Filling Machine Operators and Tenders	Production	2	No	No
Packers and Packagers, Hand	Transportation and Material Moving	2	Yes	No
Shipping, Receiving, and Traffic Clerks	Office and Administrative	2	No	No

Source: Battelle analysis of OES data from the Indiana Dept. of Workforce Development; data are those for IDWD Region 4.

Among these 49 key cluster occupations, 15 are considered to be both “specialized” in their regional concentration as well as “growing over the economic recovery” (since 2010) (Table 13). These 15 key cluster occupations represent a broad set of skills and skill levels, ranging from mechanical engineers to

inspectors/testers, to truck drivers, and assemblers. It is important to note that five of these 15 key cluster occupations are essential for a Wabash Heartland Region industry cluster.

Table 13. Specialized and Growing Key Cluster Occupations in the Wabash Heartland Region

Key Cluster Occupation	Regional Occupational Concentration	Regional Occupational Growth	# of Key Clusters
Extruding and Drawing Machine Setters, Operators, and Tenders, Metal and Plastic	6.95	115%	1
Tool and Die Makers	4.46	29%	1
Team Assemblers	4.24	25%	5
Computer-Controlled Machine Tool Operators, Metal and Plastic	2.99	94%	2
Mechanical Engineers	2.37	31%	3
Industrial Machinery Mechanics	2.33	39%	3
Machinists	2.27	54%	3
Industrial Truck and Tractor Operators	2.18	17%	2
First-Line Supervisors of Production and Operating Workers	2.04	14%	5
Welders, Cutters, Solderers, and Brazers	2.02	23%	3
Inspectors, Testers, Sorters, Samplers, and Weighers	1.96	38%	6
Lathe and Turning Machine Tool Setters, Operators, and Tenders, Metal and Plastic	1.62	11%	1
Heavy and Tractor-Trailer Truck Drivers	1.38	25%	1
Electrical and Electronic Equipment Assemblers	1.27	52%	1
Food Batchmakers	1.20	5%	1

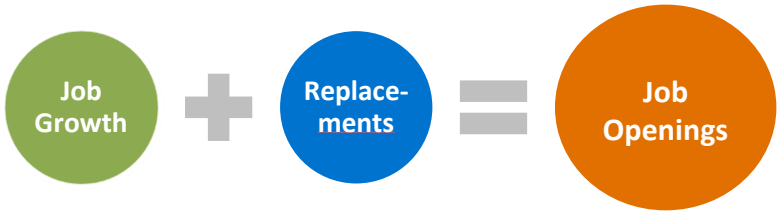
Source: Battelle analysis of OES data from the Indiana Dept. of Workforce Development; data are those for IDWD Region 4.

Workforce Demanded by Clusters

Expected regional "demand" for workers can be gauged using regional occupational employment projections, which are translated into annual job openings. Labor demand includes not only the growth of new jobs as an economy or individual sector expands, but also job openings due to replacements (Figure 25).

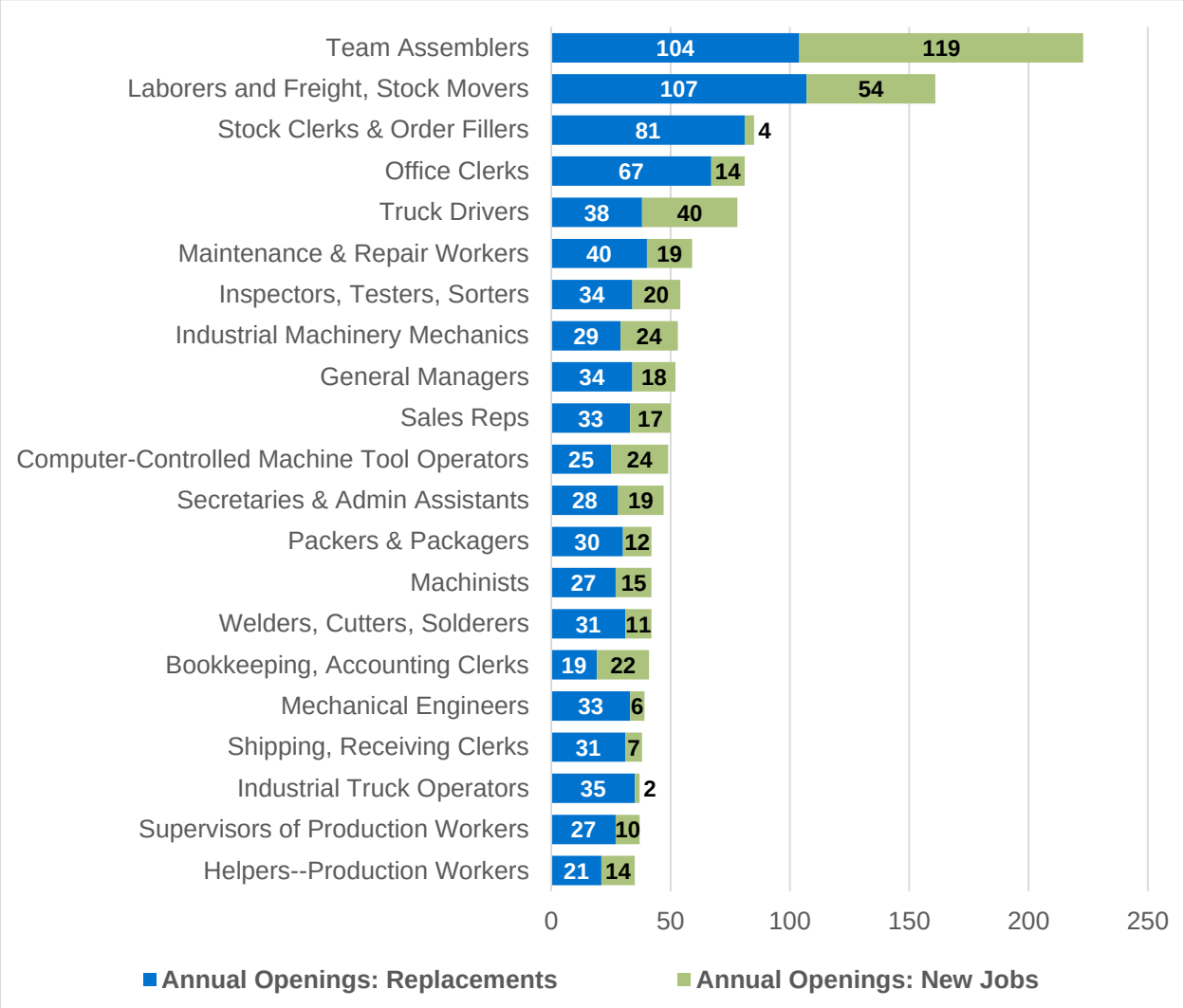
Regional labor "supply" can be gauged using recent post-secondary graduates from local institutions and occupations can be aligned with degree fields most relevant. While it is acknowledged that recent graduates do not typically possess much, if any, experience and likely cannot qualify for many openings; this is one way to assess general alignment with a region's occupational demand and to highlight potential misalignments into the future.

Figure 25. Components of Job Openings



As presented in Figure 26, among the key cluster occupations spanning more than one regional cluster, nine have projected annual job openings of 35 or more, with assembly jobs and freight and material movers requiring the most hires by far. For the continued success of these targeted clusters in the Wabash Heartland Region, attention must be paid to ensuring a workforce is available to meet the firms' needs across all the required occupations, but these 21 occupations are especially critical.

Figure 26. Annual Openings in Key Occupations within Wabash Heartland Region Targeted Clusters



Source: Battelle analysis of OES data from the Indiana Dept. of Workforce Development; data are those for IDWD Region 4.

Summary

Based upon a detailed economic analysis, eight industry clusters within the Wabash Heartland Region are targeted for future emphasis in economic development efforts. These eight clusters offer a diverse set of industries, where building upon regional capabilities and assets can lead to further economic opportunities for the region. Integral in the selection of these eight clusters was the ability for these industries to also leverage the research and innovation assets of the region, most notably Purdue University. The region's innovation assets provide opportunities to grow and expand existing cluster firms, as well as provide the building blocks upon which new and emerging firms can start and prosper in the Wabash Heartland Region. The next section describes these current research and innovation assets including opportunities to better position them to meet the needs of Wabash Heartland Region industry clusters.

Section 4: Research and Innovation Drivers for the Wabash Heartland Region

This section describes the research and innovation assets of the Wabash Heartland Region, primarily driven by Purdue University. The section also explores how these assets can be leveraged to serve as an economic engine for the region by linking the research excellence to existing companies to help them expand and ensure global competitiveness, serve as a magnet for the attraction of new corporations, and serve as a source of innovation for new entrepreneurial efforts.

Purdue University – Regional Research Anchor

Purdue University's research expenditures reached nearly $596 million in 2013, an increase of 8.5 percent from 2010 levels. Purdue is known globally for its strengths and emphasis in engineering, which can be understood by examining the overall portfolio of R&D expenditures for the University (Table 14).

Table 14. Purdue University R&D Expenditures by Field and Disciplines ($ in Thousands)

Major Fields / Detailed Disciplines	2010	2013	Pct. Chg. 2010-13	U.S. Pct. Chg. 2010-13
Life Sciences	200,781	210,663	4.9%	7.5%
Agricultural Sciences	117,440	111,740	-4.9%	12.3%
Biological Sciences	42,549	47,726	12.2%	7.2%
Medical Sciences	27,809	37,878	36.2%	6.0%
Other Life Sciences	12,983	13,319	2.6%	18.3%
Computer Sciences	12,300	22,175	80.3%	26.3%
Mathematical Sciences	6,530	8,136	24.6%	12.9%
Engineering	181,048	220,926	22.0%	15.0%
Aero/Astronautical Engineering	10,675	14,036	31.5%	8.5%
Bio/Biomedical Engineering	7,360	10,941	48.7%	19.0%
Chemical Engineering	13,958	15,010	7.5%	10.8%
Civil Engineering	30,330	43,899	44.7%	17.1%
Electrical Engineering	38,272	38,588	0.8%	17.5%
Mechanical Engineering	31,634	50,232	58.8%	12.8%
Metallurgical and Materials Engineering	5,147	6,030	17.2%	15.4%
Other Engineering	43,672	42,190	-3.4%	15.1%
Physical Sciences	32,177	29,714	-7.7%	0.5%
Chemistry	21,541	16,750	-22.2%	-2.5%
Physics	10,396	12,964	24.7%	4.8%
Other Physical Sciences	240	0	-100.0%	-4.5%
Environmental Sciences	6,430	6,166	-4.1%	6.9%
Atmospheric	4,257	6,112	43.6%	15.0%
Earth Sciences	2,130	0	-100.0%	7.3%
Other Environmental Sciences	43	54	25.6%	7.4%
Psychology	6,737	4,520	-32.9%	6.8%
Social and Other Sciences	31,142	26,264	-15.7%	5.9%
Total R&D Expenditures	**548,980**	**595,739**	**8.5%**	**9.4%**

Source: Battelle analysis of NSF Higher Education Research and Development Survey data, 2010 and 2013.

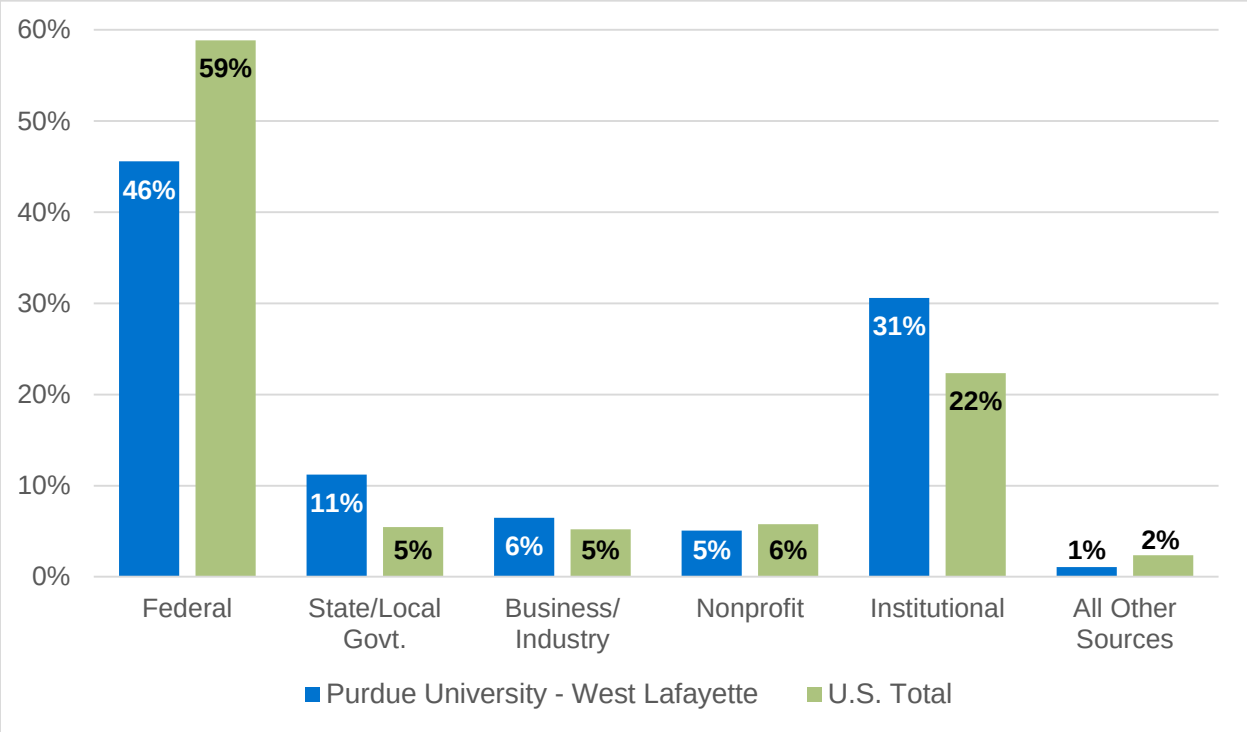
As displayed in Table 14, with R&D expenditures of $221 million in 2013, engineering is the largest "broad" field within Purdue University, accounting for 37 percent of all R&D and growing by 22 percent since 2010. By comparison, engineering R&D expenditures at the national level account for only 16 percent in 2013. Within the engineering field, the mechanical engineering discipline accounts for $50 million, or about a quarter of all engineering research in 2013, having grown by nearly 59 percent since 2010. Other key disciplines include civil, electrical, and other engineering, with civil engineering also realizing significant growth (45 percent) since 2010.

The overall life sciences field is the second largest field within Purdue University reaching an expenditure level of nearly $211 million and accounting for 35 percent of the University's R&D portfolio. This share is significantly lower than the national average share of 56 percent for life sciences, primarily due to the fact that the University does not have a medical school. A key component of Purdue's research identity lies within the life sciences, however. Purdue's largest single research discipline, agricultural sciences, accounts for $112 million of the University's research portfolio, accounting for 19 percent of all Purdue research. At the national level, agricultural research accounts for only 5 percent of higher education R&D expenditures. Biological sciences account for an additional $48 million in 2013. It should be noted that even though Purdue does not have a medical school, medical sciences research has grown by 36 percent to nearly $38 million in 2013. In a related discipline, bio/biomedical engineering has also grown substantially, by more than 48 percent, to reach nearly $11 million in 2013.

Among the other fields and disciplines, Purdue has realized an impressive 80 percent growth since 2010 in computer sciences, reaching more than $22 million in 2013.

In terms of funding sources, Purdue University has a more diverse R&D funding base than the U.S. average with greater emphasis on state and institutional funding and less on federal funds (Figure 27).

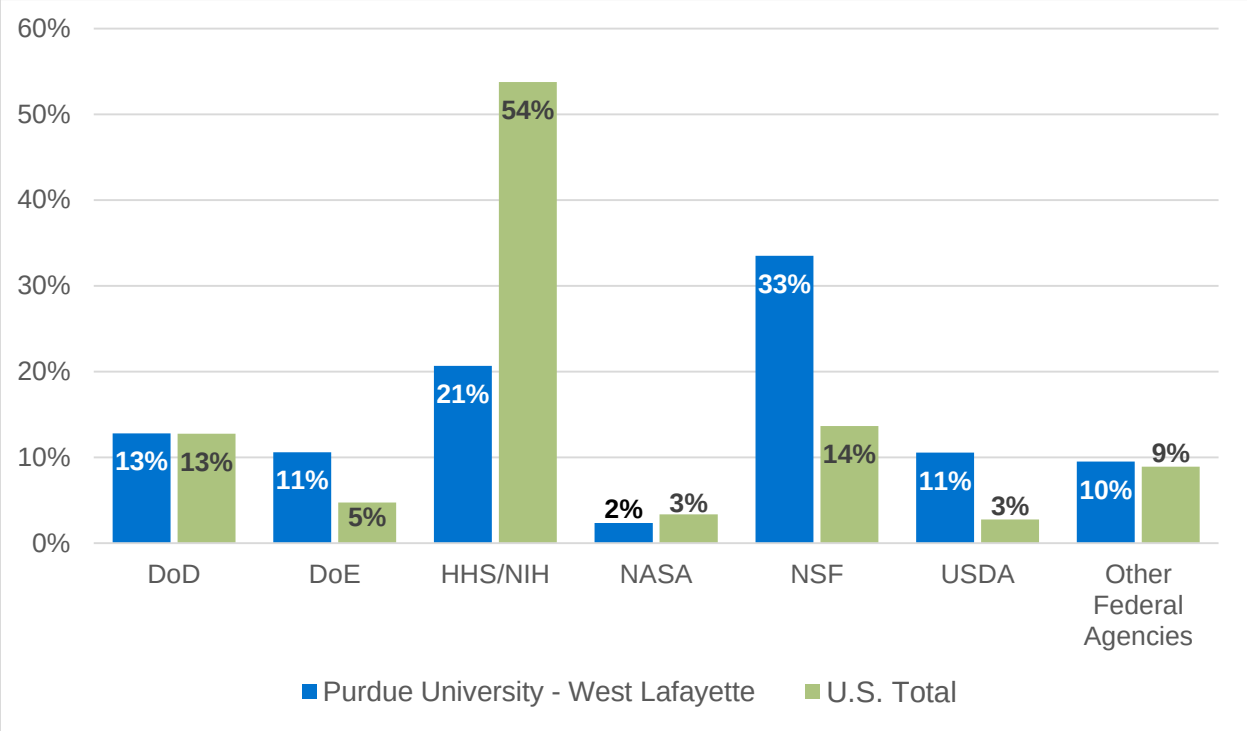
Figure 27. Distribution of R&D Funding by Source, Purdue University, and the United States



Source: Battelle analysis of NSF Higher Education Research and Development Survey data, 2013.

