

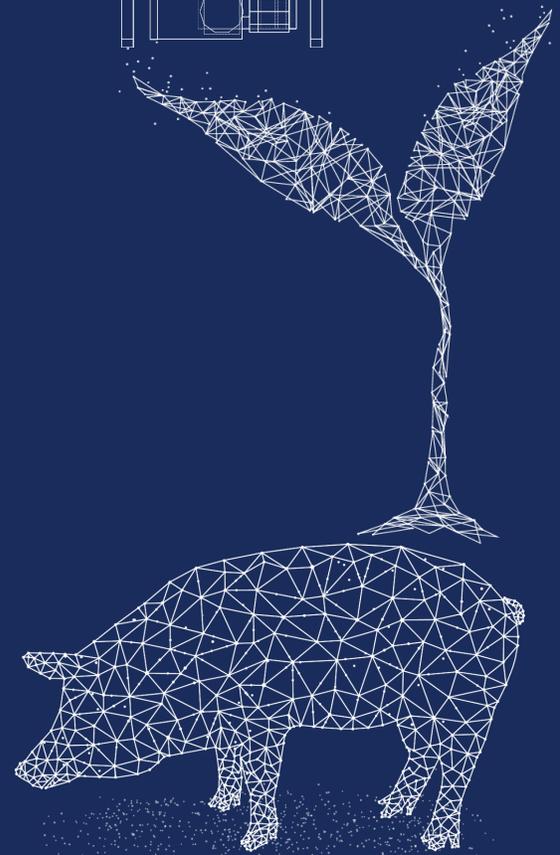
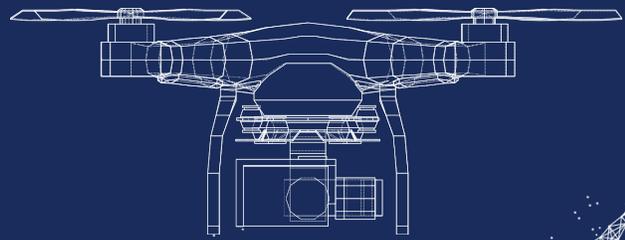
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THE ENTREPRENEURIAL ECOSYSTEM FOR AGBIOSCIENCES IN INDIANA

ECOSYSTEM ASSESSMENT

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Executive Summary

AgriNovus Indiana (AgriNovus) operates with a mission to serve as Indiana’s champion for the agbiosciences, the industry where food, agriculture, science and technology converge. AgriNovus pursues its work to make Indiana the home to unparalleled agbioscience talent and innovation via strategies that promote the industry, build networks between industry, government and higher education, develop a strong local talent pool, and nurture future agbioscience-focused innovators and entrepreneurs.

As part of this final component—nurturing Indiana’s agbioscience entrepreneurs—AgriNovus commissioned EntreWorks Consulting and Innovation PolicyWorks to undertake an in-depth analysis to understand the environment for innovation and entrepreneurship across Indiana—for those working in the agbiosciences and for Indiana-based innovators and entrepreneurs more generally. The assessment takes a deep dive into Indiana’s entrepreneurial ecosystems, i.e., the regional networks of organizations, individuals, and cultural practices focused on helping local people start and grow new companies. We assess how well Indiana, and its key regions, are positioned to help support the start-up of new companies and their transformation into fast-growing businesses that create new jobs, new wealth and new innovations in the agbiosciences and beyond.

Our research is based on several core beliefs related to today’s innovation-driven economy. First, entrepreneurial ventures are the key drivers of new job creation and new innovations. A small share of high-growth companies creates the vast majority of new jobs in the United States and nurturing entrepreneurial ventures can be a promising path to economic prosperity. Second, regions with robust ecosystems are most likely to succeed in these endeavors. A great entrepreneur can emerge anywhere, but they are more likely to start their business and to succeed in places with robust entrepreneurial ecosystems in place. Finally, we recognize that robust ecosystems cannot be conjured out of thin air. They develop in regions where many critical elements are already in place. This is especially true in technology-intensive industries such as the agbiosciences where essential building blocks, such as robust R&D capabilities, a strong talent base, and proximity to core customers, are already present in Indiana.

The Research Program

This research report assesses Indiana’s entrepreneurial ecosystems through several lenses. It begins with an assessment of how Indiana and its regions perform in terms of supporting the core building blocks of an entrepreneurial ecosystem which include policies that support:

- Specialized Infrastructure and Facilities: Meeting the unique space needs of entrepreneurs
- Talent/Human Capital: Building a regional talent base
- Market Access: Helping entrepreneurs identify, access and succeed in new markets
- Community Culture: Honoring and embracing entrepreneurship
- Regulatory/Government Support: Cutting red tape and promoting flexibility
- Business Assistance: Providing easy access to technical assistance
- Capital: Providing diverse sources of capital to help firms start and grow

Every region's ecosystem is different, with its own competitive strengths and challenge areas. We assess how Indiana performs in each of these building block components, identify areas of strength and gaps where new focus may be needed.

An added assessment examines sector data on the innovation economy. This analysis, included in Appendix I, benchmarks Indiana's recent economic performance on a variety of metrics that track the following:

- Sources of Technology and Innovation – such as research and development spending;
- Entrepreneurs and Business Dynamics – tracking the start-up and growth of new companies; and
- Capital Investment – assessing the range of funding sources to support new and growing businesses.

These ecosystem assessments are accompanied by a mini-benchmarking exercise (see Appendix II) that assesses the state of ecosystem-building in six other regions: Des Moines, Iowa; the Research Triangle region of North Carolina; St. Louis, Missouri; Pittsburgh, Pennsylvania; the Kansas City region; and Denmark. These regions were selected for several reasons: they offered economic and demographic similarities to Indiana, and, in four of the cases, also supported large-scale economic development programs focused on the agbiosciences.

Findings: How does Indiana Perform?

These various approaches to understanding entrepreneurial ecosystems across Indiana generate numerous insights about the current state and future potential of agbioscience-focused entrepreneurship. The process of building and nurturing robust ecosystems is underway across Indiana, generating numerous areas of competitive advantage. Yet, these efforts remain a work in progress, and additional investments, especially in increasing Indiana's rate of new business start-up and development of high-growth ventures, will be needed.

The innovation and entrepreneurship data benchmarking (presented in Appendix I) suggests that Indiana benefits greatly from key anchor institutions, such as Purdue University and Indiana University, and major employers such as Corteva Agriscience, Elanco, Beck's Hybrids, Clabber Girl, Ag Alumni Seed, United Animal Health, among others. New innovations, technologies and products are being spawned from these and other institutions across Indiana, and the state hosts a strong base of technical and scientific talent focused on the agbiosciences. Purdue is an especially important driver of new innovations and ranks among the country's best universities for technology transfer and commercialization.

Like many states in the Midwest, Indiana performs less well on business dynamism measures. The state has a low level of entrepreneurial activity in all sectors, including agbiosciences. A relatively small number of firms are starting up, and even fewer are becoming fast-growth companies that generate significant new jobs and revenues. This slowed entrepreneurial pipeline also factors into Indiana's average levels of performance related to new capital for growth companies. A diverse set of capital sources is in place, but deal flow, especially for higher-value venture capital deals, remains limited. Nonetheless, most observers believe that strong Indiana-based agbioscience start-ups have access to deep pools of capital—if they can provide sufficiently promising investment opportunities.

Several factors help explain this performance. Time lags may play a role. Much of Indiana's ecosystem support work is fairly new, having been established over the past few years. Start-ups take time to gain traction, create jobs, and generate new wealth. If this is the case, the metrics should improve in coming years as new firms gain traction and new tools, such as the Next Level Fund, come into play.

The report's case study analyses reinforce this conclusion. In several of the studied locations, Des Moines, North Carolina, St. Louis and Kansas City specifically, programs to nurture agbioscience-focused ecosystems have been underway for some time. Community leaders have made major investments in infrastructure, talent development, and new programs that have resulted in vibrant science and technology-based local economies.

Indiana's Current Ecosystems: A Status Report

Our primary research directly examines ecosystem building efforts across Indiana and finds a strong base of support tools and infrastructure in place across the state. Many regions, especially in denser cities like Indianapolis and Fort Wayne, host multiple organizations that view entrepreneurial support as a core mission. This embrace of entrepreneurship engages a very diverse set of players, including key state agencies, like the Indiana Economic Development Corporation (IEDC) and the Indiana State Department of Agriculture (ISDA), which include entrepreneurship promotion and support as key parts of their current strategic plans. Statewide industry initiatives, like AgriNovus, TechPoint and BioCrossroads also embrace this mission. Finally, at the local level, powerful cross-sector and bipartisan support exists among elected officials, traditional economic development organizations, private industry, and a variety of community leaders.

Indiana has succeeded in developing a strong "entrepreneur-friendly" business environment. In most cases, someone with a decent business idea and passion about entrepreneurship can and should be able to access nearly all of the support tools and networks they need somewhere in Indiana. This is no guarantee that a business will succeed, but it is a reflection that resources and support for new and growing businesses are readily available in Indiana.

Within this generally strong set of resources, several potential challenge areas arise. Growth capital for technology-intensive sectors, like agbiosciences, can be difficult to access. Like many Midwestern states, Indiana is not a prime location for institutional venture capital investments. At the other end of the spectrum, the state has limited resources for microenterprises or new funding tools like crowdfunding.

Indiana and its regions must also invest to expand the pipeline for new entrepreneurs. More Indiana residents, especially younger people, need to view entrepreneurship as a viable career option and as a common pathway to successful careers and lives. Ongoing work to build an entrepreneurial culture should continue and be expanded.

Looking Forward

Beyond engaging new partners and new entrepreneurs, these efforts also need to focus on economic sectors, like the agbiosciences, where Indiana has strong and inherent competitive advantages. The recent emergence of new ecosystem resources coincides with the growth of an increasingly strong agbioscience sector in Indiana. Indiana has always been a global leader in production agriculture; today it is also a global leader in agbioscience innovation. In addition to

fostering innovations in a host of sectors, Indiana's agbioscience firms employ more than 75,000 people across the state.

Indiana's agbioscience sector is developing in the midst of a global revolution in the agricultural and food sectors. Rising food demand and other factors are fueling the search for new ways to produce, supply, distribute, and store food. Investors are flocking to this sector and making major plays to support innovative ventures. Yet industry experts concur that the agbioscience sector remains underinvested, and that large potential growth opportunities are on the horizon.

AgriNovus and various partners around the state can and should assume a prominent role in building a stronger entrepreneurial ecosystem, especially for those working in the agbiosciences, but more generally as well. A strong pipeline and a robust ecosystem for all entrepreneurs will also help ensure a rich ecosystem for start-ups and growth ventures in the agbiosciences. AgriNovus and its partners can help to build this stronger overall ecosystem via several steps that:

- Build the Pipeline of Agbioscience Entrepreneurs in Indiana
- Accelerate Agbioscience Entrepreneurs in Indiana
- Connect Agbioscience Entrepreneurs to existing ecosystem resources
- Develop new resources targeted to the unique needs of Agbioscience Entrepreneurs

Investments in these four areas will help deepen and strengthen entrepreneurial ecosystems across Indiana in several ways. They will expand the scale and scope of business activity by encouraging more people to "take the leap" and start a new venture. Networking programs will help build deeper connections across regions, across institutions via public-private partnerships, and across disciplines as farming and agriculture experts connect and collide with partners in information technology, life sciences, finance, and the like. Meanwhile, AgriNovus will connect agbioscience entrepreneurs into existing networks and programs already in place across Indiana and will design new focused programs to make Indiana into a nationally recognized destination for these entrepreneurs.

Introduction

Since 2012, venture capital investments in the agbiosciences have jumped by a whopping 80 percent, leading the Boston Consulting Group to predict a new “green revolution” based on “a wave of start-up activity in agricultural technology.”¹ The thriving industry of the agbiosciences operates where food, agriculture, science and technology converge. The agbiosciences encompass several industry sectors, including plant sciences, animal health and nutrition, human food and nutrition, and high-tech agriculture or agtech. They also include critical enabling technologies such as data-enabled agriculture, automation and robotics, supply chain and logistics related to food security, and biofuels and bio-based energy.

Global trends in agriculture also set the stage for the surge in start-up activity. Agricultural markets are under strain, as global population growth continues. So, farmers are under pressure to be more productive with the same or reduced resources. At the same time, consumer tastes are shifting, and there is increased concern not only for sustainability, but for food safety and security, quality and health. Evolving regulations, the impacts of climate change, and economic cycles continue to challenge farmers and agribusinesses alike.

The Midwest is an important player in the field, with a strong concentration of both public and private organizations focused on the potential for massive growth in agbioscience-related business and innovation opportunities. Agribusinesses, large public and private universities and catalysts for economic development (including government and non-profit organizations) all recognize the importance of this sector.

The Midwest is very competitive because of these organizations, as well as its well-established supply chains for agriculture. The Midwest, after all, is one of the most fertile crop production areas in the world, with unique advantages in transportation, processing, human capital and research and development. However, the region suffers from a lack of equity capital, and this, combined with the long sales cycles and a limited base of home-grown technology companies, makes the start-up’s challenge even more difficult.

It is in this context that AgriNovus Indiana (AgriNovus) focuses on a core mission to make Indiana the home to unparalleled agbioscience talent and innovation. This mission involves numerous activities from publicizing Indiana’s many unique industry-related assets, supporting talent development and building collaborations between industry, academia, and government. This work also entails the nurturing of new ideas and new entrepreneurial ventures that help ensure the continued vibrancy of the state agbioscience sector.²

¹ Boston Consulting Group. 2016. “Lessons from the Frontlines of the AgTech Revolution.”

² AgriNovus Indiana defines agbioscience to include all the technologies mentioned above, generally inputs to agriculture, technologies related to production, and technologies related to manufacturing and distribution of food.

Great entrepreneurs can and do emerge everywhere, but they are more likely to emerge—and succeed—in places that have robust entrepreneurial ecosystems in place. As the Kauffman Foundation has noted:

Entrepreneurship doesn't happen in a vacuum. . . . We have to build the ecosystem that surrounds entrepreneurs. Ecosystems help entrepreneurs thrive at each step. Just as the complex biological system of soil, water, sunlight, flora and fauna in a rainforest allows individual plants to flourish, so the ecosystem for entrepreneurs is essential to their success. Healthy ecosystems allow talent, information, and resources to flow quickly to entrepreneurs as they need it.³

This report assesses the state of entrepreneurial ecosystems in Indiana, with a specific focus on the agbioscience sector targeted by AgriNovus. Beginning with a review of how ecosystems work and why they matter, the report then turns to a review of the key building blocks for effective ecosystems. Following is an assessment of how Indiana performs in terms of supporting regional ecosystems and in spawning both start-ups and scale-ups, i.e., high-growth ventures that generate significant levels of new employment, revenues, and new business opportunities. This includes a deeper dive into an assessment of how well state and regional initiatives support and nurture entrepreneurs operating in agbioscience-related sectors. **Appendix I** contains data related to the entrepreneurial ecosystem, while **Appendix II** puts Indiana in context by reviewing the ecosystems in Des Moines, North Carolina's Research Triangle region, St. Louis, Pittsburgh, Kansas City and Denmark.

What is an Entrepreneurial Ecosystem?

As the earlier Kauffman Foundation quote suggests, the concept of the “ecosystem” is consciously adopted from biology to reflect the fact that certain environments are especially conducive to supporting new and growing companies. Most of the core programmatic elements of an ecosystem, such as easy access to capital, have been well understood for years. However, the concept of an ecosystem serves as a useful organizing framework that emphasizes the importance of systems and networks in fostering entrepreneurship. In this view, there is no one single cause or factor that leads to an entrepreneur's (or a region's) success. It is the connections and interdependencies of multiple factors that matter.

There are numerous definitions of entrepreneurial ecosystems. The Organization for Economic Cooperation and Development (OECD) defines ecosystems as:

a set of interconnected entrepreneurial actors (both potential and existing), entrepreneurial organizations (e.g., firms, venture capitalists, business angels, banks), institutions (universities, public sector agencies, financial bodies) and entrepreneurial processes (e.g., the business birth rate, numbers of high growth firms, levels of 'blockbuster entrepreneurship', number of serial entrepreneurs, degree of sell-out mentality within firms and levels of entrepreneurial ambition)

³ Kauffman Foundation, *Ecosystem Playbook*, June 2017, p. 20.

*which formally and informally coalesce to connect, mediate and govern the performance within the local entrepreneurial environment.*⁴

This definition captures the complexity of ecosystems and the multiple players that operate within robust and successful ecosystems.

Why do Ecosystems Matter?

Ecosystems matter because they are associated with a region's enhanced ability to improve both the quality and quantity of local entrepreneurial activity. Regions with strong entrepreneurial ecosystems tend to have higher start-up rates as well as more success in spawning larger numbers of high growth companies.

Ecosystems matter because entrepreneurs matter. Entrepreneurial ventures are the primary creators of new jobs in the U.S. economy, but not all entrepreneurs are created equal. Most small firms and start-ups fail or do not create many new jobs.⁵ However, a small portion of new firms do grow quickly, and this subset makes the most critical contributions to job growth. Together, new firms and high growth firms (defined as those growing employment by 25% per year) account for about 70% of U.S. firm-level job creation in a given year.⁶

New wealth creation and new jobs are the core contributions of robust ecosystems, but they bring other benefits as well. Ecosystems help regions spawn a larger number of entrepreneurs, which spurs more competition and innovation, which in turn creates new opportunities for new entrepreneurs, their employees and customers and their investors.⁷ In successful regions, they help to generate a virtuous economic cycle that spawns successive generations of high growth successful companies, entrepreneurs, and investors. Silicon Valley serves as the prototypical example of this process, but numerous other regions have benefited from the development of robust entrepreneurial ecosystems. Prominent examples include Seattle, Austin, and Boston, among others.

How do Ecosystems Relate to Specific Industries?

While regions typically specialize in certain industries or clusters, effective ecosystems nurture entrepreneurs in all industries, from diverse backgrounds, and at different stages of a business' life cycle. Effective ecosystems rarely "specialize" in only one industry or a few clusters. In these regions, entrepreneurs can easily garner assistance with common business challenges, like accessing capital, grooming talent or finding qualified attorneys and other specialized consultants.

⁴ Mason, C., and Brown, R. 2014. "Entrepreneurial Ecosystems and Growth Oriented Entrepreneurship," Background Paper prepared for a Workshop organized by the OECD Local Economic and Employment Development (LEED) Program and the Dutch Ministry of Economic Affairs, p. 5.

⁵ Haltiwanger, J., Jarmin, R.S., Kulick, R., and Miranda, J. 2016. "High-Growth Young Firms: Contribution to Job, Output, and Productivity Growth." National Bureau of Economic Research Working Paper. Available at: <http://www.nber.org/chapters/c13492.pdf>.

⁶ Decker, R., Haltiwanger, J., Jarmin, R., and Miranda, J. 2014. "The Role of Entrepreneurship in U.S. Job Creation and Economic Dynamism." *Journal of Economic Perspectives*. 28:3, pp. 3-24. Available at: http://econweb.umd.edu/~haltiwan/JEP_DHJM.pdf.

⁷ Auerswald, P.E. 2015. "Enabling Entrepreneurial Ecosystems," Kauffman Foundation Research Paper, p. 10.

These general supports may be further supplemented by specialized expertise in a given industry or technical competency. For example, Boston's ecosystem supports entrepreneurs of all types, but it is especially strong in nurturing life sciences companies. Similarly, Los Angeles is home to a specialized ecosystem around media, television and film.

Economic developers have long sought to nurture economic clusters, i.e., regional ecosystems of related industries, institutions, and those with specialized expertise. It is generally agreed that "industries located in regions with strong clusters experience higher growth in new business formation and start-up employment" and the existence of the cluster contributes to start-up survival.⁸ The economics of agglomeration – things like shared technologies, skills, infrastructure and demand – lowers the cost of starting a business, enhances the opportunities for innovation, and enables better access to a range of inputs and complementary products. Clusters may also actually strengthen innovation because of competition among firms in the same region. An innovative cluster is one where the ability to innovate provides long-term, sustainable advantage for its members.⁹

Cluster support strategies can further bolster ecosystems in many ways, primarily via the creation of new knowledge which can emerge along several pathways:

1. Research and development performed by incumbent firms, at their own facilities, by their employees;
2. Research and development performed at universities or other third-party institution(s) and brought into the cluster by technology transfer mechanisms; and
3. Knowledge spillovers between "agents" where the recipient acts to commercialize the knowledge faster than the source of the knowledge.¹⁰

These knowledge creation activities help spawn new entrepreneurs, who commercialize new ideas and intellectual property via new business ventures. Via this process, knowledge "spills over and contributes to regional innovation, cluster formation and economic development."¹¹

Simply generating new ideas and intellectual property is not sufficient. Successful commercialization and knowledge spillover are more likely to occur in locations with robust ecosystems, i.e., they possess core strengths and capacities in the factors discussed later in the assessment.

Are the Agbiosciences Different?

Every industry has its own unique circumstances and operating practices, and the agbioscience cluster is no different. The agbioscience sector tends to be more technologically intensive than many other industries, with companies and universities investing in R&D and employing a more highly-skilled workforce. Larger corporations assume a more prominent role in the industry, and

⁸ Delgado, M., Porter, M., and Stern, S. 2010. "Clusters and entrepreneurship." *Journal of Economic Geography*. 10(4): 495-518.

⁹ Porter, M. 1989. *The Competitive Advantage of Nations*. New York: Free Press.

¹⁰ Boschma, R. 2015. "Do spin-off dynamics or agglomeration externalities drive industry clustering? A reappraisal of Steven Klepper's work." *Industrial and Corporate Change*. 24: 859-873.

¹¹ Qian, H. 2018. "Knowledge-based regional economic development: a synthetic review of knowledge spillovers, entrepreneurship and entrepreneurial ecosystems." *Economic Development Quarterly*. 32(2): 163-176.

barriers to entry for new start-ups are higher than found in other sectors like information technology or retail.

In technology-intensive sectors like the agbiosciences, a strong knowledge and talent base, peer networks, and labor mobility across companies and institutions assume particular importance. In these cases, successful ecosystems not only generate new ideas and knowledge, but also nurture networks and connections that facilitate the flow and development of these new ideas into new products, services, and technologies. Building these connections and activating an entrepreneurial mindset are core missions for AgriNovus.

A Framework to Assess Indiana's Entrepreneurial Ecosystem

The research literature presents a compelling case for why ecosystems matter to regional or state economic performance. A similar consensus exists around the core components of effective ecosystems. While there are many different models and classification schemes for entrepreneurial ecosystems, these multiple approaches share many characteristics.¹² Researchers typically emphasize that successful entrepreneurial ecosystems are information-rich. Successful locations have a strong local base of knowledge, in the minds of entrepreneurs, service providers, educators and investors, about the business start-up and growth process. This knowledge is also accessed via networking, links to support organizations and technical assistance, or via connectors and network hubs that serve to link entrepreneurs to the information, tools and resources needed to support business growth.

Ecosystems typically emerge at the local or regional, as opposed to the state, level. While this report discusses Indiana's entrepreneurial ecosystem, the "state ecosystem" exists as a network of regional and local ecosystems. For example, a Fort Wayne entrepreneur operates her company and participates in networking events in Northeast Indiana but may find a mentor in South Bend or an attorney in Indianapolis. These kinds of regional linkages are already occurring in Indiana through organizations like Elevate Ventures and the Purdue Foundry's operations across the state.

Robust ecosystems do not simply emerge nor can they be created from scratch. They emerge organically and are rarely created through a "top down" approach. Many successful ecosystems can be traced back to unique local cultures, natural amenities, or distinctive historical experiences. For example, many successful ecosystems have emerged from unique historical circumstances. Hong Kong is a classic example, where its role as free trade port and unique relationship to mainland China helped spawn a strong business-friendly climate. In other cases, a single company or small group of firms can help spawn a flourishing of other entrepreneurial ventures. This pattern has been common in recent U.S. history. For example, many of Silicon Valley's leading firms, such as Apple and Intel, can be traced back to a group of employees who left Fairchild Semiconductors in the late

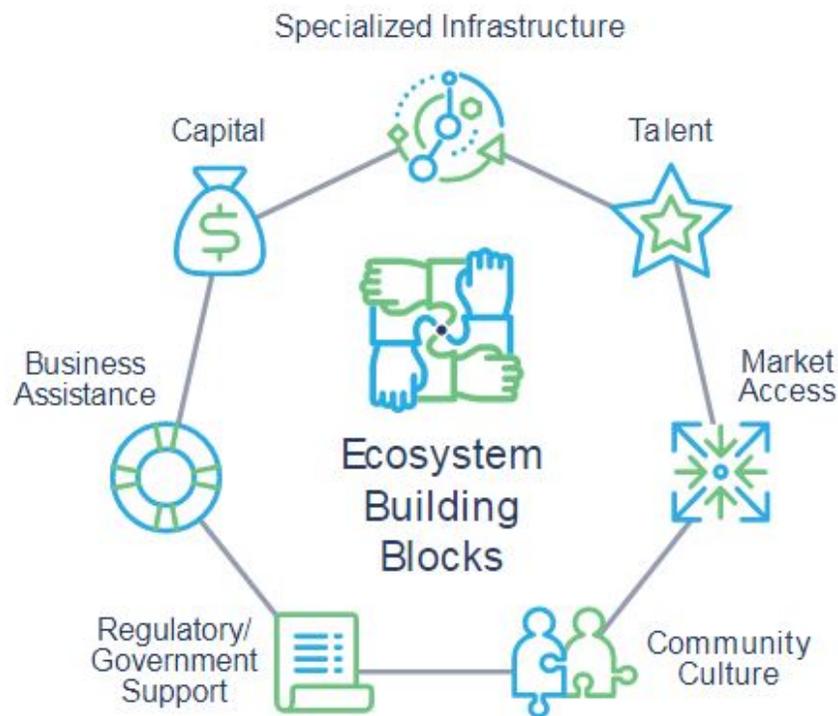
¹² See for example, Qian, H. 2018. "Knowledge-Based Regional Economic Development: A Synthetic Review of Knowledge Spillovers, Entrepreneurship, and Entrepreneurial Ecosystems." *Economic Development Quarterly*. 32:2.

1950s.¹³ Similar patterns of entrepreneurial spawning have been seen in San Diego, Kansas City, Boise and other regions.¹⁴

Beyond these important social context contributors, a number of core public policy factors do help shape entrepreneurial ecosystems. Researchers have highlighted several essential policy inputs/contributors that are closely associated with robust and effective regional ecosystems (Figure 1). They include policies that support:

- **Specialized Infrastructure and Facilities:** Meeting the unique space needs of entrepreneurs
- **Talent/Workforce/Human Capital:** Building a regional talent base
- **Market Access:** Helping entrepreneurs identify, access and succeed in new markets
- **Community Culture:** Honoring and embracing entrepreneurship
- **Regulatory/Government Support:** Cutting red tape and promoting flexibility
- **Business Assistance:** Providing easy access to technical assistance
- **Capital:** Providing diverse sources of capital to help firms start and grow

Figure 1: Public Policy Factors Contributing to a Robust Entrepreneurial Ecosystem



¹³ Kenney, M. 2000. *Understanding Silicon Valley: Evolution of an Entrepreneurial Region*. Stanford Business Press.

¹⁴ Mayer, H. 2011. *Entrepreneurship and Innovation in Second Tier Region*. Northampton, MA: Elgar; Walshok, M. and Shragge, A. 2014. *Invention and Reinvention: The Evolution of San Diego's Innovation Economy*. Stanford: Stanford University Press.

Specialized Infrastructure and Facilities

Most experts contend that soft or cultural factors are the essential components of effective ecosystems, but facilities and infrastructure can matter too. Entrepreneurs are like any other business in that they benefit from and want to work in regions that have strong infrastructure in the form of good transportation access across multiple modes, excellent water, sewer and power systems, and world class broadband access.

These types of physical assets are essential to business success but are not necessarily unique attributes of entrepreneurial ecosystems. However, some types of facilities are especially relevant for start-ups and new companies, including incubators, accelerators and coworking spaces.

Business Incubators

Business incubators often serve as key hubs in regional ecosystems. They are one of the first specialized approaches to supporting small businesses, and have long benefited from investments from federal, state, and local economic development agencies. Extensive research suggests that business incubation may help produce better business outcomes, such as higher firm survival rates and an increased likelihood that incubated firms will maintain local operations.¹⁵

Over time, many business incubators have altered their missions to now serve a wider diversity of companies, including more established firms. Many also focus less on ecosystem support and instead have a more general economic development mission. Meanwhile, some incubators' past service offerings, such as subsidized office space, are of less interest to new ventures that may operate with a limited physical footprint. This shift has been one factor driving the growth of business accelerator and coworking programs.

Indiana is home to a sizable number of business incubators, many of which have been operating for some time.¹⁶ Many of these operations are co-located on university campuses, such as [Purdue's Discovery Park](#), or in other research parks such as the incubator facility at Scott County's [Mid-America Science Park](#). Indiana is home to 23 certified technology parks, and most of these locations also include business incubation services as well.¹⁷ Other prominent incubation programs include the [Northeast Indiana Innovation Center \(NIIC\)](#) in Fort Wayne and Anderson's [Flagship Enterprise Center](#).

¹⁵ U.S. Economic Development Administration, *Incubating Success: Incubation Best Practices that Lead to Successful Ventures*, 2011. Available at:

http://edaincubatorool.org/pdf/Master%20Report_FINALDownloadPDF.pdf.

¹⁶ By some measures, Indiana may be under-served by business incubation facilities. The Milken Institute's 2016 *State Science and Technology Index* ranks Indiana as 45th among US states on its measure of the number of business incubation facilities per 10,000 business establishments. See

<http://statetechandscience.org/>

¹⁷ To view a listing of certified technology parks, visit <https://iedc.in.gov/programs/certified-technology-parks/home>

Skidmore Laboratory

Another critical resource for food-related entrepreneurs is the Skidmore Food Product Development Laboratory at Purdue which offers a state-of-the-art Pilot Laboratory. Operating as a model manufacturing area, it allows manufacturers to see how a process works before committing to full production. Wet chemistry, microbiology, and food product development laboratories are also available to solve related challenges. Capabilities include:

- Aseptic and thermal processing and packaging
- Equipment design and development
- Automated quality control/recipe management
- Process design
- Ultrasound applications/process improvement
- In-line Physical/Chemical Sensor evaluation
- Controlled/modified atmosphere, active and aseptic packaging
- Shelf-life studies and sensory evaluation

Because innovation in food is becoming an important part of agtech and the agbiosciences, commercial kitchens or kitchen incubators are important to consider. A 2016 survey identified as many as 200 commercial kitchens around the United States, including at least several operating in Indiana.¹⁸ The Indiana locations include:

- Indy's Kitchen (Indianapolis),
- Nana Clare's Kitchen (Valparaiso)
- Cook Spring Fort Wayne.
- Carmel's Kitchen (Carmel)
- One World Kitchen Share (Bloomington)
- Art House (Gary)

The typical kitchen incubator is designed to help start-up food entrepreneurs by providing access to large kitchens, cooking equipment, food storage, and perhaps some kind of loading and packaging support. Most users of these facilities run small food businesses or may operate catering or food service companies.

Business Accelerators

When it comes to accessing a full suite of business services, many regions around the world are embracing the concept of business acceleration.¹⁹ An accelerator is generally defined as a program that is provided over a brief period of time, e.g., 3 to 6 months, where companies compete to enter a

¹⁸ Econsult Solutions, *US Kitchen Incubators: An Industry Update*, March 2016.

https://econsultsolutions.com/wp-content/uploads/2016/03/U-S-Kitchen-Incubators-An-Industry-Update_Final.compressed.pdf.

¹⁹ Dempwolf, C.S., Auer, J., and D'Ippolito, M. 2014. "Innovation Accelerators: Defining Characteristics among Start-Up Assistance Organizations," Report prepared for US Small Business Administration Office of Advocacy,; Clarysse, B., Wright, M. and Van Hove, J. 2015. "A Look Inside Accelerators," NESTA (UK) Research Report.

cohort that is provided with extensive training, mentorship and support. Many accelerators include access to equity capital and/or financial awards at the conclusion of the program.

In addition to their work in spawning new companies, business accelerators are especially important because these programs typically view ecosystem development as part of their core missions. And, the regional spillover impact of accelerators appears to be positive. One recent study found that metropolitan statistical areas (MSAs) with accelerator programs tended to have higher levels of seed- and early-stage investing activity after programs have been put in place.²⁰ These impacts are not restricted to firms engaged in the programs; they also ripple out to early-stage firms more generally.

The Ag-Celerator™

Notable is the Purdue University-run Ag-Celerator™, a variant on the standard Purdue Foundry program dedicated to launching start-ups based on Purdue plant science innovations. The Ag-Celerator has a \$2 million fund associated with it that can award up to \$100,000 twice a year to the best companies in a cohort. The Ag-Celerator™ has awarded funds to six agbioscience start-ups as of mid-2018.