As previously discussed, with no medical school at Purdue, the level of National Institutes of Health (NIH) funding is also reduced, which is the principal cause for the lower share of federal funding (Figure 28). State and institutional funding made up much of this funding difference. One potential to build upon is the slightly larger share of industry funding that Purdue receives compared to the United States overall. Among Federal agencies, the National Science Foundation (NSF), which typically provides basic research funding, provides one-third of the federal funding to Purdue reaching $91 million in 2013 (Table 15).

Figure 28. Distribution of Federal R&D Funding to Universities, Purdue University, and the United States Overall



Source: Battelle analysis of NSF Higher Education Research and Development Survey data, 2013.

Table 15. Federal Funding to Purdue University by Agency, 2013

Federal Agency	Purdue University - West Lafayette
National Science Foundation (NSF)	$ 90,919
Health and Human Services/National Institutes of Health (HHS/NIH)	$ 56,134
U.S. Department of Defense (DoD)	$ 34,806
U.S. Department of Energy (DoE)	$ 28,773
U.S. Department of Agriculture (USDA)	$ 28,638
National Aeronautics and Space Administration (NASA)	$ 6,435
Other Federal Agencies	$ 25,799

Source: Battelle analysis of NSF Higher Education Research and Development Survey data. 2013 $ values in $1,000s.

Beyond looking at research expenditures, examining the publications authored or co-authored by regional scientists and researchers provides key insights into the intellectual assets within the Wabash Heartland Region upon which to build. In total, 17,981 regional publications (articles published within peer review research journals) were published between 2010-2014, with Purdue University (West Lafayette campus) accounting for 98 percent of the total (Table 16).[51]

As expected, there are broad publication strengths, both in terms of numbers of publications and publication concentration in engineering and physics-related disciplines. Agriculture and food-related strengths are also apparent, but the number of publications is typically smaller.

[51] Beyond Purdue faculty, researchers at USDA-ARS, Endocyte, MED Institute, SSCI, and P.C. Krause had ten or more peer reviewed publications during 2010-2014 (some in collaboration with Purdue researchers).

Table 16. Wabash Heartland Region Research Publications by Discipline, 2010-2014

Discipline	Regional Records	Publication Concentration
App. Physics, Cond. Matter, and Materials Sci.	1,468	1.55
Physics	1,329	2.27
Chemistry/Physics Pure and Applied	990	2.29
Psychology	770	1.08
Environment and Ecology	730	1.12
Mechanical Engineering	718	3.22
Chemistry and Analysis	674	1.58
Mathematics	651	1.69
Earth Sciences	596	0.93
Plant Sciences	576	2.45
Materials Science and Engineering	553	1.38
Physical Chemistry and Chemical Physics	542	1.16
Electrical and Electronics Engineering	529	2.10
Spectroscopy, Instrumentation, and Analytical Sciences	521	2.37
Multidisciplinary	512	0.95
Chemistry	447	1.36
Civil Engineering	419	2.33
Computer Science and Engineering	366	2.29
Biochemistry and Biophysics	362	0.79
Pharmacology and Toxicology	361	1.05
Veterinary Medicine and Animal Health	349	2.79
Animal Sciences	347	1.57
Agriculture and Agronomy	318	2.81
Neurosciences and Behavior	313	0.41
Space Science	302	0.84
Food Science and Nutrition	288	2.00
Organic Chemistry and Polymer Science	280	1.28
Environmental Engineering and Energy	274	1.35
Chemical Engineering	267	2.27
Engineering Management	262	2.40
Public Health and Health Care Science	256	0.42
Semiconductors and Solid State Materials	247	1.22
Optics and Acoustics	246	1.54
AI, Robotics, and Automatic Control	241	1.77
Information Technology and Comm. Systems	230	1.89
Animal/Plant Science	228	3.05
Microbiology	227	0.68
Environmental Studies, Geography, and Development	207	1.43

Source: Battelle analysis; Thomson Reuters Current Contents Connect Publication Database; Disciplines with 200+ publications.

Note: Some articles are cross listed among two or more disciplines. Publication concentrations of 1.00 = Wabash Heartland Region share of publications is the same as the U.S. overall.

Examining Purdue University's performance in terms of technology transfer and the generation of start-ups also sheds light on the role the university can play in terms of regional economic growth. Table 17 presents data from the Association of University Technology Managers (AUTM) regarding Purdue's performance and U.S. average. As presented, Purdue's performance in terms of technology transfer and start-ups is greater than the average U.S. university. Purdue is involved in twice the number of university-generated start-ups, each year on average, than the typical U.S. University, with higher performance in terms of invention disclosures and patent activity. The significantly lower performance in terms of average licensing income per $10 million in research expenditures again reflects the fact that Purdue does not have a medical school, the associated NIH/industry funding, and ultimately the licensing income from these biomedical inventions and technologies.

Table 17. Technology Transfer and Start-up Performance, Purdue University and U.S. Average, 2010- 2013

Research Institution	Avg. Start-ups	Metrics per $10M in Research Expenditures					
		Avg. Invention Disclosures	Avg. Start-ups	Avg. New Patent Applications	Avg. U.S. Patents Issued	Avg. Licenses and Options Executed	Avg. License Income
All U.S. Universities Reporting to AUTM – Institutional Average	4	3.63	0.12	2.18	0.81	0.96	$343,439
Purdue University (Purdue Research Foundation)	8	4.93	0.13	2.61	0.95	1.36	$86,494

Source: Battelle analysis of Association of University Technology Managers Licensing Survey (STATT) database, 2010-2013 (most recent year available).

Other Indicators of Regional Innovation Activities

Beyond the regional research driver of Purdue University, the Wabash Heartland Region possesses some key private sector organizations involved in R&D and other innovation activities of various types and scales.

Invention and Patenting Activity

Table 18 provides the key Wabash Heartland Region private sector patent assignees of patents with one or more regional inventors.[52] Cook Biotech has the largest level of patents with 51 invented/assigned patents in the 2010-2014 period. In terms of the total intellectual property being developed and acted upon by Cook Biotech, that figure could be significantly larger as many Wabash Heartland Region "invented" patents are assigned to the Cook Group headquarters in Bloomington, Indiana.

[52] Purdue University had 275 "invented" patents during this time period.

Table 18. Key Patent Inventor/Assignee for Wabash Heartland Region Invented Patents, 2010-2014

Wabash Heartland Region (GL) Headquartered Regional Organizations (7+ patents)	Number of Wabash Heartland Region "Invented" Patents
Cook Biotech Incorporated	51
Wabash National L.P.	34
MED Institute	20
Endocyte, Inc.	16
Landis+Gyr, Inc.	15
Vanguard National Trailer Corp.	12
SSCI	11
Fairfield Manufacturing Company Inc.	10
Griffin Analytical Technologies Inc.	8
Swift Fuels LLC	7
All Wabash Heartland Region Invented and Assigned Patents (Including Purdue University)	**533**
All Wabash Heartland Region "Invented" Patents	**1,399***

Source: Battelle analysis of Thomson-Reuters Thomson Innovation Patent Analysis database.
Includes all Utility, Design, and Plant Patents, 2010-2014.

Note: *Other key assignees of patents with Wabash Heartland Region inventors include other Cook Group companies, Dow Agrosciences, Caterpillar, IBM, Nucor, and Samsung Electronics.

The private sector patenting activities range from biotechnology to truck trailer components, to chemicals and analytical technologies. One somewhat surprising finding is the lack of any Wabash Heartland Region patent activity invented or assigned to Subaru of Indiana. While it is assumed that the vast majority of their technologies and intellectual property would be developed and assigned to Subaru's corporate parent, Fuji Heavy Industries of Japan, the lack of any invented patents traced to Wabash Heartland Region inventors was nevertheless surprising.

Table 19 focuses more on the technology and innovation areas in which inventors that live within the Wabash Heartland Region are most active. The data indicate significant strengths in biomedical/life science innovations, including pharmaceuticals, other organic compounds, prosthetics, new seed and plant varieties, and medical equipment. The automotive/heavy equipment context is also present with vehicle parts and engine/power plant patents also important among the region's inventors. Finally, three smaller, but also important, areas of patent generation include an emphasis on various materials (e.g., synthetic resins, metals), liquid processing equipment (e.g., fluid handling and separation technologies), and information and communication technologies (e.g., image analysis, solid state electronics, digital communications).

Table 19. Number of Wabash Heartland Region Invented Patents by U.S. Patent Class, 2010-2014

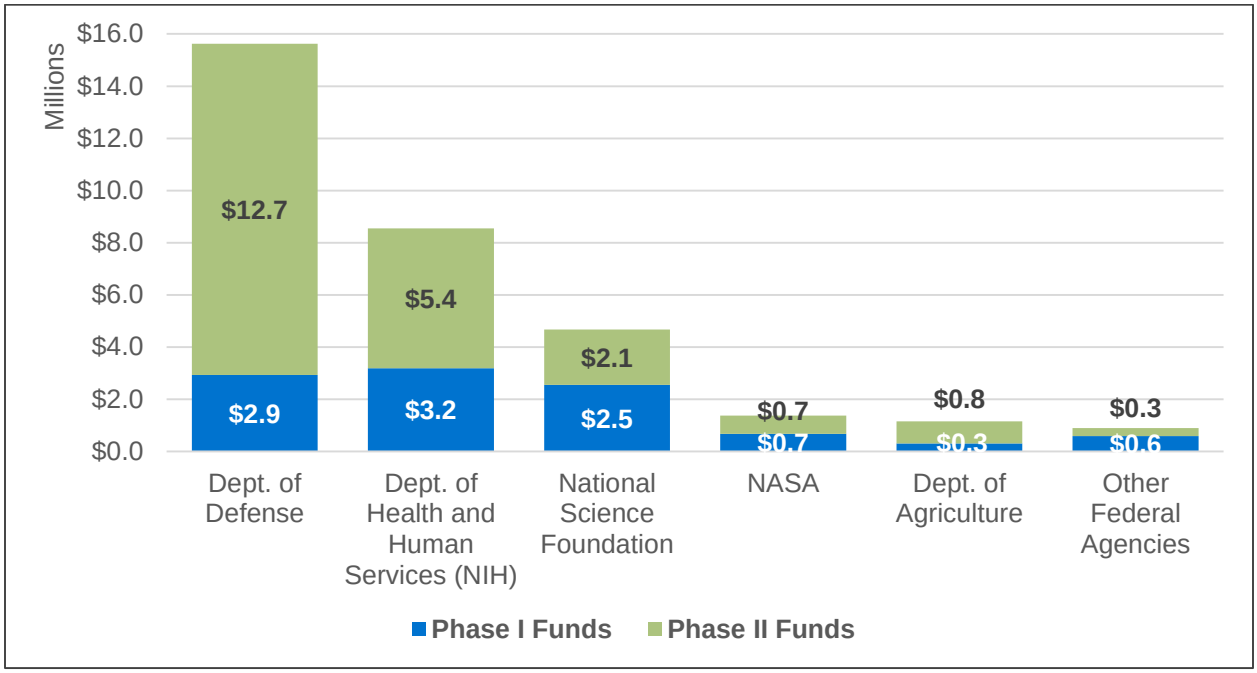
U.S. Patent Class Description (Classes with 15+ patents)	Number of Wabash Heartland Region Invented Patents
Drug, bio-affecting and body treating compositions	153
Prosthesis (i.e., artificial body members)	105
Organic compounds	59
Multicellular living organisms (seeds and plants)	52
Radiant energy	38
Chemistry: molecular biology and microbiology	37
Image analysis	30
Synthetic resins or natural rubbers	26
Land vehicles: bodies and tops	26
Plant protecting and regulating compositions	25
Pulse or digital communications	24
Metal founding	21
Power plants	19
Surgery: surgical instruments and devices	17
Environmental heating and cooling; fluid handling and sanitary equipment	17
Internal-combustion engines	16
Active solid-state devices (e.g., transistors, solid-state diodes)	15
Data processing: database and file management, data structures, or document processing	15
Measuring and testing	15
Surgery: diagnostic/therapy testing, techniques, or devices	15
Liquid purification or separation	15
All Utility, Design, and Plant "Invented" Patents	**1,399**

Source: Battelle analysis of Thomson-Reuters Thomson Innovation Patent Analysis database.
Includes all Utility, Design, and Plant Patents, 2010-2014.

Small Business Innovative Research (SBIR) Activity

Another area to examine to develop a broader perspective on the level of innovation within the Wabash Heartland Region, especially among its smaller and emerging firms, is to examine the regional firms' performance in receiving funding from the federal governments Small Business Innovative Research (SBIR) program and the related Small Business Technology Transfer Research (STTR) program. Figure 29 charts the regional firms' recent performance (2010-2014) within these programs by federal department or agency that funded the research.

Figure 29. SBIR Funding to Wabash Heartland Region Companies by Federal Agency



Source: Battelle Analysis of SBIR.gov database. Awards from FY 2010-2014.

As presented in Figure 29, DoD and HHS (NIH) fund the majority of Wabash Heartland Region's SBIR activity, with these two agencies accounting for 73 percent of all SBIR/STTR funding to the region. It should be noted that the relatively significant level of investment in Phase II activities from DoD are primarily to firms in the Engineering, Technical, and Design Services targeted cluster.

One important consideration for the regional innovation landscape, also highlighted in the figure, is the extremely limited USDA SBIR activities of less than $1.1 million over five years. Considering the significant level of agricultural research performed by Purdue University, and the significant USDA funding it receives for both research and agricultural extension work, this level of SBIR activity is concerning.

Table 20 provides details of the firms receiving SBIR/STTR awards and how these firms are aligned with the Wabash Heartland Region targeted clusters.

Table 20. Alignment of Innovative Small Businesses with Wabash Heartland Region Target Clusters

Regional SBIR/STTR Recipients	Target Cluster Context	Phase I		Phase II		Total # of Awards	Total Awards Amount
		# of Awards	Phase I Amount	# of Awards	Phase II Amount		
Spensa Technologies Inc.	Agbiosciences	2	$250.0	1	$626.9	3	$876.9
This Old Farm	Agbiosciences			1	$398.3	1	$398.3
Spero Energy, Inc.	Agbiosciences	2	$299.9			2	$299.9
Nutrabiotix, LLC	Biomedical Sciences	1	$247.6	1	$2,563.6	2	$2,811.1
Tymora Analytical Operations, LLC	Biomedical Sciences	5	$1,538.5	1	$500.0	6	$2,038.5
Concordance Health Solutions, LLC	Biomedical Sciences	2	$307.1	1	$982.8	3	$1,290.0
Akina, Inc.	Biomedical Sciences	2	$308.5	1	$612.8	3	$921.3
Microfluidic Innovations	Biomedical Sciences	2	$299.4			2	$299.4
P.C. Krause and Associates, Inc.	Engineering, Technical, and Design Services	14	$1,669.5	9	$6,270.3	23	$7,939.8
En'Urga, Inc.	Engineering, Technical, and Design Services	9	$1,264.1	2	$750.0	11	$2,014.1
Indiana Microelectronics LLC	Engineering, Technical, and Design Services	6	$637.7	2	$1,249.1	8	$1,886.8
IN Space, LLC	Engineering, Technical, and Design Services			2	$1,746.0	2	$1,746.0
Mudawar Thermal Systems, Inc.	Engineering, Technical, and Design Services			1	$653.6	1	$653.6
Hans Tech	Engineering, Technical, and Design Services	1	$150.0	1	$500.0	2	$650.0
M4 Sciences LLC	Precision Metalworking	2	$299.9			2	$299.9
Independence Science, LLC	N/A – Education Technology	1	$200.0	1	$500.0	2	$700.0
Omega Micro Technologies, Inc.	N/A – Electronic Materials	2	$150.0	1	$750.0	3	$899.9
Group 4 Development, LLC	N/A – Electronic Materials	1	$99.0	1	$1,050.0	2	$1,149.0
Advanced Process Combinatorics, Inc.	N/A – Information Technology	2	$293.4	1	$1,199.4	3	$1,492.9
Simulex, Inc.	N/A – Information Technology			1	$1,000.0	1	$1,000.0
Imaginestics	N/A – Information Technology	1	$149.7	1	$669.3	2	$819.0

Source: Battelle Analysis of SBIR.gov database. Awards from FY 2010-2014.
Note: Includes Total Awards Amounts greater than $250,000; $ values in $1,000's.

Venture Capital Investment Activity

An important characteristic of a dynamic innovation landscape is the number of regional firms receiving venture capital investments. Table 21 indicates that while there are some venture capital investments in the Wabash Heartland Region, including some to firms within the key targeted clusters, the overall level is extremely limited.

One firm, Endocyte, captured the majority of these venture capital investments, accounting for 56 percent of the total. This fact indicates the need for increased access to capital to grow emerging companies across the economy, but importantly within the targeted clusters.

Table 21. Venture Capital Investments in Regional Innovative Firms

Regional Firm	Target Cluster Context	Total Venture Capital Investments (2010-2014, $ Millions)
Endocyte, Inc.	Biomedical Sciences	$6.41
Perfinity Biosciences, Inc.	Biomedical Sciences	$2.43
Emerging Threats Pro, LLC	NA - Software	$1.80
Bioscience Vaccines, Inc.	Biomedical Sciences	$0.40
Medtric, LLC	Biomedical Sciences	$0.10
Microfluidic Innovations, LLC	Biomedical Sciences	$0.08
Telos Discovery Systems	Biomedical Sciences	$0.08
Spensa Technologies, Inc.	Agbiosciences	$0.05
Total Regional Venture Capital Investment		**$11.35**

Source: Battelle analysis of Thomson Reuters ThomsonONE venture capital analysis database, 2010-2014.

Source of Human Capital

The Wabash Heartland Region's higher educational institutions are both an economic engine in their own right, accounting for more than 16,000 jobs in the region, but also a potential source and supplier of significant human capital for the region's key targeted clusters and other components of the regional economic landscape. To better understand the magnitude of this potential, Table 22 details the numbers of total graduates from the four regional institutions in 2013. Figure 30 illustrates the geographic location of these educational institutions throughout the ten counties.