Several new accelerator programs are now up and running in Indiana. A number of these efforts tap into national programs or models. These include the new IEDC-supported gBETA Indy acceleration program, based on a partnership with gener8tor, a Wisconsin-based accelerator program. Other programs, such as Jeffersonville's Velocity accelerator or the Purdue Foundry, develop their own models and approaches.

Coworking

More recently, regions have sought to target other kinds of businesses and to support new ways of working. The past decade has seen a global boom in the development of new working spaces that have many names, such as makerspaces, hackerspaces or coworking facilities, and take many different forms.

Makerspaces and hackerspaces are targeted to providing specialized equipment, support and workspace for collaborative work. It is estimated that 400 such facilities operate in the United States, and the number of makerspaces worldwide has grown by 14 times since 2006.²¹ These spaces vary in nearly every way, and they can be located in schools, libraries, other public facilities or operated by private business or non-profits. They can range from simple hackerspaces where like-minded people can meet to do collaborative work to more elaborate makerspaces that also provide training and access to specialized equipment like 3D printers, computer design tools, and various machine tools. The more advanced makerspaces serve as digital factories. Makerspaces are important not only because they provide a place where ideas and new businesses can form, but they also seek to transform their communities. Some analysts refer to them as part of a new "civic infrastructure" which will help create local cultures that embrace innovation and creativity.

²⁰ Fehder, D.C. and Hochberg, Y.V. 2014. "Accelerators and the Regional Supply of Venture Capital Investment," Working Paper. Available at: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2518668

²¹ Lou, N. and Peek, K. 2016. "By the Numbers: The Rise of the Makerspace," *Popular Science*. The Maker Map (available at: <http://themakermap.com/>) provides an updated listing of sites across the United States.

Coworking spaces are the final component of the “new entrepreneurial infrastructure” and have experienced a growth boom of their own in recent years. Coworking spaces provide a work and meeting space for all kinds of independent workers. Many users of coworking space are freelancers, gig economy workers, or even telecommuters in traditional employment, but entrepreneurs also comprise a big share of coworking space users.

The size of the coworking market is disputed, but no one doubts that it is large and growing. The 2017 Global Coworking Census identified more than 14,000 coworking spaces around the world serving more than 1.74 million members.²² In 2005, the United States was home to one coworking space. Today, there are more than 3,200 of these locations around the country, with annual membership growth expected to average around 15% for the next several years.

Indiana has dozens of coworking spaces located throughout the state (Figure 2). Several of the coworking spaces are part of a network that includes Launch Fishers, Launch Terre Haute, and Launch Martinsville.

This emerging statewide network allows coworking space managers to share program ideas, tap into services and support available in other regions, and build closer connections between entrepreneurs in various regions. In addition, over 50 spaces offer an Indiana Coworking Passport that allows users to access multiple facilities across the state.²³

Beyond the Launch network, other notable coworking spaces include three in Lafayette and West Lafayette (Matchbox, Anvil and the Railyard), Fishtank in Columbus, Atrium (Fort Wayne), Innovation Pointe (Evansville), Dimension Mill (Bloomington), and Co:Lab (Muncie).

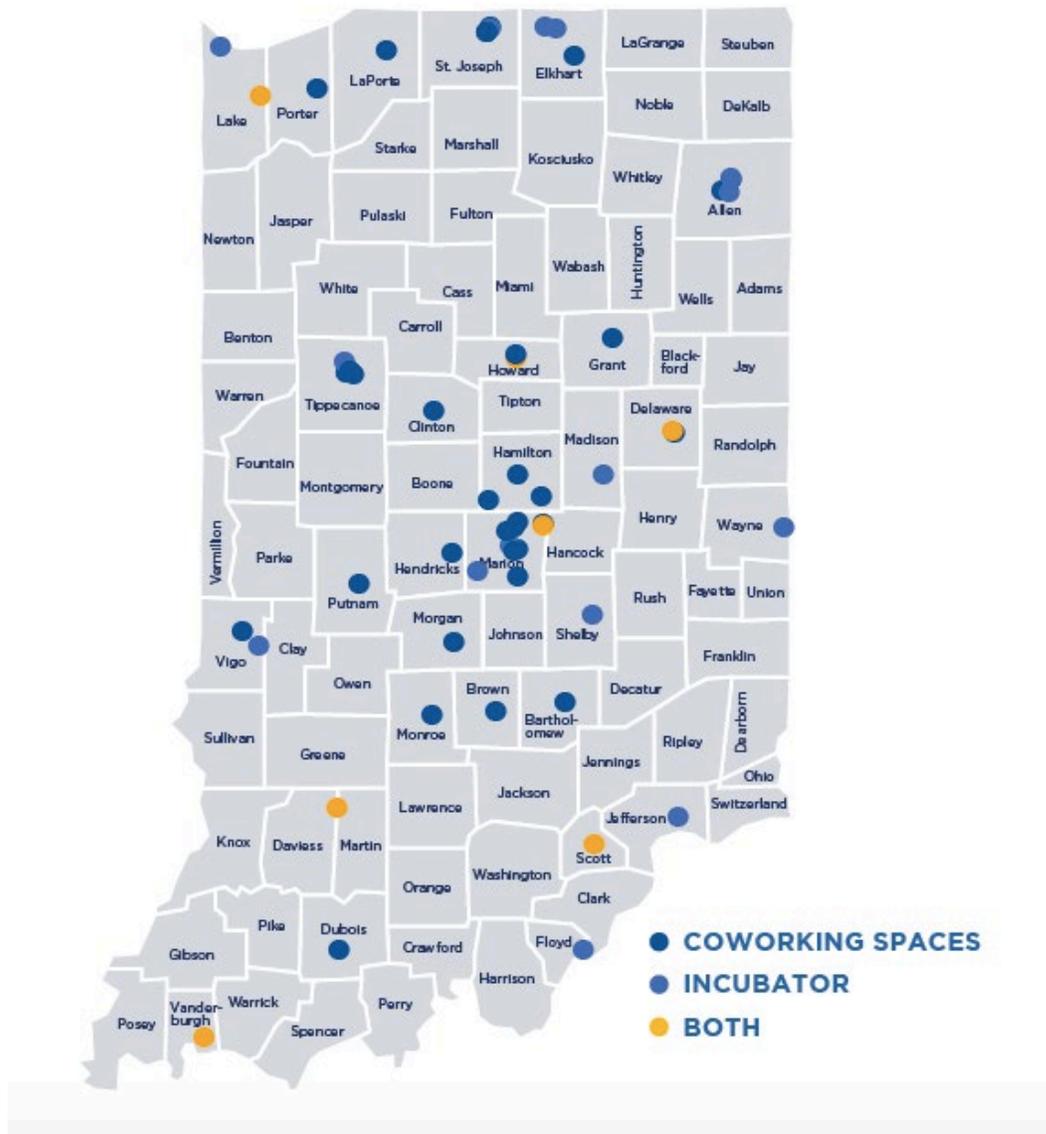
Regions across Indiana have a strong entrepreneurial infrastructure in place. Most regions have relatively easy access to business centers, incubators/accelerators, and coworking spaces. These facilities are open to entrepreneurs of all types, with only a few facilities offering specialized services to those working in the agbiosciences. The Northeast Indiana Innovation Center, for instance, offers both wet labs and a commercial kitchen, while other wet labs are available at incubators focused on the biosciences such as the Mid-America Science Park in Scottsburg or the Indiana Center for Biomedical Innovation.

The presence of these entrepreneurial hubs does not guarantee a thriving ecosystem. A building is just a building without passionate entrepreneurs who have good ideas and a network of support to help transform that idea into a successful business. Nonetheless, this strong network of entrepreneurial hubs is an area of competitive advantage for Indiana.

²² <https://gcuc.co/2018-global-coworking-forecast-30432-spaces-5-1-million-members-2022/>. See also: <http://www.deskmag.com/en/background-of-the-2018-global-coworking-survey-market-research>.

²³ For a complete list of spaces to offer the Passport: <http://www.indianacoworkingpassport.com/>

Figure 2: Coworking and Incubator Spaces Across Indiana - 2015



Source: Indiana Economic Development Corporation

Talent/Workforce/Human Capital

When it comes to sustaining strong ecosystems, few things matter more than access to talent. Without a deep base of skilled personnel, entrepreneurs will be challenged to develop fast growing ventures. This base of talent generally emerges from a culture that embraces learning, strong local educational systems and the local presence of major institutions, such as colleges, universities, or other large anchor institutions, such as sizeable corporations or research centers.

The talent base can also be nurtured via in-migration of new residents, attracted by business opportunities or other local amenities. Immigrants are an especially part of robust ecosystems, and

immigrant founders have played a critical role in a large share of America's most important technology companies. Overall, recent data suggests that immigrants account for around 25% of all new businesses created each year in the United States.²⁴ In some regions, they account for as much as 40% of new business creation.

These historical legacies are crucially important, and it is difficult to change the trajectory of a region that has not typically attracted outside talent or groomed its own home-grown talent. Indiana is less challenged on this front, as it home to high quality education systems from K-12 and beyond. The state's higher education institutions are widely recognized for their high quality.

In addition to supporting robust education programs, regional leaders can take other steps to develop a human capital base that supports business start-up and growth. This should include investments in workforce and education programs. This area is a key priority for AgriNovus in its work to enhance Indiana's agbioscience talent pipeline.²⁵ In addition, targeted efforts to enhance the local ecosystem should include the expansion of entrepreneurial education programs.

Effective entrepreneurship education programs can and should be made available to individuals from all backgrounds and from all age groups. Much education and training can and will be provided by traditional business service providers, such as the Small Business Development Center Network, which will be discussed further below. But education programs should also be offered in the formal education system and in related organizations that serve youth through adults.

Entrepreneurship education for youth is one of the most important facets of a robust regional ecosystem, especially in areas lacking a history of entrepreneurship. Changing long entrenched mindsets is difficult, and youth entrepreneurship offers one means to help start the culture shift process. In addition to increasing youth entrepreneurship rates, this training also provides other educational benefits for young people.²⁶

Youth entrepreneurship programs can take many forms, ranging from short summer camps or clubs to formal integration into the K-12 curriculum. Over the past decade, a growing number of states and local school districts have introduced formal guidelines for entrepreneurship education. At present, 42 states have adopted standards, guidelines or proficiencies for entrepreneurship education, and 18 states, including Indiana, require that entrepreneurship education courses be offered in high school.²⁷

Numerous other options exist to engage young people in learning about entrepreneurship, via groups like the YMCA/YWCA, National FFA, 4-H, Junior Achievement, the Boy Scouts, the Girl Scouts,

²⁴ Kerr, S.P. and Kerr, W.R. 2018. "Immigrant Entrepreneurship in America: Evidence from the Survey of Business Owners 2007 and 2012," National Bureau of Economic Research Working Paper No. 24494. Available at: <http://www.nber.org/papers/w24494.pdf>

²⁵ TEconomy Partners LLC. 2016. *Ensuring an Agbioscience Workforce for Indiana's Future*, Report prepared for AgriNovus Indiana.

²⁶ Aspen Institute Youth Entrepreneurship Strategy Group. 2008. "Youth Entrepreneurship in America: A Policymakers Action Guide."

²⁷ Junior Achievement USA. 2016. "The States of Entrepreneurship in America," JA Research Report. <https://tridja.org/wp-content/uploads/2016/07/The-States-of-Entrepreneurship-Education-in-America.pdf>

Chambers of Commerce and others that offer training or other tools to learn about business. Many of these groups already have a strong presence across Indiana. For example, Indiana 4-H sponsors an annual summer Entrepreneurship Academy for students in grades 9-12 with ideas for new businesses, and seven different Indiana communities sponsor an annual [“Lemonade Day”](#) where young people learn about business in the process of creating their own lemonade stand. Junior Achievement programs are found across the state, with major initiatives in both Northern Indiana and the Indianapolis region. Finally, the Indiana Department of Education offers a host of entrepreneurship learning opportunities via its [career and technical education programs](#), including active chapters of DECA (formerly Distributive Education Clubs of America), Business Professionals of America (BPA), and Future Business Leaders of America (FBLA).

In addition to these national or regional programs, communities across the state have also designed their own programs. The Innovate WithIN competition discussed later in this report is one excellent example. Another comes from Northeast Indiana where Goshen College has sponsored local high school business competitions where the winners receive scholarships to attend Goshen.²⁸ A number of other programs, such as the [South Bend Code School](#) (now operating in four Indiana locations), seek to combine entrepreneurship immersion with training in coding or other STEM-related disciplines.

Beyond high school, entrepreneurship education at community colleges and at four-year schools is booming. Over the past decade, the field has grown rapidly and programs and curricula have migrated from the business schools to other schools and academic disciplines. Indiana University has long housed one of the world’s most respected and highly ranked entrepreneurship programs at the Johnson Center for Entrepreneurship and Innovation, part of the Kelley School of Business. At the Indianapolis campus (Indiana University Purdue University Indianapolis – IUPUI), the Kelley School offers significant undergraduate and executive entrepreneurship programming, including a Master of Business Administration (MBA) in the Business of Medicine. Indiana University and Purdue University also have a joint degree program that combines a Kelley School MBA with a Master of Science (MS) degree in Agricultural Economics.

In addition to its research and education activities, the Johnson Center also manages operations of the Global Consortium of Entrepreneurship Centers, a worldwide network of university-based entrepreneurship centers. Like Indiana University, Ball State University’s programs have also been ranked among the top undergraduate entrepreneurship degree programs in the United States.

Ivy Tech Community College also operates extensive entrepreneurship programs at many of its campuses, offering majors in entrepreneurship along with certificates that accompany degrees in other fields such as culinary, nursing, or industry trades. Some campus programs can be quite extensive. For example, in Bloomington, the [Gayle and Bill Cook Center for Entrepreneurship](#) offers classes and training, while also managing the local SBDC network operations and the [Switchboard](#), a regional on-line guide to business resources.

²⁸ To learn more, visit <https://www.goshen.edu/news/2018/05/10/goshen-college-partners-indiana-counties-offer-scholarships-young-entrepreneurs/>

Nearly every college and university in Indiana now manages a robust entrepreneurship program that not only serves business majors, but students from across the university system. A study mandated by the Indiana General Assembly in 2011 and conducted by the Indiana Commission for Higher Education found that 88% of public institution campuses and 78% of private campuses offered entrepreneurship-related programming for students.²⁹

Students and faculty with interest in the agbiosciences can and do tap into this rich resource base, but they can also benefit from programs specifically tailored to agbioscience related industries and careers. Here again, Indiana offers a range of opportunities within agriculture, engineering and life sciences programs as well. Purdue has been especially active on this front with many of its programs centered at the [Burton D. Morgan Center for Entrepreneurship](#) and the [Discovery Park](#) complex of facilities. Within this cluster of activities, the Purdue [Foundry](#) has been especially important, supporting a host of programs including the Ag-Celerator effort referenced earlier in this report. Purdue's College of Agriculture also continues to garner numerous accolades and has regularly been recognized for its world's top-ranked agricultural and biological engineering program.

Purdue is not alone in providing excellent agriculture-focused education. Huntington University has created a new agricultural degree program at the [Haupt Institute for Agriculture Studies](#), and other schools across the state, such as Ivy Tech Community College, Ancilla College, Grace College, and Vincennes University, also offer agriculture curriculum and degrees. Other expanded educational programs are also under consideration. For example, the Indiana Council for Higher Education is currently assessing the feasibility of creating a new program focused on agriculture law.³⁰

New Careers in Food and Agribusiness Management

Indiana is home to one of the world's top business schools (Indiana University's Kelley School) and one of the world's top agricultural research and training schools in Purdue University. In an innovative educational partnership, the schools offer a joint MBA-MS degree in Food and Agribusiness Management. The program is designed to prepare students for careers in the agribusiness sector, and, with some minor refinement to course content and/or student projects, it could also become an important feeder of entrepreneurs and management talent into Indiana's agbiosciences start-up ecosystem. These updates could include the addition of entrepreneurship-focused course work or modules where students develop their own business ideas and plans.

Market Access

Robust ecosystems also benefit from various types of programs that seek to directly aid entrepreneurs in accessing new markets. This market identification and development work is

²⁹ Indiana Commission for Higher Education, Entrepreneurial Inventory, HEA 1006-2011, November 1, 2011. Available at: <https://www.in.gov/che/entrinv.htm>

³⁰ Indiana Commission for Higher Education, "Feasibility of an Agricultural Law Program offered by Indiana University Robert H. McKinney School of Law & Purdue University College of Agriculture," 2017. Available at: <https://secure.in.gov/che/files/Feasibility%20of%20an%20Agricultural%20Law%20Program%20-%20Response%20to%20SR%2033.pdf>

especially important in sector like the agbiosciences where company success depends on the ability to succeed in local, regional, national and global markets.

Market access programs help local firms think bigger and succeed in markets outside of the local region. Economic gardening programs are one well known example of such market access programs targeted to helping entrepreneurial ventures.³¹ This approach places heavy emphasis on providing new market intelligence to new and growing companies. Second stage ventures, firms with between 10-99 employees, are a special focus as these companies are deemed to have high growth potential. In Indiana, Elevate Ventures and the Purdue Center for Regional Development offer services similar to those found in economic gardening programs, and the [Lowe Foundation's National Center for Economic Gardening](#) is headquartered nearby in Cassopolis, Michigan.

Economic gardening programs provide market intelligence and other assistance to firms in a variety of sectors or seeking to access a wide array of new or growing markets. Other types of support programs offer more focused or specialized assistance. Examples include state and local export promotion programs, procurement assistance via the Procurement Technical Assistance Center (PTAC) network and other local partners, and targeted support for the development of specific sectors or industry clusters. The [Indiana Minority and Women's Business Division](#) is also available to help minority and women entrepreneurs access government contracting opportunities.

The range of market promotion programs in agriculture is quite impressive. Few other business clusters have such resources and capacities for new market intelligence and business development. Indiana has a strong infrastructure in place and plans to build on this foundation. The ISDA's latest strategic plan includes growing regional and international trade as a core objective.³² Indiana Governor Eric Holcomb and the IEDC also place international business attraction as a high priority for longer term job creation and investment. As an example, the Governor and IEDC partnered with AgriNovus in May 2018 on an agbioscience-focused trip to Israel, which fostered many promising business and research collaborations with Israel's own growing agtech start-up sector. Additional international missions and visits with a focus on agbiosciences are needed.

Export promotion programs can be especially important in helping firms achieve high growth. In Indiana, ISDA operates a large export promotion effort. ISDA rightly places great emphasis on agriculture-related exports, as Indiana presently ranks 7th among U.S. states for the value of its agricultural exports. At present, the agbiosciences are a tiny share of these exports, but the potential for growth is significant. The Indy Chamber has also embraced an aggressive export promotion plan, and provides [Go Global](#) market grants (of up to \$5,000) for firms to use for purposes such as trade show attendance or export market planning. This local effort does not identify agbiosciences as a targeted industry cluster, but grants are available to firms from all sectors with clear plans for export market development.

³¹ For background, see <http://edwardlowe.org/entrepreneurship-programs/economic-gardening/>

³² Indiana State Department of Agriculture, *Indiana Agriculture Strategic Plan 2027*, 2017, p. 6. Available at: <https://www.in.gov/isda/3547.htm>.

Community Culture

The role of culture in entrepreneurial ecosystems is essential, but also among the most complicated to understand and influence.³³ Researchers and entrepreneurs themselves regularly note that places with strong ecosystems “feel different” and offer a more conducive business environment.

Much of the current thinking about entrepreneurial cultures can be traced back to the 1980s when researchers began highlighting the role of informal networks and social ties in entrepreneurial success.³⁴ Subsequently, global cross-country comparisons, such as the Global Entrepreneurship Monitor (GEM), highlighted massive differences in national and regional entrepreneurship rates, which often occurred independently of other economic factors. Key cultural factors in this model include whether a society values entrepreneurship as a career choice, attitudes toward risk, and whether entrepreneurs have relatively high social status.

In general, the United States performs extremely well in various global rankings of cultural support for entrepreneurs. Yet, these strong showing masks large regional differences. Some regions can simply rely on past traditions and current business practices to sustain a strong entrepreneurial culture. Others need to actively invest in efforts to help spur interest and enthusiasm about the possibilities associated with local entrepreneurship.

Building an “entrepreneurial culture” is not a quick proposition; it requires years of work to change local attitudes and to introduce new generations to the benefits of entrepreneurship. A number of public education and outreach efforts can help further spread this message. Business plan and award competitions are especially popular, as they can typically occur with limited investments of both time and money. Business accelerators and other programs also help spread a message about the economic benefits generated by local entrepreneurs. Award programs that celebrate successful entrepreneurs and public information campaigns that highlight entrepreneurs are also low-cost methods for changing public perceptions about entrepreneurship as a career choice and source of local economic growth.

The state of Indiana is home to a diverse array of programs and initiatives that seek to promote a more entrepreneur-friendly business culture. A number of these efforts have been operating for some time. These include: the Venture Club of Indiana’s Innovation Showcase, Start-up Weekend, and awards programs sponsored by groups such as National Association of Women Business Owners, Ernst and Young, and the Indiana Small Business Development Center Network. Industry associations, business networks, and industry journals, such as TechPoint and the *Indianapolis Business Journal*, also sponsor awards that recognize the “best” in business. Finally, a small number of local governments, such as Grant County, have created their own award programs to honor new entrepreneurs and successful local companies.

³³ For background, see Bosma and Holvaert, 2017; Fritsch, M., and Wyrwich, M. “Persistence of Regional Entrepreneurship: Causes, Effects, and Directions for Future Research.” Jena Economic Research Papers 2017-003.

³⁴ Saxenian, A. 1994. *Regional Advantage: Culture and Competition in Silicon Valley and Route 128*, Cambridge: Harvard University Press; Feld, B. 2012. *Startup Communities*. New York: John Wiley & Sons.

Beyond financial awards, business plan and pitch competitions offer the opportunity to not only recognize excellence but to teach potential entrepreneurs about the “ins and outs” of starting a new venture. For this reason, these competitions are common on college campuses across Indiana. In fact, nearly every Indiana higher education institution offers some opportunity where students, and sometimes employees, can test out new ideas via competitions and contests. A sampling can be found below:

- [I-69 Innovation Challenge](#): Open to student teams from Anderson, Ball State, Huntington, Grace College, Indiana Wesleyan, and Taylor Universities.
- Indiana University: Campus competitions include the [Clapp IDEA Competition](#) for student ventures and the BEST Competition for students in Software and Technology.
- Indiana State University: [Elevator Pitch Competition](#)
- IUPUI: The [JAGStart Elevator Pitch](#) contest is open to all students at IUPUI.
- Ivy Tech: Various campuses hold regular New Venture Competitions for student business teams.
- Notre Dame: The [McCloskey Business Plan Competition](#) is open to both business ideas and social ventures.
- Purdue University: Purdue’s [Burton D. Morgan Center](#) sponsors a business plan competition and the Schurz Innovation Challenge.
- Purdue Northwest: Sponsors the [Big Sell](#) competition.
- Rose-Hulman Institute of Technology: [SPARK Competition](#)
- Valparaiso University: Valpo Innovates

The success of these college level efforts has led to an expansion of the idea to other parts of the education spectrum as well. The new [Innovate WithIN](#) competition for high school students is rightly gaining a lot of attention and enthusiasm. Developed and sponsored by Ball State University and the IEDC, this contest is open to young innovators from across Indiana. In 2018, pitches came from across the state, with 86 applications from 65 different high schools.³⁵

In addition to new events like Innovate WithIN, Indiana is also home to a unique and strategic organization in [Centric](#), whose mission is to “connect, educate, and celebrate Indiana’s innovators.” Operating since 2009, Centric provides consulting and coaching services and sponsors the annual *Indiana Day of Innovation*, which generally celebrates innovation across the state, but also provides awards to local innovations in new products, services, and companies. The awards have ranged widely from honoring more traditional business innovations from large firms (such as Dow AgroScience’s stackable polyethylene terephthalate (PET) containers) and small firms (RDM’s shrimp farming systems) to less conventional innovations such as the Thunderbird roller coaster at Holiday World or the “Artrageous with Nate” video series.

At present, few of these diverse programs have an explicit agbioscience focus. One exception is the [AgBot Challenge](#), focused on agtech innovations, sponsored by Rockville, Indiana’s Gerrish Farms. In most cases, agbioscience-focused innovators tap into more general programs and competitions such as those cited above, or those sponsored by more traditional agriculture advocates such as the Indiana Farm Bureau’s Achievement Awards or the ISDA AgriVision Award.

³⁵ To learn more, visit <https://iedc.in.gov/news/details/2018/04/10/innovate-within>

The Innovation Showcase

The Innovation Showcase, sponsored by the Venture Club of Indiana since 2009, is likely one of the oldest and widest ranging of various business plan and pitch competitions operating across the state. It begins with a series of regional pitch competitions, running from April to August, where hundreds of entrepreneurs have the opportunity to pitch new business ideas to investors, fellow entrepreneurs, and others. The effort culminates in September at inX3, a week-long celebration of innovation and entrepreneurship across Indiana. The competition includes tracks for start-ups, university-based firms, and scaleup ventures. Firms benefit from exposure to investors and to the wider technology community and connections into powerful peer networks like TechPoint and others.

On their own, awards programs and business plan competitions cannot transform community attitudes toward risk and toward greater support for entrepreneurship as a career option. They must be supplemented by additional measures that take a more proactive approach to developing talent and educating local residents about the power of entrepreneurship. These efforts include specialized training programs, such as classes and accelerator programs. These types of initiatives are discussed in greater detail below in the sections on talent, access to business services, networks, and specialized infrastructure.

Regulatory/Government Support

Entrepreneur-friendly regulations are an essential component of any robust and start-up supportive community and are thus an important ecosystem building block as well. There is much overlap between entrepreneur-friendly regulations and business-friendly regulations, but there are important differences as well. For entrepreneurs, the most important regulations are those that affect business entry and growth. Is it easy to start a business? Is it easy to support that company's growth?

Indiana has traditionally benefited from its strong business friendly climate. The state ranks 8th nationally on both the 2017 State Business Tax Climate Index and the 2018 Small Business Policy Index.³⁶ These rankings focus on states and regions where taxes are low and regulatory burdens are limited. These factors matter more to established businesses. Meanwhile, high-growth entrepreneurs and lifestyle entrepreneurs often have different needs as they relate to public policy and regulation.³⁷ High growth entrepreneurs are most interested in locations with a rich base of talent and easy access to customers, suppliers, and partners. They may be less concerned about taxation levels and other regulatory concerns.

Regardless of their attitudes to government rules and regulations, all entrepreneurs have to deal with government agencies at some point in time. Successful regions make this process as painless as possible, and provide clarity, transparency and reliability to entrepreneurs. A number of strategies and approaches help create a more "entrepreneur-friendly" regulatory system. A first step involves providing one-stop access for permits, business licenses, and other necessary business paperwork.

³⁶ Walczak, J. , Drenkard, S., and Bishop-Henchman, J. 2016. *2017 State Business Tax Climate Index*. Tax Foundation. See <https://taxfoundation.org/2017-state-business-tax-climate-index/> and Keating, R. J. 2018. *Small Business Policy Index 2018*. Small Business and Entrepreneur Council. Available at: <http://sbecouncil.org/wp-content/uploads/2018/02/SBPI2018-SBECouncil.pdf>

³⁷ Endeavor Insight (2014). "What do the Best Entrepreneurs Want in a City?" Endeavor Insight Research Report.

Indiana's [INBIZ](#) website is one of the more effective “one-stop-shops” of this type, providing videos, how-to's, and other guides to help residents with the ins and outs of starting a business and dealing with various tax, registration, and licensing issues. [Open Counter Indy](#) uses tools developed by the software firm, Open Counter, which has developed partnerships with a number of city and county governments across the United States. The Open Counter Indy web platform allows users to quickly check zoning and land use codes for various types of business uses in Indianapolis, and to also identify the types of licenses and permits needed for certain business activities.

The creation of resource navigator tools is also commonly pursued, and Indiana is home to several excellent resource guides and websites. “*I don't know where to go for help*” may be the most common complaint made by entrepreneurs seeking assistance with regulatory issues, business planning or other needs. Resource navigators are designed to simplify the process and to ease the search for answers and support programs. IEDC, the Indiana Small Business Development Center (ISBDC) network, and other state agencies provide links to various support programs and technical assistance providers, but a statewide resource navigation site does not currently exist. INBIZ assists with regulatory compliance but does not link other sources of technical assistance. Several local and regional resource navigation sites are operating and can serve as an excellent resource for existing and prospective entrepreneurs. Examples include the Indianapolis Chamber's Indy Resource Navigator and the Northeast Indiana Innovation Center (NIIC) Navigator for new businesses in that region of the state. Other excellent support guides include the Business Ownership Initiative's guide to on-line courses, the Growth Alliance of Evansville's Start a Business Guide, and support tools provided by the ISBDC network.

Indiana is also a national leader in efforts to promote government transparency via regular reviews and oversight of rules and procedures to ensure that they remain business-friendly. The IEDC Regulatory Affairs division operates a business ombudsman service to help companies facing major regulatory hurdles or problems, and a similar support effort is housed at the Indy Chamber.³⁸ On the transparency front, Indiana regularly scores among best U.S. states for its commitment to sharing government data, receiving an A+ score in the latest assessment from the U.S. Public Interest Research Group.³⁹ This commitment to effective and transparent government and open data is beneficial for ensuring transparency and access to information, but it can also help potential entrepreneurs seeking information or tools for how best to serve government agency customers.

Business Assistance

Small business owners and budding entrepreneurs regularly complain that they don't know where to go to get help with their business challenges. With a robust ecosystem in place, these complaints are rare as entrepreneurs can easily find the technical assistance or support needed to address thorny business challenges.

The types of needed technical assistance can vary greatly and can run the gamut from the basics of business planning to sophisticated support with finance, market access, or technology development. Strong ecosystems are characterized by a deep local base of talent that can provide support for most

³⁸ To learn more, visit <http://www.indy.gov/eGov/City/DCE/small-business-services/Pages/Indy-Chamber.aspx>

³⁹ Surka, M. and Ridlington, E. 2016. *Following the Money 2016*, U.S. PIRG Education Fund Report. Available at: <https://uspargedfund.org/sites/pirg/files/reports/USP%20FollowMoney16%20Report%20Apr16.pdf>.

issues facing new and growing businesses. Yet, even the most robust ecosystem will not be home to every kind of expert or resource person. The ability to connect to other regions or outside sources of expertise is also an important component of robust ecosystems.

Business assistance can and should be available from multiple sources. Traditional business support organizations are typically the first place where entrepreneurs seek outside help. These groups would include Chambers of Commerce, local economic development organizations, and programs specifically focused on small business support such as the U.S. Small Business Administration (SBA)-backed Small Business Development Center (SBDC) network and local chapters of SCORE (a resource partner of the SBA). More specialized efforts, such as those affiliated with the National Institute of Standards and Technology – Manufacturing Extension Partnership (NIST-MEP) or U.S. Department of Agriculture (USDA) Cooperative Extension programs, are also available nationwide.

In Indiana, the [Indiana Small Business Development Center](#) (ISBDC) network has ten regional offices and SCORE has 10 chapters. The Procurement Technical Assistance Center, a federally-funded program, has five locations in the state.

Additional business assistance programs are offered around the state, such as:

- [Northeast Indiana Innovation Center](#)
- [Indiana State University Business Engagement Center](#)
- [Patent Connect](#), operated by the Center for Intellectual Property Research at IU
- [Purdue Commercialization and Manufacturing Excellence Center](#)
- [Northern Indiana Lakes County Enterprise Center](#)
- [B-Start](#) in Bloomington, and
- [Rose-Hulman Ventures](#).

Elevate Ventures also provides critical business assistance and coaching services. While Elevate is typically viewed as a source of funding, the team also provides hands-on coaching and mentoring via its Elevate Advisors and statewide Entrepreneur-in-Residence (EIR) programs. These programs operate across Indiana and engage advisors with deep industry expertise, including one with extensive knowledge of the agbiosciences. The Purdue Foundry offers similar advisory services to entrepreneurs using its programs. In addition to its efforts at Discovery Park, the Foundry team is also supporting a regional acceleration and coaching program at [Purdue at Westgate](#). This effort is targeted to potential opportunities spinning out of the Naval Surface Warfare Center Crane Division.

These regional programs typically provide a diverse mix of support services to local business owners, ranging from help with developing initial ideas to business planning training to more customized services and financing as companies grow. Most of the local programs seek to operate like a “one stop shop” that can provide direct services or refer entrepreneurs to other partners.

The quality of support provided by these groups can vary greatly, but many of them provide highly effective and low-cost assistance to new and growing companies. However, these traditional forms of business assistance sometimes suffer from several shortcomings, many of which result from

limited budgets and staffing. First, they provide generalized support that may not always be customized for the unique needs of a local entrepreneur. Second, their services typically target start-ups and lifestyle businesses, and may not be appropriate for scale-up companies or technology-intensive firms such as those found in the agbiosciences. Finally, they may offer their services at times or via methods that are inappropriate or ineffective for some entrepreneurs. For example, many entrepreneurs prefer peer learning to formal training programs. Others lack the time or availability to access programs during the day, and instead prefer to access support on-line. Many entrepreneurs also prefer to tap into peer networks, as opposed to participating in more formal training programs.

These networks take many forms, and Indiana is home to a unique mix of these groups. Many of these networks can operate in a very informal manner. For example, six Indiana communities utilize the Kauffman Foundation's One Million Cups program where budding entrepreneurs and start-ups present business ideas to a group of peers at regular monthly or even weekly meet-up sessions. Similar networking events are also sponsored by groups such as Startup Grind, [Powderkeg](#), the Venture Club of Indiana, and Centric, Inc.

Several statewide initiatives have deep sector networks, such as TechPoint, Conexus and BioCrossroads, and like AgriNovus, provide an important venue for connections to be made. Finally, several networks engage target groups such as women entrepreneurs (e.g., the [National Association of Women Business Owners chapter in Indianapolis](#)) or the [Indy Black Chamber of Commerce](#).

In addition to trade associations or other nationally-backed networks, local entrepreneur networks are also growing in importance. These regional efforts serve as critical lifelines for local entrepreneurs, and can also be an important part of a region's economic development infrastructure. Many regional networks operate across Indiana. Examples include:

- Cass County Entrepreneurs
- Growth Alliance for Greater Evansville
- Start Fort Wayne
- Tech on Tap (Evansville).

In addition to networking with peers, entrepreneurs have a strong interest in finding mentors and coaches to support business growth. Mentors can be provided by traditional business service groups such as SCORE. Networks also play an important role in addressing this demand. Many national entrepreneur networks, like EO (the Entrepreneurs' Organization) and the Young Presidents' Organization (YPO), view mentoring as part of their core missions. In Indiana, mentoring is also provided through Entrepreneurs-In-Residence (EIRs) at the Purdue Foundry or Elevate Ventures.

Sparking Entrepreneurship in Northeast Indiana

Northeast Indiana has recently witnessed a booming local interest in entrepreneurship. The Northeast Indiana Innovation Center has been in business since 1999, providing important services for local businesses. More recently, this pioneering work has helped spawn the creation of numerous new local champions, including Start Fort Wayne and others, who are working to build a thriving local ecosystem. In addition to building a stronger regional network, these efforts are encouraging several other local innovations. Examples include: the Cook Spring kitchen incubator, the Fort Founders Collaborative, the Atrium coworking space, and a local branch of the South Bend Code School.

Effective regional ecosystems provide businesses with a wide and deep base of entrepreneurial expertise. Some of this knowledge resides in economic development and business support organizations, but much of the expertise is found in private support providers, such as attorneys, accountants, and other consultants. The availability of specialized business services is a critical factor in successful ecosystems; a shortfall in such services is viewed as a major impediment by many entrepreneurs. In successful ecosystems, these firms understand the unique challenges facing entrepreneurs and tailor their services and pricing practices accordingly. For example, attorneys may provide reduced rates for start-up firms with the expectation that higher billing rates will follow as the firm grows. In Indiana, there are a number of groups offering services in return for equity, including management, such as [Little Engine Ventures](#), [Innovatemap](#), [SproutBox](#) and [DeveloperTown](#).

The development of specialized business support networks is especially important in technologically complex fields like the agbiosciences. Via this project and other work, AgriNovus is seeking to develop a strong “bench” of service providers—both public and private—that can offer specialized consulting, coaching and mentoring services tailored for the distinctive needs of agbioscience start-ups and emerging ventures. Agbioscience specializations could include patent attorneys with a deep understanding of plant and animal science patents and experts with a background in USDA regulatory regimes focused on gene editing and related technologies and the regulation of pesticides or animal health products.

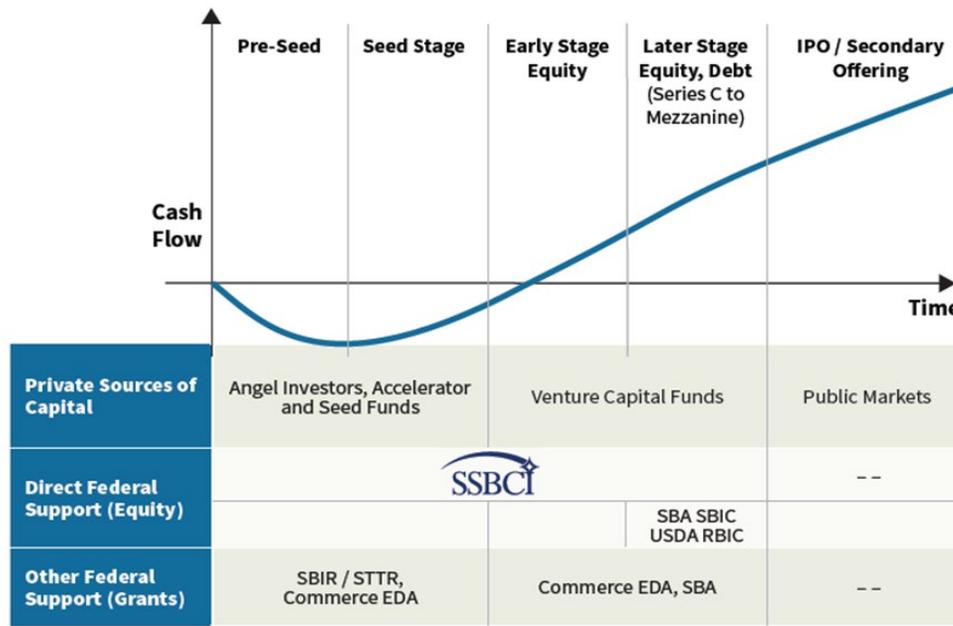
Capital

Casual observers typically consider access to capital as the most important component of an “entrepreneur-friendly” environment. Capital access is indeed a critical ecosystem building block, but other factors typically assume greater importance in successful ecosystems. Entrepreneur-friendly regions are home to diverse sources of capital, but they have the other building blocks as well. Other critical actors are those who provide the business or advisory services that help business owners and entrepreneurs effectively connect to and use capital for growth.

A diversity of funding sources and the connections between them are the critical factors for successful regional capital networks. Both debt and equity capital are needed. Suppliers of debt capital provide a range of financing from microlending to expansion and working capital to large scale project financing. Equity capital financing includes resources for product development to start-ups and seed capital to growth stage businesses and expansion/mezzanine capital. A few public sources of equity capital are available, but the bulk of equity financings come from private investors.

Figure 3 depicts equity sources of funding for a typical growing company. In early stages, these ventures may rely on angel investor or government-backed funding sources. As they grow, they may be able to tap investments from venture capitalists, private equity firms, or tap into other markets by eventually going public.

Figure 3. The Equity Capital Continuum for Growth Entrepreneurs



Source: Center for Regional Economic Competitiveness and Cromwell Schmisser

Equity investments, from angel capital to venture capital, are especially important for high-growth ventures that need large scale infusions of resources to fuel rapid expansion. Venture capital receives much attention in the press, yet most successful regions are home to a diversity of capital sources. They host venture capital investors, but they also attract and support a wide array of investors and investment vehicles. And, the causal relationships between capital and entrepreneurial regions are complex. Today, many researchers argue that, “venture capital lags rather than leads the emergence of entrepreneurial activity; it is not part of the initial environmental conditions.”⁴⁰

Firms receiving venture capital investments are typically well-established, seeking relatively large outside investments and in markets with significant upside growth potential. For example, in 2017, 36 Indiana-based firms received outside venture capital investments, with an average investment size of approximately \$3.7 million.⁴¹ Nearly all of these were in internet or health care related ventures.

⁴⁰ Mason, C. and Brown, R. 2014. “Entrepreneurial Ecosystems and Growth Oriented Entrepreneurship: Background paper prepared for the workshop organized by the OECD LEED Programme and the Dutch Ministry of Economic Affairs. p. 16.

⁴¹ Calculated from PWC Moneytree.

Most entrepreneurs, however, must look elsewhere for equity infusions, whether because they are earlier stage and not ready for venture capital, are not planning to grow fast enough to meet venture capital's investment profile, or because they are unwilling to share ownership with outside investors. In this case, they typically turn to friends and family or to angel investors. As noted elsewhere in this report, angel investors and organized angel groups are the primary equity source for companies around the United States. Angels across the country invest in roughly 64,000 ventures every year and typically invest smaller amounts in earlier stage deals. In 2016, the average deal size was around \$330,000, and 41% of deals were focused on the seed or start-up phase.⁴²

Most new businesses and small business use debt when they need outside resources to grow or to support daily operations. Since debt is generally collateralized, small businesses typically must have inventory or equipment or real estate to put up in order to get a loan. However, this also limits the applicability of debt as a source of capital to new or small businesses with intellectual property or research as their primary assets.

According to the most recent data from the Federal Reserve's Small Business Credit Survey, most start-ups (firms less than two years old) rely on personal funding and "bootstrapping" as their primary financing means.⁴³ About half (52%) of start-ups apply for outside financing, typically seeking loans or lines of credit valued at less than \$100,000. About 31% of these applications were approved in 2016.

More established small businesses operate in a similar fashion.⁴⁴ These companies are larger and have been in business for a longer period. Thus, they are more likely to seek external funding. They also rely primarily on loans or lines of credit, averaging between \$25,000 and \$250,000. Their applications also tend to be more successful. In 2016, 76% of small business credit applications received at least some financing. Forty percent of applicants received all requested funds.

Since most new ventures are seeking debt financing, a region's base of small business friendly banks and other sources of public finance can also play an important role in an ecosystem's health. These funding resources can be especially important in rural regions where businesses are much more likely to rely on small community banks or publicly-backed funding sources.⁴⁵ Given its strong production agriculture industry, Indiana is home to an enviable pool of banks and other private lenders with special expertise and interest in ag-related fields.

⁴² University of New Hampshire Center for Venture Research, Summary Angel Investing data for 2016 available at: https://paulcollege.unh.edu/sites/paulcollege.unh.edu/files/cvr-reports/2016AnalysisReportFinal_0.pdf.

⁴³ Federal Reserve Bank of New York, *Small Business Credit Survey: Report on Start-up Firms, 2017*. Available at: <https://www.newyorkfed.org/medialibrary/media/smallbusiness/2016/SBCS-Report-StartupFirms-2016.pdf>.

⁴⁴ Federal Reserve Bank of New York, *Small Business Credit Survey: Report on Employer Firms, 2017*. Available at: <https://www.newyorkfed.org/medialibrary/media/smallbusiness/2016/SBCS-Report-EmployerFirms-2016.pdf>.

⁴⁵ Federal Reserve Bank of Richmond, *Small Business Credit Survey: Report on Rural Employer Firms, 2017*. Available at: https://www.richmondfed.org/-/media/richmondfedorg/community_development/resource_centers/small_business/pdf/credit_survey/sbcs_report_rural_employer_firms_2016.pdf.

Despite the best efforts of successful investors like Steve Case and his “Rise of the Rest” fund, venture capital activity remains highly concentrated. Existing technology centers in California and Massachusetts capture the bulk of new investments from institutional venture capital investors, and few other regions attract significant dollars. The entire Midwest region saw only 92 deals worth a total of \$656 million in the first quarter of 2018, roughly 3% of total invested dollars.⁴⁶

Like its fellow Midwest states, Indiana is not a major center for venture capital investing, but it has developed a relatively robust capital ecosystem for start-ups and early stage companies. State and local leaders have supported a number of initiatives to make it easier for new and growing firms to access needed funds. These efforts include tax credits, such as the Venture Capital Investment Tax Credit which provides a 20 percent or \$1,000,000 credit for investments in Qualified Indiana Businesses (including those that are commercializing research and development or introducing new products). Other incentive programs provide credits for new job creation—the Economic Development for a Growing Economy (EDGE) credit—or for investing in new R&D. Training dollars are also available via the state’s Skills Enhancement Fund.

Several state-backed investments funds are also in place. At the pre-seed stage, [Elevate Ventures](#) administers a Small Business Innovation Research (SBIR) matching program for IEDC, granting a \$50,000 match (or 50 percent of the SBIR/Small Business Technology Transfer grant), with a lifetime maximum of \$150,000. In addition, with Purdue University, Elevate offers the Purdue Foundry Fund with “black” or “gold” investments of \$20,000 or \$50,000, respectively. Elevate also offers High Potential Start-up grants of \$5,000 to \$25,000 in some communities.

Many Indiana counties supplement these state-backed credits and funding streams by managing revolving loan funds (RLFs) that provide low-interest loans to small firms for new projects or for expansions. These funds are often capitalized with federal dollars from the U.S. Department of Agriculture (USDA) or other agencies, but other funding streams have been used as well. For example, the Floyd County RLF was created with funding from the [Horseshoe Foundation](#), the area’s primary community foundation.

Private capital resources for new ventures are also expanding. Presently, seed-stage investments are available in Indiana from angel seed funds such as:

- [VisionTech](#)
- [Indiana Angel Network Fund](#)
- [X-Cap Angels](#)
- [Irish Angels](#) (for Notre Dame-affiliated companies)
- [Purdue Angel Network \(P3\)](#)
- [Little Engine Ventures](#)

In addition, certain venture funds in Indiana make a significant number of investments. In addition to Elevate Ventures, High Alpha, Innovation Indiana Fund, BioCrossroads, Meridian Street Capital

⁴⁶ PriceWaterhouseCoopers 1Q18 Moneytree Report, https://www.pwc.com/us/en/technology/assets/MoneyTree_Report_2018_Q1_FINAL.pdf

and Charmides Capital are active seed stage investors. Allos Ventures, Gravity Ventures, 4G Ventures and CHV Ventures, among others, also make early and late-stage investments.

Coming soon will be more later-stage funding available through the Next Level Fund. This \$250 million will be deployed through professionally managed funds over the next few years. Ouabache Investments, a private equity firm funded by the family who founded Weaver Popcorn, is also focused on investments in companies in the state with EBITDA of \$1 to \$4 million. The presence of equity funds in Indiana helps ensure more investments in local companies, but outside investors also make major investments in the state. Indiana-based entrepreneurs can tap into many venture funds based elsewhere in the Midwest, notably in Illinois (e.g., firms such as Cultivian Sandbox and Open Prairie Ventures), Michigan, as well as a few California-based funds who have co-invested with Elevate Ventures.

The Next Level Indiana Fund: A New Resource for Agbioscience Investments

In 2017, the Indiana Legislature made a significant commitment to state and regional ecosystems by authorizing creation of the Next Level Indiana Fund, a “fund of funds” designed to invest up to \$250 million in promising Indiana companies. The fund is managed by 50 South Capital Advisors, which will invest directly in Indiana companies and place the lion’s share of funds with other venture capital firms. Ultimately, the fund is designed to generate positive returns, while also infusing more equity capital into Indiana’s entrepreneurial ventures. The Fund kicked off operations in April 2018 and has already made two commitments by providing funds to Indianapolis’ High Alpha Capital and the Boulder-based Foundry Group.

In addition to the publicly backed sources cited above, debt capital is also broadly available with Cambridge Capital Management offering a variety of SBA-backed loans through the Indiana Community Business Credit Corp, and LYNX Capital offering similar services for minority-owned businesses. Halo Capital Group and 1st Source are also active.

New businesses in Indiana can tap into a growing array of alternative funding streams as well. Crowdfunding is an emerging source of new business finance, and Indiana’s securities laws allow entrepreneurs to access up to \$2 million via this approach. However, to date, few Indiana firms or communities have actively embraced crowdfunding. One prominent exception is Localstake.com, an Indianapolis-based crowdfunding site that has supported multiple companies and even enjoyed one major exit with the acquisition of the Scotty’s Brewhouse chain of brewpubs. The Indiana Housing and Community Development Authority and the Indiana University Foundation are also using crowdfunding tools to garner support for various civic and community projects.

Indiana also has a very limited range of resources for microenterprise or other sources of alternative community finance. Only a few microenterprise lenders and organizations, such as Anderson’s [Flagship Enterprise Center](#) and Community Action of Southern Indiana, operate in Indiana, and the state hosts only two certified community development financial institutions (CDFIs). This limited infrastructure may be one factor behind Indiana’s extremely low rate of microenterprise ownership.

In the most recent rankings from Prosperity Now, Indiana ranked #49 in the United States for the share of the labor force that owned a microenterprise.⁴⁷

While a diverse array of funding sources is available in Indiana, these investors have not yet made significant commitments to firms operating in the agbioscience sector. As described in Appendix I, investments in the agbiosciences in Indiana have been sparse to date, with the exception of several companies who have been awarded SBIR matching grants or have won investments from Purdue Ventures or the Purdue Ag-Celerator. The largest investments to date, over \$10 million to ClusterTruck and Spensa Technologies' acquisition by DTN, have not come through traditional venture investors.

What do the Data Show?

This ecosystem assessment is supplemented by a benchmarking review (presented in Appendix I) that measures Indiana's performance on a number of datapoints related to innovation and entrepreneurship. These measures track state and regional performance in three core areas: innovation inputs, such as research and development spending; business dynamics, which track the start-up and growth of new companies, and capital, which assesses the range of capital resources and the amount of funds invested in entrepreneurial ventures.

The data analysis suggests that Indiana's ranks in the middle of U.S. states on most key metrics, much like other states across the Midwest. When compared to all U.S. states, Indiana has a relatively low level of entrepreneurial activity. This finding also holds true for the agbiosciences and is likely associated with the structure of the industry overall, with the important role of large, multinational firms. These firms may be less likely to spin out start-up companies or acquire them, preferring instead to perform a significant amount of research and development in-house.

In addition, the state has a relatively low level of broad academic agricultural research and development, although Purdue University is the state's leader in this work and is aggressively and actively promoting start-ups based on its intellectual property. According to 2016 National Science Foundation data, Purdue ranked 37th among U.S. universities for total R&D expenditures, Indiana University ranked 45th, and Notre Dame ranked 104th against this measure.

However, the March 2018 acquisition of Spensa Technologies by DTN is a positive sign that may presage future success. Since its founding at the Purdue Research Park in 2009, Spensa raised \$4.5 million and was recognized as one of Forbes magazine's top 25 innovative agtech start-ups in 2017. However, Spensa still represents a unique success story that other Indiana-based firms have not yet been able to replicate. Spensa was also one of only six Indiana companies in the sector to win SBIR/STTR awards, a common source of early stage capital for science and technology-based firms. Other than Spensa, few Indiana firms in the sector appear to have gained venture or angel backing, or to have grown substantially enough to appear on the Inc. 5000 list of America's fastest growing companies.

⁴⁷ See the 2018 Prosperity Now Scorecard at: <http://scorecard.prosperitynow.org/data-by-location#state/in>

How does Indiana Compare to Other Places?

A second mini-benchmarking study (Appendix II) has been completed and assesses the state of ecosystem-building in six other regions: Des Moines, Iowa; the Research Triangle region of North Carolina; St. Louis, Missouri; Pittsburgh, Pennsylvania; Kansas City; and Denmark. These regions were selected for several reasons: they offered economic and demographic similarities to Indiana, and, in most cases, also supported large-scale economic development programs focused on the agbiosciences.

Several key lessons emerged from these case studies:

- **Research Excellence Matters, but So Does University Attitudes Towards Start-ups**
All of the studied regions are home to world-class research universities. Beyond excellent research capacity, the ability to engage with local entrepreneurial ecosystems matters greatly to regional prosperity. St. Louis has been most effective in terms of supporting a strong agbioscience-focused ecosystem, but strong outreach programs are also in place at Purdue and at North Carolina State University.
- **Large Agbioscience Corporations Have Limited Impact on Start-ups**
Like Indiana, all of these regions are home to major corporations, which, to date, have played a limited role in local start-up development. Firms are opening up, especially in their roles as investors. But, finding ways to better engage corporate partners can help to jump-start ecosystem developments.
- **Physical Hubs Matter**
All of the case study locations are home to what would be called “entrepreneurial hubs,” i.e., locations where key partners are headquartered and where entrepreneurs regularly participate in meetings, networking events, and other programs. These hubs are most consequential when located in business or population centers, such as St. Louis’ Cortex Community and 39 North District. Purdue’s Discovery Park and Convergence project, Indianapolis’ 16 Tech development, and the Fort Wayne Electric Works project are designed to serve this type of innovation district function in Indiana.
- **Agbioscience Builds on Bioscience and IT Excellence**
It is probably not a coincidence that St. Louis and the Research Triangle have long-standing and strong clusters in both information technology and life sciences that underpin their agbioscience cluster and entrepreneurial ecosystem. The depth of workforce talent with technical and entrepreneurial experience is a key component of the ability for newer clusters to emerge.
- **A Robust Entrepreneurial Ecosystem in General Supports Agbioscience**
Places with strong ecosystems in general also support agbioscience entrepreneurship. A small number of agbioscience accelerator programs are in place in the studied regions, but the most important initiatives support entrepreneurs across a variety of industry sectors.
- **Both Top-Down and Bottom-Up Initiatives Required**
Ecosystem building is an “all hands on deck” exercise. No one organization can be in charge, and partners can (and should) include private firms, government agencies, educational

institutions and non-profits. Successful ecosystem building combines bottom-up innovation with strong top-down support from government, private industry, and support organizations like AgriNovus.

How is Indiana Doing? Assessment of Gaps and Strengths in its Entrepreneurial Ecosystem

This review of Indiana's entrepreneurial ecosystem assets clearly indicates that a strong base of support tools and infrastructure are in place across the state. Many regions, especially in denser cities like Indianapolis and Fort Wayne, host multiple organizations that view entrepreneurial support as a core mission. This embrace of entrepreneurship engages a very diverse set of players, including key state agencies, like IEDC and ISDA, that include entrepreneurship promotion and support as key parts of their current strategic plans. Statewide industry initiatives, like AgriNovus, TechPoint and BioCrossroads, also embrace this mission. Finally, at the local level, powerful cross-sector and bipartisan support exists among elected officials, traditional economic development organizations, private industry, and a variety of community leaders.

Given this public attention and focus, Indiana has succeeded in developing a strong "entrepreneur-friendly" business environment. In most cases, someone with a decent business idea and passion about entrepreneurship can and should be able to access nearly all the support tools and networks needed somewhere in Indiana. This is no guarantee that a business will succeed, but it is a reflection that resources and support for new and growing businesses are readily available in Indiana.

Indiana's Ecosystem Advantages

Indiana's entrepreneurial support resources are especially strong in several areas. Entrepreneurs regularly complain about limited access to capital, so it is unlikely that business owners will be fully satisfied with Indiana's current array of public and private investors. Nonetheless, the state does host a strong and diverse set of capital sources, including a number of active angel groups, numerous local and regional banks, and publicly backed sources like Elevate Ventures and the new Next Level Fund.

Within this generally strong set of resources, two potential challenge areas arise. Like many Midwestern states, Indiana is not a prime location for institutional venture capital investments. At the other end of the spectrum, the state has limited resources for microenterprises or new funding tools like crowdfunding. Several regions have recognized this gap and are acting to address these challenges. For example, in Northeast Indiana, Elevate Ventures has recently created the Farnsworth Fund which will provide small grants (up to \$1,000) to help budding entrepreneurs test the potential of new ideas.

Indiana's network of incubators, technology parks, and coworking spaces is also impressive, and ongoing efforts to link these sites across the state should continue. While the Launch Indiana effort is no longer operating, connecting entrepreneurial support organizations across Indiana makes sense. Many of these facilities, especially coworking spaces in the former Launch Indiana network, are also doing a good job of operating as local entrepreneur hubs as opposed to real estate projects that offer coworking space. Effective centers offer workshops, meetups, and access to services and

networks as well. Centers located at college and university campuses are also providing enhanced services and are actively working with the wider community, as opposed to working only with students and faculty.

Indiana's commitment to entrepreneur-friendly government also represents an important competitive advantage. Starting a business in Indiana is a simple process, and clear guidance and support is available. Entrepreneurs often face obstacles in finding needed resources and business services, but a significant number of resource guides and navigation tools are available. These tools cannot solve every problem for an entrepreneur, but they reduce friction in the search for assistance.

Ecosystem Challenge Areas

While Indiana is building a stronger infrastructure to support new and growing companies, these accomplishments are not yet reflected in data on statewide and regional start-up activity. Indiana does not rank highly on most national benchmarking assets of innovation and entrepreneurship, such as the Kauffman Foundation Index of Entrepreneurial Activity or the Milken Institute's State Science and Technology Index. Similarly, Indiana's larger cities typically rank on the lower end of benchmark assessments. The analysis in this report also notes that Indiana lags U.S. averages in areas such as new establishment growth and job creation by small firms.

Several factors could explain this performance. Time lags may play a role. Much of Indiana's ecosystem support work is fairly new, having been established over the past few years. Start-ups take time to gain traction, create jobs, and generate new wealth. If this is the case, improved performance may emerge in coming years as new firms gain traction and new tools, such as the Next Level Fund, come into play.

Experience suggests that other causes may be at work too. In particular, the pipeline for new entrepreneurs in Indiana could be expanded. More Indiana residents, especially younger people, need to view entrepreneurship as a viable career option and as a common pathway to successful careers and lives. Ongoing work to build an entrepreneurial culture should continue and be expanded. New efforts like the Innovate WithIN competition and the growing number of accelerator and coworking efforts are positive signs of a "buzz" around innovation and entrepreneurship. Continued support to keep the "buzz" alive is needed. In addition, this message needs to reach more Hoosiers—not just those in larger urban areas or working in technology sectors. All Hoosiers have the potential to be entrepreneurs and economic success will ultimately depend on engaging a wider swath of the population in these endeavors.

The Agbioscience Opportunity

Beyond engaging new partners and new entrepreneurs, these efforts also need to focus on economic sectors, like the agbiosciences, where Indiana has strong and inherent competitive advantages. The recent emergence of new ecosystem resources coincides with the growth of an increasingly strong agbioscience sector in Indiana. Indiana has always been a global leader in production agriculture; today it is also a global leader in agbiosciences innovation. In addition to fostering innovations in a host of sectors, Indiana's agbioscience firms employ more than 75,000 people across the state.

Indiana's agbioscience sector is developing in the midst of a global revolution in the agriculture and food sectors. Rising food demand and other factors are fueling the search for new ways to produce,

supply, distribute, and store food. Investors are flocking to this sector and making major plays to support innovative ventures. A 2016 Boston Consulting Group study estimated that major corporate players, such as Monsanto, Dow AgroSciences, and others, invested anywhere from \$20 to \$25 billion in their agribusiness activities.⁴⁸ According to Pitchbook, global venture capital investing in agtech is also growing, rising from \$185 million to \$877 million between 2014 and 2017.⁴⁹ While this figure may sound impressive, it represents an extremely small share—only 1.7%—of total venture capital investments. Industry experts concur that agtech is underinvested, and that large potential growth opportunities are on the horizon.

Several agbioscience sectors are considered to have the greatest potential for new innovations and as spurs to new economic growth. They include:

- Plant Science and Crop Production
- Animal Health and Nutrition
- Value-Added Human Food and Nutrition
- Agriculture Equipment Technologies and Systems (commonly referred to as agtech or high tech agriculture)

Indiana has impressive strengths and assets in all of these areas. In addition to the ecosystem assets identified in this report, Indiana also benefits from its strong heritage and experience with production agriculture. It is home to a large base of producers, major corporate players like Corteva Agriscience, Elanco and others, world-class universities and researchers, and a desirable location with robust infrastructure and easy access to major markets.

Most of the competitive advantages noted above have arisen over multiple decades and are based on Indiana's role as an important center for production agriculture. Moving forward, AgriNovus has the potential to link Indiana's traditional agriculture assets to its newly emerging entrepreneur-focused assets. To date, this connection has remained limited, but great potential exists.

Several nascent initiatives are starting to spread the word that "it's happening here," i.e., that Indiana is home to a unique and powerful combination of assets in the agbiosciences. Promising new initiatives include Purdue's Ag-Celerator program and its new Skidmore Food Development Lab. Meanwhile, across Indiana, the number of commercial kitchens is growing. Finally, AgriNovus is assuming a leadership role as an agbioscience sector advocate, sponsoring industry-focused research and well-publicized events that highlight new industry opportunities.

How can Indiana Improve its Performance?

AgriNovus and various partners around the state can and should assume a prominent role in building a stronger entrepreneurial ecosystem, especially for those working in the agbiosciences, but more generally as well. A strong pipeline and a robust ecosystem for all entrepreneurs will also help

⁴⁸ Boston Consulting Group. 2016, p. 5.

⁴⁹ Startup Genome Project. 2018. Global Start-up Ecosystem Report. Pp. 67-73. Available at: <https://startupgenome.com/reports/2018/GSER-2018-v1.1.pdf>.

ensure a rich ecosystem for start-ups and growth ventures in the agbiosciences. AgriNovus and its partners can help to build a stronger ecosystem via several deliberate approaches, including:

- Build the Pipeline of Agbioscience Entrepreneurs in Indiana
- Accelerate Agbioscience Entrepreneurs in Indiana
- Connect Agbioscience Entrepreneurs to existing ecosystem resources
- Develop new resources targeted to the unique needs of Agbioscience Entrepreneurs

The recommendations detailed below focus on the role of AgriNovus as an advocate for agbioscience entrepreneurship, as a support network for the sector’s founders and managers, and as a champion and investor in new programs that help Indiana’s agbioscience firms launch, grow, and prosper.

1. Build the Pipeline of Agbioscience Entrepreneurs in Indiana

As noted above, the development of an entrepreneur-friendly culture is an essential component of successful and robust ecosystems. In these regions, starting a business is a “normal thing,” a common and desirable career path. Indiana can do a better job of encouraging Hoosiers—especially young people—to consider taking the entrepreneurial leap. And, AgriNovus can help by encouraging these new entrepreneurs to consider starting new ventures focused in the agbiosciences.

Successful entrepreneurs emerge from multiple locations, but several areas of focus offer great potential:

- a. AgriNovus should consider developing a statewide youth ag-entrepreneurship initiative in collaboration with organizations with existing networks. For instance, work with organizations such as National FFA and 4-H and build on existing partnerships, such as the new Blue Room, an innovation experience unveiled at the 2018 National FFA Convention and Expo in Indianapolis. This effort should include creation of new curriculum, award programs, and other support to encourage Indiana youth to consider entrepreneurship as an exciting and viable career option.

AgriNovus should also develop new programming that brings agbioscience-focused activities and curricula to Indiana’s growing array of STEM, robotics, and other science-focused education and youth development programs. Potential programming might include hackathons or robotics competitions focused on key challenges facing Indiana’s farming communities.

- b. AgriNovus should focus on an untapped talent asset in Indiana’s agbioscience ecosystem: executives at major agbioscience corporations. Consider developing a new network for these executives to learn about trends in the industry, to create start-up teams, and to help identify new business development opportunities. Many of these talented managers, especially those nearing retirement or who might leave during reorganizations, have the skills and knowledge needed to become successful entrepreneurs. However, they may lack specialized start-up knowledge or linkages to partners and service providers.

2. Accelerate Agbioscience Entrepreneurs in Indiana

In addition to generating greater local interest in agbioscience-focused entrepreneurship, AgriNovus and its partners should also support efforts that help new ventures grow and prosper. Generally, this work involves linking new company founders into peer networks at various stages of the business lifecycle.

- a. At the ideation stage, AgriNovus should consider sponsoring a series of meetings such as the Kauffman Foundation's One Million Cups program around the state. Founders need help in developing ideas and in testing those ideas with potential customers. In the idea generation phase, nascent entrepreneurs would benefit from a sounding board via regular convenings of an agbioscience-focused forum. These efforts provide a "safe space" to test ideas and garner feedback.
- b. After founders move from ideas to real start-ups, they need support networks as well. AgriNovus should consider chartering its own statewide start-up network that could meet on a semi-regular basis and allow new company founders to share ideas and learn from peers. This effort would operate similarly to a "mastermind" group for agbioscience start-ups.
- c. Develop a focused accelerator program that provides coaching and other support to promising agbioscience start-ups. This new effort could be structured in several ways. It could be built onto existing platforms or programs, such as the existing Purdue Ag-Celerator program, or it could be created as a new stand-alone organization led and managed by AgriNovus. A final option would be to engage a third-party investor or support organization to develop and manage the program on behalf of AgriNovus and its partners. Regardless of structure, the programming must be available and accessible to agbioscience entrepreneurs from across the state.
- d. AgriNovus should lead an effort to build a network of entrepreneurs-in-residence and coaches/mentors with expertise in key agbioscience sectors. These mentors can further supplement the support available to Hoosier entrepreneurs via programs like Elevate Ventures, the Foundry, and SCORE. Sector-specific experience and expertise is critical to helping agbioscience entrepreneurs overcome challenges unique to agricultural markets, regulatory environment and technologies.

3. Connect Agbioscience Entrepreneurs to Existing Ecosystem Resources

These new companies will have greater prospects for success when and if they have easy access to Indiana's growing array of ecosystem support tools. AgriNovus and its partners can play an important role in connecting founders to these resources. In general, AgriNovus should position itself to serve as a "business concierge" for aspiring and new entrepreneurs and existing companies operating in the agbiosciences. In this role, AgriNovus serves as a network weaver to make it easier for agbioscience entrepreneurs to find and utilize the business development services already in place across Indiana.