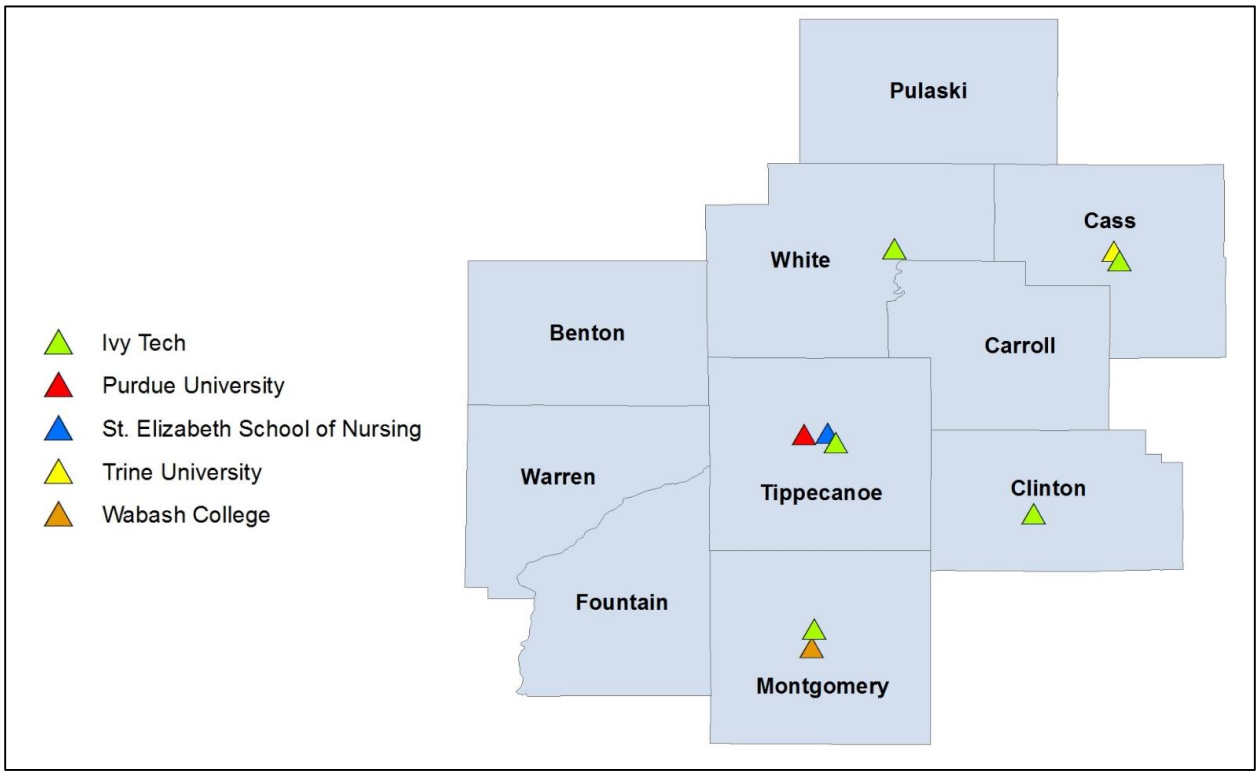
Table 22. Total Graduates from the Wabash Heartland Region's Higher Education Institutions

Regional Higher Education Institution	Total Graduates, 2013
Purdue University – Main Campus	10,121
Ivy Tech – Lafayette	1,350
Wabash College	213
Saint Elizabeth School of Nursing	70
Total, Wabash Heartland Region Higher Education Institutions	**11,754**

Source: National Center for Educational Statistics, IPEDS Data, School Year 2012-2013; Data from Ivy Tech.

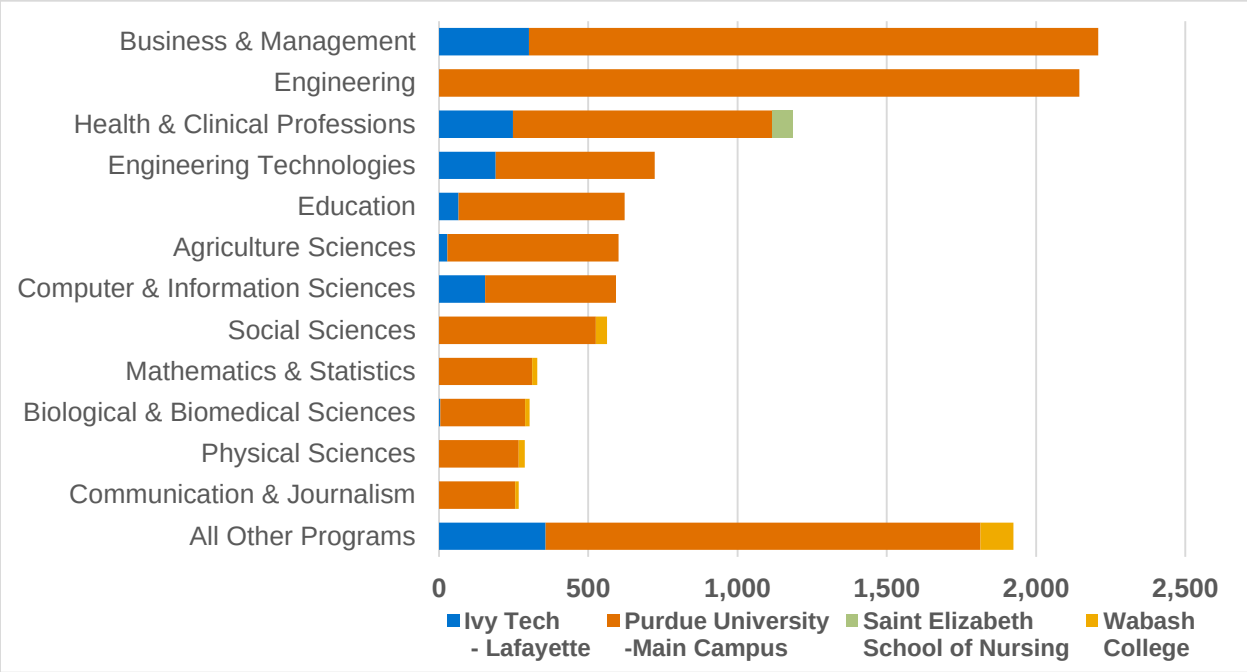
Note: Discrete data for the Trine University Professional Studies Branch in Logansport is not available from IPEDS.

Figure 30. Geographic Locations of the Region's Higher Education Institutions



Purdue University accounts for the vast majority of these total degrees at 86 percent. However, given the statewide, national, and international students that attend Purdue, this figure significantly overstates the number of recent graduates that truly enter the labor pool for the Wabash Heartland Region's employers. In this regard, while Ivy Tech Community College graduates only 11 percent of the total, a significant share of these students is direct entrants into the regional labor pool. Figure 31 provides details of these four institutions degree programs by major field.

Figure 31. Major Degree Areas by Wabash Heartland Region Higher Education Institutions



Source: National Center for Educational Statistics, IPEDS Data, School Year 2012-2013; Data from Ivy Tech.

As is typical in most higher educational systems, Business and Management degrees are the largest single field. For the Wabash Heartland Region, Engineering degrees are second and would easily exceed Business and Management if the Engineering Technologies (Technician-level) degrees were included. The next degree field, Health and Clinical Professions, is substantially lower (again due in part to the lack of a Medical School at Purdue University), but shows further involvement by Ivy Tech and Saint Elizabeth's School of Nursing.

Table 23 details the total 11,754 degrees by the type/level of degree, ranging from certificate programs through professional degrees. The majority of the degrees fall into the Bachelor's degree category at 63 percent, followed by Graduate degrees at 19 percent. Figure 32 provides the detail of these same degree levels by the major fields within the four Wabash Heartland Region institutions of higher education.

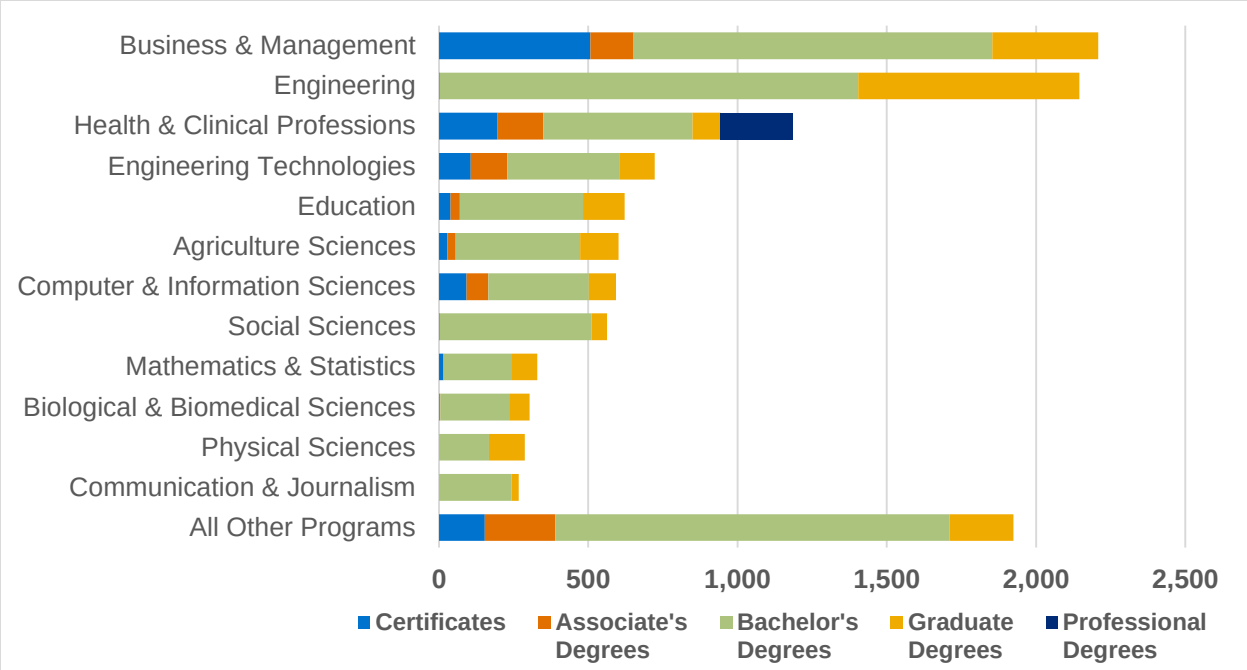
Table 23. Total Graduates from the Wabash Heartland Region's Higher Education Institutions by Degree Type

Regional Higher Education Degrees	Total Graduates, 2013
Certificates	1,141
Associate's Degrees	794
Bachelor's Degrees	7,348
Graduate Degree's	2,229
Professional Degrees	242

Total, Wabash Heartland Region Higher Education Institutions	**11,754**

Source: National Center for Educational Statistics, IPEDS Data, School Year 2012-2013; Data from Ivy Tech.

Figure 32. Major Degree Areas from Wabash Heartland Region Higher Education Institutions by Degree Type



Source: National Center for Educational Statistics, IPEDS Data, School Year 2012-2013; Data from Ivy Tech.

A key point from Figure 32 is that a significant share, 35 percent, of the engineering degrees are graduate-level degrees. Likewise, a significant share of all graduate degrees from the region, 33 percent, are engineering degrees. This combined fact reiterates the importance of the graduate-level education and research function within Purdue's engineering programs—and the need to improve the connections between the Wabash Heartland Region targeted clusters and these engineering efforts at Purdue.

One other interesting point stems from the Professional Degrees award from within the Wabash Heartland Region. All of these degrees originate from Purdue University and are all within the Health and Clinical Professions field-- including both Pharmacy and Veterinary Medicine degrees.

Finally, to bring some additional perspective to the degree profiles of the Wabash Heartland Region's major institutions, Table 24 provides the top five Science, Technology, Engineering, and Math (STEM) Degrees for Purdue University and Ivy Tech Community College.

Table 24. Total Graduates from the Wabash Heartland Region's Higher Education Institutions by Field of Study

Ivy Tech Community College – Lafayette Campus		
Major STEM Field	**Specific Field**	**Number of 2013 Graduates**
Computer and Information Sciences	Information Technology	70
Engineering Technologies	Energy Management and Systems Technology	70
Engineering Technologies	Industrial Technology	68
Computer and Information Sciences	Computer and Information Sciences, General	52
Engineering Technologies	Drafting/Design Technology	33
Purdue University-West Lafayette Campus		
Major STEM Field	**Specific Field**	**Number of 2013 Graduates**
Engineering	Mechanical Engineering	458
Engineering	Electrical and Electronics Engineering	324
Engineering	Civil Engineering, General	270
Engineering	Aerospace Engineering	259
Engineering	Industrial Engineering	213

Summary

The R&D portfolio at Purdue University is more balanced between engineering/life sciences than many universities, with the breadth of disciplines within each providing additional R&D diversity for the Wabash Heartland Region. The strength in engineering is globally recognized, yet the importance of agricultural sciences research cannot be overlooked as an engine for regional economic development. Tapping into the research strength of the university to help ensure global competitiveness for the region's targeted industry clusters will be critical for future economic growth. Furthermore, the Wabash Heartland Region's higher educational institutions are both an economic engine in their own right, accounting for more than 16,000 jobs in the region, but also a potential source and supplier of significant human capital for the region's key targeted clusters and other components of the regional economic landscape.

Section 5: Strategy and Action Recommendations

The desire by the Wabash Heartland Region's leaders to strategically focus significant time, effort, and investment in order to catalyze economic growth and community prosperity is understandable. The growth of a number of the region's key industry clusters, coupled with the potential to leverage the significant research assets of both a Tier 1 Land-Grant Research University and a base of innovative industries, positions the region for economic growth for decades to come.

The mandate is quite simple— the Wabash Heartland Region needs to focus its economic development efforts to ensure that not only can its existing industry drivers raise their level of competitiveness and added value, but that it can also identify new drivers of innovation to improve the region's economic prospects. This strategy is designed to address the most pressing needs of the region and identify the elements and ingredients to successfully position the region to build on its strengths, seize its opportunities, and put into action a set of strategies that catalyze economic and community prosperity.

The analysis suggests that to truly transform the region's economy will require taking advantage of the following opportunities:

- Regional industrial clusters that can be positioned to promote further economic growth
- An existing industrial base that seeks a skilled workforce, thereby providing employment opportunities for the region's citizens
- A world-class research base that provides opportunities to diversify the region's economy through innovation and entrepreneurship
- A growing understanding that quality of life issues are a critical component of a region's ability to foster economic growth

The identified opportunities stand as strategic priorities, which if effectively leveraged, will enable the region to ignite the growth of the economy leading to community prosperity. It is proposed that the Wabash Heartland Region initiate a set of four strategies and an associated set of 16 actions as summarized in Table 25 to focus its efforts on fostering synergies between the region's industrial clusters and its academic assets so that their combined effect is greater than the sum of their individual efforts. These strategies and actions are outlined in this section. The following strategic plan has been designed to be driven by industry and capitalize on the region's comparative innovation assets.

Table 25. Summary of Proposed Strategies and Actions

Strategy	Actions
Strategy 1: Catalyze the growth of industrial clusters for which the region has a unique comparative advantage	• Expand the footprint of targeted industry clusters and their related supply chains to create greater economic opportunities throughout the region. • Develop a regional branding/marketing campaign for a greater sense of regional identity. • Achieve a 21st Century digital and transportation infrastructure to enhance access to and adoption of digital connectivity and innovative multimodal methods of transporting goods, services, and people.
Strategy 2: Advance systemic workforce development/talent initiatives aligned with industry cluster needs	• Annually develop a projected occupational needs assessment of the targeted industry clusters. • Actively inform and educate students, parents, and educators on career opportunities that exist in the identified industry clusters and the educational requirements and career pathways needed to access them. • Improve Science, Technology, Engineering, and Math (STEM) education at the K-12 level, including soft skills, leveraging current best practices, industry partnerships, and experiential learning to scale a systemic workforce/talent initiative that reaches across the region. • Working with industry, create career pathways that include experiential learning experiences for high demand careers within the region. • Launch a campaign to attract skilled technical and managerial talent, including efforts to engage veterans and other targeted groups, to near-term employment opportunities within the region.
Strategy 3: Leverage the region's long-standing research strengths and recent investments to diversify the economy through innovation and entrepreneurship	• Leverage the recent increase in National Institute of Standards and Technology (NIST) Manufacturing Extension Partnership (MEP) funding for Purdue's Technical Assistance Program (TAP) Manufacturing Program. • Leverage the recent Purdue investments in the Research Park Aerospace District to develop a targeted industry cluster in aircraft manufacturing. • Leverage the recent Purdue investments and Ivy Tech's existing agbioscience programs, as well as Purdue's extension office network, to position the region for growth in multiple segments of food and agriculture, including plant science, livestock, and precision agriculture technological advancements. • Leverage commercialization and entrepreneurial investments to diversify the region's economic base. • Leverage the recent investment in the Purdue Polytechnic Institute by linking the regional industrial workforce demands to the curriculum and experiential learning opportunities.
Strategy 4: Foster a high-value quality of place	• Foster an environment that is welcoming, inclusive, and collaborative in nature for all people. • Support localities' efforts to undertake strategic planning efforts to improve the quality of life for its citizens and strategize how best to leverage regional strengths. • Jointly develop solutions to common quality of life problems being faced across the region.

Strategy 1: Catalyze the Growth of Industrial Clusters for which the Region has a Unique Comparative Advantage

Why Focus on Industry Clusters?

Clusters offer regions the opportunity to specialize by gaining specific core competencies and knowledge that allows the region to compete effectively, and by allowing public investment and other resources to be focused where they will bring the most economic benefit. The value of cluster development is found both in advancing a region's economic competitiveness and in helping to organize its economic development efforts.

Clusters are a key driver of regional economic growth. Harvard's Michael Porter, one of the nation's leading experts in business and regional competitiveness, explains:

> *"Clusters are a striking feature of virtually every national, regional, state and even metropolitan economy, especially in more economically advanced nations… Clusters are not unique, however; they are highly typical—and herein lies a paradox: the enduring competitive advantages in a global economy lie increasingly in local things—knowledge, relationships, motivation—that distant rivals cannot match."* [53]

The value of a strong cluster is that it spurs growth and competitive advantage. With a vibrant cluster, the typical economic gains are substantial, including:

- 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 start-up 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 many other support services such as conferences, restaurants, and entertainment.

Clusters are a powerful means for organizing a region's economic development efforts. Pursuing cluster development provides more than just a focus for regional economic development efforts; they provide an organizing framework, which includes:

- Rather than assisting one firm at a time, cluster development efforts require solving related problems and addressing common needs of groups of firms.
- 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.

[53] Michael Porter, Harvard Business School Professor, "Clusters and the New Economics of Competition," Harvard Business Review, November-December 1998.

- 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 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 realizing economic returns. One such area is biotechnology in Maryland and San Diego, biofuels in Iowa, electronics in Austin, medical devices in Warsaw, robotics/computers in Pittsburgh, and semiconductors in Oregon. Clusters are a powerful means for organizing a region's economic development effort. High-value industry clusters drive the regional economy by:

- Creating jobs
- Driving employment in business support industries such as finance, insurance, and real estate, and in population serving industries such as retail and food services
- Serving as a catalyst for innovation
- Being a source of entrepreneurship

Table 26 provides a summary of the cluster analysis found in Section 3 illustrating the position of the Wabash Heartland Region's targeted industry clusters.