Several areas of focus make sense. AgriNovus can use its industry connections to help Indiana agbioscience ventures gain access to new sources of capital and to new markets. Several actions could be implemented to facilitate these connections:

- a. Include a pitch-competition at the AgriNovus annual Innovation Summit that links Indiana companies to investors around the globe, and helps the companies identify new opportunities and network connections.
- b. Active marketing of “star” Indiana entrepreneurs to investors located outside of Indiana.
- c. Coaching and other support to help Indiana agbioscience entrepreneurs succeed in major national competitions such as Ernst & Young’s Entrepreneur of the Year Awards, the National Farm Bureau’s Rural Entrepreneurship Challenge, and the Inc. 5000 list.
- d. Partnering with the Governor’s Office and IEDC to support more agbioscience-focused trade missions, more local participation in trade shows, and to encourage greater foreign direct investment into Indiana’s new agbioscience-focused ventures.
- e. Linking entrepreneurs to core service and infrastructure available from partners like Purdue University and USDA. AgriNovus should identify and develop easy ways for entrepreneurs to access resources like laboratories, greenhouses, hives, test farms, farm and laboratory equipment, and perhaps consider sponsoring an innovation voucher program to help defray the costs of using these facilities and services. (See also 4(a)(ii) below).

4. Develop New Resources Targeted to the Unique Needs of Agbioscience Entrepreneurs

Many of the resources needed for company growth and start-ups are in place across Indiana, but a few gaps do exist, particularly in areas specifically related to the agbiosciences. In these areas, AgriNovus and its partners should consider developing new programs or capabilities. Potential focus areas include:

- a. **Market Intelligence:** The presence of customers—in the form of farmers and of large agbioscience focused corporations—is a huge competitive asset for Indiana and for Indiana’s entrepreneurs. Yet, it can be difficult for new companies to understand customer needs and market trends. AgriNovus can help on this front via several tactics, including:
 - i. Continue to publish research and data on the industry, including an annual report that benchmarks industry progress and achievements.
 - ii. Work with partners, such as the Indiana Farm Bureau, to create an Indiana Agbioscience Test Bed, a group of farmers who agree to meet on a semi-annual basis to discuss market needs and pressing challenges facing production agriculture in Indiana. In addition to providing a new peer network for farm-based entrepreneurs, these sessions could serve as a means to inform entrepreneurs about potential new market opportunities. This group might also serve as a test bed network to assess new products, technologies, and distribution channels.

iii. Host work sessions designed to identify “innovation challenges” facing larger corporate players. These have been successfully used in multiple sectors and can be organized around a specific challenge raised by a major company or industry leader. Small firms or teams are then encouraged to develop and share potential solutions. They operate akin to a “hackathon,” and can be an excellent means to spur innovation and to link small firms into larger global supply chains.

b. Capital: Several new capital sources, developed by AgriNovus and key partners, could provide critical assistance for early stage ventures in the agbioscience sectors.

i. Working with Purdue and Elevate Ventures, AgriNovus should consider creation of a new agriculture-focused SBIR Phase Zero program. This program would offer small seed grants, of up to \$5000 per entrepreneur, to help test the feasibility of new business ideas and concepts.

ii. Agbioscience entrepreneurs may also require access to pre-seed funding that helps them further develop their business ideas and new products, services and technologies. This fund could operate like the Elevate Ventures Purdue Foundry Fund (Black and Gold Funds) but would be available to any and all eligible agbioscience entrepreneurs operating in Indiana. Funding would be focused on early stage ventures with typical investments falling in the \$25,000 to \$75,000 range.

c. Advocacy: AgriNovus should continue in its important mission to “amplify the agbioscience innovation story”. AgriNovus should be the knowledge source for data about the sector and about what’s happening with Indiana’s agbioscience entrepreneurs. This advocacy role should include several important events and activities, such as:

- i. Entrepreneur-focused program as a core part of the AgriNovus Annual Agbioscience Innovation Summit and related events.
- ii. Creation of an annual Agbioscience Entrepreneur of the Year Award, along with a Hall of Fame that honors the history and legacies of earlier entrepreneurs.
- iii. Annual benchmarking report on the industry, along with a master list of new companies and new investments.
- iv. Expanded efforts to market the Agbioscience opportunity in Indiana, with speakers from outside of Indiana to discuss emerging trends.

#

APPENDIX I

DATA ANALYSIS

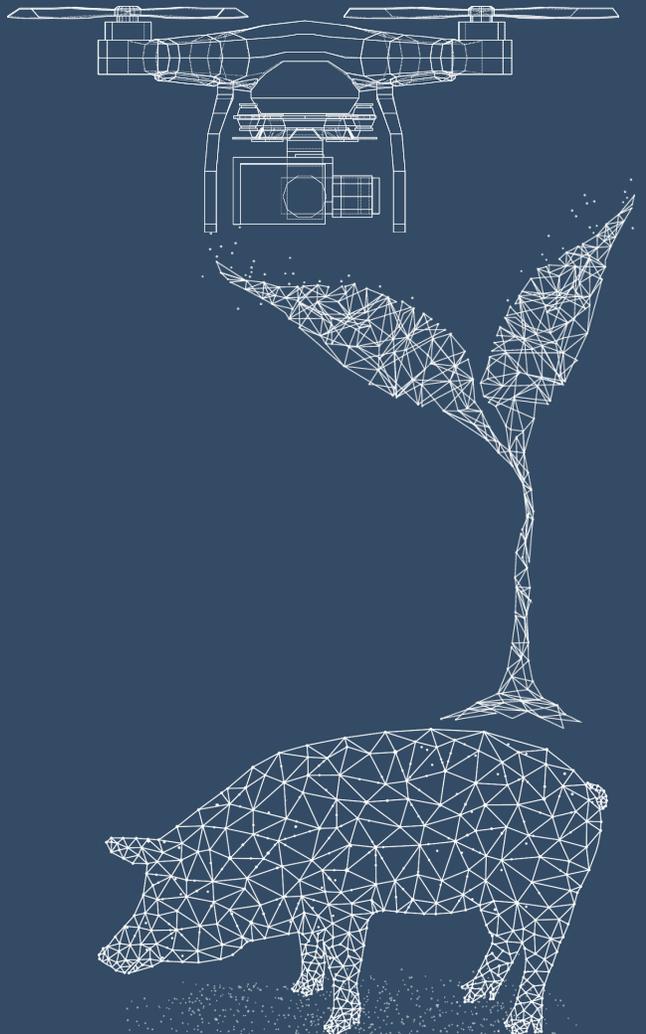


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Introduction

The agbiosciences has been identified as a strong sector in Indiana's economy. While the industry has long been led by major corporate players such as Corteva Agriscience and Elanco, it is also spawning a rich mix of new start-ups and innovative growth companies. These firms have the potential to transform the industry, while also creating new jobs and business opportunities for Hoosiers across the state.

This assessment seeks to understand the potential for start-ups and growth-oriented entrepreneurial ventures in Indiana's agbioscience sector. It reviews available data to quantify the size and scope of entrepreneurial and innovation-related activities within these sectors and related parts of the Indiana economy.

This analysis focuses on the agbiosciences, defined as the industry cluster where food, agriculture, science and technology converge. Agbioscience encompasses several sub-sectors, including plant sciences, animal health and nutrition, human food and nutrition, and high-tech agriculture or agtech. To capture both the biology-based technologies contained in the original Battelle/Teconomy definitions of agbioscience and the information technology-based applications of agtech, we have created a Concordance containing both North American Industry Classification System (NAICS) codes and U.S. Patent and Trademark Office (USPTO) Cooperative Patent Classifications (CPCs). The complete list is available in Appendix A. Several parts of this analysis present data on agtech and the agbiosciences in separate sections. This approach helps to capture the different pathways for entrepreneurs in these sectors, largely due to differences in technology commercialization complexity, timelines, funding and expertise.

To understand the sectors in Indiana's economy, we look at sources of technology and innovation as a necessary precursor to entrepreneurship in agtech and agbioscience; business dynamics to try to approximate the density and success levels of entrepreneurs in the sectors; and capital, both as a measure of support for sector start-ups, but also a way to identify firms that are gaining traction.

These data present a single snapshot in time, and, because of limitations with research sources, the analysis may sometimes include data that covers sectors in addition to the agbiosciences. The data present an important baseline and benchmarking opportunity, and the analysis was further bolstered with findings from interviews and focus groups that provide a more refined understanding of the entrepreneurial systems for this sector in Indiana.

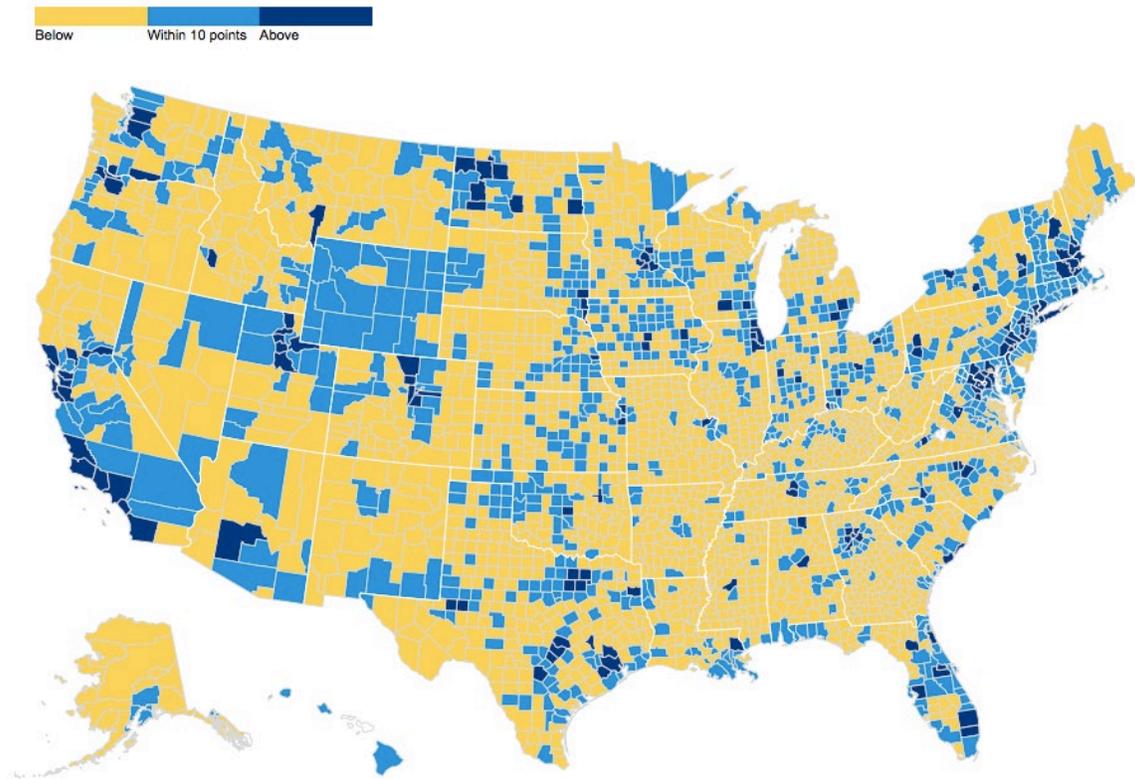
Summary of Findings

Based on the data detailed below, a key high-level finding is that the scale and pace of entrepreneurial activity in Indiana remains relatively low, compared to other states of its size, and relative levels of entrepreneurship in the agbiosciences also remain low. This finding accords with that of other national benchmarking assessments such as the Kauffman Index of Entrepreneurial Activity or the State New Economy Index. Figure 1 presents mapping from Indiana University's StatsAmerica databases, with darker blue designating high performing counties and yellow depicting weaker performers on a basket of metrics measuring innovation performance for all sectors. In this assessment, many counties in Indiana rank

among lower performing regions, with the exception of the Indianapolis region, and the counties that are home to Purdue University and Indiana University.

Figure 1. Comparative Innovation Performance by County

Compared to 100



Source: <http://www.statsamerica.org/ii2/map.aspx>

Several factors help explain this lagging performance. The basic structure of the agbioscience industry, with the important role of large multinational firms, is critical. These companies may be less inclined to spin-off technologies or to license new advances to other, smaller firms, and instead opt for in-house development of promising ideas and technologies. This sector structure is quite different from the life sciences, where large pharmaceutical firms have increasingly relied on academic institutions and start-up companies to perform the research and development (R&D), proof of concept, and testing required to commercialize new products, moving to an investment and ultimately merger and acquisition (M&A) of the firms when products have been substantially de-risked.

Another driver is the relatively low level of agricultural R&D performed across the state universities. Although Purdue University, the state's leader in academic agricultural R&D, is aggressively and actively promoting start-ups based on its intellectual property, this strategy is resulting in only a few agbioscience and some agtech firms emerging in West Lafayette. Impacts on other parts of the state are limited at the moment.

The concentration of new start-ups and high growth companies in Indiana is relatively low when compared to other U.S. states. Over 40% of all Indiana firms in agriculture are sixteen years or older, and the number of self-employment ventures in the sector, other than in production agriculture, is relatively small. This may also be linked to the geography and demographics of the state, with many counties characterized by low population, lower median incomes, and low diversity and limited in-migration of new residents.

The March 2018 acquisition of Spensa Technologies by DTN is a positive sign that may presage future success. Since its founding at the Purdue Research Park in 2009, Spensa raised \$4.5 million and was recognized as one of Forbes magazine's top 25 innovative agtech start-ups in 2017. However, Spensa still represents a unique success story that other Indiana-based firms have not yet been able to replicate. Spensa was also one of only six Indiana companies in the sector to win Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) awards, a common source of early stage capital for science and technology-based firms. Other than Spensa, few Indiana firms in the sector appear to have gained venture or angel backing, or to have grown substantially enough to appear on the Inc. 5000 list of America's fastest growing companies.

The sections below present a deeper dive into various aspects of Indiana's innovation and entrepreneurial ecosystem, as they relate to start-ups and growth companies in general and with a specific focus on agbiosciences and agtech related ventures. The research presents data and analyses that assess Indiana's recent performance in several categories:

- **Sources of Technology and Innovation** – R&D spending and university technology commercialization.
- **Entrepreneurs and Business Dynamics** – tracks the recent performance of Indiana's start-ups and small businesses.
- **Access to Capital** – assessing the extent to which Indiana's companies are raising outside capital.

As noted above, Indiana ranks in the middle of U.S. states on nearly all these metrics. The state's performance is likely strongest in the areas related to **Sources of Technology and Innovation**, where Indiana's world class companies and higher education institutions are important players in sponsoring cutting-edge research and aggressively supporting technology commercialization. Indiana performs less well in metrics related to **Entrepreneurs and Business Dynamics**. The state has a below average track record in terms of generating new start-up companies and in nurturing these new firms toward becoming successful high-growth ventures. Finally, Indiana is similar to many Midwestern states when it comes to **Access to Capital**. It has developed some promising new capital sources, but it is not a major recipient of venture capital investments or other funding streams that typically fuel high-growth entrepreneurial ventures.

Sources of Technology and Innovation

Because the agbiosciences is a science and technology-based sector, the strength of the entrepreneurial ecosystem is directly related to the strength of the overall innovation system in the associated scientific disciplines. Academic researchers are often referred to as the "entrepreneurship nexus." Entrepreneurs are carriers of innovation, serving as one vehicle by which scientific and technical innovation enters the market and the broader community. A

region with a strong science base can often spin off a large number of technology-based start-ups.

This analysis looks at the sources of technology and innovation, i.e. the core inputs in the creation of new ideas and new companies. Below, we assess research and development levels at Indiana universities and corporate research and development; technology transfer from Indiana universities, especially to local start-ups; and finally, patents, as a proxy for new knowledge developed in these fields.

Academic Research and Development Related to the Agbiosciences

Six Indiana-based universities perform research and development, but only Purdue University and Indiana University perform agricultural sciences-related R&D. Four of the universities support modest R&D in computer and information sciences that may support agtech and some biological and medical R&D that may contribute to agbiosciences (Table 1). According to 2016 National Science Foundation data, Purdue ranked 37th among U.S. universities for total R&D expenditures, Indiana University ranked 45th, and Notre Dame University ranked 104th against this measure.

Table 1. University Research and Development Expenditures, 2016-17

Institution	Total	Ag sciences	Biological & biomedical	Computer & information science
	(\$ 000's)			
Purdue University (West Lafayette campus)	\$ 606,302	\$ 130,723	\$ 15,644	\$ 18,896
Indiana University (Bloomington campus)	\$ 508,766	—	\$ 92,372	\$ 23,244
University of Notre Dame	\$ 202,216	\$ 993	\$ 27,597	\$ 9,309
Ball State University	\$ 11,763		\$ 884	\$ 1,075
Rose-Hulman Institute of Technology	\$ 611	—	—	—
Butler University	\$ 282	—	—	—

Source: National Science Foundation, <http://www.ncses.data.nsf.gov>

Corporate Research and Development

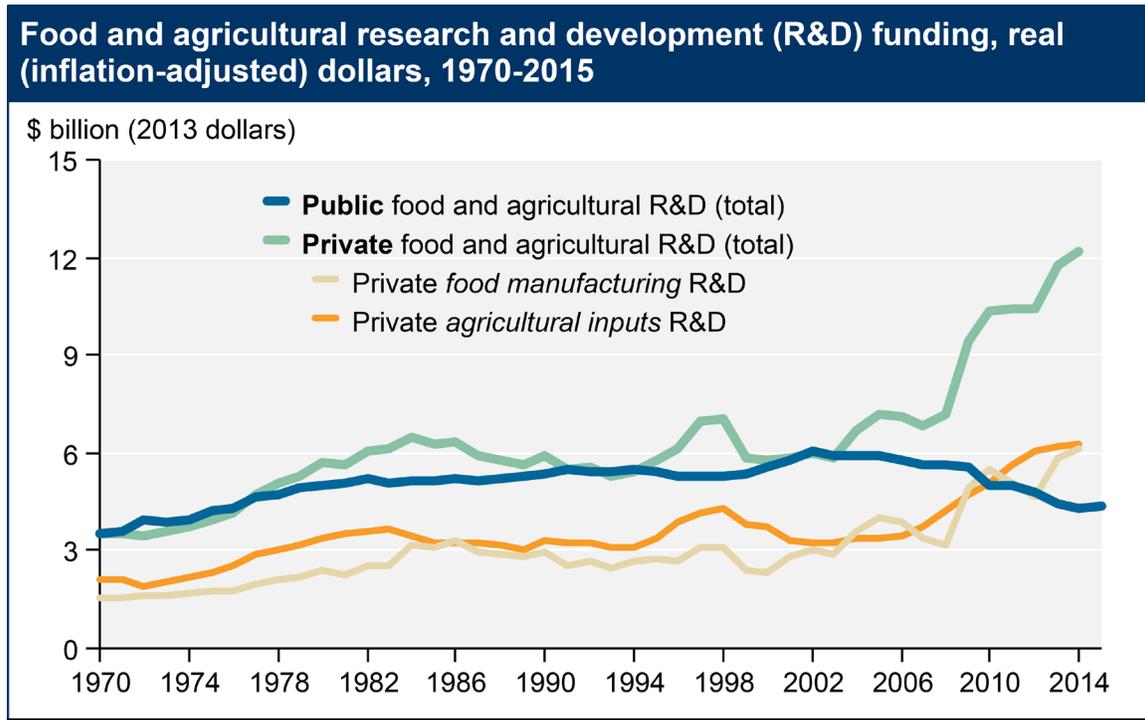
Timely data on corporate research and development can be difficult to capture. Public data, from the National Science Foundation (NSF) and others, is not released on a timely and consistent basis, thus prohibiting a detailed annual review of spending patterns. At the same time, most large corporations perform R&D in multiple locations, so assigning specific investments to specific states or locations can be challenging. Nonetheless, a review of existing data sources does offer some insights.

Over the past several decades, numerous observers have warned of the consequences of the steady decline in U.S. public investments in agricultural R&D.¹ As public spending has dropped, private sector R&D expenditures in food and agriculture have grown rapidly. (See Figure 2). For example, between 2008 and 2013, total public R&D expenditures in food and agriculture dropped by 20%, as private R&D expenditures grew by 64%.²

¹ Matthew Clancy, Keith Fuglie, and Paul Heisey, “U.S. Agriculture R&D in an Era of Falling Public Spending,” *Amber Waves*, November 10, 2016. Available at: <https://www.ers.usda.gov/amber-waves/2016/november/us-agricultural-rd-in-an-era-of-falling-public-funding/>

² *Ibid*, p. 1.

Figure 2. Food and Agricultural Research and Development – 1970-2015



Note: Private agricultural research funding data are through 2014; public agricultural research funding is available through 2015.³

The most recent NSF corporate R&D survey provides data from 2014. Table 2 shows that the largest amount of internally sponsored corporate R&D in Indiana is occurring in the pharmaceutical industry, followed by automotive, medical supplies and plastics. Surprisingly, given the amount of plant genetics and pesticides research performed by Dow AgroSciences (now Corteva Agriscience) and other large agbioscience corporations in Indiana, these topics are not among the top twelve sectors on this list.⁴

Other related data sources suggest that Indiana’s agbioscience sector is supporting significant investments in R&D. These factors include the high level of patenting activity (discussed below), and high levels of academic publishing activity in many key industry subsectors.⁵

³ U.S. Department of Agriculture (USDA), Economic Research Service (ERS) using data from National Science Foundation, USDA’s Current Research Information System, and various private sector data sources. Data are adjusted for inflation using an index for agricultural research spending developed by ERS.

⁴ The absence of the agbiosciences in this list could be the result of data classification. As there is no single NAICs code for agbioscience, research conducted by companies such as Dow AgroSciences could be classified in other categories (i.e., fertilizers) or the funding may not have been associated with Indiana because the Dow Chemical headquarters is in Michigan.

⁵ Battelle Technology Partnership Practice. 2014. Innovative Agbioscience in Indiana: A Baseline Assessment.

Table 2. Top Twelve Fields for Corporate R&D in Indiana – 2014

Domestic R&D Funded by Corporate Sources (\$ mill)		
Industry	Codes	Indiana
Pharmaceuticals and medicines	3254	2,124
Automobiles, bodies, trailers, parts	3361-3363	921
Medical equipment and supplies	3391	526
Plastics and rubber products	326	394
Engines, turbines, power transmission equipment	3336	151
Other machinery	other 333	138
Publishing	511	86
Software publishers	5112	86
Aerospace products and parts	3364	75
Communications equipment	3342	70
Professional, scientific, technical services	54	66
Navigational, measuring, electromedical, and control instruments	3345	57

Source: National Science Foundation, National Center for Science and Engineering Statistics. 2018. *Business R&D and Innovation: 2014. Detailed Statistical Tables NSF 18-302*. Alexandria, VA. Available at <https://www.nsf.gov/statistics/2018/nsf18302/>

Technology Transfer

Universities that perform research and development have established technology transfer offices (TTOs) that capture innovation created by faculty, staff, and sometimes students through disclosures, assess that innovation and sometimes patent the technology, and subsequently offer the technology to others through licensing and options to license. Increasingly, TTOs try to capture the value of some of their intellectual property by licensing new innovations to start-up companies. These companies may include university personnel, such as professors, but may also be unaffiliated with the university.

In Indiana, only Indiana University and Purdue University have data captured by the annual survey conducted by the Association of University Technology Managers (AUTM). Based on the most recent survey (conducted in FY2016), both Purdue and Indiana University have roughly the same size TTO (as shown by full-time equivalent (FTE) headcount) and comparable research capacity (Table 3.) Purdue is a strong performer on all other metrics, exceeding the AUTM averages by large margins, and ranking 3rd in the AUTM assessment on the number of start-ups spawned from university programs. These data are for all fields; data by technology segment is not available.

Table 3. Technology Transfer Metrics for Purdue and Indiana Universities, 2016

University	FTEs	R&D (\$mill)	Licenses	Options	Disclosures	New Patent Applications	Start-ups	Patents Awarded
Indiana University	6.7	529	35	10	150	100	5	53
Purdue Research Foundation	7	622	107	40	376	195	27	118
US Averages						12.8	5.2	26

Source: Association of University Technology Managers (AUTM)⁶

In general, Purdue's technology commercialization activities are considered to be among the top tier of U.S. universities. Purdue's performance ranks high on the AUTM rankings, which are considered as the state of the art assessment of these activities. Other assessments are similarly positive. The most recent Milken Institute University Technology Transfer and Commercialization Index ranks Purdue as 12th among U.S. universities.⁷

Patents

Patents issued by the U.S. Patent and Trademark Office provide a snapshot of innovative activity in an area for a specific period of time. They are admittedly an imperfect measure of new knowledge, because some technologies are not patentable, or difficult to patent, such as computer programs, or are rarely patented for business reasons. However, the patent data does provide a glimpse of some parts of the innovation pipeline in Indiana.

This analysis assessed all patents awarded in calendar year 2017 with at least one inventor based in Indiana. This review focused on technology segments (called Cooperative Patent Classifications) that are related to either agbiosciences (per Battelle, 2014) or AgTech (see Appendix A, Concordances).

The analysis focused on the assignee for each patent, as this method allows for employment relationships to be mapped. Most employees engaged in research and development are bound by agreements signed upon employment to assign all rights to discoveries made at work over to their employer. This includes university professors and staff. When the assignee's name is the same as, or similar to, an inventor's name, it usually indicates that the inventor is working on his/her own behalf.

Of the 3,389 patents awarded to Indiana inventors in 2017, 233 were in agbioscience-related sectors. Most patents (211) were in bioscience-related sectors like plant science and animal health. Another 22 patents were focused in agtech. Sixty-two percent of these patents were awarded to Indiana companies; with a majority of the patents assigned to out-of-state companies having large operations in the state.

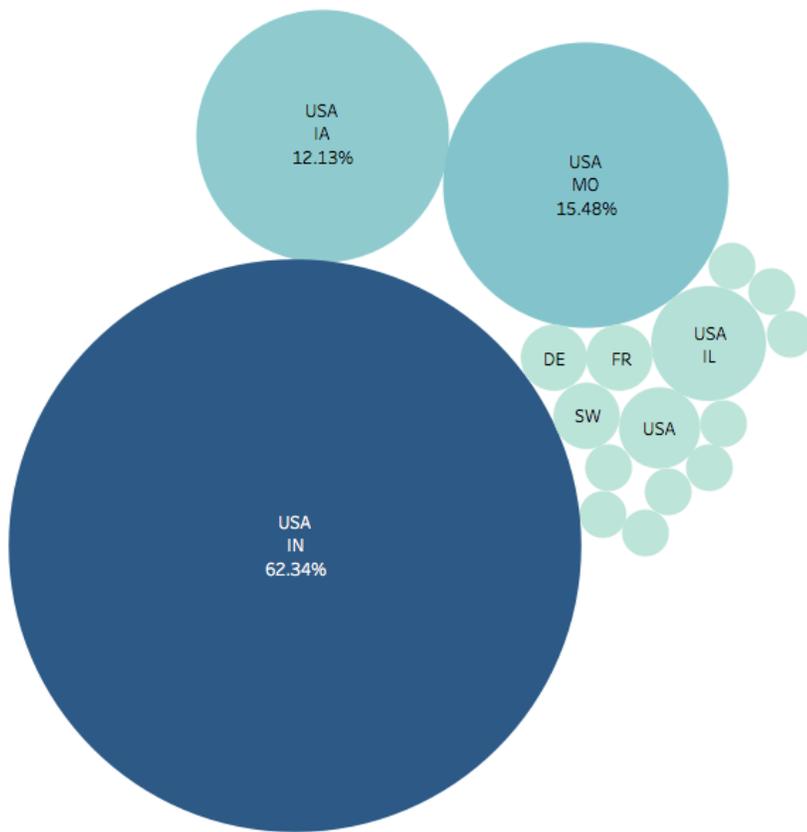
As shown in Figure 3, the patents awarded in-state were mostly to companies located in Indianapolis, and the vast majority were to large companies such as Dow AgroSciences (now Corteva Agriscience) and Agrigenetics, a subsidiary of Mycogen and now also part of the newly formed Corteva.

⁶ Association of University Technology Managers (AUTM), U.S. Licensing Activity Survey: FY2016, A Survey Report of Technology Licensing (and Related) Activity for U.S. Academic and Nonprofit Institutions and Technology Investment Firms. S. Hawkins, Y. Kostoulas, A. Li, N. Mercier, M. Mroz, O. Novac, R. Robertson, N. Ruey, A.J. Stevens, A. Turley and K. White, eds.

⁷ DeVol, R. Lee, J., Ratnatunga, M. 2017. *Concept to Commercialization Report: The Best Universities for Technology Transfer*. Milken Institute. <https://www.milkeninstitute.org/publications/view/856>. This index ranks IU at number 49, and Notre Dame at 124.

Figure 3. Location of Assignees of Patents Awarded to Indiana Inventors – 2017

Sixty Percent Assigned to IN Companies



AgBio Companies HQ'd in IN by Patents, 2017

State	City	Assignee	Count
IN	Atlanta	Beck's Superior Hybrids	1
	Auburn	Tony Wayne Covely	1
	Batesville	Daniel Armstrong	1
	Bloomington	Cook Medical Technologies	1
	Columbus	Steven Booher	1
	Fischers	Steadyserve Tech	2
	Fishers	FD Deskins Inc	1
	Fortville	AEMERGE	1
	Ft Wayne	William Spindler	1
	Greenfield	Activation Technologies	2
	Indianapolis	Dow Agrosciences	101
	Indianapolis	Agrigenetics	16
	Indianapolis	Eli Lilly	2
	Indianapolis	Alforex Seeds	1
	Indianapolis	Cook General Biotechnolo..	1
	Indianapolis	Nico Corporation	1
	Kokomo	Merrell Brothers	1
	Lebanon	C Laser, Inc	1
	Libertyville	Valent Biosciences	3
	Milford	CTB	2
Peru	Trent Jones	1	
Sheridan	JBS United	1	
South Bend	Chad Legus	1	
Warsaw	Biomet Biologics LLC	1	
West Layfa..	Purdue Research Foundat..	4	

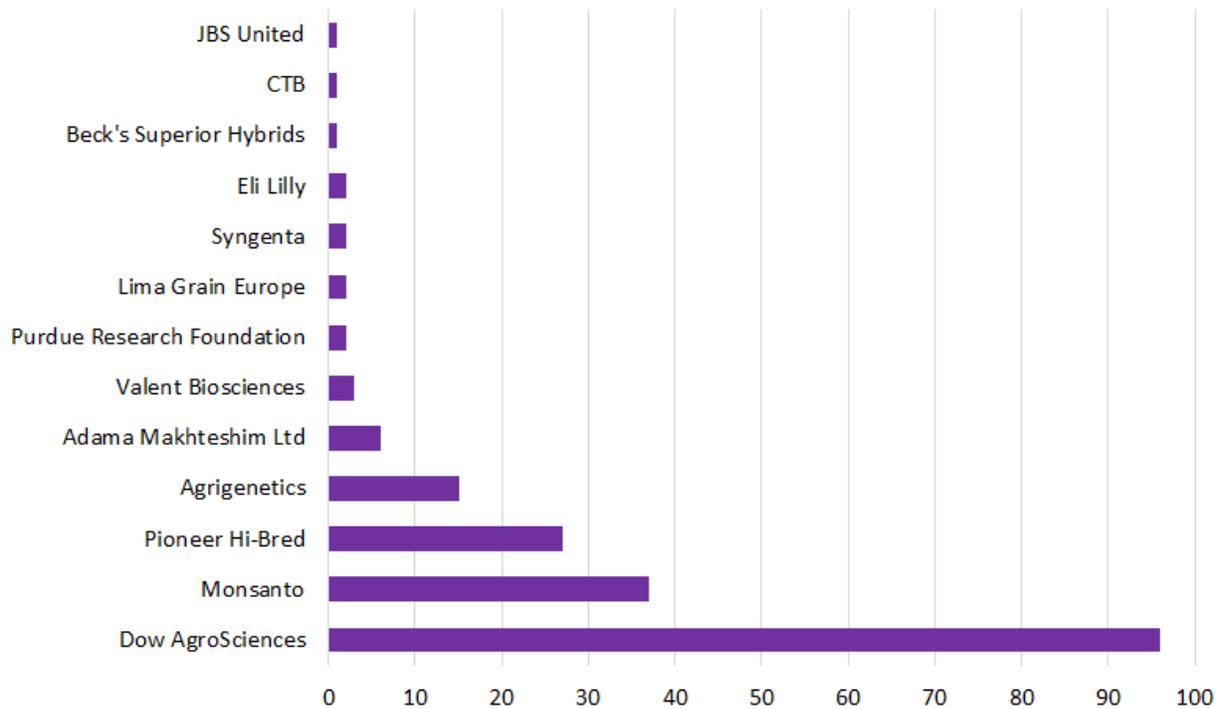
Source: Innovation Policyworks analysis of USPTO Patent Full-Text and Image Database (PatFT), <http://www.uspto.gov>.

Figure 4 and Table 4 further assess these patents by assignee and by industry sub-sector. They highlight the outsized role of corporate R&D investments in the Indiana agbioscience innovation ecosystem in 2017. Only four of the patents were assigned to the Purdue Research Foundation, and even fewer to start-up companies.⁸ This is in stark contrast to the situation in other technology segments, where universities and start-ups have a greater relative role in technology development and commercialization.

As noted in previous AgriNovus research, plant science and plant protection are particular areas of innovation advantage for Indiana. Plant varieties were the dominant technology patented by Indiana inventors in 2017, followed by pesticides and biocides (Table 4).

⁸ Overall, Purdue is a powerhouse in terms of patenting and start-ups, but these data refer only to ag-related technologies.

Figure 4. Representative Assignees of Patents Awards to Indiana Inventors – 2017



Source: Innovation Policyworks analysis of USPTO Patent Full-Text and Image Database (PatFT), <http://www.uspto.gov>.

Table 4. Patents Awarded to Indiana Inventors, 2017, by Class

Cooperative Patent Class (CPC)	Number of Indiana Patents in 2017	% of Total Number of IN Patents by CPC
Plant Varieties	107	44.8%
Biocides/Pesticides	101	42.3%
Agricultural Systems	11	4.6%
Measuring Technologies	10	4.2%
Fertilizers	5	2.1%
Pharma/Biopharma (Ag only)	4	1.7%
Veterinary Instruments	1	0.4%

Source: Innovation Policyworks analysis of USPTO Patent Full-Text and Image Database (PatFT), <http://www.uspto.gov>

Entrepreneurs and Business Dynamics

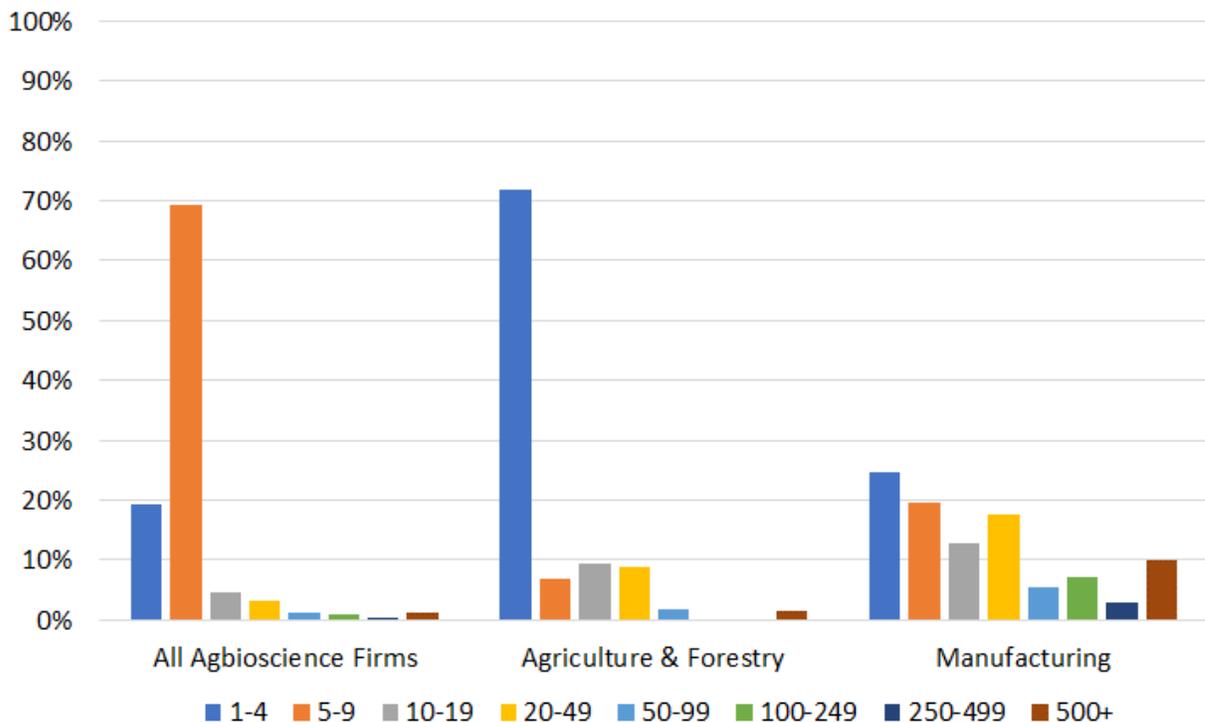
Entrepreneurs and their companies are primary drivers of new jobs and new wealth creation in Indiana and around the United States. Prosperous regions and states may be home to major corporate operations and headquarters facilities, but they also support the creation of new ventures and rapid growth of these new companies.

Data on new business dynamics suffers from a number of shortcomings. Federal data is slow to arrive and often incomplete. As such, solid information is lacking on the total number of firms in a region and the industry make-up of these companies. Recognizing these limitations, a number of data snapshots are presented that offer glimpses of what is happening with entrepreneurs, in agbioscience and beyond, across Indiana.

Size and Years in Business for Indiana Firms

The U.S. Census Bureau has recently started publishing an annual Survey of Entrepreneurs. The latest, with data for 2015, shows patterns of entrepreneurship and small business ownership in Indiana at the 2-digit NAICS level. Figure 5 shows businesses in Indiana by size. Compared to Indiana’s overall economy, most of the sectors that contribute to the agbiosciences are comprised of firms with 1-4 employees, except manufacturing whose members are more evenly distributed over the size categories.

Figure 5. Size of Firms (by Number of Employees) in the Total Indiana Agbioscience Sector and Select Sub-Sectors (Agriculture/Forestry and Manufacturing) – 2015



Source: Innovation Policyworks analysis of data from the 2015 Annual Survey of Entrepreneurs, US Census, <https://www.census.gov/programs-surveys/ase.html>.

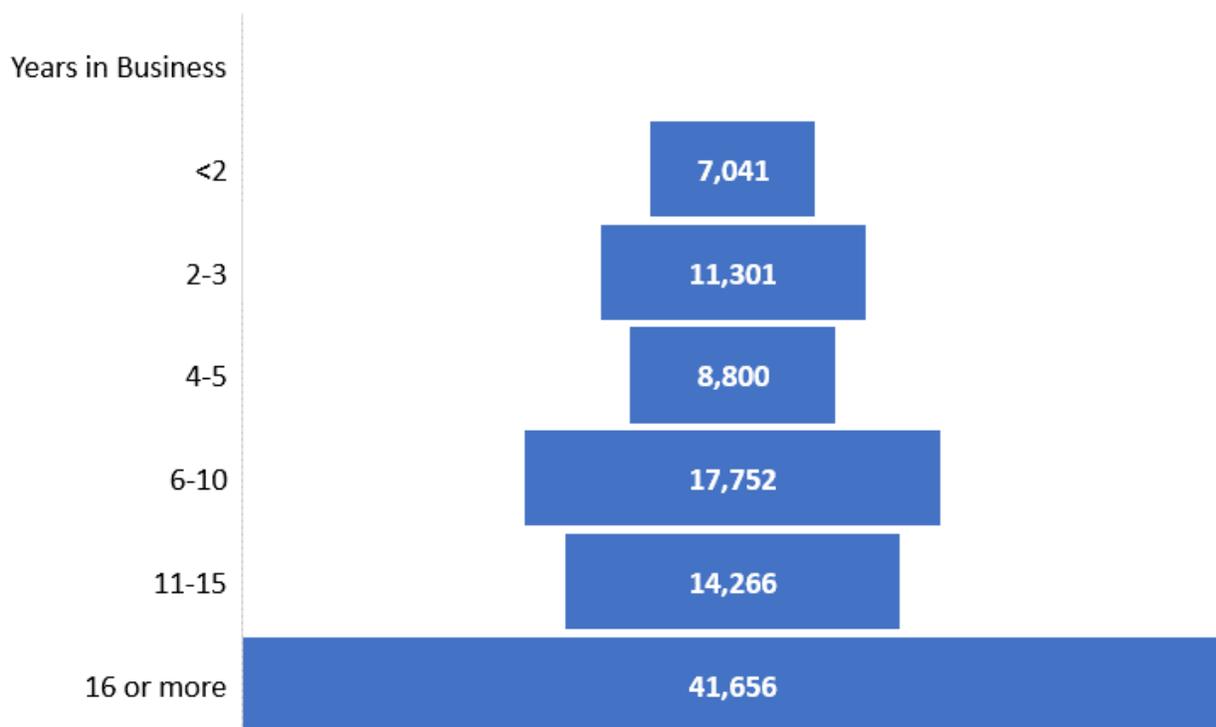
These patterns concerning the size of Indiana’s business establishments are similar to those found in many other parts of the United States. Other data on the number of years in business suggest that Indiana-based establishments are older than average. Census data (see Figure 6) show that a majority of Indiana firms have been in business for sixteen years or more. According to the U.S. Census Bureau, firms in business for more than 16 years account for roughly 29% of all U.S. businesses.⁹

⁹ For background, see Lawrence, J., Haltiwanger, J., and Goldschlag, N. 2017. “The Role of Firm Age in the Dynamics of Business Creation and Destruction,” U.S. Census Bureau Blog, September 20,

These patterns vary by industry. Indiana is home to a large base of agricultural and manufacturing firms, which tend to be older than firms found in other sectors. The data also show that a larger share of younger firms is found in the information and professional services sectors that would likely include many agtech and agbioscience firms.

The longevity of Indiana-based companies is a sign of economic stability, but it may also be a cause for potential concern. New firms are core drivers of new jobs and new innovations, and net job creation levels decline greatly as firms age. Thus, the state's ability to support the formation and growth of new ventures is an important indicator of its capacities to grow and innovate in the future.

Figure 6. Years in Business for Agbioscience Firms in Indiana – 2015



Source: Innovation Policyworks analysis of data from the 2015 Annual Survey of Entrepreneurs, US Census, <https://www.census.gov/programs-surveys/ase.html>.

Self-Employment in Indiana

Most new businesses are started by one entrepreneur or a small team. The majority of these companies remain small in size, but some of these new ventures will undoubtedly grow and prosper. Given these patterns, a review of self-employment levels in Indiana can offer another means to understand the state's entrepreneurial potential. And, as the so-called gig economy, with its growing importance on more flexible employment arrangements, becomes

2017. Available at: https://www.census.gov/newsroom/blogs/random-samplings/2017/09/business_dynamics.html.

a more important part of the state’s economy, the economic impacts of these sole proprietors will grow.

Table 5 shows Indiana’s top fifteen agbioscience-related sub-sectors for self-employment in 2018. While Animal Production and Bakery-related sectors are prevalent, so are Computer-related sectors, and Soil Preparation, Planting and Cultivation, as well as Farm Management Services. These latter sectors could coincide to some degree with agtech and agbioscience, but are primarily connected to production farming. Note that other than Animal Production and Computer Systems Design, the total numbers of self-employed are quite small, and in all but four instances have decreased since 2008. Average earnings per job are generally below Indiana’s median income of \$50,433.

Table 5. Self-Employment Trends in Sectors Related to Agbioscience (Indiana)

NAICS (All levels)	Description	2008 Jobs	2018 Jobs	2028 Jobs	2008-18 Change	2008-18 % Change	2018-28 Change	2018-28 % Change	Avg. Earnings Per Job
54151	Computer Systems Design and Related Services	1,943	1,766	1,786	(177)	(9%)	20	1%	\$25,356
541512	Computer Systems Design Services	863	731	740	(132)	(15%)	9	1%	\$25,356
311811	Retail Bakeries	194	213	250	19	10%	37	17%	\$14,492
54194	Veterinary Services	303	180	118	(123)	(41%)	(62)	(34%)	\$121,318
424490	Other Grocery and Related Products Merchant Wholesalers	132	167	222	35	27%	55	33%	\$29,062
115112	Soil Preparation, Planting, and Cultivating	157	147	133	(10)	(6%)	(14)	(10%)	\$24,145
115116	Farm Management Services	51	97	131	46	90%	34	35%	\$24,145
541519	Other Computer Related Services	135	96	82	(39)	(29%)	(14)	(15%)	\$25,356
311812	Commercial Bakeries	<10	79	122	Insf. Data	Insf. Data	43	54%	\$23,801
42445	Confectionery Merchant Wholesalers	37	59	82	22	59%	23	39%	\$29,062

Source: Emsi

Table 6 organizes the same information but sorts it by Location Quotient (LQ). LQ measures the percentage of employment in Indiana in a sector compared to the percentage for the nation as a whole. If the LQ is over 1.0, then the Indiana employment is stronger than the national average.

All of these sectors are highly concentrated in Indiana when compared to the United States as a whole. Indiana has fourteen sectors related to agtech and agbioscience where self-employment is stronger than the national average, but the overall employment numbers are very small, except for Crop Production (farming) at 8,971 jobs.

Table 6. LQs for Self-Employment in Sectors Related to Agbioscience (Indiana)

NAICS (All levels)	Description	2018 Jobs	Avg. Earnings Per Job	2018 Location Quotient
311211	Flour Milling	<10	Insf. Data	8.94
511210	Software Publishers	43	\$62,527	3.78
115116	Farm Management Services	97	\$24,145	2.99
424510	Grain and Field Bean Merchant Wholesalers	42	\$36,061	2.57
311824	Dry Pasta, Dough, and Flour Mixes Manufacturing from Purchased Flour	19	\$23,801	2.39
311119	Other Animal Food Manufacturing	18	\$29,981	2.19
111000	Crop Production	8,971	\$28,580	2.11
311821	Cookie and Cracker Manufacturing	17	\$23,801	2.07
115115	Farm Labor Contractors and Crew Leaders	48	\$24,145	1.95
42491	Farm Supplies Merchant Wholesalers	34	\$132,800	1.77
311111	Dog and Cat Food Manufacturing	<10	Insf. Data	1.55
115112	Soil Preparation, Planting, and Cultivating	147	\$24,145	1.41

Source: Emsi

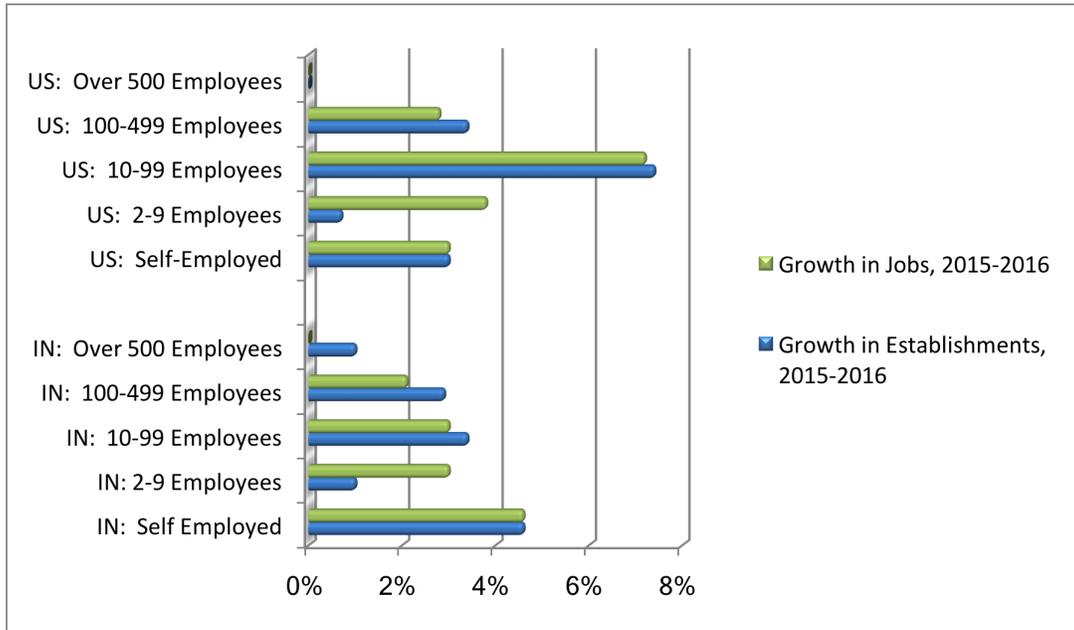
Growth Rates in Indiana Firms and Employment

Indiana's entrepreneurial potential can be further assessed using data that tracks establishment and job growth over time. Figures 7 and 8 use data from the University of Wisconsin's Business Dynamics Research Consortium.¹⁰ Here, Indiana's recent performance related to the growth of new business establishments and jobs based on company size is assessed. Specifically, the state's most recent performance (2015-2016) and performance over a longer time frame (2011-2016), comparing Indiana's performance to national averages is examined.

In general, Indiana's growth rate for jobs and new business establishments has lagged national averages. The patterns of growth have differed in several ways. Between 2015 and 2016, Indiana saw robust growth in the number of self-employed and among firms employing between 10-99 people. Indiana's rate of self-employment growth outpaced national averages, but it lagged U.S. benchmarks in job growth for all other business size categories.

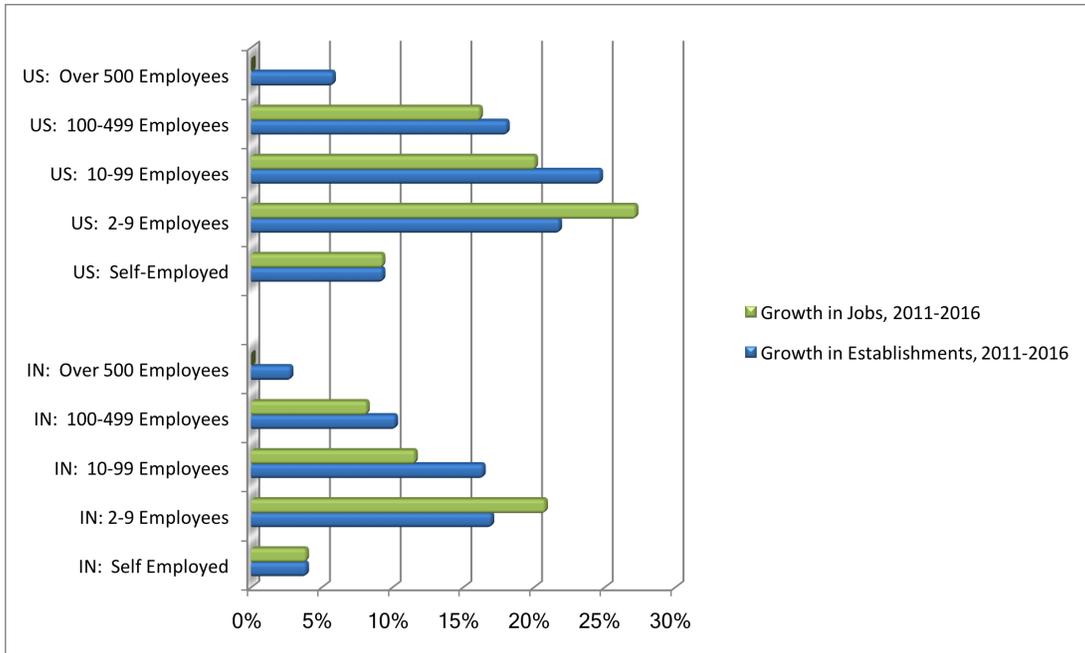
¹⁰ This dataset can be accessed at www.youreconomy.org.

Figure 7. Growth in Establishments and Jobs by Company Size, Indiana and the United States: 2015-2016



Source: *Youreconomy.org*. Accessed May 5, 2018

Figure 8: Growth in Establishments and Jobs by Company Size, Indiana and the United States: 2011-2016



Source: *Youreconomy.org*. Accessed May 5, 2018

Over the longer time frame of 2011 to 2016, Indiana’s patterns are again different from national trends. Here, Indiana’s self-employment growth is very low, while firms with 2-9 employees grew at a faster pace, albeit at rates still lower than national averages. For the United States, firms with 2-9 employees had much higher growth in jobs, and growth in each category was higher than in Indiana. This may indicate that Indiana’s recovery from the Great Recession was slower than in the country as a whole.

It is not exactly clear why Indiana’s growth rates are lagging, but it is likely a combination of factors including fewer numbers of entrepreneurs and start-up businesses, fewer companies comparatively in some of the faster-growing sectors like Information Technology, less early stage capital available and under-developed resources and support for entrepreneurs.

Kauffman Index of Entrepreneurship

In addition to the data developed above, Indiana’s performance was also evaluated on the leading third-party assessment of state entrepreneurial performance: The Kauffman Foundation Index of Entrepreneurial Activity.¹¹ The 2017 Index showed Indiana to be 20th among the 25 largest states, a ranking unchanged from 2016. Table 7 summarizes the Indiana results. When compared to other large Midwestern states, Indiana’s relative performance improves. It is ranked lower than Ohio, Minnesota, and Illinois, but ranks higher than Michigan and Wisconsin.

Table 7. Kauffman Index of Entrepreneurship, Indiana, 2017

Measure	Indiana Score (Scale of 1-100)	Explanation
Rate of Start-up Growth	57.4%	A proxy measure of business growth and startup traction. This measures the average percentage growth of a cohort of new employee firms in the first 5 years of operation
Share of Scale-ups	1.2%	A proxy for how many startups become scaleups. Measures the prevalence of companies that start small and become medium-sized by their 10th year of operation.
High-growth Company Density	55.1%	Prevalence of high-growth companies (at least \$2 million in revenue and 20% annualized growth over a 3-year period)

Nonetheless, these results suggest that Indiana faces challenges in terms of spurring the creation of new companies and in helping these companies achieve rapid growth post start-up stage.

The Kauffman Index also assesses the performance of the 40 largest metropolitan statistical areas in the United States, including Indianapolis-Carmel. Like the state, Indianapolis ranks at the lower end of these metro rankings. It ranks 38 (among 40 metros) for start-up activity, but performs much better (ranking #10) for its density of high-growth companies. The region

¹¹ Ewing Marion Kauffman Foundation. 2017. Kauffman Index Growth Entrepreneurship: State Trends. All data come from the U.S. Census Business Dynamics Statistics, and do not assess the performance of specific industries or clusters.

showed strong improvement on this measure, rising ten spots on the ranking between 2016 and 2017. Because this measure tracks established firms (with more than \$2 million in annual revenue), this robust performance most likely reflects the overall strong economy in Indianapolis as opposed to improved performance by new companies.

Inc. 5000 Companies

The Inc. 5000 annual listing of high-growth companies offers another means to capture the performance of companies that are scaling rapidly. It is imperfect because companies self-nominate, and so the list is not necessarily exhaustive. Some high-growth firms may avoid the spotlight, and do not provide their statistics to the magazine. Sixty-seven Indiana companies made the 2017 list, and three of these companies operate in fields related to agriculture and the agbiosciences. Table 8 shows that all three are in the food and beverage field.

Indiana ranks 22nd in the number of companies on the list. The top three states were: California, Texas and Florida. Neighboring states included: Illinois (239); Ohio (171); Michigan (101); Missouri (81); Wisconsin (54); and Iowa (28).

Table 8. Inc. 5000 Agbioscience Companies in Indiana – 2017

Rank	Company	Growth	Revenue (mil)	Industry
911	Ben's Soft Pretzels	484%	\$11.5	Food and beverage
1,170	Hoosier Hill Farm	357%	\$3.5	Food and beverage
4,014	Ellison Bakery	70%	\$31.1	Food and beverage

Source: Inc. 5000.com

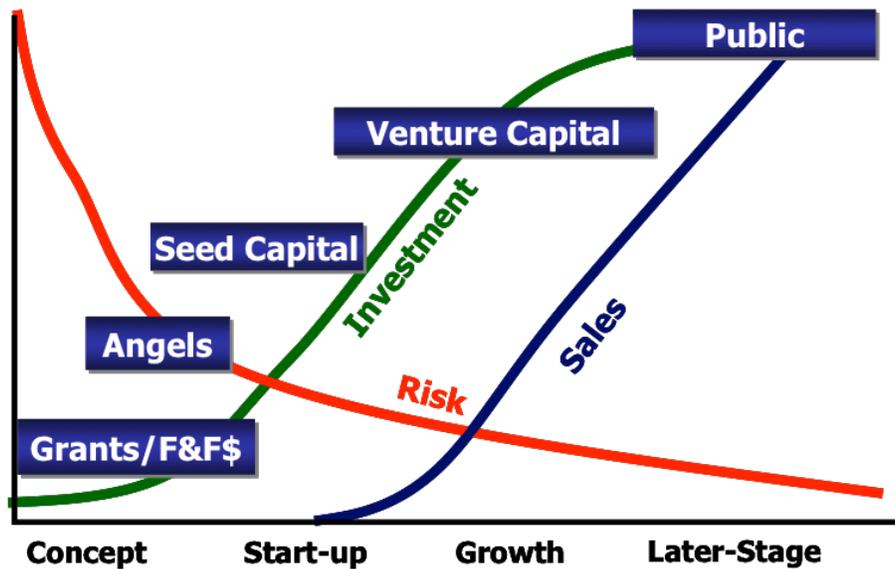
Capital Investment

Capital is critical for the expansion of growth-oriented businesses, and especially for science and technology-based firms such as those in agbioscience. Capital is available along a continuum of grants, angel investments, seed, and venture capital, and is presented in that order. As noted elsewhere in this project, successful regions host a diversity of capital sources so that local entrepreneurs can easily access the capital they need based on where they fall in the business lifecycle (Figure 9).

Grants: SBIR/STTR

The Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) programs provide grants through ten federal agencies. These agencies are required to set aside a small percentage of their intramural research and development budgets to fund the SBIR and STTR programs. Each agency conducts regular competitions with research topics of interest to its mission. These topics are published and small companies (generally, less than 500 employees) are encouraged to submit proposals describing how they would approach the research. The proposals are scored using a peer review panel, and the top proposals are awarded grants. Phase I grants, generally between \$100,000 and \$150,000, are for early work on the topic such as proof of concept, while Phase II awards, generally \$250,000 and up, are for companies that have successfully completed their Phase I work.

Figure 9: Types of Capital Available Along the Commercialization Continuum



Source: <https://www.marsdd.com/mars-library/angel-investors-seed-or-venture-capital-investors-that-depends-on-your-stage-of-company-development/>

SBIR/STTR is an important source of pre-seed capital for young and small companies whose products or services are science or technology-based, both because the award denotes passing a peer review (and subsequently signals technical competence to other investors) and because the grants are non-dilutive. Unlike follow-on debt or equity funding, SBIR/STTR awards do not affect a company’s balance sheet. The presence of large numbers of SBIR/STTR award recipients is considered one sign that a state or region is home to new and small companies with significant science and technology-related expertise and capacity.

According to the Small Business Administration, Indiana companies have received around 50 SBIR or STTR awards each year during the period 2013-17, but a much smaller number of awards on topics related to agbioscience.¹² As shown in Table 9, six agbioscience companies shared a total of 14 awards 2013-17, for a total of \$3,465,925. By mid-2018, two agbioscience companies had received awards: The Bee Corp and Akanocure Pharmaceuticals. Full data for 2018 is not yet available.

¹² Data can be accessed at: <http://www.sbir.gov>

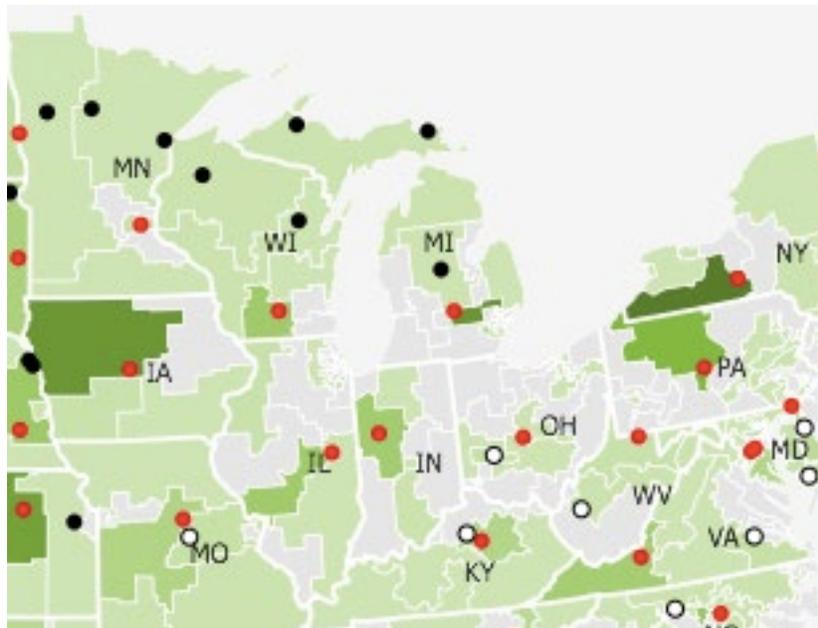
Table 9. SBIR/STTR Winners Related to Agbioscience in Indiana – 2013-17

Year	Company Name	City	SBIR/STTR	Agency	Phase	Amount	Technology
2017	Nutramaize, LLC	Lafayette	STTR	NSF	I	\$ 225,000	Corn variety
2017	Biominerall Systems	Mishawaka	SBIR	NSF	I	\$ 224,911	Fungicide
2017	Biominerall Systems	Mishawaka	SBIR	USDA	I	\$ 100,000	Fertilizer
2017	Nutramaize, LLC	Lafayette	SBIR	USDA	I	\$ 99,977	Corn variety
2017	VinSense	West Lafayette	SBIR	NSF	II	\$ 514,295	IT/Ag
2016	VinSense	West Lafayette	STTR	NSF	I	\$ 224,949	IT/Ag
2016	Trellis Growing Systems	Ft. Wayne	SBIR	USDA	I	\$ 99,961	Hops
2014	Spensa Technologies	West Lafayette	SBIR	NSF	II	\$ 626,927	IT/Ag
2014	En'urqa, Inc.	West Lafayette	SBIR	USDA	I	\$ 100,000	Diagnostics
2014	En'urqa, Inc.	West Lafayette	SBIR	USDA	II	\$ 450,000	Diagnostics
2014	Trellis Growing Systems	Ft. Wayne	SBIR	USDA	II	\$ 449,905	Hops
2013	Spensa Technologies	West Lafayette	SBIR	USDA	I	\$ 100,000	IT/Ag
2013	En'urqa, Inc.	West Lafayette	SBIR	USDA	I	\$ 100,000	Diagnostics
2013	Spensa Technologies	West Lafayette	SBIR	USDA	I	\$ 150,000	IT/Ag

Source: sbir.gov

Indiana ranks 13th in the United States for funding from the National Institute of Food and Agriculture (NIFA), the USDA’s primary extramural science funding agency. NIFA invests in a variety of areas, including food security, water, and bioenergy. Among Midwestern states, only Iowa received more funds than Indiana (in 2017) on a competitive basis. Figure 10 shows the relative intensity of NIFA funding; the darker green is a higher level of funding. The dots indicate the institutions receiving funds are primarily land-grant universities.

Figure 10. National Institute of Food and Agriculture Midwest Funding – 2017



Source: https://portal.nifa.usda.gov/web/maps/nifa-funding-by-congressional-district/?from_site=NIFA

Angel Investing

For most regions of the United States, angel investing is the most important source of equity funding for new and growing companies. In 2016, U.S.-based angel investors put more than \$21 billion into just over 64,000 ventures across the United States.¹³

At present, detailed state-level data on angel investing is not available. The best resource, the Angel Resource Institute’s (ARI) HALO Report, tracks investments by angel investment groups, but only reports data at the regional level.¹⁴ In 2017, ARI tracked 3,388 deals of less than \$4 million in round size. Nearly 90% were new deals, while 10.9% were follow-on investments. Table 10 compares the national statistics with data for investments made in the Great Lakes Region (Illinois, Indiana, Michigan, Ohio and Wisconsin). Angel investors in the Great Lakes closely followed national trends, with somewhat higher round size and somewhat lower median investment. In each case, 26.7% of the investments were made in software companies; agriculture-related investments were not specifically noted.

Table 10. Angel Investing in the United States and Great Lakes Region – 2017

	US	Great Lakes
Median Pre-money Valuation	\$3.5 million	\$3.4 million
Median Funding Round Size	\$285,000	\$350,000
Median Angel Group Investment	\$200,000	\$173,000

Source: 2017 Halo Report

The most active groups in the Great Lakes were: Hyde Park Angel Network, Michigan Angel Fund, Queen City Angels, Wisconsin Investment Group, Central Illinois Angels and Irish Angels. Of these, only Irish Angels is based in Indiana, but is focused on Chicago-area opportunities. Launched in 2012, Irish Angels includes more than 200 individual investors. They are not affiliated with the University of Notre Dame, but are interested in leveraging Notre Dame connections. The group invests between \$6 million and \$7 million per year in start-ups raising seed and Series A rounds.

State Sources of Pre-Seed and Seed Capital

Elevate Ventures, a venture development organization focused on building sustainable innovation and entrepreneurship in Indiana and fostering and developing high potential, high-growth businesses for investment and return for its stakeholders, is funded by the Indiana Economic Development Corporation (72.1% in 2017), regional partnerships and key supporters (25%) and by the federal State Small Business Capital Initiative (SSBCI) (2.4%). Elevate operates the state’s SBIR match program as well as invests directly in Indiana ventures. A key partnership is with Purdue University and its Foundry. Purdue Ventures manages the Ag-Celerator program’s investment fund and the Purdue Foundry Fund.