Table 26. Identified Growth Opportunity Clusters for the Wabash Heartland Region Industry Clusters

Strategic Area	Key Targeted Clusters	Decision Tree Assessment
Life- and Agri-Sciences	Agbiosciences	Current Opportunity
	Food Processing and Manufacturing	Current Opportunity
	Biomedical Sciences	Emerging Strength
Value-Added Metals Processing	Automotive/Heavy Vehicle Equipment	Current Strength
	Metals Production and Related Manufacturing	Current Strength
	Precision Metalworking	Current Opportunity
Key Support Clusters	Engineering, Technical, and Design Services	Emerging Strength
	Packaging Products	Current Strength

Actions to Pursue

1. Expand the footprint of targeted industry clusters and their related supply chains to create greater economic opportunities throughout the region.

2. Develop a regional branding/marketing campaign for a greater sense of regional identity.

3. Achieve a 21st Century digital and transportation infrastructure to enhance access to and adoption of digital connectivity and innovative multimodal methods of transporting goods, services, and people.

Action 1: Expand the footprint of targeted industry clusters and their related supply chains to create greater economic opportunities throughout the region.

Within the Wabash Heartland Region, there is growing optimism about the future of the targeted industry clusters. As the region's production capacity rebounds after the recession, this industrial base is a top contributor to the regions' gross domestic product thereby supporting broad community prosperity. Finding ways to further support these targeted industry clusters and support further expansion of existing firms as well as the attraction of related supply chain components will create additional economic opportunities throughout the region.

However, in order to achieve an expanded footprint of the targeted industry clusters, the region must work proactively to develop synergies between the existing companies that comprise each 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 dialog between industry, academia, and the public sectors 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 non-profit sectors. However, the Wabash Heartland 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.

Depending on the specific needs and opportunities of one of the specific industry clusters identified, a tailored approach to strengthening the region's cluster footprint can be undertaken. Activities could include:

- Fostering relationships and synergies amongst cluster members through the expansion or creation of network groups that include dedicated resources focused on cluster development.
- Identifying common needs through dialogue with companies in the identified clusters, and then focus 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, regulatory issues, etc.
- Serving as the portal/coordinated effort for attraction and expansion opportunities to ensure that seamless and unified information and services are provided.
- Targeting out-of-state 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 and help existing firms by filling supply chain gaps by locating in the region.

- Aggregating and then addressing an 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 Strategy 2).
- Staying abreast of emerging business issues impacting the cluster, including federal regulatory changes, legislative issues, foreign trade issues, etc. 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 provided by providers external to the community that could actually be fulfilled by local suppliers.

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, several different options to catalyzing initiatives include:

- Providing start-up funding to regional cluster groups and organizations that establish membership-owned and -driven organizations with an extensive scale of networking.
- Identifying key champions to serve as a catalyst or facilitator to foster relationship building.
- Encouraging expansion or formation of sector-advocate organizations with full-time resources dedicated to cluster development.

No matter the model, networks and connectivity can help expand the footprint of targeted industry clusters and their related supply chains to create greater economic opportunities throughout the region.

Action 2: Develop a regional branding/marketing campaign for a greater sense of regional identify.

Expanding the economic footprint of a region requires that the region be perceived as a dynamic hub—a place with many job opportunities, a constant flow of innovation, and a supportive business environment. To obtain this reputation, more and more regions are undertaking a branding/marketing campaign that communicates to key audiences, both nationally and internationally, the depth and breadth of the region's assets and the unique resources and opportunities that the region provides.

In addition to the identified regional industry clusters, the Wabash Heartland Region also has significant natural assets, such as the Wabash River, which offer opportunity to provide real quality of life and place improvements throughout the region. By encompassing both industry and quality of life into a strategic branding and marketing campaign for the region, there can be greater connectivity among workforce supply and demand.

In establishing an externally and internally focused brand name campaign, a series of coordinated activities must occur to position the Wabash Heartland Region and communicate key messages on the depth and breadth of its cluster base.

Elements of the internal branding/marketing effort could include:

- **Development of a "regionally acceptable" brand name.** A brand name or theme is needed for the region to develop an awareness of and creditability for either the region's geographic leadership or cluster leadership. For example, St Louis's "the BioBelt" brand or Iowa's "Cultivation Corridor" brand has successfully positioned the regions as leaders in the plant and life sciences. Another effective branding technique to establish a sense of place, such as Research Triangle Park or Silicon Valley, connotes the value of the region for economic development. The Wabash Heartland Region needs to develop a regional "brand name" that is widely understood, recognized, and adopted throughout the ten-county region and carried through in collateral materials, including brochures, targeted handouts, trade show exhibits, videos, and web sites. Incorporating a common element that touches all ten counties, like the Wabash River and its tributaries, may demonstrate the appropriate connectivity and sense of regionalism this ten-county area needs. It is widely understood that the current naming convention being used for this report will not be broadly acceptable to the ten-county audience. A new brand needs to be developed immediately before widespread dissemination of the strategy can occur.
- **Community support and involvement.** Initial efforts should focus on building a local awareness of the strengths of the region's targeted industry clusters. Internal education and awareness-building efforts are key to effectively shaping outsiders' views of the region. The most frequent and effective marketers of the Wabash Heartland Region are its residents who have ongoing contacts with those outside the region. The internal education efforts should be closely aligned with the overall branding campaign, but they also require a distinct set of activities. Efforts such as creating a cluster ambassador program to reach schools and civic organizations and holding regular monthly and quarterly events are among the types of activities to be pursued. A key goal is to make meaningful connections between the region's cluster resources and the broader community, especially students and their families, and the overall business community.
- **Regionally focused earned media campaign.** Additionally, an internal earned media campaign should be pursued after completion of this strategy. Articles focusing on the opportunities, strengths, and efforts underway in the region create a significant amount of "buzz." The placement of such articles requires an active public relations outreach to key publications and active development of news stories. A consistent and regular updates of progress toward the strategy's actions in business outlets and the general press should also be considered.

Once the branding is complete and the internal marketing is well underway, efforts need to then be focused on external marketing activities. Elements of the external marketing effort could include:

- **Active media**. Developing a consistent and active media presence in major business and technology publications involving infomercials 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 nationwide describing the region's plans will play a key role in changing the region's image. 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 domestic and 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.
- **Host conferences and events.** Build upon the region's reputation by hosting international and national conferences and events.

Action 3: Achieve 21st Century digital and transportation infrastructure to enhance access to and adoption of digital connectivity and innovative multimodal methods of transporting goods, services, and people.

Across the United States, there is growing optimism about the future of advanced manufacturing and its related supply chains. As many regions' production capacity rebounds after the recession, the industrial base once again is becoming a top contributor to most regions' gross domestic product and exports. So why does the tide appear to be turning? Reasons may include:

- Across regions, surviving manufacturers have transformed to become stronger, leaner, and more innovative. This transformation applies to a broad range of manufacturers, including industrial equipment, electronics, vehicles and vehicle components, and agriculture and food-related manufacturing.
- Manufacturers in some industries are beginning to shift from foreign to local sources as the costs of doing business internationally increase.
- Others are recognizing they can compete globally by adapting to a rising demand for customization and to a continuous demand for new and innovative products.

This growth is placing significant demands on traditional transportation infrastructure that has historically allowed for the movement of goods across the region. In addition, an increasing demand for technological infrastructure is becoming increasingly evident, including digital connectivity, wireless internet, cloud-based data storage, and fiber connectivity—a 21st century infrastructure backbone that is required to support sustained growth and quality of life. Transportation infrastructure options are also changing with multimodal systems connecting traditional mass transit with car and ride sharing all connected by digital infrastructure and on-demand service. Industry in the region will soon require access to these technologies in rural areas as a standard for doing business, rather than simply a benefit. In addition, emerging high-tech industries that are developing, building on regional manufacturing capabilities, require existing digital infrastructure in order to function properly, such as fiber networks, Wi-Fi, and digital connectivity.

In many regions today, discussions about manufacturing are focusing more on growing a strong base than on saving a declining economic sector. Job creation through innovation, business expansion, and supply chain linkages is at the heart of this new dialogue. However, growth can occur only when production capacity is increased, which is in part reliant upon supply chain efficiencies which requires access to sound infrastructure to allow for the flow of goods and talent.

Poor infrastructure impedes a region's economic growth. Transportation system and digital infrastructure improvements can affect economic growth and productivity by changing access to markets and business productivity. Improvements to transportation infrastructure allows for the flow of goods between supply chain partners, thereby providing opportunities for localities throughout the region to benefit from an expanded industrial cluster footprint, as well as providing additional employment opportunities for the region's citizens, but only if they have access to reliable transportation. Innovative methods of transportation should be considered as well—including multimodal transit like car and bike sharing, mass transit, trails, and other forms of personal mobility—in order to better connect businesses, employees and customers together. The advent of the shared economy has also presented new opportunities for individuals to access services, such as package and grocery deliveries or shared rides, in ways that can dramatically improve system efficiency and quality of life.

Enhancing digital connectivity throughout the region, particularly in rural areas, can provide tremendous support to farmers incorporating precision agriculture technologies into their crop fields, or making it simpler for a company to relocate its business to the region, placing it on a level playing field with other comparable regions.

A 2010 study by the U.S. Department of the Treasury with the Council of Economic Advisers found that, "Research has shown that well designed infrastructure investments can raise economic growth, productivity and land values, while also providing significant positive spillover to areas such as economic development, energy efficiency, public health…"[54] It goes without saying that both the lack of infrastructure investments as well as poorly planned, non-strategic, infrastructure investments are not only a waste of resources, but can negatively impact future economic growth. With limited funding available, it is important to select investments that will provide the greatest return.

The Hoosier Heartland Highway that connects Lafayette to Logansport opens the door to a wide variety of supply chain opportunities for that portion of the region. However, too much of the region suffers from inadequate transportation infrastructure that allows for the flow of goods and talent between communities. For example, the I-65 closure during the summer of 2015 caused significant economic disruptions due to the lack of alternative routes and highlighted the lack of connectivity between many of the region's communities.

Without substantial offerings in rural broadband and other digital infrastructure, emerging industries like precision agriculture and other tech-enabled industries cannot take root in the region. Enhancing infrastructure to meet the needs of the 21st century will only better position the region to embrace new business and accelerate technology in current industry sectors.

The challenge to develop the region's infrastructure can be facilitated by a review and a subsequent plan to establish and identify the transportation and digital investments that are needed, and how to prioritize them. Major trends in technology and the "on demand" or sharing economy need to be heavily evaluated in terms of how it changes the needs of transit and digital infrastructure. A good plan will provide information on the state of the region's existing infrastructure, and also serve as a framework for prioritizing the infrastructure requirements going forward and facilitate their development.

Strategy 2: Advance Systemic Workforce Development/Talent Initiatives Aligned with Industry Cluster Needs

In a global economy where jobs are outsourced from one continent to another, it is appropriate to ask whether workforce is a relevant competitive factor. Is labor a commodity like utilities, and thus unable to create a significant competitive differentiation or advantage, or can it be unique to a firm or region, like location or intellectual property, and confer a significant competitive advantage?

Workforce can and must be an essential part of any strategy by a firm or region to create a competitive advantage. If a firm does not use its workforce as anything more than a low-skill, low-wage, and high-turnover commodity, then it will not generate or retain any type of enduring market advantage in a

[54] https://www.whitehouse.gov/sites/default/files/infrastructure_investment_report.pdf

marketplace that is increasingly emphasizing the use of high-tech tools that add value for suppliers and end customers. So, how does human capital factor into a region's comparative advantage?

Simply put, human capital 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 or firm from its competition. A region cannot change its physical location, so its location advantages are fixed. Firms can purchase new and emerging technology; but, if these are "off-the-shelf" technologies, then they are available to the competition. In contrast, human capital is a locally provided and locally managed resource, thus able to be differentiated from other regions. In addition, human capital is an essential element in implementing advanced technology solutions. The quantity, quality, and management of human capital are competitive factors very much in local control.

Unfortunately, in many regions there is a lack of human capital that meets the needs of many of the region's leading firms. This lack of human capital in part is driven by the lack of understanding and preparation for the jobs that are available. A report by the National Governors' Association noted that, "the traditional approaches to worker preparation are rooted in the supply side of the labor market, building the skills of job entrants with minimal input from employers or regard for how these skills are further developed and used in the workplace. A wide gap has emerged between the public training and employment services system and the human resource development strategies and operations of firms."[55] Improving the effectiveness of the workforce development system requires adopting a "demand-side strategy" that builds on employers' economic interests.

There are a number of exciting and innovative initiatives being undertaken throughout the Wabash Heartland Region that are attempting to tackle issues related to the lack of an available skilled workforce for the job opportunities being created in the region today as well as preparing the region's future workforce for the jobs of tomorrow. However, the efforts are often localized to a single school system, employer, or community. To date, there has been no effort to coordinate programs or best practices across the region. This lack of coordination leads to localities "reinventing the wheel" in terms of tackling similar issues, as well as expending resources and energy on initiatives that have varying levels of results and impacts.

To advance a regional talent pipeline, a broader ten-county regional effort needs to be initiated so that resources, expertise, and networks can be developed to a scale of critical mass that can truly impact the availability of workers to meet the industrial demands of the region. Much like the need for industry cluster councils or organizations in Strategy 1, there is a need to create a focal point that is charged with developing a systemic talent pipeline throughout the entire region. Furthermore, because access to a skilled workforce is the greatest concern voiced by regional industry, it might make sense to have the industry cluster organization take the lead system workforce development/talent initiatives.

The bottom line is that the industry cluster initiatives outlined in Strategy 1 will not have a high likelihood of success unless there is an adequate workforce available to support and retain these growing industries. Until educational and community leaders understand and agree upon the economic and occupational importance of these clusters, it is unlikely to receive much attention or support from the regional system of education and training because their experience tells them that many of these clusters

[55] National Governors' Association, State Strategies for the New Economy, 1999.

are (a) not a viable industry or career path in the first place or (b) its jobs are uniformly unattractive. These perceptions must be met head on and diffused.

The following actions attempt to begin to address the lack of a skilled workforce that meets the needs of the region's targeted industry clusters—the greatest impediment to future economic growth vocalized by industry leaders during interviews and focus groups.

Actions to Pursue

1. Annually develop a projected occupational needs assessment of the targeted industry clusters.
2. Actively inform and educate students, parents, and educators on career opportunities that exist in the identified industry clusters and the educational requirements and career pathways needed to access them.
3. Improve STEM education at the K-12 level, including soft-skills, leveraging current best practices, industry partnerships, and experiential learning to scale a systemic workforce/talent initiative that reaches across the region.
4. Working with industry, create career pathways that include experiential learning experiences for high demand careers within the region.
5. Launch a campaign to attract skilled technical and managerial talent, including efforts to engage veterans and other targeted groups, to near-term employment opportunities within the region.

Action 1: Annually develop a projected occupational needs assessment of the targeted industry clusters.

An industry cluster must develop and disseminate its current and future workforce requirements so that the larger workforce system, as represented by the educational community and public workforce agencies, can support an adequate workforce response. Otherwise, the cluster's workforce needs will be at the mercy of general labor market dynamics and probably overshadowed by the more articulate and better understood workforce demands of other sectors. Lack of awareness of a particular industry's workforce opportunities and demand will further exacerbate the employment recruitment barriers previously discussed. Such an articulation of workforce need is a prerequisite to mount an effective career awareness, marketing, and recruiting campaign.

An annual occupational needs assessment of the targeted industry sectors is necessary for many reasons. Without knowledge of the jobs that currently exist in the region, it is impossible to market the various targeted clusters as a career, to construct attractive career paths, to convince educational institutions to dedicate scarce resources to education and training programs, to help career counselors and parents to understand and encourage careers in this sector, to raise resources to support further workforce development, and to comprehend the workforce needs of the firms in the region. An annual workforce and occupational survey is an essential element in a campaign to make the clusters more visible, more defined, and more attractive to many important audiences.

Such a survey can be implemented using the Internet, focus groups, secondary labor market information, and a quarterly sample of personal interviews. It will be important for the region to leverage other

occupational survey efforts being undertaken by the Indiana Department of Workforce Development (DWD) in partnership with the Central Indiana Corporate Partnership's (CICP) Workforce Development Initiative.

The role of the survey is multiple, in that the audiences that it will inform and the policies that it will shape are far-ranging. Understanding the volume of each type of position, projected growth, and age profile will help inform the development of educational and training programs. Understanding the different types of positions and their positive and negative aspects will help with recruitment, career counseling, and developing appropriate career paths between different jobs. Understanding their economic impact will help secure support for this and related cluster initiatives.

Action 2: Actively inform and educate students, parents, and educators on career opportunities that exist in the identified industry clusters and the educational requirements and career pathways needed to access them.

The lack of understanding of the types of jobs that are available within the targeted industry clusters is a problem with respect to workforce attraction, recruitment, and retention. To help overcome this issue, the region and the industry must begin a multi-faceted communications campaign to inform the populace of the occupational opportunities that currently exist and are forecasted to be in demand in the future. Using a range of communication and organizing tactics, this campaign will target not only educational providers, such as teachers throughout the K-12 system, administrators, and guidance counselors, but also the students, parents, regional leadership, and community thought leaders about employment opportunities within the targeted industry clusters or through entrepreneurial endeavors. Building off of existing and ongoing activities such as the successful Manufacturing Day, the following types of efforts suggest some other potential elements of this campaign.

- **Regional Workforce Conferences.** Drawing on industry-specific occupational, marketing, and communications material, the region needs to convene a series of conferences focused on the targeted industry clusters and their current and future workforce challenges based on the initial workforce survey results. In the future, the conferences could be an annual event releasing findings and trends from each year's survey.
- **Employee/Entrepreneurial Ambassadors.** Current employees and entrepreneurs are important targets for an industry education campaign. Providing speakers at various educational events and community gatherings (chambers, service organizations, etc.) will be an important component of spreading the word about career opportunities.
- **Creation of Higher Education Career Councils.** Another series of essential marketing and communications targets are the leadership, staff, and students of the regional college and universities. It is essential that each industry cluster create a formal and ongoing connection to the region's higher education institutions. One step could be the creation of higher education careers councils. Members of the council could be university and college leaders, key department chairs, selected academic instructors, and appropriate career counseling staff. As a formal mechanism to involve academic leadership as well as career counseling staff from the region's college and universities, this council would provide a forum for an ongoing dialogue about the employment, education, and training issues facing the targeted industry clusters. The council need not meet more than annually, but written communication could be monthly and committees could be formed on special topics of concern.