Indiana companies in the agbiosciences and agtech that have received seed funding from Elevate and Purdue in the period 2013-17 are listed in Table 11.

¹³ Center for Venture Research, University of New Hampshire, “UNH Finds Robust Appetite for Seed and Start-Up Investing in 2016 Angel Market,” Press Release, June 6, 2017. Available at: <https://www.unh.edu/unhtoday/news/release/2017/06/06/unh-finds-robust-appetite-seed-and-start-investing-2016-angel-market>

¹⁴ Angel Resource Institute, HALO Report, 2017. Available at: <http://www.angelresourceinstitute.org>

Table 11. Seed Investments in Indiana Agbioscience Companies – 2013-2017

Company	Location	Stage	Amount	Investor
Akanocure	West Lafayette	Seed	\$ 50,000	Purdue Ag-Celerator
Gen3Bio	West Lafayette	Seed	\$ 40,000	Purdue Ag-Celerator
Heliponix (formerly HydroGrow)	West Lafayette	Seed	\$ 25,000	Purdue Ag-Celerator
Heliponix (formerly HydroGrow)	West Lafayette	Seed	\$ 80,000	Elevate Purdue Foundry Fund
Heliponix (formerly HydroGrow)	West Lafayette	Seed	\$ 20,000	Elevate Purdue Foundry Fund
Jua Technologies	Carmel	Seed	\$ 50,000	Purdue Ag-Celerator
Jua Technologies	Carmel	Seed	\$ 20,000	Elevate Purdue Foundry Fund
NutraMaize	Lafayette	Seed	\$ 49,900	SBIR Match*
Phicrobe LLC	West Lafayette	Seed	\$ 75,000	Purdue Ag-Celerator
Precision Drone		Closed	\$ 60,000	Purdue Ag-Celerator
Spensa Technologies	West Lafayette	Acquired	\$ 50,000	SBIR Match
Trellis Growing Systems	Fort Wayne	Seed	\$ 49,900	SBIR Match
VinSense	West Lafayette	Seed	\$ 50,000	SBIR Match
VinSense	West Lafayette	Seed	\$ 20,000	Elevate Purdue Foundry Fund
VinSense	West Lafayette	Seed	\$ 50,000	Purdue Ag-Celerator
VinSense	West Lafayette	Seed	\$ 80,000	Elevate Purdue Foundry Fund
ZeaVaxx	West Lafayette	Seed	\$ 100,000	Purdue Ag-Celerator
*SBIR match estimated from 50% of latest Phase I Award, not to exceed \$50,000.				

Venture Capital

While angel investors target more early stage ventures, venture capitalists typically focus on larger growth opportunities. Venture capital investments are a major source of growth capital for firms around the world. In 2017, a total of \$84 billion of venture capital was invested in the United States, with over 80% going to companies located in California, Massachusetts, and New York.¹⁵

2017 saw “the clear maturing of agtech investment, with rising round sizes and notable VC-backed exits,” according to Finistere and Pitchbook. They note that \$1.5 billion was invested internationally in 2017, with 300 distinct investors doing over 100 deals, compared to only 31 deals totaling \$200 million 2007.¹⁶ Drivers of these investments are disruption in the retail food value chain (e.g., the IPO of Blue Apron, and Amazon’s purchase of Whole Foods) and in the agricultural value chain. The latter is seeing “increasing land turnover and altered land use, renewed focus on sustainability and ...changing consumer preferences.¹⁷

To date, Indiana has not been a hot spot of agtech venture capital investment. A search of the Crunchbase database of investments in companies going back over ten years, plus AgriNovus’ data, reveal only a few examples of venture-backed companies in the sector (Table 12). The major success story, Spensa Technologies, raised \$4.5 million from Village Capital and Elevate Ventures, among others, before being acquired by DTN in March 2018. ClusterTruck, launched in 2015 by Chris Baggott, the ExactTarget co-founder, has raised almost \$15 million to date, and is expanding rapidly across the Midwest and West with its unique “Uber for food” delivery concept.

¹⁵ 4Q 2017 PitchBook-NVCA Venture Monitor, January 15, 2018. Available at: <https://pitchbook.com/news/reports/4q-2017-pitchbook-nvca-venture-monitor>.

¹⁶ Kukutai, A. and Maughan, S. 2018. “Major Trends in Agtech for 2018.” *TechCrunch*. Available at: <https://techcrunch.com/2018/03/08/major-trends-in-agtech-for-2018/>.

¹⁷ Ibid.

Table 12. Recent Venture Investments in Indiana Agbioscience Companies

Company	Location	Stage	Total Investments	Notes
Spensa Technologies	West Lafayette	M&A	\$4.5 million	Acquired March 2018 by DTN
Algaeon	Indianapolis	Venture	\$1.6 million	Last round 2016
Worm's Way	Bloomington	M&A		Acquired 2017 by Sun Capital Partners
Channel Bio	Kentland	M&A		Acquired by American Seeds in 2004; now Monsanto subsidiary
ClusterTruck	Indianapolis	Venture	\$15 million	Investors not disclosed
Bee Corp	Bloomington	Series A	\$35,360	Village Ventures, High Alpha

Source: crunchbase.com

Appendix A: Concordance

These tables show the NAICs and U.S. Patent and Trademark Office codes that are used in this report to define agbioscience. For the sake of consistency between this report and previous work commissioned by AgriNovus, the codes are the same as those used by Battelle/TEconomy Partners in earlier Agbioscience Innovation studies.

Segment	Subsegment	NAICs	NAICs Description
Ag & Biological Research, Testing & Services	Biological and Agricultural R&D	54171AG	Biological and Agricultural R&D
	Testing Laboratories	541380AG	Testing Laboratories
Inputs to Production	Veterinary Services Ag Machinery and Equipment	541940	Veterinary Services
		333111	Farm Machinery and Equipment Manufacturing
		333210	Sawmill and Woodworking Machinery Manufacturing
		333291	Paper Industry Machinery Manufacturing
		333294	Food Product Machinery Manufacturing
		423820	Farm/Garden Machinery and Equipment Merchant Wholesalers
		Agricultural Chemicals	325311
	325312		Phosphatic Fertilizer Manufacturing
	325314		Fertilizer (Mixing Only) Manufacturing
	325320		Pesticide and Other Agricultural Chemical Manufacturing
	Agricultural Inputs Wholesaling	424910	Farm Supplies Merchant Wholesalers
Veterinary Medicines and Vaccines	325413AG	Pharmaceutical Preparation Manufacturing	
Primary Production	Agricultural & Biomass Production	111	Crop Production
		113	Forestry and Logging
		1151	Support Activities for Crop Production
		1153	Support Activities for Forestry
		Livestock Production	112
	1152		Support Activities for Animal Production

Entrepreneurial Ecosystem Assessment

Segment	Subsegment	NAICs	NAICs Description
Agricultural & Biomass Processing	Agricultural Processing	311211	Flour Milling
		311212	Rice Milling
		311213	Malt Manufacturing
		311221	Wet Corn Milling
		311222	Soybean Processing
		311223	Other Oilseed Processing
		311225	Fats and Oils Refining and Blending
		311311	Sugarcane Mills
		311312	Cane Sugar Refining
		311313	Beet Sugar Manufacturing
Food, Nutrition & Health	Biomass Processing	321113	Sawmills
		322110	Pulp Mills
	Beverage Manufacturing	325193	Ethyl Alcohol Manufacturing
		312111	Soft Drink Manufacturing
		312112	Bottled Water Manufacturing
		312113	Ice Manufacturing
		312120	Breweries
		312130	Wineries
		312140	Distilleries
		Food Processing & Manufacturing	Botanicals, Diagnostics, and Biological Products
315413	In-Vitro Diagnostic Substance Manufacturing		
325414	Biological (except Diagnostic) Manufacturing		
Food Processing & Manufacturing	3111		Animal Food Manufacturing
	3113		Sugar and Confectionary Product Manufacturing
	3114		Fruit/Vegetable Preserving and Speciality Food Manufacturing
	3115		Dairy Product Manufacturing
	3116		Animal Slaughtering and Processing
	3117		Seafood Product Preparation and Packaging
	3118		Bakeries and Tortilla Manufacturing
3119	Other Food Manufacturing		
Wholesaling, Distribution & Storage Operations	Agricultural Commodity Wholesaling	311230	Breakfast Cereal Manufacturing
		42451	Grain & Field Bean Merchant Wholesalers
		42452	Livestock Merchant Wholesalers
		424590	Other Farm Product Raw Materials Merchant Wholesalers
		Food Product Wholesaling	424430
	424440		Poultry Product Merchant Wholesalers
	424470		Meat and Meat Product Merchant Wholesalers
	Warehousing and Storage	424480	Fruit and Vegetable Merchant Wholesalers
		493120	Refrigerated Warehousing and Storage
			493130

Entrepreneurial Ecosystem Assessment

Segment	Subsegment	NAICs	NAICs Description
Agricultural Technology	Electronic Systems	334220	Radio/TV, Wireless
		334510	Electro-medical and Electrotherapeutic Apparatus
		334513	Instruments for Measuring, Displaying and Controlling Industrial Processes
		334511	Detection, Systems and Instruments
		336413	Aircraft Parts and Equipment
		334516	Analytical Laboratory Instruments
	Computer Systems	511210	Software publishers
		541360	Mapping and Surveys (Geophysical)
		541370	Surveys and Mapping
		541511	Custom Computer Programming Services
		541512	Computer Systems Design

Source: Battelle Technology Partnership Practice. 2014. *Innovative Agbioscience in Indiana: A Baseline Assessment*. Appendix A.

USPTO Cooperative Patent Classifications		
Agbioscience	A01H	New plant varieties, cultivars, genotypes and processes for engineering them
	A01N	Preservation of human or animal bodies or plants, biocides, pesticides
	C05B	Phosphatic fertilizers
	C05C	Nitrogenous fertilizers
	C05D	Inorganic fertilizers
	C05F	Organic fertilizers
	C05G	Fertilizer mixtures
	A61D	Veterinary instruments
	A61K	Pharmaceuticals, biopharmaceuticals
	AgTech	A01G
G01		Measuring
G01B		Measuring length, surfaces
G01C		Measuring distances
G01D		Measuring not specifically adapted for a single variable
G01H		Measurement of mechanical vibrations or ultrasonic or sonic or infrasonic waves
G01K		Measuring temperature
G02		Optics
G04		Time measurement
G05D		Systems for controlling, regulating
G06		Computing
G08		Signalling
G11		Information Storage
H04W		Wireless communications

Source: Agbiosciences from TEconomy Partners, 2016. "The Value of Bioscience Innovation in Growing Jobs and Improving Quality of Life." AgTech list compiled from master list of Cooperative Patent Classifications, an international standard, at <https://www.cooperativepatentclassification.org/cpcSchemeAndDefinitions/table.html>.

APPENDIX II

CASE STUDIES

DES MOINES
RESEARCH TRIANGLE
ST. LOUIS
PITTSBURGH
KANSAS CITY
DENMARK

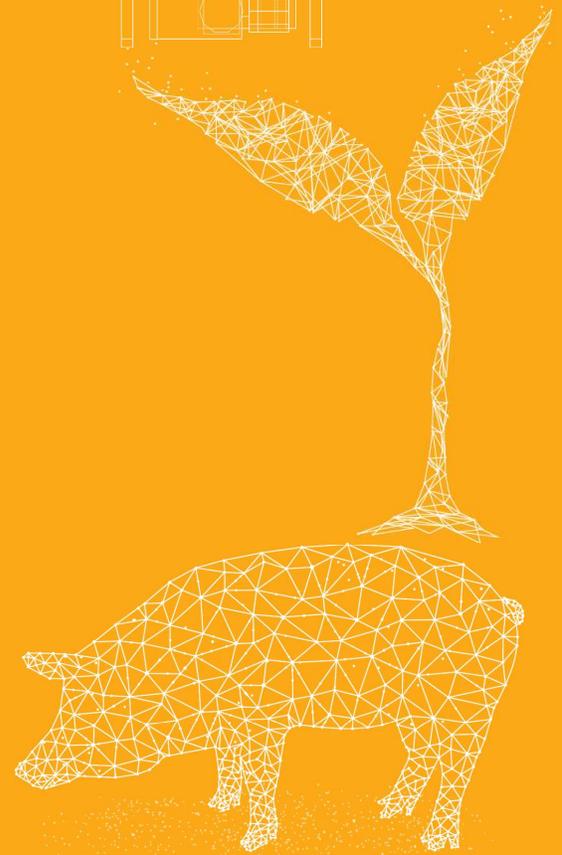
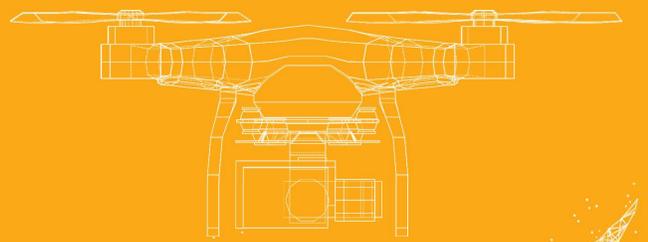


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Research Triangle, North Carolina	9
St. Louis, Missouri	15
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Introduction

Understanding the evolution of entrepreneurial ecosystems is not a simple exercise that can be pursued via one research method or approach. Data sources are often limited, so other qualitative research methods also make sense. This report section presents findings of mini-cases studies that examine the development of entrepreneurial ecosystems in regions that share important characteristics with Indiana and the Indianapolis-Carmel Metropolitan Statistical Area (MSA). Working with the team at AgriNovus, the researchers identified six locations for deeper-dive assessments.

Often it is informative to compare the ecosystems in one place to other similar locations or geographies. Using this technique, findings can be placed in context, best practices explored and lessons learned. These were the objectives of this set of six case studies commissioned by AgriNovus as part of the study of Indiana’s entrepreneurial ecosystem focused on the agbiosciences. The case study locations are:

- Des Moines, Iowa
- Research Triangle, North Carolina
- St Louis, Missouri
- Pittsburgh, Pennsylvania
- Kansas City (MO/KS) Metropolitan Area
- Denmark

These locations were selected for their recent successes in developing robust ecosystems focused on innovation and entrepreneurship. With the exception of Pittsburgh, all of the locations also host strong concentrations of agbioscience-related activities.

Figure 1 presents findings from the Kauffman Index of Entrepreneurial Activity related to each of the U.S. case study locations. These data are presented at the state level, so there are limitations in their ability to capture the nuances of developments within the specific metropolitan areas. However, they do offer a general baseline for understanding the nature of each region’s entrepreneurship base. All of the states fall into the middle ranks of U.S. states in terms of overall levels of entrepreneurial activity. Indiana and Pennsylvania are strong performers in terms of Main Street businesses, i.e., long established “Mom and Pop” small businesses. Meanwhile, Missouri and North Carolina show stronger performance on measures of start-up growth.

Figure 1. Entrepreneurship Metrics

	Indiana	Iowa	North Carolina	Missouri	Pennsylvania
RANKINGS					
Start-up Activity	21st	21st	9th	10th	23rd
Growth Entrepreneurship	20th	22nd	18th	22nd	19th
Main Street Entrepreneurship	6th	11th	14th	24th	5th

Source: The Kauffman Foundation, Entrepreneurship Index, 2017

Each case study assessment follows a similar format, with a quick review of recent economic performance followed by a brief history of recent ecosystem-building efforts. Each profile concludes with a brief review of lessons learned that are particularly relevant to AgriNovus and to ecosystem-building efforts across Indiana.

Summary of Findings

The case studies offer several relevant lessons for AgriNovus and its partners. Iowa, Missouri and North Carolina, like Indiana, share deep agricultural roots, so it is not surprising that each of these states host major metropolitan areas with strong agbioscience clusters and entrepreneurial ecosystems. These three metropolitan areas, Des Moines, St. Louis and Raleigh-Durham-Chapel Hill (Research Triangle), share a number of characteristics with each other and with Indianapolis. While Pittsburgh is not home to a major center for the agbiosciences, its experiences with technology-based economic development offer useful insights for ecosystem building in Indiana. Several key lessons learned can be derived from these case studies.

Research Excellence: Necessary but not Sufficient

All of the studied regions are home to world-class higher education institutions. In many cases, such as Pittsburgh, Raleigh, and St. Louis, major universities are located in the core metropolitan area. And, in most cases, major land-grant institutions, like Iowa State University and the University of Missouri, are within a short drive from major metro centers. These universities are often accompanied by other major agbioscience research centers, including the St. Louis-based Danforth Plant Science Center and the U.S. Department of Agriculture (USDA) National Animal Disease Center in Ames, Iowa. These centers operate much like Purdue in Indiana: they are core components of state and regional agbioscience ecosystems.

These universities and research centers are prodigious generators of new research and development, new technologies, and new ideas. They all rank among the top research institutions in the United States. Nonetheless, research excellence does not automatically translate into high levels of entrepreneurial activities. Successful regions combine research excellence with an entrepreneur-friendly business culture.

A key component of the success of the entrepreneurial aspects of the agbioscience clusters, however, is the attitudes, policies and actions of these research assets with respect to start-up companies based on the intellectual property developed at these institutions. North Carolina State University, and Purdue, for instance, are very strong in this dimension, while Iowa State's adoption of proactive technology transfer policies is more recent. In Pittsburgh, local leaders are heavily focused on improving connections between academic researchers and the entrepreneurial community via the new InnovatePGH initiative.

All of the universities have strong entrepreneurship programs, responding to students' interests in starting companies. This bodes well for the long-term pipeline of agbioscience entrepreneurs when the programs have strong linkages between the business schools and agricultural research, for example.

Physical Hubs Matter

One cornerstone of St. Louis' entrepreneurial ecosystem is its innovation district, Cortex, and the 39North District focused on the agbiosciences. Similarly, the Centennial Campus is North Carolina State University's research park and an important component in the

agbioscience cluster in North Carolina, even more so than the Research Triangle Park itself. Pittsburgh is in the process of developing its own innovation district located near the University of Pittsburgh and Carnegie Mellon University. Denmark is also home to large number of business development centers and incubators focused on agriculture and other leading industry clusters. These entrepreneurial hubs are all located in the heart of the city, offering places to convene and network and serving as a hub and beacon for the area's innovators.

The benefits of centrally-located physical hubs are not present at this time in Des Moines or Indianapolis, where major research parks for Iowa State University and Purdue University are located roughly fifty miles away from major business centers. Land grant universities historically were located in agricultural centers as opposed to urban areas. This distance can have the effect of weakening the benefits of central hubs or innovation districts focused on new ideas and new business development.

Agbioscience Builds on Bioscience and IT Excellence

St. Louis, Kansas City, and the Research Triangle rely on long-standing and strong clusters in both information technology and life sciences to underpin their agbioscience cluster and entrepreneurial ecosystems. Depth of workforce talent with technical expertise combined with entrepreneurial experience will help newer clusters emerge and grow. Successful agbioscience developments will depend greatly on a region's base of bioscience and information technology talent, especially when this talent base can also be combined with agricultural roots. Both St. Louis and North Carolina have used this talent base to build strong agbioscience clusters. In Kansas City, the Animal Health Corridor builds on legacy industry strengths. Similar growth in Iowa has been hampered by the absence of deep talent pools in information technology and the life sciences. Meanwhile, Pittsburgh is a global center for talent in these sectors but has not focused on developing an agbioscience cluster.

A Robust Entrepreneurial Ecosystem in General Supports Agbioscience

The case study analyses also suggest that places with strong ecosystems in general also support agbioscience entrepreneurship. To the extent that accelerators, mentors, sources of capital and other support networks are in place, agbioscience entrepreneurs can take advantage of them. A small number of agbioscience accelerator programs are in place in the studied regions, but the most important initiatives support entrepreneurs across a variety of industry sectors.

Large Agbioscience Corporations Have Limited Impact on Start-ups

Each of the profiled regions (with the exception of Pittsburgh, has like Indiana significant, large agbioscience companies located in the metropolitan regions. These major corporations, while developing much intellectual property related to agbioscience, are not necessarily deeply invested in collaborations with local universities, governments or entrepreneurs.

One bright point, however, is that the major corporations have provided a funding backbone for many entrepreneurial support initiatives and/or sources of capital. These are necessary, but not sufficient, for a robust ecosystem.

Embrace Experiments

All of the case study regions operate with an interesting mix of top-down and bottom-up initiatives. With the exception of Pittsburgh (and Denmark), where local and state government is quite strong, most of the ecosystem-building activities are led by the private sector, non-profits, or public-private partnerships. Public funds help build capacity and are

also used to develop business investment pools. But, top-down directives will not build an ecosystem. High-level investments must also be accompanied by active networks of entrepreneurs working together in the community. And, there is no single pathway to success. Experimentation is required.

Ecosystem building is an “all hands on deck” exercise. No one organization can be in charge, and partners can (and should) include private firms, government agencies, education institutions and non-profits. Successful ecosystem building combines bottom-up innovation with strong top-down support from government, private industry, and support organizations like the Central Indiana Corporate Partnership and AgriNovus.

Concluding Thoughts

The recent experiences of these regions should be a cause for optimism in Indiana. Many of the successful initiatives noted in these case studies, such as St. Louis’ Cortex District or North Carolina State’s Centennial Campus, have shown to have tangible impacts on regional economic performance. Indiana is now adopting similar strategies, such as the development of 16 Tech in Indianapolis and the expansion of Purdue’s Discovery Park through its Convergence project. In addition, the state is embracing other new strategies, such as the InnovateWithIN business competition and the creation of entrepreneurial hubs in places like Fort Wayne and Bloomington that are generating bottom-up buzz about the potential for Indiana’s innovation economy. These case studies suggest that Indiana is well-positioned to build stronger state and regional ecosystems focused on the agbiosciences.

Des Moines, Iowa

When one thinks of Iowa, farms almost always come to mind. Farmland does account for 92% of Iowa’s total land base, and about one-third of the highest quality farmland in the United States is located in the state. Iowa is the leading producer of corn, pork, eggs and soybeans, and food processing and other agricultural-related manufacturing are also big business. Most small farms in Iowa have given way to large mechanized operations, providing an advantage for Iowa in the context of agbioscience. If a start-up wants to have production agriculture customers, Iowa is a great place to start since there are so many farm businesses/operations there.

Despite its image, Iowa today is really a highly diversified economy, with only 3.5% of GDP derived from agriculture, forestry, hunting and fishing.¹ Manufacturing is the largest contributor to GDP at 22%. However, slow population growth and a contracting labor force, along with a lack of diversity (a 91% white population) suggest that future economic progress may be threatened. Indeed, recent real declines in agricultural and manufacturing GDP have been experienced and nonfarm growth is also lagging the United States.

The state has a strong reputation as a good place to do business, ranking #12 by Forbes’ Best State for Business, and #1 Best State in the 2018 U.S. News and World Report rankings.²

¹ Bureau of Economic Analysis, U.S. Dept. of Commerce - Bureau of Economic Analysis, U.S. Dept. of Commerce.

² <https://www.usnews.com/news/best-states/iowa>. The Best States ranking of U.S. states draws on thousands of data points to measure how well states are performing for their citizens. In addition to health care and education, the metrics take into account a state’s economy, the opportunity and quality of life it offers people, its roads, bridges, internet and other infrastructure, its public safety and the fiscal stability of state government.

History of Ecosystem Building

While Iowa is also a state of small businesses, the entrepreneurial ecosystem being built here is of relatively recent vintage. The Resource Navigator for Iowa Source Link lists 350 public organizations that support entrepreneurs and small business.³ This list includes many state agencies and trade associations in addition to those focused only on entrepreneurs.

The oldest building block in the ecosystem is the **Iowa State University Research Park**. Established in 1987 as a not-for-profit corporation under Iowa State University (Iowa State), the Park now has 12 buildings. The tenants in the buildings employ over 1,700 persons and have access to technology and wet/dry lab incubators.

In the mid-1990s, prominent Iowa entrepreneur John Pappajohn, who made his fortune in insurance and other sectors, donated \$5 million to the state to establish five new entrepreneurship centers at Iowa institutions of higher education: Iowa State University, University of Northern Iowa, University of Iowa, North Iowa Area Community College and Drake University. All five are still operating, and offer a mix of support programs, such as workshops and trainings, youth programming, and coaching/mentoring for new business owners.

At Iowa State, for instance, the **Pappajohn Center for Entrepreneurship** is an innovation and entrepreneurial community focused on student entrepreneurs. In addition to a host of student focused programming, the Center also supports the Iowa Small Business Development Center and CYstarters, a ten-week summer accelerator for Iowa State students and recent grads.

The **Iowa Economic Development Authority**, the economic and community development agency for the State reorganized as a quasi-public agency in 2012, operates four programs to support entrepreneurs.⁴ The programs, listed below, have been operational since 2007, under the predecessor organization. They include:

- *Development Fund*, up to \$125,000 available for marketing or business development, requiring a 1:2 match for Iowa-based companies with less than 500 employees.
- *Iowa Innovation Acceleration Fund* for advanced manufacturing, bioscience or information technology (IT), requiring a 1:1 match. The Propel level supports up to \$300,000, and Innovation Expansion loans go up to \$500,000.
- *Proof of Commercial Relevance low-interest loans* are for \$25,000 and require a 1:2 match in order to validate a business model or market potential or develop intellectual property in advanced manufacturing, bioscience or IT.
- *SBIR matches* are available through the Iowa Innovation Corporation with a \$50,000 maximum match for Phase One winners. (Note: the Iowa Innovation Corporation is currently pivoting to the Iowa Bioscience Development Center and hiring a new CEO, with both precision and digital agriculture, vaccines and immunotherapies among its targeted opportunities.)

In a recent round of funding provided by the Iowa Economic Development Authority, two agtech companies received awards. Accelerated Ag Technologies received a \$300,000 loan

³ <http://iasourcelink.org>.

⁴ <https://www.iowaeconomicdevelopment.com/Business>.

from the Innovation Acceleration Fund, and Swine Tech \$100,000 from the Development Fund.

Iowa supports innovators through its tax code as well. There is a R&D tax credit, investment tax credit, a credit for venture capital investment, high quality jobs program and innovation fund tax credit.

Co-working is strongly supported across the state with over 20 locations across the state. Many of the co-working facilities are part of the **Iowa Coworking Collaborative**.

In Cedar Rapids, there is the **Iowa Start-up Accelerator**, run by NewBoCo, which invests up to \$250,000 in its cohort companies, as well as four other “accelerators” and eight incubators, including those at ISU and University of Northern Iowa for students. The **Entrepreneurial Development Center (EDC)**, started in 2003 in Cedar Rapids as well, is a community-sponsored non-profit that connects entrepreneurs with qualified local and state resources and provides hands-on business assistance. Founded by and run by Curtis Nelson, a successful entrepreneur and angel investor himself, the EDC has assisted over 800 Iowa-headquartered businesses.

Des Moines itself provides significant local support for start-ups, and is considered the second most supportive location for entrepreneurs (after Ames) according to a 2017 ranking of “Silicon Prairie” Hot Spots. Activities include weekly One Million Cups meetings (starting in 2012), and more recently, monthly events such as DM Start-up Drinks, Open Co-working at Gravitate, Gravitate Happy Hour, Start-up Sister, and Tech Brew. The annual Accelerate DSM is a full-day conference focused on entrepreneurship and start-ups.

The Greater Des Moines Partnership started an entrepreneurial support organization, **SquareOne DSM**, in 2007. This is a program that helps start-ups develop business models, connect with investors and raise capital. SquareOne DSM also runs **Plains Angels**, a group of Midwest-based entrepreneurial investors.

A Rich Agbioscience Ecosystem

The Midwest has a strong concentration of public and private entities focused on agricultural technologies and agbiosciences, including land-grant universities and agricultural-related businesses. **Cultivation Corridor**, with offices in Ames and Des Moines, is a public-private partnership (funded with an original budget of \$700,000) whose objective is to attract investment, talent and research in agricultural bioscience and technology to the region.^{5,6} The Corridor, founded in 2014, has backing from the Ames Chamber of Commerce, Iowa State University, the Greater Des Moines Partnership and several private sector companies.

The Cultivation Corridor has to date focused on three major initiatives: the completion of the Iowa Ag/Bioscience Asset Portal (an asset inventory); helping establish the Agritech Accelerator; and advocating for the Biorenewable Chemical Tax Credit. According to the most recent 2016-17 Annual Report, the organization claims credit for the establishment of 883 new jobs, 25 location or expansions of agbioscience companies, and \$737 million in new capital investment.

⁵ <http://www.cultivationcorridor.org>.

⁶ <https://www.desmoinesregister.com/story/money/business/2015/07/10/cultivation-corridor-bioscience-agriculture/29979801/>.

A large number of agbioscience research-focused entities are part of the innovation ecosystem in the Des Moines region, and many are located in the Iowa State University Research Park.

- Ag Leader Technology
- Ames Laboratory
- BASF Plant Science LLC
- Boehringer Ingelheim Vet Medica
- Bridgestone Firestone Ag Tire Division
- Center for Bioplastics and Biocomposites, a National Science Foundation (NSF) Industry-University Cooperative Research Center (IURCC)
- Dupont Pioneer Innovation Center
- Harrisvaccine (now part of Merck Animal Health)
- John Deere Intelligent Solutions Group
- Kemin Industries
- Kent
- Monsanto Learning Center
- USDA National Animal Disease Center
- NSF Engineering Research Center for Biorenewable Chemicals
- Renewable Energy Group
- Bioeconomy Institute
- World Food Prize
- Vermeer Manufacturing

Central to the agbioscience ecosystem is Iowa State University in Ames. Its **College of Agriculture and Life Sciences** is one of the world's leading institutions of agriculture, with more than 160 years of leadership in science, education and extension. The college ranked in the top four percent worldwide among 301 institutions for the past five years and has ranked among the top 10 for four of the past six years.⁷ In addition, the College of Veterinary Medicine is a globally recognized center of research into animal vaccines.

Technology Transfer at Iowa State is increasingly focused on start-ups in agriculture. Around 25% of Iowa State disclosures and roughly one-third of all patents are concentrated in biosciences and agriculture. According to the National Academy of Inventors, Iowa State is 83rd in patents awarded and compares to these other institutions in some of the profiled regions: Purdue University (17th), University of North Carolina (26th), Indiana University (54th), Washington University (74th) and North Carolina State University (90th). In FY 2017, ten companies started from Iowa State licensed technology, up from two in FY 2013.⁸

Agbiosciences and Entrepreneurship in the Des Moines Area

In Des Moines and nearby Ames, focused programs to develop the agbioscience entrepreneurial ecosystem are relatively new, encompassing:

- Iowa State University's Agriculture Entrepreneurship Initiative;
- Iowa State University Research Park's Agriculture Start-up Engine; and
- Iowa Agritech Accelerator.

⁷ <https://www.topuniversities.com/university-rankings/university-subject-rankings/2016/agriculture-forestry>.

⁸ <http://techtransfer.iastate.edu>.

Iowa State's **Agriculture Entrepreneurship Initiative** was founded in 2005, and primarily targets undergraduate students.⁹ It was started because at least 20% of agriculture grads from Iowa State between 1982 and 2006 created at least one business and 10,000 jobs in total. Around 200 students take the Entrepreneurship in Agriculture course each year. At any one time, there are between 15-25 student-led companies in the incubator.

The **Agriculture Start-up Engine (ASE)** located at the Iowa State University Research Park has a deep pool of mentors available as well as early seed round investments of \$25,000 to \$50,000.¹⁰ It is a private effort started in 2016 to fund agtech entrepreneurs and help them to succeed. Entrepreneurs are typically faculty, students or alumni of Iowa State. ASE works in tandem with the Iowa State Start-up Factory, Iowa State Pappajohn Center, and the Iowa State Agricultural Entrepreneurship Initiative around agriculture-centric ventures.

The **Iowa AgriTech Accelerator** is a mentor-led program launched by the Greater Des Moines Partnership and Cultivation Corridor in Des Moines two years ago.¹¹ This is a 100-day program that features “dozens of mentors” and \$40,000 seed funding for participants. The Iowa program attracts entrepreneurs from around the world. The five companies in the 2018 cohort are from Iowa, Michigan, Maryland, Minnesota and Nigeria. In 2017, there were four companies from California, Indiana, Kansas and one from Iowa.

Because the AgriTech Accelerator operates under the Des Moines Partnership umbrella, it is difficult to obtain detailed figures on its budget and expenses. The presence of major corporate partners involved with the accelerator suggests some reliance on corporate contributions. At the national level, funding patterns for accelerators can vary tremendously, depending on the organization's business model and the scale and scope of its investment activities. National benchmarks find that most U.S. accelerator programs are new, with few employees, and average annual budgets below \$500,000.¹² Outside funding typically comes from a variety of sources, including government grants, angel investors and venture capitalists, and corporate donations or partnerships. The AgriTech Accelerator's limited history and scope to date suggest that it likely operates with a similar level of staff and resources.

Assessment and Lessons Learned

- Strong research isn't enough.

While Iowa State's academic and research strengths related to agbioscience, in both plant-based agriculture and animal health, are significant, these have not yet translated into start-ups. TEconomy's 2017 assessment of the Iowa's Biosciences sector, specifically opportunities in precision and digital agriculture, vaccines and immunotherapies, suggests the need to “build intent and momentum among faculty to advance innovations”.¹³ The study identified the importance of the new USDA National Animal Disease Center (located in the Iowa State University Research Park), but also noted that building on this competitive

⁹ https://smallbusiness.house.gov/uploadedfiles/2-15-18_kimle_testimony.pdf.

¹⁰ <https://www.agstartupengine.com/about>.

¹¹ <https://agiowa.com/contact/>.

¹² Federal Research Division, Library of Congress. “Evaluating the U.S. Small Business Administration's Growth Accelerator Fund Competition,” February 2018, pp. 51-52. Available at: https://www.loc.gov/rr/frd/pdf-files/SBA_Accelerators.pdf.

¹³ https://www.iowaeconomicdevelopment.com/userdocs/news/IABIO_Report_122017.pdf.

asset will require deeper collaboration among government, industry and university researchers.

- Venture capital often lags.

Although Iowa offers government grants for the commercialization of new products and services, consistent with national practice, and several angel groups and venture capitalists operate in the state, local firms do not attract much outside investment, especially for agbioscience. Few Iowa bioscience firms have won SBIR grants, an important precursor for equity capital for science-based start-ups, and fewer than five agbioscience start-ups have gained outside equity funding. Most of these firms are located in Ames as opposed to Des Moines.

- Investment in student entrepreneurs, especially in agriculture, is a long-term strategy.

In the two decades since John Pappajohn first invested in student entrepreneurship at five Iowa universities and colleges, and a decade after the establishment of the Agricultural Entrepreneurship Initiative at Iowa State, the number of start-up firms in the sector remains low. For example, the AgriTech Accelerator, has attracted only two entrepreneurs from Iowa among its first ten companies.

- Less than robust and consistent state support for science and technology-based economic development and entrepreneurship is a signal for investors.¹⁴

Iowa's level of public investment in economic development programs, other than for the attraction of large corporations, is relatively low when compared to other states and regions. Iowa, like ten or so other states, has changed its organizational structure for economic development to a quasi-public organization. At the same time, the Iowa Innovation Corporation has experienced a revolving door at the CEO position, as well as an unclear mandate and relationship with the broader economic development community. The most recent decision to change the Iowa Innovation Corporation to the Iowa Biosciences Corporation signals a future focus on elements of agbioscience, but Iowa is clearly a latecomer to the world of science and technology-based economic development characteristic of thriving tech economies like North Carolina and Missouri.

Research Triangle, North Carolina

Sixty years ago, the region now known as the Research Triangle was largely pine forest and tobacco fields. The three towns of Raleigh, Durham and Chapel Hill were sleepy places, but home to three great universities: Duke University, the University of North Carolina at Chapel Hill, and the land-grant, North Carolina State University (NC State).

The North Carolina economy was reliant on three traditional industries at that time: furniture, textiles and tobacco. The furniture industry was leaving in the post-World War II period, textiles were also facing growing competition from Asia, and tobacco manufacturing employment was declining due to both increased automation and declining demand.

¹⁴ <https://businessrecord.com/Content/Tech-Innovation/Technology/Article/IICorp-seeks-new-CEO-to-establish-biosciences-center/172/834/83248>.

Business, industrial and educational leaders in North Carolina in the late 1950s saw the need to diversify the economy and reverse an outmigration of young people. And, so began an ambitious effort to develop a research park known as Research Triangle Park (RTP), a name now synonymous with the region encompassing the three surrounding towns as well.¹⁵

Today, RTP is home to over 250 companies employing more than 50,000 people and producing over 3,000 patents to date. The vision that a place focusing the intellectual power of three major universities in collaboration with research entities from government and the private sector has been wildly successful.¹⁶

But, the success of RTP is only half of the story. The spillover effect of RTP on the surrounding region has also been profound. In 2017, the Raleigh Metropolitan Statistical Area was ranked the second-best performing economy in the country by the Milken Institute.¹⁷ This strong showing was attributed to the strength of the high-technology sector in the region, anchored by North Carolina State and its Centennial Campus as well as the Park itself. Employment in the large metropolitan areas in North Carolina (predominately Raleigh and Charlotte) has grown at twice the national rate, 13.6% versus 6.6%, since their pre-Great Recession employment peak in 2007.¹⁸

Within the twelve-county Research Triangle region, the major industries are: manufacturing, life sciences, information technology, logistics, cleantech and agribusiness.¹⁹ Agribusiness is significant in the region with three of the world's top plant agricultural biotechnology firms operating here: BASF, Bayer Crop Science (acquired Monsanto) and Syngenta. Other notable biotechnology firms include Novozymes, Edison Agrosiences and Agile Sciences.

These companies are embedded in a rich statewide agricultural economy. Agriculture and agribusiness contribute \$76 billion to the North Carolina economy and generate 633,000 jobs.²⁰ In North Carolina, there are 49,500 farms and 8.4 million acres under cultivation. About half of the state's agricultural sector is in livestock (mostly turkeys and hogs) and the other half in a very diversified set of commodities. Among U.S. states, North Carolina ranks:

- #1 in sweet potatoes
- #2 in turkeys, hogs and pigs
- #3 in cucumbers, pickles and strawberries
- #4 in broilers and upland cotton
- #6 in peanuts, tomatoes, cabbage and Burley tobacco
- #7 in blueberries
- #8 in watermelons and apples
- #9 in squash and grapes.

¹⁵ Link, A.N. 1995. *A Generosity of Spirit: The Early History of the Research Triangle Park*. Durham, NC: Research Triangle Park Foundation of North Carolina.

¹⁶ <https://www.rtp.org>.

¹⁷ <https://assets1b.milkeninstitute.org/assets/Publication/ResearchReport/PDF/best-performing-cities-report-2017-1.pdf>.

¹⁸ North Carolina Department of Commerce, Labor and Economic Analysis. <https://www.nccommerce.com/lead/research-publications/the-lead-feed/artmid/11056/articleid/334/the-geography-of-job-growth-in-north-carolina>.

¹⁹ <https://www.rtp.org>.

²⁰ North Carolina State University, College of Agriculture and Life Sciences, https://www.ces.ncsu.edu/wp-content/uploads/2017/01/NC-Agriculture-Economic-Pocket-Guide_NC-State-CALS.pdf?fwd=no.

North Carolina is also home to a significant food processing industry with close to 1,000 firms employing 62,500 workers. Significant employers include Tyson, Butterball, Smithfield, Campbell's, Snyder's-Lance and Texas Pete.²¹ The North Carolina Department of Commerce, through the Economic Development Partnership of North Carolina, focuses on food processing and manufacturing as a targeted sector. Supporting initiatives include:

North Carolina Food Manufacturing Task Force

Established in 2014, North Carolina's Food Manufacturing Task Force works to expand agriculture-based businesses through food processing and manufacturing. The initiative is part of Governor McCrory's efforts to diversify and add value to North Carolina's food manufacturing industry. The task force recruits, supports and fosters growth within the industry.

North Carolina Cooperative Extension

As part of the national Cooperative Extension programs, North Carolina State University and North Carolina A&T State University support agricultural extension services across the state. Agricultural specialists assist with in-field research and provide educational programs and research-based information to both the agricultural community and the general public.

North Carolina Department of Agriculture and Consumer Services

The North Carolina Department of Agriculture and Consumer Services (NCDA&CS) operates research and support facilities across the state. The organization provides agribusiness development services for food-related businesses, including initiatives such as "Got to Be NC," a marketing program meant to increase visibility of North Carolina products.

North Carolina A&T University's Center for Excellence in Post-Harvest Technologies

The Center for Excellence in Post-Harvest Technologies (CEPHT) fosters interdisciplinary research in post-harvest technologies such as functional food R&D, shelf-life extension, food packaging and food process engineering.

History of Ecosystem Building in the Research Triangle

Although RTP is dominated by large corporations, many regional success stories, such as technology firms Red Hat and SAS have entrepreneurial roots. And, the significant research performed at the three dominant universities and large corporate research centers has helped sustain a vibrant start-up community, especially in life sciences and information technology.

In 2017, entrepreneurs in North Carolina raised over \$1 billion in new venture capital, and deals totaling \$408 million were also completed in the Triangle. Life sciences and technology dominated, but deals were well distributed by stage and size. There were 30 exits statewide in, and roughly 50% of investors came from within the state.²²

The year before, 2016, the HALO Report which analyzes investment activities of U.S. angel investors ranked RTP Capital, a local angel group, as one of the most active in the Southeast.²³ Duke University announced a new angel group made up of alumni (<https://dukeangelnetwork.duke.edu>), and both University of North Carolina – Chapel Hill

²¹ <https://edpnc.com/industries/food-processing-manufacturing/>.

²² <https://cednc.org/innovatorsreport/pdfs/2017InnovatorsReport.pdf?v=20180305>.

²³ <https://angelresourceinstitute.org/research/report.php?report=106&name=2016%20Annual%20Halo%20Report>.

(<https://www.carolinaangelnetwork.com>) and North Carolina State (<https://research.ncsu.edu/win/>) have followed suit.

These results owe much to two important elements of the region's entrepreneurial ecosystem that were founded over thirty years ago. The primary resource for entrepreneurs in the Triangle (and statewide) is the **Council for Entrepreneurial Development (CED)**. As one of the largest entrepreneurial membership organizations in the country, CED engages and connects a wide range of entrepreneurial companies, maturing enterprises, corporate partners, investors, academics, service providers and other organizations interested in entrepreneurship. Programming includes Connections to Capital, Venture Mentoring, and signature conferences that empower member companies to go further faster.

CED began operations in 1984, with support from the region's legal and consulting communities. It operated with a small staff and shoestring budget for many years. It initially provided networking and training programs and has since added a host of new offerings and initiatives. CED has historically operated without any funding from local, state or federal government agencies, instead relying on a mix of dues, contributions, and fees for service to fund its programming. In 2017, CED operated with a budget of nearly \$1.2 million in funding with contributions and dues accounting for approximately 70% and program revenues the remaining 30%.

The other essential entrepreneurial resource is the **NC Biotechnology Center (NCBiotech)**. Funded by the North Carolina General Assembly for over three decades, the mission of NCBiotech is to accelerate the life sciences sector in the state through innovation, commercialization, education and business growth. For instance, in 2016-17, NCBiotech awarded \$4.2 million in loans to 17 young companies, helping them develop and commercialize products and technologies, and positioning them for follow-on investments from other sources.²⁴ In addition, NCBiotech hosts a large number of events and scientific and regional networking groups within the industry, all designed to increase the density of connections among participants. NCBiotech is slated to receive roughly \$14 million in state funding for FY 2018-2019.

Co-working centers are a more recent addition to the ecosystem. (Various incubators have been active over the years, but lost state funding in the mid-2000s). Many of these spaces operate in former manufacturing centers. For example, Durham's American Underground is housed at the former American Tobacco company campus. It is now operated in four locations, reporting over 275 participating companies with 608 new jobs created. Significantly, 48% of these firms were led by minority or women entrepreneurs, helping to address the diversity challenge facing the region.²⁵ Durham is also home to the relatively new **LaunchBio** business accelerator, focused on biotechnology and life science companies.

While still attracting less venture capital than California, Massachusetts or New York, the Triangle has garnered a significant amount of new capital, with over \$1 billion invested last year. Multiple venture and angel groups are headquartered in the region, and all three universities have created alumni angel groups in the last few years.

Agbioscience Entrepreneurial Ecosystem in the Triangle

There is a substantial community of agbioscience and agtech entrepreneurs in the Triangle, with close to 40 companies listed by Crunchbase as operating in agriculture, farming, food

²⁴ https://www.ncbiotech.org/sites/default/files/inline-files/NCBiotech-Annual-Report_2016-17.pdf.

²⁵ <https://americanunderground.com/why/>.

and food manufacturing. These range from AgBiome, a leading company in biological pesticides, that just received a significant Series C round, to start-ups like Foosye, that has developed a food truck app. Of 11 North Carolina companies that have received agbioscience-related SBIR awards in the past five years, six are based in the Triangle.

A unique asset for agbioscience entrepreneurs is the **AgTech Accelerator™** a start-up accelerator focused on discovering and developing emerging agricultural technology companies. Unlike other incubators that cross multiple industries or use a volume-oriented crowd-funding approach, AgTech Accelerator™ is hands-on and directly manages investments in select start-ups in-house. This approach leverages the same experienced management team, advisory board and board of directors across multiple opportunities, removing common business development hurdles faced by science start-ups. Located in a new building in RTP, and funded in large part by Elanco and Syngenta, the AgTech Accelerator has invested in three companies in its two years of existence: Borgen, Skyline Vet Pharma and Vindara.

NCBiotech has a specific program to support agbiosciences companies, but it also relies on the programming provided by CED and its broader funding offerings to support entrepreneurs. The **Agriculture Sector Development** team does recruiting, talent development, events for small companies, and crop commercialization (problem solving) for the sector. Recruiting is an especially big focus area. They look for 10-15-person companies, primarily in the plant/crop sector, who want to come to the United States to grow or expand their businesses.

The Agriculture team at NCBiotech also coordinates research projects of interest to the entire industry and manages the projects on behalf of a number of universities, industry players, and in some cases, regional projects with Virginia and South Carolina. For example, they have a \$1.87 million federal grant from the USDA's National Institute of Food and Agriculture (NIFA) and the U. S. Department of Energy (DOE) to develop new feeds for chicken and pigs. The project includes North Carolina State, Virginia Tech, University of Maryland, and swine and seed companies. The pork and sorghum commodity groups also provided matching funding.²⁶

There are many universities in the Research Triangle, including Duke University and the University of North Carolina-Chapel Hill. However, North Carolina State is the key player in agbiosciences as the land-grant university for the state. The College of Agriculture and Life Sciences (CALs) educates, performs cutting edge research, and communicates its knowledge to the community. With 18 research stations across the state as well as at its main campus location, CALs performs significant agricultural research. And, with Cooperative Extension offices in all 100 counties in North Carolina, CALs can reach out across the state.

Strategically, CALs recognizes its core missions of education, research and service, but has also adopted these broader societal themes:

1. Enhancing the production, quality, accessibility and profitability of food, plant, animal and bioenergy products for North Carolina, the nation and the world;
2. Ensuring environmental stewardship and sustainability of air, land, soil and water resources;
3. Creating a food supply that is safe, secure, healthy, affordable and of high quality;

²⁶ <https://www.ncbiotech.org/news/187m-grant-lets-ncbiotech-lead-se-sorghum-initiative>.

4. Improving human health and well-being for individuals, families and communities; and
5. Preparing students and stakeholders for leadership and success in the global workforce.

In addition, the North Carolina State research park, **Centennial Campus**, is a national hub for education, innovation and public-private partnership. It is a place where North Carolina State students and faculty live, work and learn alongside leaders in industry. It is a proving ground for new ideas and new businesses. And, it is launching pad for the university's mission: creating prosperity across North Carolina and the nation. It is home to three of North Carolina State's colleges, many thousands of students and numerous university research centers, institutes, laboratories and departments. Each of the companies, agencies and nonprofits housed on Centennial Campus has programmatic connections to the university.

Centennial Campus operates as both a science and research park, and as an educational campus. It is housed on government-donated land adjacent to the main North Carolina State campus. It hosts about sixty companies which operate in their own buildings or in facilities leased from the university. Overall campus development was financed via a mix of state funds, university revenue bonds, and private funds.

A major new initiative, **The North Carolina Plant Sciences Initiative (PSI)** is among the College's efforts to enhance scholarship and research, with the goal of making North Carolina the global leader in plant sciences. This initiative is receiving significant public attention and has secured extensive funding from the North Carolina General Assembly. The project is slated to operate with an initial \$160 million in funding. Major contributions include a \$45 million grant from the Golden Leaf Foundation (created by North Carolina's tobacco settlement funds), \$85 million in state-backed bonds and \$9 million from a coalition of 42 agriculture groups operating in the state. A new program director was recently hired, and groundbreaking for a new Plant Sciences Research Complex (at the Centennial Campus) is projected for early 2019.

Centennial Campus is also home to the university's Office of Technology Commercialization and New Ventures. North Carolina State was recently ranked by Milken Institute as one of the top 25 universities for technology transfer, coming in right in the 25th spot.²⁷ The university launched 15 start-ups in 2017, with 57 total over the past five years. In FY 2017, three of the start-ups came out of CALS and were focused on agbioscience and food production.

Assessment and Lessons Learned

- Compared to Indiana (and indeed many places), the Research Triangle has a more robust entrepreneurial ecosystem.

It has been developing for over thirty years and is supported by two strong networks: the CED and NCBiotech. In addition, the strength of the university systems in the region and the large number of major employers with research capacity means that there is a ready and highly educated workforce and significant intellectual capital available.

²⁷ (For reference, Purdue University was ranked number 12.)

<https://assets1b.milkeninstitute.org/assets/Publication/ResearchReport/PDF/Concept2Commercialization-MR19-WEB.pdf>

- The agbioscience sector is small because life sciences and IT are dominant in the region. However, the strength of the overall ecosystem and the natural advantages of North Carolina's business climate, location, and critical mass appear to have contributed to a strong sector.

Dozens of companies have grown from start-ups to significant employers over the past ten years, and the pipeline appears to be robust. Agbioscience-specific support organizations include the Agricultural Science Sector team at NCBiotech and the private AgTech Accelerator.

- North Carolina State University, CALS and Centennial Campus all contribute to the sector, and the University's strength in technology transfer and focus on start-ups continue to accelerate.

Centennial Campus, in particular, with its co-location of existing agriculture companies and start-ups with research capabilities, is a huge asset. And, the new Plant Science Initiative has the potential to take the region to the next level. Like the Iowa State University Research Park and Purdue University's Research Park, Centennial Campus is a magnet for technology and innovation-based employers. Centennial Campus, however, has the extra benefit of being located immediately in the Raleigh metropolitan area, rather than being 40-50 miles away.

St. Louis, Missouri

St. Louis has served as an important economic engine for the United States for much of the country's history. It was the jumping-off point for Lewis and Clark, and it has been a center of manufacturing and a major transportation and logistics hub ever since. Like other U.S. manufacturing centers, St. Louis has faced decades of de-population and industry job loss, yet it remains an important economic anchor for the Midwest, currently ranking 22nd in the United States in terms of gross metropolitan product.

While the regional economy has stabilized, St. Louis still faces many challenges including racial divides that flared in the 2014 unrest in Ferguson, Missouri. Yet, at the same time, promising developments are generating local optimism. These include a thriving biotech sector, world-class universities, and a booming innovation district known as the **Cortex Innovation Community**.²⁸

History of Ecosystem Building

As St. Louis' community leaders invested in efforts to stem industrial decline and to diversify the regional economy, they actively embraced a wide range of strategies to promote entrepreneurial development. Conscious and focused efforts to develop a more robust ecosystem gained traction in the late 1990s. These efforts were able to build on some important legacies, including St. Louis' strengths in key sectors like manufacturing and advertising and strong local universities with entrepreneurship programs in place. In addition, the region was home to a strong physical infrastructure of business incubators,

²⁸ Wagner, J. 2016. "In St. Louis, a Gateway to Innovation and Inclusion," Metropolitan Revolution blog (Brookings Institution), May 5, 2016. Available at: <https://www.brookings.edu/blog/metropolitan-revolution/2016/05/05/in-st-louis-a-gateway-to-innovation-and-inclusion/>.

many of which were developed in response to major local defense downsizing in the early 1990s.

At this time, regional leaders supported major investments to develop a life sciences cluster that capitalized on local assets such as the presence of Monsanto and a world class research institution at Washington University. Other programs focused directly on building an entrepreneurial culture, such as Innovate St. Louis and Washington University's Skandalaris Center, also emerged during this period. In 2001, the **Danforth Plant Science Center** was founded. Ever since, it has served as an anchor for connecting agriculture and plant sciences to ongoing regional economic development efforts. The [Cortex Innovation Community](#) and the Biogenerator program were also founded at this time.

By the late 2000s, these initial investments were bearing fruit, leading to a boomlet in new entrepreneurship efforts. In fact, many of the key ecosystem players were founded in this era between 2011 and 2013.²⁹ The **Arch Grants** played an important role in this evolution. This program provided small grants of up to \$50,000 for start-ups that agreed to launch their businesses in St. Louis. At the same time, the region kicked off a major investment program, known as the **Regional Entrepreneurship Initiative**, with the goal of making St. Louis into a top ten location for entrepreneurs in the United States.³⁰ The makings of a vibrant ecosystem were in place.

Recent Developments

Due to the local presence of Monsanto (now Bayer Crop Science) and a number of other core assets, St. Louis has always hosted a strong base of agbioscience expertise and resources. The region's most notable recent shift has been the development of a strong entrepreneurial ecosystem to accompany these historic competitive advantages.

Between 2013 and 2015, the region entered a period that Ken Harrington, former director of Washington University's Skandalaris Center for Interdisciplinary Innovation and Entrepreneurship, has referred to as, "ecosystem scaling", where entrepreneur development continues to expand and diversify.³¹ A host of new initiatives sprung up. Not all of these efforts succeeded, but they were indicators of a fertile and nurturing landscape for innovation among entrepreneurs and among policy makers, as well.

This period of "ecosystem scaling" included a number of highlights. First, traditional players in economic and community development, such as local universities and the Missouri Department of Economic Development, expanded their investments in entrepreneurship and innovation-focused programs.

Second, conscious efforts to diversify the regional pipeline for entrepreneurs emerged at the grassroots level. These included programs to encourage minority and immigrant entrepreneurs. Around the region, the **St. Louis Mosaic Project** sought to create a more immigrant-friendly environment. Student entrepreneurs were engaged through efforts like

²⁹ Motoyama, Y. and Watkins, K.K. 2014. "Examining the Connections within a Startup Ecosystem: The Case of St. Louis," Kauffman Foundation Research Study; Harrington, K. 2016. "Is your Ecosystem Scaling?" *Innovations Journal*. 11:1-2, pp. 137-8.

³⁰ St. Louis Regional Council. 2013. *St. Louis Regional Entrepreneurship Initiative Report*. Available at: <https://www.scribd.com/document/148439173/St-Louis-Regional-Entrepreneurship-Initiative-Report-Seeks-to-Reach-Immigrants-Minorities>.

³¹ Harrington, *op. cit.*, p. 138.

Idea Labs, a Washington University incubator to help commercialize student ideas.³² This student-run program was so successful that it has expanded to multiple locations around the United States and has even developed new partnerships with the American Medical Association.

Third, St. Louis entrepreneurs and related support organizations expanded their horizons to think bigger and build connections on a regional, national and global basis. **BioSTL** was formally chartered in 2011, spinning out of the local Coalition for Life and Plant Sciences that had operated since 2001. The new organization embraced the Coalition's previous work, but also included a much stronger commitment to supporting pre-seed and seed investments and new company formation. It also sought to expand the regions global presence via events like the Ag Innovation Showcase and Global StL, an initiative to attract high-growth international companies to St. Louis. This latter effort has been especially successful with agbioscience-focused firms, and has recently attracted five Israeli firms to locate in the region.

BioSTL is an independent 501(c)(3) non-profit that operates with an annual budget of approximately \$7 million, and was originally chartered with a \$30 million investment from Washington University, BJC Healthcare and other local partners. It is managed by a board of trustees and also operates with a large (45 member) advisory board, the BioSTL Coalition.³³

Finally, St. Louis has combined programmatic innovations with investments in physical infrastructure. Cortex is internationally recognized as a leading innovation district and as a model for locales around the world. First envisioned in 2002, it now hosts more than 250 companies that support more than 4,200 technology-related jobs. Cortex's success has spawned local interest in developing additional innovation districts, including **39 North**, a major new agtech focused innovation district. Development of 39 North has been supported with federal, state, and local funding. When build-out is complete, the district will be anchored by the Danforth Center, the headquarters of Bunge North America, and the Helix Center Biotech Incubator. This district will then extend along a corridor that links to other agricultural resources, including the Missouri Botanical Garden and the University of Missouri.

Cortex and related projects were first developed by a consortium that included St. Louis University, the University of Missouri-St. Louis, Washington University, and other partners.³⁴ The initial planning and funding included more than \$20 million in funds for planning and land acquisition, along with a variety of state and local tax credits. In 2012, the area was approved as a Tax Increment Financing District, allowing Cortex to access around \$168 million in public funds for further build-out and development. These funds have helped to spark a more recent wave of development, including new facilities and a host of other infrastructure improvements.

The Danforth Plant Science Center currently operates with an annual budget of roughly \$30 million (2017). Revenues are generated from a mix of sources, with the largest shares coming from research grants and contracts and from endowment funds. Since the Center

³² Now known as SlingHealth. To learn more, visit <http://slinghealth.org/about.html>

³³ Initiative for a Competitive Inner City. 2017. "Building Strong Clusters for Strong Urban Economies." pp.5-6. Available at: http://icic.org/wp-content/uploads/2017/06/JPMC-Cluster-Report_Building-Strong-Clusters_FINAL_v2.pdf

³⁴ For background, see <https://media.bizj.us/view/img/10106030/cortex-innovation-community-1.pdf>

was first founded in 1998, the now-defunct Danforth Foundation has been its largest backer. Between 1998 and 2011, the Foundation invested \$226 million to support the Center’s creation and subsequent operations.

Today, St. Louis is widely recognized as a leader in agbioscience innovation and entrepreneurship, with a host of resources and organizations anchoring the region’s agtech and food ecosystem (see **Figure 2**). Interviewees noted a few areas where gaps exist in the current ecosystem, especially in later stage investment vehicles and in the region’s capacities to attract and retain a diverse mix of entrepreneurs and executive talent. Nonetheless, most of the key resources to support an entrepreneur—in agtech or other sectors—through business development process are in place. In the course of 10-15 years, the St. Louis agbiosciences innovation community has undergone a tremendous and impressive evolution.

Figure 2. The St. Louis AgTech and Food Ecosystem



Source: Global STL

Within this ecosystem, the St. Louis region has supported development of a several unique assets related to the agbiosciences. There is no single industry cluster advocate akin to AgriNovus, but prominent organizations and convenings include:

- [Ag Innovation Showcase](#): Celebrating its tenth anniversary in September, this event brings the world’s leading agbioscience innovators to St. Louis every year to share ideas and network with one another.
- [Agri Business Club](#): Important networking group for those working in ag-related sectors.
- [Biogenerator](#): The investment arm of BioSTL, Biogenerator provides grants and equity investments, along with coaching and mentoring, to area life sciences and agtech firms.
- [BRDG Park/Helix Incubator](#): The science park and facilities associated with the Danforth Center. They are currently home to ten firms using the facilities’ specialized equipment and lab spaces.

- [Cultivation Capital](#): Local venture capital firm that has invested in Missouri-based technology ventures since 2012.
- [Danforth Plant Science Center](#): A major driver of the regional ecosystem, the Center is home to leading researchers working in fields such as bioenergy, crop improvement, genomics and plant-environment interactions.
- [YieldLab](#): Agtech focused accelerator program operating in St. Louis, in partnership with Cultivation Capital.

Assessment and Lessons Learned

The evolution of the St. Louis regional ecosystem offers a number of potential lessons learned for similar work in Indiana and beyond.

- Research excellence matters.

St. Louis' success in ecosystem building did not emerge out of thin air. To a large extent, it emerged from a strong science and research base built by local companies and universities that was further strengthened by more recent investments such as the Danforth Plant Science Center. In many ways, the Danforth Center is the spiritual heart of the St. Louis agbioscience ecosystem. It is the primary magnet to attract world-class researchers and start-ups to the region. It is the core anchor for the 39 North District, and also supports many of the ecosystem's most important programs, such as the Ag Innovation Showcase.

- Physical hubs matter.

The concept of innovation districts has gained much public attention in recent years. Locations like Cambridge's Kendall Square and Cortex have shown that companies and workers can thrive in denser mixed-use neighborhoods where talent, amenities, and networks are closely clustered. The development of 39 North is intended to generate similar synergies for the St. Louis agbioscience cluster. Development of the 16 Tech District in Indianapolis will also embrace this approach.

- Financing is necessary but not sufficient.

Capital has not served as a major impediment for the development of the regional ecosystem and the new ventures operating within it. A number of local venture funds were developed in the late 1990s and early 2000s, but these investors found limited opportunities to back local companies. Faced with this challenge, ecosystem partners expanded their focus on building the pipeline, i.e., on helping more local people start companies and to turn their business ideas into viable and successful companies.

These pipeline building efforts proved very successful. They not only helped build a stronger base of local entrepreneurs, but they also helped to spawn and attract new capital sources to the region. These include more recent ventures such YieldLab, Lewis and Clark Ventures, the iSelect Fund, and others.

- Embrace experimentation.

The early development of the St. Louis entrepreneurial ecosystem was accompanied by a constant tension. Should the development of new initiatives be driven by top-down planning or by experimentation and improvisation? As Harrington of the Skandalaris Center further notes, local leaders opted to embrace both strategies. They developed top down plans but

did not seek to squash new initiatives or programs.³⁵ The result was a messy mix of dozens of initiatives that promised to be the “next big thing” for entrepreneurship in St. Louis. Many of these efforts failed to live up to the hype, but experimentation allowed for the testing of new ideas and the refining and strengthening of successful programs.

- Think global.

St. Louis and its agbioscience ecosystem suffer from a lack of diversity. Women and minority entrepreneurs are underrepresented, and the region has not traditionally served as a major landing sport for immigrant entrepreneurs. Community leaders recognized these gaps from the start, and ecosystem building efforts have long been accompanied by strategies to be more inclusive. The Mosaic Project has targeted immigrant entrepreneurs, and programs like BioSTL’s Inclusion Initiative are reaching out to minority and women entrepreneurs. Meanwhile, efforts like Global StL and the World Trade Center St. Louis work to attract foreign investment and to help local firms do more business overseas.

Pittsburgh, Pennsylvania

Most of America’s major industrial centers underwent wrenching economic dislocations in the 1970s and 1980s, but few places were as hard hit as Pittsburgh. Between 1980 and 1985, Southwestern Pennsylvania lost 44% of its manufacturing jobs, and, over the course of the 1980s, Pittsburgh’s population declined by more than 8%—the steepest decline faced by any U.S. major metropolitan area over this time period.³⁶

This overwhelming economic devastation led to extensive public debate and discussions, and an active search for new economic development strategies that could better prepare Pittsburgh for the new economy.³⁷ A number of different strategies and approaches, such as the Allegheny Conference’s Strategy 21, were developed, most of which shared a focus on high-technology development as the key to creating a new “post-industrial” Pittsburgh.

These strategies were designed to capitalize on the strong technology assets present in Pittsburgh in the form of excellent universities, deep pools of technical talent, world-class hospitals and medical facilities, and major corporate headquarters operations. Much of Pittsburgh’s core technology and innovation infrastructure, such as the Pittsburgh Technology Council, Carnegie Mellon University’s Software Engineering Institute, and the Benjamin Franklin Technology Partnership programs (the Pittsburgh operation is now known as Innovation Works) was started at this time.

History of Ecosystem Building

Since the 1980s, the Pittsburgh region has aggressively embraced technology-based economic development strategies, designed to help move the region “from metals to minds.” And, by most accounts, these efforts have been highly successful, and Pittsburgh is touted around the world as a model for industrial revitalization and resurgence.

³⁵ Harrington, *op cit.*

³⁶ Briem, C. 2014. “How many People Left Pittsburgh during the 1980s?” *Pittsburgh Economic Quarterly*.

³⁷ For background, see Ward, A.D. 2016. *Beyond Rust: Metropolitan Pittsburgh and the Fate of Industrial America*. University of Pennsylvania Press.

Over time, Pittsburgh has re-positioned itself as a knowledge center, and it is home to a deep pool of talented workers operating in fields such as health care, software development, and advanced engineering and manufacturing. The region is seeing rapid growth in “advanced industries, i.e., high potential sectors with strong prospects for technology development and new wealth creation.”³⁸ In addition, Pittsburgh is among national leaders in its levels of university research and development spending and in the local concentration of technical workers.

On its way to becoming a center of technology development and job creation, Pittsburgh has never really become a strong center for start-ups and for high-growth entrepreneurial ventures. Speculation on the reasons for this lagging performance is something of a local growth industry. In fact, Richard Florida’s development of his creative class concept stems largely from his own experience in Pittsburgh where he wondered why the region’s world-class technical talent never spawned a new Silicon Valley.