- **Internet Presence.** Many employment sectors have created excellent marketing and recruitment initiatives that the Wabash Heartland Region should review and possibly emulate. Given that young people are intensely involved with online media, providing career and employment information via the Internet is an increasingly common, cost-effective, and often extremely useful marketing channel to explore. An excellent example of a career website presence is the efforts of the Virginia Career Education Foundation through their efforts at www.KnowHowVirginia.org. The website has content tailored for students, parents, as well as offers excellent resources for teachers and educators regarding career opportunities.

In summary, there are a host of communication techniques available to significantly increase targeted industry cluster visibility, especially with respect to the existing and new workforce. Many initiatives are currently ongoing throughout the region, but are often focused within a specific school district or locality. In order to build scale and reach a critical mass that can begin to impact the overall attitudes and culture of the region, it will be imperative that lessons are learned and best practices are emulated so that a systemic regional initiative can be developed and scaled to reach across the ten counties.

Action 3: Improve STEM education at the K-12 level, including soft skills, leveraging current best practices, industry partnerships, and experiential learning to scale a systemic workforce/talent initiative that reaches across the region.

One hears the acronym STEM (Science, Technology, Engineering, and Math) a lot whenever the discussion turns to improving education in the United States, and there is a good reason - STEM job creation over the next ten years will outpace non-STEM jobs significantly, growing 17 percent, as compared to 9.8 percent for non-STEM positions. STEM disciplines are the cornerstones of the jobs that will keep America competitive in the near and distant future.

Engaging students in scientific or technological careers while engraining the knowledge and adoption of soft skills is seen as a difficult challenge across the country. It is recognized that a child should be introduced at an early age to mathematics and the sciences; otherwise, the child will quickly fall behind and be unprepared to enter post-secondary engineering or scientific curricula. Developing programs and initiatives designed to interest students and parents in technology is critical. It is generally agreed that students choose early in their educational careers to take the necessary math and science classes to prepare them for advanced work in technological fields. Therefore, it is extremely important that technology careers are promoted so that students can understand the benefits of pursuing a scientific course of study. Schools should have “invention” laboratories supporting broad career exploration, authentic strategies for academic instruction, and opportunity for student creativity in solving problems. Student experiences (technology competitions, technology mentors, higher education summer enrichments, etc.) contribute to a climate of high expectations and opportunities. The industry clusters should support middle, junior, and high school student and teacher experiences in relevant cluster fields.

One way to build and retain talent is to establish personal relationships with students while they are still in school. Experience indicates that efforts such as internships and co-op programs can be effective in increasing the retention rate of graduates, reducing their out-migration to other states and regions. Such an effort not only keeps students in the region, but also exposes firms to new skills and approaches as they address their product development needs.

A number of initiatives exist within the region to link students with employees for internship opportunities. While such individual programs are extremely valuable to the students and companies they serve, a more region-wide systemic and structured internship/co-op initiative could provide a matchmaking service to link targeted industry cluster firms with students across the Wabash Heartland Region's education institutions. Many benefits could accrue from an enhanced, systemic internship/co-op function, including:

- Increasing the perceived value of the Wabash Heartland Region's education, to both prospective students and parents. Parents increasingly desire evidence that their child is receiving both a theoretical and practical set of experiences and an education that will prepare him or her ultimately for the world of work.
- Providing important real-world feedback to curriculum and instruction, helping to ensure that course content, programs of study, and laboratory experiences are high quality.
- Increasing graduate retention rates.

The bottom line is that internships and other experiential learning activities help make students aware of local employers and also help local employers recruit future workers.

The Wabash Heartland Region can improve STEM, soft-skilled, and experiential learning education opportunities at the K-12 level by:

- **Sowing STEM Seeds Early.** Students who have exciting experiences in STEM subjects early are more likely to follow through. Eighth graders with an interest in STEM are three times more likely to pursue degrees in those careers later.
- **Showing Students Why STEM Careers Matter.** Underrepresented groups, like women and minorities and students from low-income areas, need to observe others like them who are involved in STEM-related careers to spark their interest.
- **Explaining that STEM Education Creates Opportunity.** Every targeted industry cluster needs additional graduates with STEM focus and the requisite soft skills to fill the growing number of jobs that require those skills.
- **Providing Real-World Experiences.** Connecting targeted industry clusters to students through internships and co-ops programs.

Project Lead the Way (PLTW) is one example of STEM programming that has met with success in other areas of Indiana and is being tried by different school districts in the Wabash Heartland Region. The project-based aspects of the Project Lead the Way curriculum provides students a chance to apply what they know, identify a problem, find unique solutions, and lead their own learning, rather than be passive recipients of information in a question-and-answer, right-or-wrong learning environment. PLTW programs using the following approach and guiding tenets:

- Collaboration: ongoing input and feedback from students, teachers, administrators, and subject matter industry experts.
- Research/Evidence-Based: develop a cohesive and coherent instructional path for students.
- Problem-Based: activity-, project-, problem-based experiences prepare students to solve problems. This approach creates scaffolding for student learning and provides the rigor and relevance that engages and empowers students.

Scaling PLTW or a similar STEM educational activity so that they can be incorporated systemically through the region's educational systems will bring an economies of scale type solution to a region wide problem.

Another potential solution would be the development of one or more Purdue Polytechnic High Schools in the region and/or developing portable curriculum for existing high schools throughout the region. A new initiative of Purdue, the Purdue Polytechnic Indianapolis High School, the first in the state scheduled to open its doors in the fall of 2017, is a STEM-based curriculum in which the first two years encompass problem- and project-based learning focused on science, technology, engineering, and mathematics with a connection between those subjects and real-world challenges. Students entering 11th grade select a specific pathway to master skills, earn college credit, and gain industry credentials while learning in the high school classroom, at Purdue's West Lafayette campus and in the workplace. In the 12th grade, students complete an internship of their chosen pathway. Offering this unique high school experience, through the development of one or more Polytechnic High School in the region and/or developing portable curriculum for existing high schools through the region, focused on the specific target industry clusters could be a unique comparative advantage for the region.

Action 4: Working with industry, create career pathways that include experiential learning experiences for high demand careers within the region.

With few exceptions, publicly supported education systems are not well aligned with workforce, economic development, and social service systems at any level of government, and none of these systems is adequately responsive to the labor market. In other words, our public systems—and our investments in those systems, as taxpayers and customers—are not paying off; they are producing too few workers with the skills our communities need to thrive in the emerging knowledge economy.[56]

As the economy becomes more complex and competitive, the labor market becomes more complex and confusing for students, parents, job seekers, employees, employers, and educational leadership. For younger and many middle-aged employees and employees-to-be, the rules of job success and likely career paths in the economy they are entering are vastly different than the economy that shaped either their prior experiences, or for existing students, their parents' experience and careers. This is one place where it is difficult for older generations to pass on experience and knowledge to the next generation. Previous education and career paths do not work as well, or in some cases are not even available, in the global economy.

This drastic change in labor market expectations and pathways has extremely significant implications for the Wabash Heartland Region's targeted industry clusters. When there is confusion and lack of knowledge in any marketplace, people will fall back on the tried-and-true "certainties" that they believe they know, and they will avoid areas that are unfamiliar to them (or their parental or educational advisors). This risk-avoiding behavior is natural, and the labor market is no exception. In this case, it means that students, parents, employees, and institutions will tend to gravitate toward educational activities and careers in "known" fields with clear career paths and industry awareness, such as healthcare, public administration, teaching, and finance. In contrast, the region's targeted industry cluster's career fields and

[56] Jenkins, D. "Career Pathways: Aligning Public Resources to Support Individual and Regional Advancement in the Knowledge Economy." Workforce Strategy Center. August 2006.

industries are not as well known; they have careers and jobs that range between invisible and unattractive; and the sectors do not have an industry culture with a history of reaching out and building community connections. In summary, the changing labor and career marketplace has created challenges for all industries; but, for those sectors like value-added metals processing and life sciences that are complex, confusing, and poorly known, these challenges are a much greater problem.

On an institutional level, the educational and workforce training career structures, linkages, and job advancement practices that served to provide skills and knowledge to a past generation are now no longer effective for a new generation of employees, and a new set of economic challenges. The labor market rules of success and failure have been and are continuing to be reinvented by the forces of globalization. Because of this, there is an important need to reinvent not only individual knowledge of how the labor market now works ("career literacy"), but also to create a new set of structural relationships between students, employees, educational institutions, and industry. Many would argue that it is misleading to put students through an education and training process designed for the economy of the 1960s to 1980s, and expect them to succeed in the dramatically reinvented global economy of 2015 and beyond.

One relatively new tool essential in helping the Wabash Heartland Region's workforce to this new economy is the creation and support of "career pathways." Career pathways is a new and somewhat multipurpose term covering activities focused on more effectively coordinating a community's or region's educational institutions with the workforce needs of the region's economy. An interesting specific example of this type of educational offering within the region is the "Pathway to Purdue" program, a partnership between the Purdue University's College of Agriculture and Ivy Tech Community College-Lafayette that is designed to help make higher education even more accessible to Indiana students. The program allows Ivy Tech students to co-enroll at Purdue in preparation for an undergraduate degree in the College of Agriculture. Pathway students take courses simultaneously at both institutions with the goal of earning a Bachelor of Science degree in agriculture from Purdue. In addition to this specific program, Ivy Tech and Purdue have worked to develop 12 additional STEM-related transfer pathways, which include programs relevant to a number of the targeted industry clusters, such as:

- Mechanical Engineering
- Mechanical Engineering Technology
- Electrical Engineering Technology
- Computer Science
- Information Technology/Informatics

If the targeted industry clusters aspire to build a competitive advantage based on its workforce and human capital assets, then developing a set of defined career pathways with local high schools, community colleges, and 4-year institutions is a critical action step.

Aligning Regional Resources via Career Pathways

"Career pathways" is a term for a framework by which regions can better align publicly supported [education and workforce] systems to build a workforce customized to the needs of local labor markets. A career pathway is a series of connected education and training programs and support services that enable individuals to secure employment within a specific industry or occupational sector, and to advance over time to successively higher levels of education and employment in that sector.

Career pathways target jobs in industries important to local economies. They are designed to create both avenues of advancement for current workers, jobseekers and new and future labor market entrants and a supply of qualified workers for local employers. They also serve as a strategy for strengthening the "supply chains" that produce and keep a region's knowledge workforce up to date. The specific form and content of a career pathway will depend on the particular industries targeted, the requirements of employment and advancement in the target sectors, and the existing infrastructure for education and workforce development in those sectors.

Jenkins, D. "Career Pathways: Aligning Public Resources to Support Individual and Regional Advancement in the Knowledge Economy." Workforce Strategy Center. August 2006.

Common Features of Career Pathways

Career pathway programs and structures vary greatly, given the variation between industry and job targets; however, common elements are as follows:

- Jointly produced occupation "road maps" that show how education and industry intersect for occupation and advancement potential
- User-friendly linkages between remedial, educational, and occupational training
- Heavy reliance on specific occupational data, job progression patterns, and job requirements
- Course content defined in terms of competencies required for jobs and, where possible, tied to industry skill standards and certifications
- Training and education offered in modules that represent clear stepping stones to advancement
- Training offered at times, places, and with support services to enable maximum participation
- Outreach and bridge building to middle, high, and vocational schools
- Blending of private and public funding

The following are several core tasks that would be involved in building each career pathway:

- Create a joint industry, education, and public sector collaborative to illuminate in detail the region's workforce supply and demand situation and, with that information, to select the most pressing employment and career pathways for industry focus.
- Create a series of linked education and training opportunities and curricula so that students from middle school through college can understand the kind of knowledge they need to acquire to create career opportunities for themselves in the targeted industry cluster.
- Develop a detailed understanding of the internal recruiting, internal corporate training, promotion, and job progression path that exists within and among companies for existing employees (the "internal" workforce pathways).

It should be noted that there is no single type of career pathway. Career pathways vary because this is a new tool for education-industry partnerships to use and because different jobs require different education and skill levels. For instance, a career pathway for occupations that primarily require certificates (e.g., truck driving and a commercial driver's license) differs significantly from that for jobs that require formal, post-graduate education (e.g., computer software programmer).

In addition, the ability of students to move seamlessly from one level of education to the next in their chosen field of study without missing a beat in obtaining their ultimate educational goal, whether it be an associate's degree, bachelor's degree, or advanced degree, is critical. This seamless integration is achieved through enhancing real partnerships between all educational institutions and workforce development training organization in the Wabash Heartland Region across the various levels that result in students achieving their long-term learning goals. With recent changes to the Federal

Workforce Investment Act's (WIA) funding priorities that now focus more intently on working more closely with industry, and well as Indiana's Department of Workforce Development's Skill-Up Indiana! Initiative, there has never been a better time to attempt to align the various resources to meet the needs of regional industry by creating career pathways. The efforts should also coordinate and leverage the regional efforts being undertaken as a result of the 2020 Workplace Conference that was held in October of 2015.

Action 5: Launch a campaign to attract skilled technical and managerial talent, including efforts to engage veterans and other targeted groups, to near-term employment opportunities within in the region.

Because of the out-migration that has occurred from the Wabash Heartland Region, many natives of the region have undertaken successful careers elsewhere. Due to these individual's natural affinity and ties to the region, it may be possible to attract them back to the region if an opportunity to do so was presented. In addition, due to the region's central location between Chicago and Indianapolis, the region is also presented with the opportunity to attract talent from the larger urban centers, particularly those who are seeking a higher quality of life at a lower cost of living.

Among several targeted groups, one such group of talent to attract is veterans. At nearby Ft. Campbell in Kentucky, approximately 2,000 soldiers are expected to be discharged in the first half of 2016. These soldiers will have an immediate need to identify the direction of their career paths moving forward into civilian life. Additionally, because of the reduction in active duty forces in the Middle East, the potential for more returning soldiers is expected to increase even further.

Within the Wabash Heartland Region, approximately 1,000 veterans, reservists, and National Guard members are being served by Ivy Tech Community College and Purdue University, and employers within the region (including GE and Subaru) have active recruiting programs for veterans. The Greater Lafayette Chamber also has been involved with recruitment efforts, including career fairs, and regional leaders are currently planning, in concert with state leaders, broader initiatives to recruit veterans. Some of these programs include:

- Purdue University Entrepreneurship Bootcamp for Veterans with Disabilities, through Purdue's Krannert School of Management
- Military Family Research Institute at Purdue University
- Veterans Success Center for Purdue University students
- Ivy Tech Community College support for student and non-student veterans through its Veterans Affairs Office
- Greater Lafayette Chamber's support for Ft. Campbell soldiers to provide weekend transportation to the region for tours and skills assessments by regional employers, and
- Major employers within the region (e.g., Wabash National, Subaru, GE Aviation, etc.) attending Ft. Campbell career fairs to inform them of career opportunities.

But what is lacking is a cohesive, regional effort to engage this talent pool with opportunities across the major employers throughout the region.

Other regions have pursued efforts to reach out to publicize the quality of career opportunities, quality of place, and even help in matching workers to jobs in their regions. This effort includes state efforts such as Project Boomerang in Oklahoma and the Iowa Careers Consortium. In Huntsville, Alabama, home to the Army's Redstone Arsenal, the regional Chamber of Commerce has an active marketing campaign to attract high-skilled workers to the region, focusing on Huntsville as "a smart place." In this effort, it features all of the live-work-play advantages that Huntsville offers to technology and other high-skilled professionals, plus features a "find a job" website that provides information about civilian jobs at Redstone Arsenal and features a job matching service for job seekers and employers. A more hands-on focus to match workers with specific skill sets to employers is the Pittsburgh Digital Greenhouse, which in its early years focused on helping in talent recruitment for firms in Pittsburgh to pursue lab-on-a-chip technology development, and later focused more broadly on electronics and robotics. What has been learned from these efforts is the importance of creating a public-private partnership, which develops and maintains dynamic databases of jobs and skilled workers, conducts outreach marketing, and serves as a key point of access for job seekers and employers in selected areas.

The targeted industry clusters should work with the region's academic institutions to identify alumni that might be interested in joining a firm, starting a firm, or encouraging their employer to consider the Wabash Heartland Region as a location in which to expand. Consideration should also be given to undertaking a limited marketing campaign in the Chicago and Indianapolis markets that advertises the region as an alternative location emphasizing the quality of place that the Wabash Heartland Region provides. Finally, there is also an opportunity to tap into retirees who may have the desire to return to the region and provide their services/expertise on a volunteer basis.

Strategy 3: Leverage the Region's Long-Standing Research Strengths and Recent Investments to Diversify the Economy through Innovation, Entrepreneurship, and Education

In this global, knowledge-based economy, it is not surprising that university research is viewed as a comparative advantage for a region's economic development efforts. As the National Governors' Association, in its guidance to governors on State Leadership in the Global Economy, explains:

> *"World class research is a passport to success in the global economy. Industry can no longer compete by selling standard products made with standard processes and that could be produced anywhere in the world at lower cost. Businesses must constantly innovate to raise the quality of production, introduce new product lines or services, and add greater value to their outputs. For this reason, states must create an environment that supports continuous innovation. This requires investment in cutting-edge research, facilities and equipment."*[57]

Indeed, the evidence on the importance of research universities to advancing technology-based economic development is overwhelming:

[57] National Governor's Association, "A Governor's Guide to Trade and Global Competitiveness," 2002, page 5.

- The Milken Institute notes that research centers and institutes are "indisputably the most important factors in incubating high-tech industries." In a widely cited study, they found that 65 percent of the difference in economic success for regions from 1975 to 1998 is accounted for by the presence and growth of high-technology industries.[58]
- According to a study prepared for the U.S. Small Business Administration, "Research universities and investment in research universities are major factors contributing to economic growth in the labor market areas in which the universities are situated."[59]
- Studies by the Office of Technology Policy and others have found that all areas of technology-based economic development in the United States have strong concentrations of both university and private research.[60]
- A long term longitudinal study of the relationship between the stocks of knowledge from academic publications and industrial productivity found a significant and large impact.[61]
- An industry survey by Carnegie Mellon University found that university and government laboratory research importantly affects industrial R&D across much of the manufacturing sector, equally through suggesting new projects and contributing to the completion of existing projects and that the influence of research on industrial R&D is disproportionately greater for larger firms as well as start-ups.[62]

The benefits that a region's university research base can advance are best considered through a number of standpoints:

- What is the overall university research growth trajectory and its ability to compete for federal research funding?
- Where are the areas of research excellence that stand out and how do they align with key industry drivers?
- How well is the university research base directly connected to industry?
- How does the university research base perform in turning transferring their discoveries to the marketplace?

Regions such as Boston, Silicon Valley, and, more recently, Austin, Texas and the Greater Washington, DC Corridor, utilize the research strengths of their leading universities, research institutes, and private industry to build new industries and generate broad economic gains. It is essential to recognize, however, that regions that will excel in the future will not pursue research for research's sake. Instead, they will develop integrated, comprehensive development strategies that link core research

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[58] Milken Institute, America's High-Tech Economy, 1999.

[59] Bruce Kirchhoff, "The Influence of RandD Expenditures on New Firm Formation and Economic Growth," Maplewood, N.J.: BJK Associates, 2002.

[60] U.S. Department of Commerce, Office of Technology Policy, *The Dynamics of Technology-based Economic Development: State Science and Technology Indicators*, Washington, D.C., 2000.

[61] James D. Adams, "Fundamental Stocks of Knowledge and Productivity Growth, Journal of Political Economy, 98:673–702.

[62] Cohen, Nelson and Walsh, "Links and Impacts: the Influence of Public Research on Industrial RandD, Management Science, January 2002, Vol. 48, No 1.

strengths with technology industry drivers, both existing and emerging, while recognizing that research must move at the speed of business rather than on a standard university timetable.

As Section 4 discussed in detail, the Wabash Heartland Region has a unique comparative advantage with regard to the level and quality of research that is taking place within its borders. How to leverage that research to serve as a unique economic engine tied to industrial needs and opportunities will be a critical element in developing economic and community prosperity for the region. Economic development is often viewed as a three-legged stool—retention/expansion, attraction, and new business creation. How Purdue and other regional research assets can be leveraged to drive growth among each of these three legs needs to be a vital component of the economic development strategy across the region moving forward.

The following actions attempt to leverage the region's long-standing research strengths and recent investments to diversify the economy so that this unique economic engine can drive business retention/expansion, attraction, and creation.

Actions to Pursue

1. Leverage the recent increase in National Institute of Standards and Technology (NIST) Manufacturing Extension Partnership (MEP) Funding for Purdue's Technical Assistance Program (TAP) Manufacturing Program.

2. Leverage the recent Purdue investments in the Research Park Aerospace District to develop a targeted industry cluster in Aircraft Manufacturing.

3. Leverage the recent Purdue investments and Ivy Tech's existing agbiosciences programs, as well as Purdue's extension office network, to position the region for growth in multiple segments of food and agriculture, including plant science, livestock, and precision agriculture technological advancements.

4. Leverage commercialization and entrepreneurial activities to work to diversify the region's economic base.

5. Leverage the recent investment in the Purdue Polytechnic Institute by linking the regional industrial workforce demands to the curriculum and experiential learning opportunities.

Action 1: Leverage the recent increase in NIST MEP Funding for Purdue's TAP-Manufacturing Program.

The U.S. Department of Commerce's National Institute of Standards and Technology (NIST) Manufacturing Extension Partnership (MEP) is a nationwide system of resources that provide services, education, and training to help manufacturers compete globally, support greater supply chain integration, and provide access to technology for improved productivity. MEP is built around manufacturing extension centers locally positioned throughout the nation.

Within Indiana, Purdue MEP is the designated manufacturing extension center for the state. Purdue MEP is a business unit of the Purdue Technical Assistance Program (TAP), which provides high-value solutions that help Indiana businesses maximize their success by increasing profits, reducing costs, and implementing growth systems.

This past year, the TAP-Manufacturing Program was awarded $13.79 million in federal funding over the next five years to serve the competitive needs of small and mid-sized manufacturers in Indiana through the Purdue MEP program. The funding, which quadruples the size of the center, allows for a dramatically increased presence in critical manufacturing areas across the state; increases services for small, emerging and rural firms; and provides a stronger focus on services related to product, customer and market growth.

In the past decade, the organization has provided on-site assistance to more than 950 manufacturing clients with services such as lean manufacturing assessment and implementation, Six Sigma certification, quality improvement, supply chain optimization, energy efficiency and sustainability, and quality management systems. This assistance has resulted in the Center's clients collectively achieving more than $1.2 billion of economic impact in Indiana.

As a result of the increase in funding, Purdue MEP plans to build upon its competencies in productivity and management systems, as well as its role as a client engagement manager to many other Purdue assets. Once fully implemented, the Center anticipates working with more than 1,000 Indiana manufacturers each year through meaningful competitive improvement projects.

As the Wabash Heartland Region works to expand the economic footprint of its targeted industry clusters as outlined in Strategy 1, the region has the opportunity to leverage the additional federal funding received by Purdue MEP to ensure that manufacturing companies in the region are aware of and take advantage of the services that are offered, which include:

- Lean manufacturing and lean office
- Six Sigma
- Supply chain optimization
- Innovation and product development
- Quality and environmental improvement
- Energy efficiency and sustainability
- Project management
- Leadership development

While it is anticipated that Purdue MEP will be increasing its level of outreach as a result of the increase in funding, it is important to recognize that this program is statewide. Therefore, it would benefit the region if the industry cluster initiatives that are established in Strategy 1 include an effort to undertake additional outreach and communication about the capabilities of MEP Purdue and foster linkages between local manufacturers and the services offered to ensure that any company in the region that could benefit from the services is aware of the effort and is linked to the program. By leveraging this capacity that is housed within the region, the Wabash Heartland Region has the ability to intensify its business retention and expansion efforts within the targeted industry clusters, including reaching the rural areas of the region.

Action 2: Leverage the recent Purdue investments in the Research Park Aerospace District to develop a targeted industry cluster in Aircraft Manufacturing.

Aerospace products and parts manufacturing represents a $225 billion global industry that has been growing at an annualized rate of 6.4 percent over the last five years. The market is driven by the increased demand for air transportation and defense spending. Over the past five years, the industry sector has seen a rapid increase in demand from the commercial sector, while the demand from the defense industry has fallen off. Looking ahead, federal demand is still uncertain; however demand from the commercial sector is expected to increase, especially as industry members invest in more fuel efficient engines for newer fleets as well as to upgrade older fleets. Overall industry revenue is expected to grow at an annualized 4.2 percent to reach $276.9 billion over the 2015-2020 time frame.[63]

The three companies with the largest market share in the U.S. aerospace products and parts manufacturing market include The Boeing Company (34.5 percent), United Technologies Corporation (9.3 percent), and Lockheed Martin Corporation (6.6 percent). The Boeing Company, one of the world's largest aerospace companies, is headquartered in Chicago and is the only large commercial jet manufacturer based in the United States. United Technologies Corporation is headquartered in Hartford, CT, and manufactures and supplies technology products and services to the aerospace and other industries. Lockheed Martin Corporation is composed of five segments, with its aeronautics division being most industry relevant. It is Lockheed's largest division, and its products include stealth and multirole fighter jets and military transport aircraft. The company is located in Bethesda, Maryland.[64]

The aerospace products and parts manufacturing industry sector can be broken down into three primary segments:

- **Aircraft Manufacturing:** This industry segment, which represents 60.5 percent of the overall aerospace products and parts manufacturing industry sector, includes the manufacturing of both private and military grade aircraft. With federal budget cuts over the past five years and the reduction of combat operations in the Middle East, the revenue share from combat and defensive aircraft manufacturing is expected to fall from 40 percent in 2010 to about 25 percent in 2015. However, demand from the commercial sector has realized significant growth over the past five years with revenue from this sector anticipated to climb to 75 percent of the overall market.[58]
- **Aircraft Engine Manufacturing:** The manufacturing of engine parts, modifications, and whole engines (both private and military) makes up roughly 19.2 percent of revenue in the U.S. aircraft manufacturing industry. As with the aircraft manufacturing segment, commercial engine manufacturing accounts for more than half of the segments revenue. Fuel efficiency and environmental factors are expected to increase demand in this sector. General Electric, with an estimated market share of 4 percent, is recognized as a major supplier of both military and private aircraft engines. Its subsidiary, GE Aviation, creates aerospace systems, engines, and replacement parts. GE Aviation is expected to make $9.1 billion in revenue in the United States in 2015.[58]
- **Aircraft Auxiliary and Other Parts Manufacturing:** Comprising 20.3 percent of the overall aerospace products and parts manufacturing industry sector, items produced in this segment include

[63] IBISWorld Market Report: *Global Commercial Aircraft Manufacturing*, September 2015.
[64] IBISWorld, *Aircraft, Engine and Parts Manufacturing in the U.S.,* September 2015.

rotors, transmission equipment, landing gear, etc. The aircraft parts manufacturing segment is less concentrated compared to the engine manufacturing segment, with large aircraft development and assembly firms typically having many different parts contractors that they are engaged with to supply aircraft parts. As air travel increases, demand for products in this segment increases as aircraft parts wear out and need to be replaced. The 2015-2020 period is expected to realize increased demand for air travel. This demand should lead to increased demand for products from this sector.[58]

The Wabash Heartland Region has a unique opportunity to attract components of the aerospace products and parts manufacturing industry sector to the region by leveraging the research strengths of Purdue University and the recent investments by both the university and private industry in this market space. For example, Purdue's recent investment in a 980-acre aerospace technology park provides unparalleled opportunities to attract components of the aerospace products and parts manufacturing industry sector that are interested in developing collaborations with Purdue's:

- Maurice J. Zucrow Laboratories for Rocket and Jet Propulsion Research
- Mach 6 Quiet Flow Ludwieg Tube Wind Tunnel
- Polytechnic Institute Department of Aviation Technology
- Indiana Manufacturing Institute to Support Advanced Composite Materials
- Advanced Aviation Analytics Institute for Research
- Air Transport Institute for Environmental Sustainability
- Center of Excellence for General Aviation: PEGASAS
- Rig Testing for NextGen Alternative Fuels for General Aviation
- Purdue Center for Materials Processing and Metal Casting Research
- Center of Excellence on Aircraft Noise and Aviation Emissions Mitigation
- Center for Materials Processing Research
- Airliner Cabin Environment Research (ACER)
- Institute of Thermal-Hydraulics

Numerous researchers' patented technologies to improve engines, sensors, propulsion systems, blade designs and composite materials. Already, the region has been able to leverage this world-class research and investment by attracting:

- GE Aviation's new $100 million jet engine assembly facility, a 225,000-square-foot facility in Lafayette that assembles the new LEAP engine.
- Rolls-Royce's aerospace research and development facility, which was recently announced to be developed within the research park.

Therefore, it would benefit the region if the industry cluster initiatives that are established in Strategy 1 include an effort to undertake a strategic attraction campaign focused on the global aerospace products and parts manufacturing industry sector, which is highly complementary to the existing Value-Added Metals Processing cluster already identified as a key industry target. By leveraging the historic research strengths of Purdue, along with the recent momentum and excitement that is building around the

announcements by the aerospace technology park, GE Aviation, and Roll-Royce, the region has the opportunity to strategically target its business attraction efforts to include this growing market segment.

Action 3: Leverage the recent Purdue investments and Ivy Tech's existing agbiosciences programs, as well as Purdue's extension office network, to position the region for growth in multiple segments of food and agriculture, including plant science, livestock, and precision agriculture technological advancements.

As was discussed in Section 3 and again highlighted in Strategy 1, the Agbioscience industry cluster represents a significant comparative advantage for the region based on the size and concentration of the industrial base. A key global challenge that the Agbioscience industry is working to solve involves how to increase agricultural production without pressing more land into agricultural use. Striving to increase yield from every square foot of farmland, researchers and equipment producers are increasingly deploying new technologies to create a "precision agriculture" industry. Precision agriculture systems deploy highly precise global positioning systems, advanced sensors, and data analysis technologies—all of which are dependent on strong digital connectivity, as referenced in Strategy 1—to provide the tools and information farmers need to optimize and customize the timing, amount, and placement of seed, fertilizer, pesticides, irrigation, and other inputs. All of this technology focuses on the goal of producing maximum yield at the lowest cost.

Precision agriculture represents a significant market opportunity as it drives the next evolution in production systems, embracing an emerging set of technologies in sensing and data analytics to gather, track, and analyze agricultural data, usually in conjunction with other systems such as harvesting, planting, or field-inputs application machinery. Integrating multiple hardware and software technologies, precision agriculture includes not only traditional agricultural equipment manufacturers, but also includes companies engaged in information- or computer-oriented technologies, including agricultural decision support software, sensors and monitoring systems, global positioning system (GPS) and mapping systems, predictive modeling technologies, and unmanned aerial surveillance (UAS) and imaging technologies.

The Economist views precision agriculture as "the biggest change to agriculture in rich countries since genetically modified crops"[65] and Battelle concurs with that assessment. Precision agriculture is being empowered by advancements in "big data" analytics. Big data involves an ongoing major paradigm shift in the processing and use of data. Rather than analyzing data collected over time to assess what occurred in the past to make decisions – which is today's standard approach to using more high-powered analytics to analyze massive data sets stored in data warehouses – this new paradigm will be using real-time continuous processes for sensing, gathering, protecting, analyzing, and interpreting data that allows one to improve an outcome during an event based on real-time information from sensors, radio frequency identification, and other devices.[66] AgInformatics is a new term used to describe the study and practice of creating, storing, finding, manipulating, and sharing food and agricultural information and data along the entire value-chain. This shift in technology requirements is entirely dependent on a strong data network,

[65] *Schumpeter*, "Digital Disruption on the Farm," The Economist, May 24, 2014.

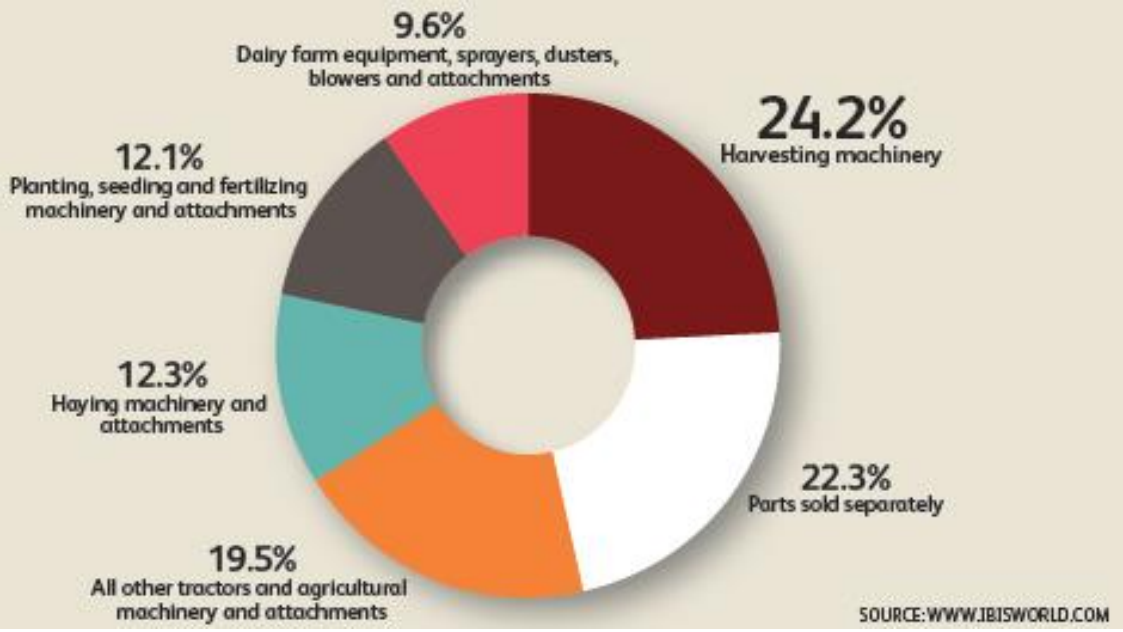
[66] See Davenport, Barth and Bean, "How "Big Data" is Different," MIT Sloan Management Review, July 30, 2012.

including Wi-Fi, cloud-based data storage, broadband, and fiber networks that are essential to create the necessary digital connectivity for this emerging industry.

Recent market research concludes that the aggregated revenue of US manufacturers of agricultural machinery totaled $41.6 billion in 2014, with exports totaling $11.8 billion. IBISWorld projects annual growth in the sector from 2014 through 2019 to be 2.4 percent (a decrease over the previous annual growth rate for 2009-2014, which stood at 3.9 percent).[67] IBISWorld notes there to be 1,138 businesses in the sector within the United States with a total employment of 17,211 personnel. Market researchers at the Freedonia Group are projecting that the global market for agricultural equipment will grow 6.9 percent annually through 2018 to reach $208 billion.

The IBISWorld report divides the US agricultural equipment manufacturing sector into six segments as illustrated in Figure 33.

Figure 33. IBISWorld Market Research – Segmentation of the US Agricultural Equipment Manufacturing Sector (2014)



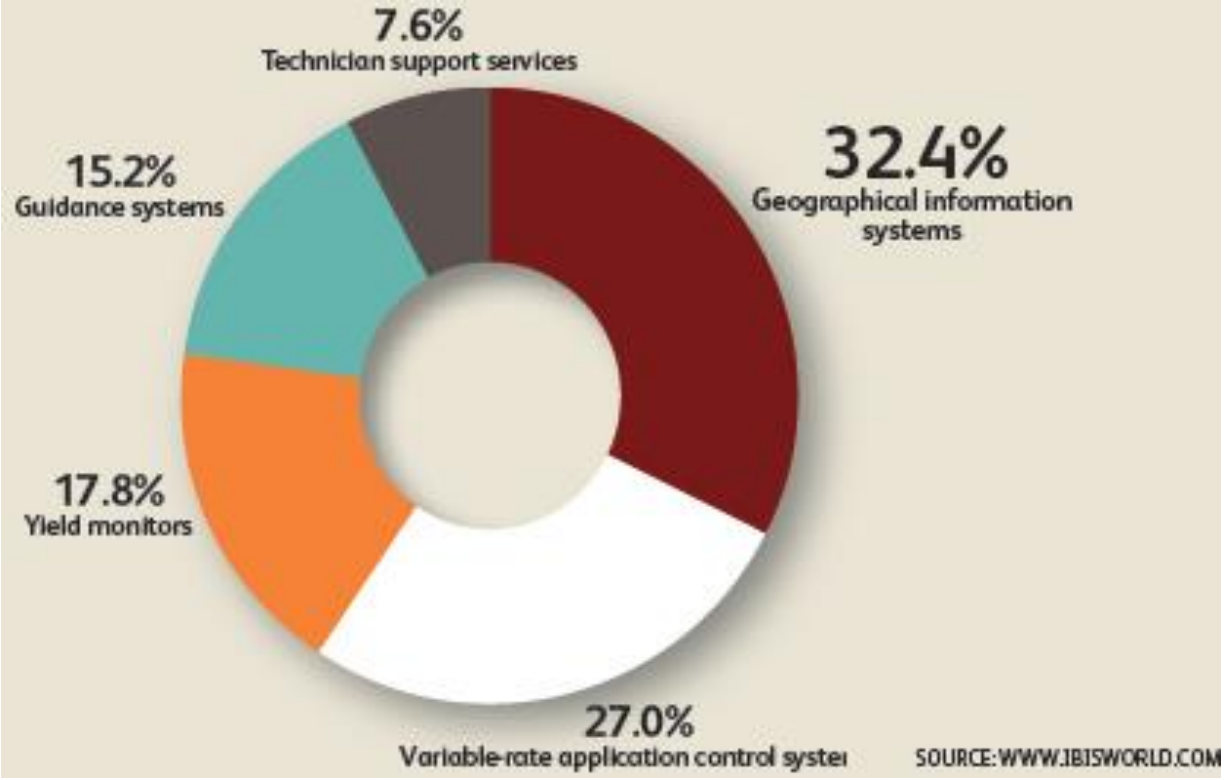
The emerging precision agriculture technology segment is obviously smaller in total market size – representing a sub-segment of the overall agriculture equipment marketplace. IBISWorld research specific to precision agriculture systems and services in 2014 places the sector as having overall revenues of $1.5 billion in the United States (3.6 percent of total US agricultural equipment revenues). The emerging nature of the sector, however, is evident in growth statistics and projections, which indicate the sector grew at an annual growth rate of 5.3 percent during 2009 through 2014, projected to increase

[67] IBISWorld. “Tractors and Agricultural Machinery Manufacturing in the U.S.” June 2014.

to an annual rate of 6.6 percent from 2014 through 2019 (2.8 times the rate of growth projected for the overall domestic agricultural equipment sector).[68]

The precision agriculture sector lends itself, more so than the overall agricultural equipment sector, to entrepreneurial business development. Like other high-tech and information technology intensive sectors, precision agriculture systems provide a market for small companies to introduce innovations. This characteristic of the sector is evidenced by data indicating there to be 1,446 businesses operating in this sector in 2014 (a number larger than the number of businesses in the agricultural equipment manufacturing sector overall). Trimble Navigation Limited is identified as having the largest market share in the sector (22 percent) followed by Deere and Company at 12.9 percent. Segmentation of product and service categories in the precision agriculture space in the United States is illustrated in Figure 34.

Figure 34. IBISWorld Market Research – Segmentation of the US Precision Agriculture Systems and Services Sector (2014)



There are a range of views on the future growth of precision agriculture. The current market for precision agriculture in the United States is probably fairly estimated to be in excess of $1.5 billion. Some market researchers view it as an extremely fast moving market with expected compound annual growth of over 13 percent from 2013 to 2018, while others view the market growing at a more modest pace of under

[68] IBISWorld. “Precision Agriculture Systems and Services in the U.S.” May 2014.

7 percent.[69] Even under the less optimistic forecasts, the market for precision agriculture in the United States is expected to reach close to $2 billion by 2018, employing over 5,000 workers.

What is most interesting and relevant to the Wabash Heartland Region is the fact that no single region, university, or company has captured dominant market share in this industry sector to date. This fact leaves the industry sector open for both attraction and new business creation opportunities. Therefore, it would benefit the region if the industry cluster initiatives that are established in Strategy 1 include an effort to undertake a strategic attraction campaign as well as a business creation effort focused on the precision agriculture sector, which is a unique opportunity within the existing Agbioscience cluster already identified as a key industry target. By leveraging the historic agricultural research strengths of Purdue along with its recent investments through Purdue Moves in the plant sciences with relevant work in aginformatics and precision agriculture technologies, coupled with the region's industry drivers, both large OEMs and smaller firms, precision agriculture technological represent a unique opportunity for further economic growth within the region. Additionally, Ivy Tech's existing precision agriculture program can serve as a model to support the addition of other programs throughout the region.

Purdue University's extension office network also represents a unique opportunity to reach all corners of the region by disseminating information about precision agriculture, plants and livestock technologies to farmers and co-ops. By offering students in these programs the opportunity to use the technology in real-world environments, farmers in rural areas can simultaneously gain access to and begin incorporating the technologies into their fields to increase crop yields.

Action 4: Leverage commercialization and entrepreneurial activities to work to diversify the region's economic base.

The key to the Wabash Heartland Region's ability to achieve success in developing the third leg of the economic development stool, business creation, will be the region's ability to develop an entrepreneurial ecosystem that leverages the ongoing commercialization and entrepreneurial activities that currently exist to focus on scaling companies in an effort to diversify the region's economic base. It is important to recognize that innovation, in and of itself, will not necessarily translate into economic activity. Rather, it is the application of a technology and its introduction into the marketplace that results in economic growth. A number of studies point to the importance of entrepreneurship in changing regional economies. Starting with David Birch's work and validated by the Office of Advocacy of the U.S. Small Business Administration (SBA) and further refined by studies commissioned in recent years by the Kauffman Foundation and others, it is clear that technology, innovation, and entrepreneurship drive economic growth: "The large portion of entrepreneurial firms and the significant number of jobs created by newer, small firms in the U.S. are a strong indication that the entrepreneurial sector with its flexibility and capacity to adapt quickly is poised to become an even more important protagonist in the future economic growth of the country."[70]

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[69] Market intelligence is drawn from several reports including IBISWorld, Precision Agriculture Systems and Services in the U.S., May 2014; Focus Investment Banking, Precision Agriculture: Special Market Report, Winter 2014; and news releases from MarketsandMarkets, Precision Farming Market: Global Forecast and Analysis 2013-2018.

[70] Global Entrepreneurship Monitor: National Entrepreneurial Assessment USA 2003 Executive Report, p. 7. See www.kauffman.org/items/cfm/536, 11/11/04.

Indeed, research demonstrates that entrepreneurial activity is closely tied to a state or region's level of economic growth. The Global Entrepreneurship Monitor (GEM), a leading research consortium that seeks to improve understanding of the link between entrepreneurship and national economic growth, suggests that levels of entrepreneurship may account for as much as one-third of the variation in economic growth among regions, states, and nations.[71]

However, catalyzing entrepreneurial activity is a challenge for many regions. It is often stated that entrepreneurship is a "contact sport," and the barriers and obstacles to being able to scale a firm is significant, particularly technology firms. The three areas that entrepreneurs indicate are their greatest obstacles are talent, capital, and sales. Of these, the most significant obstacle to creating and growing entrepreneurial companies is the lack of experienced management talent. For the Wabash Heartland Region, there simply is not a cadre of experienced, serial entrepreneurs who know how to turn an idea or a product into a successful venture. Such serial entrepreneurs are needed not only to lead new ventures but also to serve as mentors to help fledgling entrepreneurs develop their skills and increase their chances of success. They have contacts in the investor community, can recognize quality deals, and help to generate deal flow that helps firms' access capital markets.

The second challenge facing entrepreneurs is access to capital. Entrepreneurs require access to capital at each stage of their development, from early-stage, proof-of-concept and prototype development to Series A and B venture financing. The Wabash Heartland Region has limited risk capital in which to invest, which leaves the region's entrepreneurial companies on the "runway"—unable to take off and reach their growth potential.

The third challenge that entrepreneurs face is to find customers and markets. The entrepreneurship assistance programs that exist focus primarily on providing financial, business planning, and incubator support to start-up companies to increase their chance of survival. And indeed, start-up companies face many obstacles. But, just because a start-up company remains in existence does not mean that success has been achieved. For many of these companies, the real challenges come when they are ready to grow. Once they have a management team and an organization in place, have obtained investment capital, and are ready to move to the next level, fewer resources are available to assist these companies in finding customers, identifying new markets, and generally increasing sales—all factors that will determine the level of their contribution to the economic health of the communities in which they reside. In addition, firms have difficulty keeping up with the competition, being aware of new discoveries that may affect their markets, and supporting continued product development, obstacles which can be lessened through closer interactions with universities and their researchers.

There have been a number of activities/initiatives undertaken within the Wabash Heartland Region to catalyze entrepreneurial growth and activity. Initiatives have included efforts such as:

- Purdue's Idea Foundry
- Purdue Research Park's Incubator
- Lafayette's MatchBOX

[71] Global Entrepreneurship Monitor 1999 Executive Report, p. 10.

- Initiatives in other regional localities to develop incubators, co-working spaces, or provide entrepreneurial support services

However, interviews with entrepreneurs, faculty inventors, CEOs of companies, and economic developers suggest that it can still be difficult to access the Wabash Heartland Region sophisticated, value-added entrepreneurial support services as well as risk capital across the financial continuum. A streamlined, efficient, and fast-paced approach to accessing the multitude of entrepreneurial and business support resources within the region is lacking. Three approaches that the region should consider undertaking to impact the entrepreneurial ecosystem and meet these needs include:

- Providing comprehensive in-depth and streamlined support services to entrepreneurs on a regional level to enable them to obtain private capital and move their entrepreneurial ideas forward at the speed of business. The coordinated “concierge service” or one-stop shop for access to existing services would create the connectivity and mentoring for new start-ups to have a comparative advantage with the assets already available in the region.
- Fostering the creation of indigenous angel and pre-seed funds.
- Leveraging the region’s proximity to the larger Indianapolis region’s financial and entrepreneurial support efforts to try to develop a larger critical mass of activity to jumpstart the region’s entrepreneurial ecosystem.
- Leverage the assets and resources at Purdue University—state-of-the-art labs, equipment, and modeling services—for entrepreneurs along with offering transparent and discounted costs for their use.

The bottom line is that by leveraging existing efforts as well as finding different and unique ways to systemically support entrepreneurs and the growth of entrepreneurial companies throughout the region must be a critical component in the region’s overall economic efforts to complete the three legs of the economic stool. The region needs a methodical way to connect entrepreneurs with the numerous assets for research and development, applied engineering, and business commercialization capabilities and resources at Purdue and within other regional businesses and industry to provide streamlined access in a “one-stop shop” environment to boost growth in start-up businesses that in turn will have a broader impact on the regional economy.

Action 5: Leverage the recent investment in the Purdue Polytechnic Institute by linking the regional industrial workforce demands to the curriculum and experiential learning opportunities.

In the spring of 2015, as part of the Purdue Moves initiative, the Purdue University Board of Trustees approved renaming the College of Technology to the Purdue Polytechnic Institute to better reflect its changing and expanded mission. The Purdue Polytechnic Institute provides an applied technical education that prepares students with the skills, knowledge, and experiences demanded by industry. The institute has revamped its teaching methods to match the evolving needs of the marketplace by developing a bachelor's degree in transdisciplinary studies in technology—the competency-based degree, the first of its kind at a research-intensive university.

In addition to the transdisciplinary degree, Purdue Polytechnic Institute has expanded the number of undergraduate majors it offers to capitalize on industry needs and faculty strengths. Students enrolling in the fall of 2016 can choose from unmanned aerial systems, audio engineering technology, supply chain management technology, game studies, or healthcare construction management. In all, students can choose from 36 majors, and more are planned to be added.

Team-based, learn-by-doing activities are formally integrated throughout the Polytechnic Institute curriculum—from freshman year through industry-sponsored, senior capstone projects and internship experiences. All first-year students experience curricula that highlight the intersection between their major, design thinking, English composition, and fundamentals of speech communication. This approach provides a foundation for the types of experiences students can expect through this broader and more holistic view of technology education.

New or expanded programs will focus on providing experiences where students can address real-world issues with the skills and knowledge they gain in the classroom and laboratories. Seniors, for example, will apply their expertise to real-world problems as part of their capstone projects. The School of Engineering Technology has already integrated this practice into its requirements with industry-sponsored projects. Summer and in-semester internships, global experiences, and exposure to commercialization concepts will add to their skill sets what employers say they need most from today's workforce.

While it is anticipated that the Purdue Polytechnic Institute will be undertaking outreach efforts to industry, it is important to recognize that this program is global. Therefore, it would benefit the region if the industry cluster initiatives that are established in Strategy 1 include an effort to undertake relationship building with the Institute to foster linkages between local manufacturers and the Institute to ensure that companies in the region benefit from the internships/experiential learning opportunities, co-ops, and capstone projects. In addition to post-graduate education, high school students can also take advantage of the Purdue Polytechnic High School model, currently being operated in Indianapolis, that could be replicated within the region as well. By leveraging this capacity that is housed within the region, the Wabash Heartland Region has the ability to intensify its ability to retain top talent within the targeted industry clusters.

Strategy 4: Foster a High-Value Quality of Place

Quality of place indicators can paint an extremely unique picture of a particular region. Both potential employers and employees must factor in not only the industrial strengths and innovation assets of a region, but also elements such as recreation, cultural arts, education, housing, crime, and environment. Furthermore, the community mindset, whether or not strong collaborations and partnerships are fostered to solve problems and promote economic growth and community prosperity, is becoming increasingly important.

Regions that are viewed as having a high quality of place have focused on developing and sustaining attributes that promote the satisfaction and happiness of its populace. Some quality of place factors are reliant upon the environmental aspects of a particular region—a region either sits next to an ocean or on top of a mountain or it does not. Other attributes can be more purposefully planned for and developed to ensure a high quality of life for the region's citizenry.

The regions that appear to foster and leverage their quality of place assets seem to understand two things:

- One must make the most of what one has in terms of natural attributes.
- Quality of place factors change and evolve over the course of an individual's life. Therefore, it is critical for a vibrant region to take into account a wide variety of diverse and heterogeneous needs.

Regions that are viewed as having positive quality of place policies that address the needs of its citizenry have the presence of the following assets:

- 21st Century Infrastructure, including access to reliable modes of transportation, transportation arteries that foster connections/linkages, and data/telecommunications connectivity.
- Natural/environmental attributes (i.e., access to water, mountains, wilderness) and the subsequent activities they afford a region (boating, extreme sports, hiking, etc.).
- Man-made attributes (i.e., galleries, museums, vibrant downtowns) and the subsequent activities they afford a region (restaurants, shopping, culture, etc.).
- Quality of education – K-12 and post-secondary, including average educational attainment levels.
- Crime rate – sometimes referred to as the popsicle index – percentage of people in a community who believe that a child can safely leave his or her home, walk to the nearest possible location to buy a popsicle, and walk back home safely.
- Access to a diverse array of affordable housing options to meet various life styles and stages of life.

In addition, regions are addressing the needs of various segments of its population by focusing on specific issues such as:

- Providing Millennials with access to:
  - Loft-like or studio apartment rental housing
  - Coffee shops, outdoor cafes, and trendy restaurants
  - Health clubs

- Providing young families with access to:
  - Affordable first-time homes
  - Quality daycares, pre-schools and early-education programs
  - Family-friendly leisure activities (parks, playgrounds, zoos, etc.)
- Providing baby boomers with access to:
  - Condominiums
  - Senior housing and assisted living programs for aging parents

Regardless of the particular quality of place asset, regions are beginning to realize that in order to remain competitive economically, it must focus on creating a quality environment for its citizens if true community prosperity is to be obtained.

Actions to Pursue

1. Foster an environment that is welcoming, inclusive, and collaborative in nature for all people.

2. Support localities' efforts to undertake strategic planning efforts to improve the quality of life for its citizens and strategize how best to leverage regional strengths.

3. Jointly develop solutions to common quality of life problems being faced across the region.

Action 1: Foster an environment that is welcoming, inclusive, and collaborative in nature for all people.

The presence of a diverse, creative environment that fosters an open, collaborative, dynamic community with a collective commitment to common long-term/sustaining goals and proactive, strategic transformation that in turn attracts more creative people, as well as businesses and capital, is critical to the long-term economic viability of a region.

A region that values the difference in people is one that recognizes that people with different backgrounds, skills, attitudes and experiences bring fresh ideas and perceptions. Successful communities encourage and harness these differences. Studies show that the lack of cohesion between races, sexes and cultures is due to mistrust, stereotyping, and language barriers. When these problems are not paid attention to it may lead to an inability to endorse ideas, the inability to gain agreement on decisions, and inability to take united action.

Today, diversity and inclusion efforts are common place for almost all companies. Executives understand that their companies can't be successful on a global platform if they don't have a diverse and inclusive workforce. A diverse and inclusive workforce is necessary to drive innovation, foster creativity, and guide business strategies. Multiple voices lead to new ideas, new services, and new products, and encourage out-of-the box thinking. Companies no longer view diversity and inclusion efforts as separate from their other business practices, and recognize that a diverse workforce can differentiate them from their competitors and can help capture new clients.

As a result, regions that are welcoming, inclusive, and collaborative in nature for all people are more apt to attract and retain the type of workforce that most companies seek. Therefore, it is critical for the

Wabash Heartland Region, if it desires to expand the economic footprint of its targeted industry clusters and seek additional opportunities as a result of the region's research strengths, to develop programs and initiatives that ensure that the region's "quality of culture" embraces inclusion and collaboration.

Action 2: Support localities' efforts to undertake strategic planning efforts to improve the quality of life for its citizens and strategize how best to leverage regional strengths.

It is widely understood throughout the Wabash Heartland Region that creating a high-value quality of place factors heavily into the region's ability to attract employees, residents and additional investment in the area. Quality of place attributes such as housing, natural and cultural offerings, and retail, restaurant and other amenities help to create a prosperous community, just as industrial and research assets do. It is also widely understood that while the other three strategies focus on the strength of the region by building critical mass through systemic initiatives, many aspects of a well-regarded quality of place are extremely localized—in that way, a region's quality of place can only be as strong as its individual localities. Addressing these "main street" types of developments to create a better region in which to work, live, and play can serve as a source of talent and investment attraction and overall community prosperity.

There are a number of individual localities throughout the region that have been strategically focused on improving its quality of place, including:

- Greater Lafayette's Good to Great strategic efforts
- Delphi's Stellar Community initiatives
- Crawfordsville's efforts that led to the community to be recently named an Indiana Stellar Community
- Wabash River frontage development plans, including Little Turtle Waterway and Wabash River Enhancement Corporation (WREC) master plans

Additionally, Purdue University and West Lafayette have two major development projects currently in progress: **State Street Redevelopment and the Innovation District**. State Street is the heart of the West Lafayette/Purdue community, and has served for generations as the primary road leading to and through downtown West Lafayette and Purdue University.

The City of West Lafayette and Purdue University recently partnered to advance the $122.7 million **State Street Redevelopment Project**, which will stretch from the Wabash River through downtown West Lafayette and Purdue University's campus to its intersection at U.S. 231. Two tax increment financing (TIF) districts, including the newly-established West Lafayette 231 Purdue Economic Development Area (the "231-Purdue TIF"), will generate the funds necessary to pay for the project.

The State Street Redevelopment Project is a model of how a unique local partnership is successfully advancing economic development opportunities and establishing an enhanced "sense of place" for the city and university alike. The use of a "P3" project delivery method yielded faster project completion and significant cost savings by giving the private sector opportunities to innovate and to offer ideas for saving money, both in terms of project design and execution.

Community-wide collaboration and innovation are essential to the successful completion of the State Street Redevelopment Project, which will achieve the following goals upon its completion:

- Transform the thoroughfare into a destination that reflects the vibrant spirit of the community
- Encourage growth in the local economy
- Improve the quality of life for residents, students and visitors

- Deliver safety enhancements
- Provide improved multi-modal facilities for bicycle and pedestrian travel and collaboration with local transit
- Simplify traffic patterns and execute one-way street conversions, and
- Incorporate community elements including greenspaces and public art

When the transformation is complete, the renewed State Street will help draw development to the Purdue Innovation District, located where the Purdue campus meets U.S. 231. In turn, the Innovation District, which is located in the 231-Purdue TIF, will generate the tax revenues that will help pay for the State Street project.

The **Purdue Innovation District** will transform the west side of Purdue's West Lafayette campus, making it a new gateway to both the city and the university that will drive economic and workforce development. The opening of U.S. 231 around the west side of the City of West Lafayette has made the Purdue Innovation District an important entry to Purdue and to the City. This $1.2 billion project is designed to complement and support other initiatives already taking place on the west side including the State Street Project (discussed above), Horticulture Park and Purdue Research Park Aerospace District.

Continuing collaborations among Purdue University, Purdue Research Foundation, City of West Lafayette, the Greater Lafayette Community, and the State of Indiana are primary in building on the recent economic, space and quality of life projects already taking place in the area. The 980-acre Purdue Research Park Aerospace District has already been named an Indiana Economic Development Corporation Certified Tech Park, which allows the area to recapture certain state and local tax revenue to be invested in the development of the Park. Rolls-Royce America will move into the Aerospace District in Fall 2016, where they will conduct jet engine component research. Other such companies are in negotiations and/or talking with Purdue Research Foundation for space in the Park.

The Purdue Innovation District, is slated to take place over a 15 to 20-year period and includes development of as much as 7 million square feet of interior building space. The economic and quality of place goals for the Purdue Innovation District include:

- 3,083,543 square-feet of residential housing for young adults, families and senior care
- 3,100,000 square-feet for industrial development
- 590,041 square-feet for mixed-use and free-standing retail
- 355,446 square feet of dedicated office space
- 250,000 square-foot hotel and conference center

The Purdue Research Foundation is in the final stages of signing a letter of intent with a Master Developer who will provide and manage a major portion of the funding for the Purdue Innovation District. Other funding will come from private and public partnerships, among collaborators.

Working together, the Purdue Innovation District, State Street Project, Horticulture Park, and Purdue Research Park Aerospace District are transforming the present and the future for Purdue University and the Greater Lafayette Community.

It is proposed that the above quality of place activities currently in progress could be built upon by developing a broader "playbook" for "main street" work, life, play enhancements and investments in communities across the region, offering direct technical support including planning, design, and financing.

For example, the **Wabash River frontage** is another natural quality of place asset. The river and its tributaries touch all counties in the region. It is also largely considered an underutilized asset. This shared waterway is a common challenge for all 10 counties, and therefore it would be beneficial for the Wabash

Heartland Region to further support its protection for future generations. Given the attention it is receiving through several development planning initiatives, the Wabash Heartland Region could consider further supporting those planning efforts with financial support (private or foundation matches, additional funding opportunities, etc.) to ensure all residents across the region have access to the Wabash River's enhanced economic and recreational uses.

It was noted by several regional leaders that the greatest limiting factor for many of the region's strategic initiatives is the lack of available funding. Therefore, it is proposed that a fund be developed that would be directed toward seeding the implementation of localized quality of place efforts in order to attract outside investment from developers and others. For those localities that do not currently have a quality of place plan developed, this effort would also support efforts to educate, stimulate, and support local solutions by providing strategic planning grants and helping localities to learn from best practices already developed and leverage the analytic capabilities of Purdue's Center for Regional Development and other though leader resources within the region.

While the main emphasis is on supporting individual localities' unique efforts to improve their specific quality of place, the initiative should consider giving priority to those plans/initiatives that seek to leverage and build upon broader regional initiatives so that while individual localities are seeking to improve their localized quality of place, they are doing so in a way that links to other regional assets.

Action 3: Jointly develop solutions to common quality of life problems being faced across the region.

While recognizing that many quality of place issues are location-specific and need to be addressed by an individual locality through the previous action, it is also important to note that there are quality of place issues that are common across the region and will require broader efforts and initiatives to address.

The need for regionalism, or area-wide planning and coordination, is rooted in the fact that problems often cannot be solved within municipal boundaries, and decisions made by one municipality can have adverse impacts on other municipalities. As municipal budgets are strained, cooperative program delivery that provide for the coordination of services and the pooling of resources become more important. The region, through the unified regional economic development effort (see Strategy 1), should work together to tackle problems that are common to many of the region's localities, such as:

- **Broadband and cellular connectivity:** As mentioned in Strategy 1, the need for high-speed internet, cloud-based data storage, cellular connectivity, and other digital infrastructure is needed on a regional basis, as communication technologies are critical not only for certain technological industries, but also are considered a key component of high quality of life locales.
- **Health and well-being:** Several counties within the Wabash Heartland Region rank high across the state of Indiana for prescription drug abuse and illegal drug use. Because residents of rural counties are twice as likely to suffer an overdose as those in urban larger urban environments, the overall health and well-being of those in the ten-county region is of critical importance.[72] Statewide, the number of total overdose deaths increased dramatically from 184 deaths in 1999 to 1,152 deaths in 2014, and Tippecanoe County in particular ranked in the 10th highest in the state for drug overdose

[72] CDC Vital Signs: http://www.cdc.gov/vitalsigns

deaths.[73] Additionally, three counties in the region ranked in the top 10 for non-fatal emergency room visits for opioid overdoses from 2009-2014, and the region accounts for more than 13 percent of the state's drug poisoning death rates from 2011-2014.[74]

- **Childcare and elder-care:** Services such as childcare for working parents, after-school programs, elder-care (in-home or senior daycare), and senior transportation are several examples of programming that can greatly increase the desirability for families to locate within the region.
- **Affordable housing for low-income families:** In Tippecanoe County alone, the Community Health Needs Assessment indicated more than one in five households with less than $40,000 annual income had a personal need for affordable housing.[75] Homelessness was also reported as an issue, one that appears to have increased since the previous assessment, for both children and adults.
- **Environmental protection and preservation:** Maintaining and preserving the natural and environmental assets within the region, such as the Wabash River, demonstrates a redevelopment opportunity that not only benefits the beautification of the region but can also contribute to conservation efforts, water quality issues, and other protections for the region's assets and residents.

As a result, the same fund as referenced above could also serve as a method through which communities, non-profits, and related service providers throughout the Wabash Heartland Region could come together to develop unique solutions to systemic problems that can only be effectively addressed as a region. This effort could also be a way in which existing funds could be redirected to more effectively solve common problems.

To help ensure that the myriad of governmental, non-profit, and other entities that are currently working to address in some way these larger regional quality of life issues that have been identified leverage one another, it is proposed that a networking cluster, similar to the industry cluster proposed in Strategy 1, be created to raise awareness and build relationships to help solve these regional issues. It is widely understood that the region must work proactively to develop synergies between the existing service providers that affect these various issues—relationships that for the most part do not currently exist. The region currently lacks the 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.

[73] Indiana State Department of Health, Epidemiology Research Center, Data Analysis Team: http://www.in.gov/isdh/26689.htm

[74] Indiana State Department of Health, Epidemiology Research Center, Data Analysis Team: http://www.in.gov/isdh/26689.htm

[75] *Tippecanoe County Community Health Needs Assessment, February 2016.* http://www.tippecanoe.in.gov/DocumentCenter/View/10015

Section 6: Conclusion

The Wabash Heartland Region is at a unique economic development crossroad. The region's industrial base has weathered the Great Recession remarkably well, and specific growth opportunities are presenting themselves, such as the General Electric Aviation facility now open and assembling engines and in the recently announced expansion at Subaru of Indiana. Through state and institutional investments, Purdue University is further positioning itself as both a global research university and a key source for tomorrow's workforce via its traditional and polytechnic educational programs.

Yet, the challenge for the Wabash Heartland Region is to foster economic growth and broad community prosperity by focusing its efforts on building synergies between the region's industrial clusters and its academic assets so that their combined effect is greater than the sum of their individual efforts.

The Wabash Heartland Region has the opportunity to build upon its economic foundation by focusing on key regional opportunities that if seized will enable the region to "leap forward" and become a leading job- and wealth-generating economy over the next decade. In today's global knowledge-based economy, the recipe for economic success is quite simple—the Wabash Heartland Region needs to focus its economic development efforts to ensure that not only can its existing industry drivers raise their level of competitiveness and added value, but that it can also identify new drivers of innovation to improve the region's economic prospects. This strategy is designed to address these challenges and identify the elements and ingredients to successfully position the region to build on its strengths, seize its opportunities, and put into action a set of strategies that catalyze economic and community prosperity.

The analysis suggests that to truly transform the region's economy will require taking advantage of the following opportunities:

- Regional industrial clusters that can be positioned to promote further economic growth.
- An existing industrial base that seeks a skilled workforce, thereby providing employment opportunities for the region's citizens.
- A world-class research base that provides opportunities to diversify the region's economy through innovation and entrepreneurship.
- A growing understanding that quality of life issues are a critical component of a region's ability to foster economic growth.

Taking advantage of these opportunities requires a comprehensive, systematic effort that will require the broad support of the entire ten-county region. Consensus around the vision outlined in this strategy and the specific actions outlined must be viewed as a top economic priority by all.

By working together, the opportunity for the Wabash Heartland Region to grow its economic base and increase community prosperity is substantial. If successful, it is expected that what will emerge is a public-private partnership that will advance the region for the coming decades.

Appendix A: Cluster Analysis Details

Table A-1. Wabash Heartland Region Targeted Cluster NAICS Codes

Wabash Heartland Targeted Cluster	NAICS 2012	NAICS Description
Agbiosciences	115111	Cotton ginning
	115112	Soil preparation, planting, and cultivating
	115113	Crop harvesting, primarily by machine
	115114	Other postharvest crop activities
	115115	Farm labor contractors and crew leaders
	115116	Farm management services
	115210	Support activities for animal production
	311221	Wet corn milling
	311222	Soybean processing
	311223	Other oilseed processing
	311225	Fats and oils refining and blending
	325193	Ethyl alcohol manufacturing
	325311	Nitrogenous fertilizer manufacturing
	325312	Phosphatic fertilizer manufacturing
	325314	Fertilizer, mixing only, manufacturing
	325320	Pesticide and other ag. chemical mfg.
	423820	Farm and garden equip. merchant wholesalers
	424510	Grain and field bean merchant wholesalers
	424520	Livestock merchant wholesalers
	424590	Other farm product raw material merch. whls.
	424910	Farm supplies merchant wholesalers
Automotive/Heavy Vehicle Equipment	332991	Ball and roller bearing manufacturing
	332999	Miscellaneous fabricated metal product mfg.
	333111	Farm machinery and equipment manufacturing
	333612	Speed changer, drive, and gear manufacturing
	333618	Other engine equipment manufacturing
	333924	Industrial truck, trailer, and stacker mfg.
	336111	Automobile manufacturing
	336112	Light truck and utility vehicle manufacturing
	336120	Heavy duty truck manufacturing
	336211	Motor vehicle body manufacturing
	336212	Truck trailer manufacturing
	336213	Motor home manufacturing
	336214	Travel trailer and camper manufacturing
	336311	Carburetor, piston, ring, and valve mfg.
	336312	Gasoline engine and engine parts mfg.
	336321	Vehicular lighting equipment manufacturing
	336322	Other motor vehicle electric equipment mfg.
	336330	Motor vehicle steering and suspension parts
	336340	Motor vehicle brake system manufacturing
	336350	Motor vehicle power train components mfg.
	336360	Motor vehicle seating and interior trim mfg.
	336370	Motor vehicle metal stamping
	336391	Motor vehicle air-conditioning manufacturing
	336399	All other motor vehicle parts manufacturing
	339991	Gasket, packing, and sealing device mfg.
	423110	Motor vehicle merchant wholesalers
	423120	New motor vehicle parts merchant wholesalers

Table A-1. Wabash Heartland Region Targeted Cluster NAICS Codes (Cont.)

Wabash Heartland Targeted Cluster	NAICS 2012	NAICS Description
Biomedical Sciences	325411	Medicinal and botanical manufacturing
	325412	Pharmaceutical preparation manufacturing
	325413	In-vitro diagnostic substance manufacturing
	325414	Other biological product manufacturing
	334510	Electromedical apparatus manufacturing
	339112	Surgical and medical instrument manufacturing
	339113	Surgical appliance and supplies manufacturing
	339114	Dental equipment and supplies manufacturing
	339115	Ophthalmic goods manufacturing
	541710	N/A
	541711	Research and development in biotechnology
	541712	Other physical and biological research
	621511	Medical laboratories
Engineering, Technical, and Design Services	541310	Architectural services
	541320	Landscape architectural services
	541330	Engineering services
	541340	Drafting services
	541350	Building inspection services
	541360	Geophysical surveying and mapping services
	541370	Other surveying and mapping services
	541380	Testing laboratories
	541410	Interior design services
	541420	Industrial design services
	541430	Graphic design services
	541490	Other specialized design services
	541620	Environmental consulting services
	541690	Other technical consulting services

Table A-1. Wabash Heartland Region Targeted Cluster NAICS Codes (Cont.)

Wabash Heartland Targeted Cluster	NAICS 2012	NAICS Description
Food Processing and Manufacturing	311111	Dog and cat food manufacturing
	311119	Other animal food manufacturing
	311211	Flour milling
	311212	Rice milling
	311213	Malt manufacturing
	311230	Breakfast cereal manufacturing
	311311	Sugarcane mills
	311312	Cane sugar refining
	311313	Beet sugar manufacturing
	311320	Confectionery manufacturing from cacao beans
	311330	Confectionery mfg. from purchased chocolate
	311340	Non-chocolate confectionery manufacturing
	311411	Frozen fruit and vegetable manufacturing
	311412	Frozen specialty food manufacturing
	311421	Fruit and vegetable canning
	311422	Specialty canning
	311423	Dried and dehydrated food manufacturing
	311511	Fluid milk manufacturing
	311512	Creamery butter manufacturing
	311513	Cheese manufacturing
	311514	Dry, condensed, and evaporated dairy products
	311520	Ice cream and frozen dessert manufacturing
	311611	Animal, except poultry, slaughtering
	311612	Meat processed from carcasses
	311613	Rendering and meat byproduct processing
	311615	Poultry processing
	311811	Retail bakeries
	311812	Commercial bakeries
	311813	Frozen cakes and other pastries manufacturing
	311821	Cookie and cracker manufacturing
	311822	Mixes and dough made from purchased flour
	311823	Dry pasta manufacturing
	311830	Tortilla manufacturing
	311911	Roasted nuts and peanut butter manufacturing
	311919	Other snack food manufacturing
	311920	Coffee and tea manufacturing
	311930	Flavoring syrup and concentrate manufacturing
	311941	Mayonnaise, dressing, and sauce manufacturing
	311942	Spice and extract manufacturing
	311991	Perishable prepared food manufacturing
	311999	All other miscellaneous food manufacturing
	312111	Soft drink manufacturing
	312120	Breweries
	312130	Wineries
	312140	Distilleries

Table A-1. Wabash Heartland Region Targeted Cluster NAICS Codes (Cont.)

Wabash Heartland Targeted Cluster	NAICS 2012	NAICS Description
Metals Production and Related Manufacturing	331111	Iron and steel mills
	331112	Ferroalloy and related product manufacturing
	331210	Iron, steel pipe and tube from purchase steel
	331221	Rolled steel shape manufacturing
	331222	Steel wire drawing
	331311	Alumina refining
	331312	Primary aluminum production
	331314	Secondary smelting and alloying of aluminum
	331315	Aluminum sheet, plate, and foil manufacturing
	331316	Aluminum extruded product manufacturing
	331319	Other aluminum rolling and drawing
	331411	Primary smelting and refining of copper
	331419	Primary nonferrous metal, except Cu and Al
	331421	Copper rolling, drawing, and extruding
	331422	Copper wire, except mechanical, drawing
	331423	Secondary processing of copper
	331491	Nonferrous metal, except Cu and Al, shaping
	331492	Secondary processing of other nonferrous
	331511	Iron foundries
	331512	Steel investment foundries
	331513	Steel foundries, except investment
	331521	Aluminum die-casting foundries
	331522	Nonferrous, except Al, die-casting foundries
	331524	Aluminum foundries, except die-casting
	331525	Copper foundries, except die-casting
	331528	Other nonferrous foundries, exc. die-casting
	332111	Iron and steel forging
	332112	Nonferrous forging
	332114	Custom roll forming
	332312	Fabricated structural metal manufacturing
	332313	Plate work manufacturing
	332322	Sheet metal work manufacturing
Packaging Products	321920	Wood container and pallet manufacturing
	322211	Corrugated and solid fiber box manufacturing
	322212	Folding paperboard box manufacturing
	322213	Setup paperboard box manufacturing
	322214	Fiber can, tube, and drum manufacturing
	322215	Non-folding sanitary food container mfg.
	322221	Coated and laminated packaging paper mfg.
	322222	Coated and laminated paper manufacturing
	322223	Coated paper bag and pouch manufacturing
	322224	Uncoated paper and multiwall bag mfg.
	322225	Flexible packaging foil manufacturing
	322226	Surface-coated paperboard manufacturing
	326111	Plastics bag and pouch manufacturing
	326112	Plastics packaging film and sheet mfg.
	326140	Polystyrene foam product manufacturing
	326160	Plastics bottle manufacturing
	326199	All other plastics product manufacturing
	332115	Crown and closure manufacturing
	332431	Metal can manufacturing
	332439	Other metal container manufacturing

Table A-1. Wabash Heartland Region Targeted Cluster NAICS Codes (Cont.)

Wabash Heartland Targeted Cluster	NAICS 2012	NAICS Description
Precision Metalworking	332116	Metal stamping
	332611	Spring, heavy gauge, manufacturing
	332612	Spring, light gauge, manufacturing
	332618	Other fabricated wire product manufacturing
	332710	Machine shops
	332721	Precision turned product manufacturing
	332722	Bolt, nut, screw, rivet, and washer mfg.
	333511	Industrial mold manufacturing
	333512	Metal cutting machine tool manufacturing
	333513	Metal forming machine tool manufacturing
	333514	Special tool, die, jig, and fixture mfg.
	333515	Cutting tool and machine tool accessory mfg.

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