Researchers have identified several factors that may have inhibited the development of start-ups and high-growth ventures in Pittsburgh. The overwhelming importance of major universities, especially Carnegie Mellon and the University of Pittsburgh, is often noted. These universities dominate the local technology scene and are major centers for research and development. However, they do less well in terms of technology commercialization and development. According to Brookings Institution research, local colleges and universities generate 230% of the national average for university-based R&D expenditures, yet only spin off 25% more start-ups than the national average and perform below average in patent and licensing activity.³⁹

In general, connections between universities, private industry, and the start-up community are weak. Regional areas of technical strength are not reflected in large bases of local employees or world-class companies specializing in these technical competencies. The region is not spawning a new generation of high-growth entrepreneurs, as seen in Pittsburgh’s low rankings in the 2017 Kauffman Index reports where Pittsburgh ranks last among the top 40 U.S. metropolitan areas (Indianapolis ranked #38) for start-ups, and 23rd for high-growth ventures (Indianapolis ranked # 10).⁴⁰

Unlike other regions included in this case study analysis, Pittsburgh does not have a primary focus to support firms operating in agbioscience-related sectors. However, it is home to a thriving health care and life sciences clusters, anchored by the University of Pittsburgh Medical Center (UPMC). Extensive efforts, such as the Pittsburgh Life Sciences Greenhouse, have been made to further develop these capabilities. A 2017 Brookings Institution study recommends several steps to jumpstart these sectors: the creation of a comprehensive life sciences economic development organization, akin to BioCrossroads; development of a translational research center; development of a new corporate innovation matching fund; and construction of a new life sciences-focused innovation district.⁴¹

³⁸ Andes, S., Horowitz, M., Helweg, R., and Katz, B. 2017. *Capturing the Next Economy: Pittsburgh’s Rise as a Global Innovation City*. Brookings Institution.

³⁹ Andes et al., p. 27.

⁴⁰ The 2017 Kauffman Index of Entrepreneurial Activity can be accessed at <https://www.kauffman.org/kauffman-index>

⁴¹ Andes et al., p. 34.

Recent Developments

While Pittsburgh's entrepreneurial ecosystem development has not been as successful as some observers had originally hoped, the region is home to a strong base of players and support organizations. Pittsburgh benefits from the presence of several major foundations, such as the Heinz Endowment and the Mellon Foundation, which have consistently invested major sums in a wide array of economic and community development initiatives.

In addition to foundations, other large institutions play an important role in Pittsburgh's entrepreneurial ecosystem. Carnegie-Mellon and the University of Pittsburgh (Pitt) are major players, and both schools have invested in support for innovation, entrepreneurship, and technology development. Current projects include the **LifeSciencesPittsburgh** project, Carnegie-Mellon's **Swarz Center for Entrepreneurship**, and Pitt's **Institute for Entrepreneurial Excellence**. Both schools are also partnering in a major effort to build an innovation district in Oakland, the neighborhood adjoining both schools. Pitt and Carnegie-Mellon are the largest schools in the area, but Pittsburgh benefits from more than 40 colleges and universities operating in the region.

Pittsburgh's ecosystem also benefits from strong government support at the local and state level from the Allegheny County government and the City of Pittsburgh, among others. For example, the Urban Redevelopment Authority of Pittsburgh runs a web portal for start-up companies (launchpgh.com) and a fund to invest in new companies. Similarly, the City has embraced a new strategy—**Inclusive Innovation PGH**—to encourage more minority entrepreneurship and has created an Advisory Board on Entrepreneurship and Start-ups to offer advice on improving city services and support for new businesses. Meanwhile, Innovation Works, part of the state Ben Franklin Partnership program, is one of the core nodes of the regional ecosystem. Innovation Works recently celebrated its 20th anniversary. Over this time period, its programs have invested more than \$78 million in area tech start-ups. Along the way, they have also pioneered a host of new programs, including **Alpha Labs**, one of the first U.S. accelerators, **AlphaGear Labs** (a hardware development accelerator), and **Riverfront Ventures**, one of the region's key early-stage investment funds.

These large institutional programs have counterparts in industry as well. On this front, the **Pittsburgh Technology Council** is a major force with more than 1,300 members, sponsoring numerous networking events and publications focused on the region's technology sectors. Finally, much of Pittsburgh's economic development decision-making is driven by public-private partnerships such as the **Allegheny Conference for Community Development** and its partner groups, which has operated since the 1940s. Most of these groups include a focus on innovation and entrepreneurship in their work programs.

Pittsburgh's ecosystem is not just a top-down exercise. While major institutional players are engaged, a vast array of non-profits and networks operate with a focus on start-ups, STEM talent, inclusive entrepreneurship, neighborhood development and the like.⁴² Numerous blogs, newsletters, and social media sites regularly cover the start-up and technology scenes. There is no shortage of thought and ideas about how to best build Pittsburgh's innovation economy.

In recent years, ecosystem building efforts have targeted two sets of issues. First, community leaders are heavily focused on jumpstarting the region's entrepreneurial

⁴² For a recent summation of key players, see Rabkin, B. 2018. "Your Guide to the Steel City Startup Scene," Medium, January 12, 2018. The StartNow PGH e-newsletter and blog also track new ecosystem developments.

economy. This effort, known as **InnovatePGH**, emerged in response to a 2017 Brookings Institution study, *Capturing the Next Economy: Pittsburgh's Rise as a Global Innovation City*. While much of the report was highly positive, it also noted that the region could improve in terms of supporting entrepreneurial ventures. InnovatePGH accepted this charge, and is now leading a set of strategies to build an innovation district in Oakland and to strengthen the region's automation, manufacturing, and life sciences clusters.

A second set of strategies focuses on inclusive entrepreneurship. As noted earlier, the City of Pittsburgh has aggressively supported this effort, and the Allegheny Conference has stressed inclusion in its latest strategic plan, "Creating a Next Generation Economy for All."⁴³ As in other parts of the ecosystem, a whole host of smaller initiatives focused on inclusive entrepreneurship are also at work. These include **Startable**, focused on building a diverse pool of tech talent; **Inclusive Innovation PGH**, and **Connecting Urban Entrepreneurs**, a training and technical assistance program targeting minority business owners.

Assessment and Lessons Learned

The evolution of the Pittsburgh regional ecosystem offers a number of potential lessons learned for similar work in Indiana and beyond.

- There are pros and cons with big institutions.

Pittsburgh is blessed with large—and deep-pocketed—institutions with a strong commitment to support regional economic development. Foundations and regional economic development leaders are committed to innovation, and willing to invest in core programs. Funds to support programs are in place, but they have yielded what some critics have referred to as "an unbalanced start-up ecosystem," where support programs proliferate but have limited impact on building a stronger pipeline of growth entrepreneurs.⁴⁴

- Patience is key!

Much of the essential infrastructure for robust ecosystems is already in place in Pittsburgh. The region has few major gaps in core areas such as capital, entrepreneur networks, accelerators and incubators, and the like. Pittsburgh's middling entrepreneurial performance may simply be the result of time lags, with major transformations on the way. Some observers have embraced this perspective and have flagged Pittsburgh as a tech economy on the move. For example, VentureBeat has identified Pittsburgh (and Indianapolis as well) as a "Tech Hub to Watch in 2018."⁴⁵ Similarly, 2017 was a record fundraising year for Pittsburgh area companies, which tapped into \$687 million in outside investments.⁴⁶

- It's not just about technology.

Since the 1980s, Pittsburgh has pursued strategies that position the region as a technology hub, where tech talent is readily available and where new ideas and innovations get

⁴³ Allegheny Conference on Community Development. *Creating a Next Generation Economy for All, 2018-2019 Agenda*. Available at: https://www.alleghenyconference.org/wp-content/uploads/2018/04/018_AgendaDocument_sprd.pdf

⁴⁴ Quayle, J. 2017. Pittsburgh: The Unbalanced Start-up Ecosystem," *Medium*. July 23, 2017

⁴⁵ Hensel, A. December 27, 2017. "4 U.S. Tech Hubs to Watch in 2018," *VentureBeat*. Available at: <https://venturebeat.com/2017/12/27/4-u-s-tech-hubs-to-watch-in-2018/>

⁴⁶ Innovation Works and Ernst & Young. March 2018. *A Decade of Growth: Investment in Pittsburgh's Technology Sector: Trends and Highlights, 2008-2017*.

developed. It has succeeded beyond expectations on this front, attracting major investments and operations from tech firms like Facebook, Google, Uber, and the like. These technology developments have been impressive, but they have not yet spawned a deep base of home-grown start-ups. That is the next phase for the regional ecosystem building.

- Embrace inclusion.

Pittsburgh is emerging as a national and global leader in terms of embracing inclusive entrepreneurship and technology development. It has developed a host of world-class programs that are engaging the region's minority community and building a more inclusive and welcoming ecosystem. Indiana would benefit from similar programs, especially in regions, such as Gary and Indianapolis, with larger minority populations.

Kansas City

First founded in 1838, Kansas City has long benefited from its desirable location on the Missouri River and centralized access to markets across the United States. Its economy first developed and grew around its role as the jumping off point for Western pioneer trails, and later as a central hub in national rail networks. Because of this infrastructure, Kansas City became a major center for food processing and other manufacturing. Over time, Kansas City also became a major center for distribution and other back-office operations.

Like other U.S. urban centers, Kansas City faced economic decline in the 1970s and 1980s. Yet, during this period, new companies like Sprint and Marion Labs emerged and would later become key drivers of regional regeneration. Today, the regional economy faces a number of challenges, especially related to inclusion and income inequality, but recent growth has been relatively strong. The greater Kansas City Metropolitan area currently ranks 17th among U.S. metros in terms of gross regional product, but job and median income growth are lagging below national averages. Yet, there are positive signs as well. A number of major new infrastructure projects, such as complete redevelopment of the current antiquated airport, are underway. And, as will be discussed below, Kansas City is widely touted as a global leader in its efforts to support local entrepreneurship and innovation-related activity in the agbiosciences and beyond.

History of Ecosystem Building

Kansas City has a long history of birthing great companies, like Hallmark Cards, H&R Block, and Sprint. Yet, recent developments in ecosystem development can mainly be traced back to Ewing Marion Kauffman and his role as the founder of Marion Labs and his eponymous foundation. Today, the Ewing Marion Kauffman Foundation is Kansas City's (and the country's) most important investor in ecosystem building.

Kansas City's experiences with ecosystem building offer a number of important lessons, particularly as they relate to "second tier regions," i.e., smaller metro areas that may lack the deep networks and resources (e.g., venture capital and specialized support services) that can be found in larger world-class centers like Silicon Valley or Boston.⁴⁷ Faced with these limitations, Kansas City's ecosystem building efforts first focused on how best to capitalize on unique regional assets, especially large corporate facilities.

⁴⁷ Heike Mayer, "Entrepreneurial Community in Kansas City: From Fragmented to Collaborative?" Kauffman Foundation Research Report, November 2012.

The Kansas City region is home to relatively large concentrations of business activity in animal health, information technology, and engineering services, anchored by firms such as Marion Labs, Cerner, Sprint, and Black & Veatch. Marion Labs (now part of Sanofi) played an especially catalytic role in this process, and much of the region's life sciences industry can be traced to spin-offs from Marion.

Many key components of the Kansas City ecosystem can be traced back to the early 2000s. At this time, the Kauffman Foundation began seeding a number of critical programs and major anchor institutions, such as the [Stowers Institute for Medical Research](#) and the **Kansas City Area Life Sciences Institute** (KSALSI) began operations. In Kansas, the state legislature created the Kansas Bioscience Authority to make major life science-focused investments, and programs from the Kansas Technology Enterprise Corporation (KTEC) were also expanded.

Early ecosystem building efforts focused on developing a regional "infrastructure" of programs and initiatives to help local people start and grow businesses of all types. As a large metro area, Kansas City was already home to many of the basic business support tools found in U.S. regions, including Small Business Development Center (SBDC) programs, business incubators, loan funds and the like. They were further supplemented by Kauffman Foundation-backed programs like the **FastTrac** business training courses.

While many individual programs were in place, local entrepreneurs often struggled to find resources and to tap into networks of peers and colleagues. In an effort to build a stronger community and referral networks, [KC SourceLink](#) opened for business in 2003. Based at the University of Missouri-Kansas City (UMKC), it began operations with the intention of serving as a "resource navigator," linking entrepreneurs to resources via a web page, a phone call-in center, and various events and other promotional activities. The initial SourceLink partnership list included 51 organizations and today has 249 partners.⁴⁸

The basic KCSOURCELINK resource navigator still exists today and serves as a "business concierge" providing referrals to thousands of local entrepreneurs each year. Since 2003, the KCSOURCELINK network has grown and blossomed, and now encompasses a number of focus areas, including:

- [Digital Sandbox](#): Proof of concept fund that provides small grants (up to \$20,000) to help entrepreneurs further develop and commercialize new ideas.
- [Whiteboard to Boardroom](#): A program to link entrepreneurs to promising technologies developed by UMKC Faculty
- [ScaleUP! KC](#): Focused on providing peer networking and coaching for existing business owners hoping to accelerate company growth
- [KC Rise Fund](#): A side car fund to co-invest with venture capitalists in local early stage ventures.

KCSOURCELINK's local impacts have been extensive, helping provide connections and support services to more than 35,000 local business owners. Each year, Kansas City-based start-ups

⁴⁸ KCSOURCELINK, *We Create: Making KC America's Most Entrepreneurial City: Year 5*, 2017, p. 14. Hereafter referred to as *We Create KC: Year 5 Report*.

create more than 16,000 local jobs and, in 2017, they attracted more than \$540 million in outside investments.⁴⁹

KCSourcelink and other partners sought to provide basic business services to all types of entrepreneurs, but a number of other initiatives have focused on creating more high-growth ventures in the KC region. The [Helzberg Entrepreneurial Mentoring Program](#) began operations in the mid-1990s and is one of the country's longest running local business mentoring programs. The [PIPELINE](#) program began operations in 2006 as part of the now-defunct Kansas Technology Enterprise Corporation. PIPELINE, which now operates in Kansas, Missouri, and Nebraska, targets early stage entrepreneurs with potential for rapid growth. It supports annual cohorts of entrepreneurs who are linked into peer networks and mentoring connections with experts from around the United States. Its goal is to build world-class entrepreneurial ventures that are based in the Midwest, what some observers refer to as the "Silicon Prairie".

Various ecosystem building efforts were moving at a swift pace through the early 2000s and then got a big boost—in terms of leadership focus and publicity—when the Greater Kansas City Chamber of Commerce commenced a major strategic planning effort in 2011. This effort produced what was dubbed "The Big 5" – five major initiatives designed to transform the Kansas City region. Among the Big 5 was the goal to make Kansas City into America's most entrepreneurial city.

This public attention helped further raise the profile of ecosystem building as a key contributor to future regional prosperity. Since 2011, dozens of new initiatives have sprung up, and Kansas City is being nationally and globally recognized as a center for innovative approaches to building entrepreneurial ecosystems. One example is the [KC Startup Village](#), a local neighborhood effort to attract entrepreneurs to Kansas City, Kansas that was tied to the city's selection as an initial testbed for Google Fiber services.

KCSourcelink and its partner organizations operate around a shared vision that focuses on a number of key ecosystem building strategies, including:

- 1) Building a Pipeline
- 2) Fostering Connections
- 3) Promoting Opportunity
- 4) Investing Capital
- 5) Engaging Corporate Partners
- 6) Measuring Impact

Kansas City's ecosystem building efforts have typically avoided targeting a specific industry or business sector. However, regional leaders have placed great emphasis on supporting innovation and entrepreneurship in the life sciences, with a special focus on animal health. Much of this work has been centered on two initiatives first developed by the **Kansas City Area Development Council (KCADC)**: [BioNexus](#) (previously known as KCALSI) and the [Kansas City Animal Health Corridor](#). BioNexus first opened for business in 2001, with support from major area universities and research centers such as the Stowers Institute. BioNexus supports a variety of missions with a primary focus on expanding bioscience-related R&D in

⁴⁹ *We Create KC: Year 5 Report*, pp. 6,16.

the greater Kansas City region. Its current strategic plan, *The Path to 2025*, identifies the “nexus of human and animal health” as a primary regional focus area.⁵⁰

The work of BioNexus and other partners proceeds in tandem with the activities of the Kansas City Animal Health Corridor, a major regional effort focused on public policy/advocacy, workforce development, and advancing innovation. The Animal Health Corridor launched in 2006, as part of a recognition that the region would benefit from a specific focus on its unparalleled animal health assets (as a supplement to the work of BioNexus and other partners with a focus on all biosciences). The Corridor project serves a wide region from Manhattan, Kansas to Columbia, Missouri, and encompasses 18 counties. The Corridor engages more than 300 animal health-related companies and is also home to major research institutions, such as the Veterinary programs at the University of Missouri and Kansas State University and the new National Bio and Agro-Defense Facility at Kansas State.

The Kansas City Animal Health Corridor focuses most of its work on industry promotion and advocacy, promoting the region as a good place for new investments and encouraging local residents to consider careers in animal health related fields. Its Annual Investment Forum is a major event that attracts firms and investors from around the world while also generating important buzz about Kansas City’s world-class animal health assets.

In Kansas City (and St. Louis as well), local and regional economic development organizations take the lead in supporting the agbiosciences. But, both regions have also embraced ag-focused entrepreneurship via various local and state strategies and programs. In Kansas, recent budget challenges have limited the availability of resources for new initiatives, but promotion of ag technology and entrepreneurship is a core plank of the 2018 Strategic Action Plan for Kansas Agricultural Growth.⁵¹ In Missouri, the Missouri Partnership is leading an aggressive strategy to position the state as the global leader in agtech.⁵²

Recent Developments

In recent years, Kansas City has reaped the benefits of its long-term commitment to a focused strategy of ecosystem building. The region has been highly ranked in various recent benchmarking assessments such as Entrepreneur magazine’s “Hot Startup Cities” rankings and the Kauffman Foundation’s Index of Entrepreneurial Activity.⁵³ Regional ecosystem building efforts have also won numerous federal grant competitions, including several i6 awards from the U.S. Economic Development Administration. The Digital Sandbox program is one of the only projects to have received multiple grants in these annual competitions. Interviews with high-growth entrepreneurs find general satisfaction with local resources, such as investors and mentors, and find that connecting into the ecosystem for partners and customers is fairly painless.⁵⁴

Regional developments related to capital access have been especially successful. Like many U.S. regions, Kansas City is not a major market for venture capital investments, but it does

⁵⁰ BioNexus KC, *Path to 2025*, 2016. Available at: <https://bionexuskc.org/path-to-2025-regional-life-sciences-strategic-assessment/>

⁵¹ Kansas Department of Agriculture, *AgGrowth: 2018 Strategic Plans for Kansas Agriculture Growth*, pp. 14-18.

⁵² Missouri Partnership, *Missouri: The Global Leader in Agtech, 2018*. Available at: <https://www.missouripartnership.com/wp-content/uploads/2018/01/Agtech.pdf>.

⁵³ *We Create KC: Year 5 Report*, p. 7.

⁵⁴ Yasuyuki Motoyama et al. “Leveraging Regional Assets: Insights from High-Growth Companies in Kansas City,” Kauffman Foundation Research Report, July 2013.

boast a wide array of publicly-backed capital sources and a robust market for angel investors. Local angels and angel groups actively seek out local deals. For the past three years, locally-sourced deals have exceeded those backed by investors from outside of Kansas City. And, in 2017, the region saw 144 equity investments, the highest level in five years.⁵⁵

While Kansas City has made major advances, local leaders and entrepreneurs recognize that further progress is needed. They point to several challenge areas. Inclusion is a major focus of current efforts, as minority entrepreneurs report some barriers to full engagement with the region's ecosystem resources.⁵⁶

A number of high growth entrepreneurs have called for better coordination within the regional ecosystem. They note that many new and high-profile ecosystem building efforts are underway in Kansas City, but that there could be better linkages and connections between these efforts. These "patchwork" initiatives could be improved, especially by building better ties between Kansas City's business establishment and its new and emerging entrepreneurs.⁵⁷ These challenge areas also relate to linkages between general ecosystem support efforts and focused efforts targeting the agbiosciences. While promising programs are in place, connections between agbioscience-focused initiatives and entrepreneurship programming remain under-explored.

Finally, local leaders note that area universities could be better engaged and could serve as more important drivers of innovation and R&D. None of the area's universities, including flagship institutions in both states, is considered to be a major driver of entrepreneurial activity.⁵⁸ Efforts to address these challenge areas are underway, via programs like **Whiteboard 2 Boardroom** and via funding programs operated by organizations like BioNexus and by private investors such as TechAccel.

In general, most interviewees noted that ecosystem building efforts in Kansas City have been quite successful. While room for improvement always exists, they noted that the region is a good place to start and grow a company and that needed resources were available.

Assessment and Lessons Learned

The evolution of the Kansas City regional ecosystem offers a number of potential lessons learned for similar work in Indiana and beyond.

- Embrace ecosystem building as an intentional strategy.

Leaders in Kansas City have consciously embraced ecosystem building as an intentional strategy to advance regional economic development. This commitment runs across the region and is embraced from the highest levels of business, as evidenced by the Kansas City Chamber's Big 5 commitment to the daily work of dozens of non-profits addressing various aspects of ecosystem development.

⁵⁵ *We Create KC: Year 5 Report*, p. 11.

⁵⁶ See, for example, "EDCKC Supporting TechWeek Diversity and Inclusion in Tech Entrepreneurship Track," September 26, 2018. Available at: <https://www.edckc.com/edckc-supporting-techweek-diversity-and-inclusion-in-tech-entrepreneurship-track/>

⁵⁷ Motoyama et al., p. 21-23.

⁵⁸ For background see W. Richard Goe, Martin Kenney, and Donald Patton, "Measuring Entrepreneurial Activity at Kansas and Missouri Universities," Berkeley Roundtable on the International Economy Working Paper, 2016-8, March 16, 2018.

- Think big: focus on high growth.

In many regions, ecosystem building targets start-ups of all types. Kansas City supports programming of this sort, but its high-profile initiatives are heavily targeted to high growth ventures that will help create new jobs and new wealth. Programs like Pipeline and HEMP are not open to brand-new start-ups; they instead target companies and entrepreneurs with significant growth potential. Given this focus, the programs also push participants to think bigger in terms of markets, focusing on building global success stories as opposed to serving only local markets.

- Don't forget your history.

Ecosystem building efforts in Kansas City reflect the region's history. Initiatives like the Kansas City Animal Health Corridor build on the region's agriculture and transportation legacies. Entrepreneurship programming similarly builds on the legacies of Ewing Marion Kauffman and other business leaders. Today's emerging focus on inclusion has similar historic ties and seeks to recapture Kansas City's role as a business hub for African-Americans. These historical connections matter as they help to "normalize" entrepreneurship as a core part of Kansas City's regional identity.

- Commit for the long haul.

Conscious ecosystem building strategies have been underway in Kansas City for more than two decades. In fact, local leaders will contend that ecosystem building is never completed and that it is a process of constant change and transformation. Kansas City's leadership has embraced this approach, pursuing a long-term and patient strategy to position the region as "America's most entrepreneurial city." They have combined patience with a spirit of experimentation that tests new programs and designs new approaches to deal with new challenges as they arise. Recent examples of this successful experimentation include the Digital Sandbox, the Kansas City Rising Fund, and current efforts to build a more inclusive ecosystem.

Looking Outside the United States – Denmark

Denmark has long relied on agriculture as a core economic driver. It was one of the first European nations to support a large base of independent farmers, and this history has also led Denmark to become a global leader in support for agriculture-focused innovations. Dating back to the mid-1800s, these include an active embrace of new technologies, new farming practices, and new approaches to agriculture policy, such as cooperatives and the use of advisory services akin to the USDA's Extension programs. Unlike England and other European powers, Denmark has been an agricultural nation for much of its recent history. It was not until the 1950s that Denmark's industrial workforce surpassed its agriculture workforce.

Today, Denmark remains one of Europe's and the world's leading center for agricultural and food-related production and innovation. It is the birthplace of Nordic gastronomy, but it is also a pioneering innovator in numerous other agbioscience-related sectors as well. For example, 61% of Denmark's total land area is cultivated, and the Danish ag cluster exports roughly 2/3 of its production. Overall, ag-related exports account for 20% of all Danish

exports.⁵⁹ Major production sectors include pork, dairy, beef, poultry, and mink. Aquaculture and bioenergy are also areas of rapid growth and innovation. Danish agriculture is highly productive and efficient, and its farmers openly embrace innovation and new technologies. Danish farmers have aggressively embraced organics, and the country is now a global leader in organic production. In addition to its own domestic programs focused on agriculture, European Union policies and programs also greatly affect domestic agbioscience companies in terms of both regulation and public funding support.

Denmark's economic policies are heavily influenced by its small size. With only 5.8 million people living in an area of roughly 16,000 square miles, Denmark is slightly less populated than Indiana with a land mass less than half that of the state. Faced with these limitations, Danish entrepreneurs and public officials must invest smartly and intently focus on how Danish firms can succeed in the global marketplace.

History of Ecosystem Building

Denmark was somewhat late to the game in terms of formal government policies to promote innovation and entrepreneurship. Yet, in the last ten years, Denmark has emerged as a European and global leader in supporting innovation-focused development strategies. For example, Denmark ranks 8th in the world in the annual competitiveness rankings from the World Economic Forum, and also ranks quite high on sub-score rankings for business dynamism (6th) and innovation capability (12th).⁶⁰ Within Europe, Denmark ranks as the second most innovative economy (following Sweden), according to the 2018 Europe Innovation Scorecard.⁶¹ It is especially strong, ranking first in Europe, in the areas of information technology adoption and human resources (i.e., skilled talent).

In recent years, Denmark has been widely lauded as one of the world's best places to start and grow a company. This represents a major shift from past perceptions of Denmark and other Nordic countries as conservative and somewhat risk averse.

Denmark has aggressively embraced innovation and entrepreneurship as core parts of its national economic strategies. Its digital growth strategies were first unveiled in 2012. Its current "Digital Growth Strategy," released in January 2018, continues the national government's focus on advancing the Danish economy via continued investments to maintain Denmark's leading position as a digital hub, with more flexible and nimble regulations and education policies to train youth on STEM and other computational skills.⁶²

Recent Developments

Denmark's innovation strategies contain a number of interesting components. Support for key clusters is a critical part of its policy mix. Denmark is home to several major industries, with large sectors in biotech and ag/food-related industries. In biotech, Novo Nordisk is the nation's largest firm. In agriculture and food, firms like Carlsberg (brewing) and Arla Foods (dairy) are major players. The Danish government promotes aggressive and expansive

⁵⁹ Facts and Figures: Denmark- A Food and Farming Country. Danish Agriculture and Food Council, 2016.

⁶⁰ World Economic Forum, *The Global Competitiveness Report 2018. Country Report: Denmark*. Available at: <http://reports.weforum.org/global-competitiveness-report-2018/country-economy-profiles/#economy=DNK>

⁶¹ Data from Copenhagen Capacity. See <http://www.copcap.com/newslist/2018/denmark-is-the-second-most-innovative-country-in-the-eu>

⁶² To learn more about the 2018 Digital Growth Strategy, visit <https://investindk.com/insights/the-danish-government-presents-digital-growth-strategy>

programming to support its leading industry clusters, with specific policies tailored to different regions or to various industry subsectors.⁶³

Support for entrepreneurs is channeled through the **Danish Business Authority (DBA)**. The DBA manages and sponsors a diverse mix of programs and policies that serve as a national foundation for the Danish entrepreneurial ecosystem. These include:

- On-Line Portals to direct entrepreneurs and enterprises to needed services;
- A network of five Regional Business Development Centers (Vaeksthus) to provide direct support;
- Support for the Danish Foundation for Entrepreneurship-Youth Enterprise, which funds and support curriculum development and youth entrepreneurship programming; and
- A Market Development Fund, which is designed to help small firms to prototype new products and services. Project funds support investments of \$450,000 and above.

These new strategies seek to advance Denmark's ecosystem building efforts. Earlier projects sought to build needed capacity by creating new funding pools, improving business access to higher education resources, and expanding youth entrepreneurship programming. Newer strategies build on these earlier investments and are designed to get more people starting companies and to help early stage firms move to the next level of growth.

On the regulatory front, Denmark's national and regional governments do strive to be "entrepreneur-friendly."⁶⁴ Overall tax burdens are high relative to the United States, but Danish officials offer several benefits to entrepreneurs. For example, they are able to meet (at no cost) with tax authorities to review business tax rules and procedures. Similarly, displaced workers can receive self-employment support for up to 78 weeks. In addition, public grants are available for students to pursue business start-ups, and other public benefits (such as generous maternity and paternity leave) are available to the self-employed as well as full-time employees. Via **Start-Up Denmark**, the country also offers "start-up visas" for promising entrepreneurs seeking to locate their companies in Denmark. The visas offer a two-year residence/work permit along with full access to Denmark's generous education and health benefits for the entrepreneur and their families.

When compared to the United States, Denmark and its regions provide a wide array of financing tools for new ventures. In addition to the Market Development Grants and student grants noted earlier, many regional governments offer a form of innovation vouchers that fund technical assistance for new business owners.⁶⁵ For example, the regional Growth Entrepreneur Initiative provides 15 hours of free consulting support and covers up to around \$2,000 in funding for outside business consulting.

⁶³ For background, see Danish Ministry for Higher Education and Danish Agency for Science, Technology and Innovation, *Cluster Strategy 2.0: Strategy for Denmark's Network and Cluster Strategy 2016-2018*. Available at: https://ufm.dk/en/publications/2016/files/danish-cluster-strategy-2-0_eng.pdf

⁶⁴ Organization for Economic Cooperation and Development, *Inclusive Entrepreneurship, Country Note 2016: Denmark*, pp 10-11.

⁶⁵ Organization for Economic Cooperation and Development, *Inclusive Entrepreneurship, Country Note 2017: Denmark*, p.16.

Beyond government efforts, Denmark is also home to a rich array of more than 500 organizations that see entrepreneurship and ecosystem building as core missions.⁶⁶ Public and private organizations are especially engaged in supporting entrepreneurship education, with programs such as the **Danish Foundation for Entrepreneurship** (part of the global JA network) that funds educators and students involved in entrepreneurship training at all levels of the Danish educational system.

Copenhagen is emerging as one of the leading startup hubs in the Nordic region and in Europe more generally.⁶⁷ It is home to a wide range of ecosystem resources, and most of the leading ecosystem advocates are based in or around Copenhagen. Prominent players and activities include the **Startup Village**, a physical hub that currently hosts 40 new companies, and the wider Copenhagen region is home to 19 science parks and innovation incubators.⁶⁸ The region also hosts the annual TechBBQ start-up summit that attracted more than 6,500 attendees this year.⁶⁹

Denmark's active interventions to support innovation and entrepreneurship are reinforced and further supported by a host of specific strategies targeting the food and agriculture-related sectors. The food and agriculture sectors remain very attractive in Denmark and receive significant amounts of public attention. They also receive extensive support from national, regional, and local governments. At the national level, key players include the Danish Ministry of Agriculture and Food, the Danish Food and Agriculture Council, the Danish Food Cluster, and Food Nation, a new public-private partnership. Local initiatives include the Copenhagen-based CPH Food and Connector, which focuses on Central Denmark.

Much of Denmark's current focus on food and agriculture seeks to build on the nation's legacy as an efficient and sustainable producer of food products.⁷⁰ Areas of research and investment include the following sectors:

- Bioenergy and agriculture biomass
- Reducing Food Waste
- Food Safety
- Foods for a Healthier Life

Sectors with linkages to wider sustainability objectives have received significant levels of public interest and investment. These areas align well with Denmark's overall interest in a global leadership position on issues of sustainability.

These varied programs provide a comprehensive suite of services to existing ag and food companies and to potential and aspiring entrepreneurs. For example, the **Danish Food Cluster** provides networking and other support and, via its Danish Food Innovation program, helps new firms enter into export markets, provides training, and also offers company match-making services. The **Future Food Innovation program** is based at AgroPark in Jutland and is part of the EU-wide Enterprise Europe Network of entrepreneur support programs. It

⁶⁶ Niels Holst, Danish Startup Ecosystem Map, May 17, 2017. Available at: <https://medium.com/@InnoOverblik/danish-startup-ecosystem-map-e3dd32a3ce56>

⁶⁷ For background on Copenhagen's tech startup scene, visit <http://cphftw.dk/>

⁶⁸ Data from Copenhagen Capacity.

⁶⁹ <https://www.techbbq.dk/>

⁷⁰ For background, see State of Green, *Producing More with Less: The Danish Transition to a Bio-Based Society with Resource-Efficient Production*, White Paper, July 2018.

provides workspace, coaching, mentoring, and funding to help firms start and grow. The program will even convene interdisciplinary advisory groups that offer insights from different types of companies and sectors, so that entrepreneurs can gain a unique 360-degree view of their new ventures. Denmark also hosts a food tech accelerator set up as part of the Scale Up Denmark program, a national initiative to help spawn growth-oriented start-ups in leading Danish clusters.⁷¹

Denmark has a long history of active public support for its food and agriculture sectors. More recently, it has also embraced a more activist approach to innovation and entrepreneurship. These two policy positions are currently merging to produce an exciting new mix of initiatives that are designed to back up the slogan of Denmark as the world's "food nation."

Assessment and Lessons Learned

The evolution of Danish innovation and entrepreneurship support programs offers a number of potential lessons learned for similar work in Indiana and beyond.

- Embrace comprehensive approaches.

As noted in our accompanying reports, effective ecosystem building efforts do not rely on a single program or single government agency. Comprehensive and holistic approaches are needed. This lesson clearly emerges from the Danish experience, where a huge number and range of programs and support are available to Danish entrepreneurs. Financing, consulting, market development, and a host of other services are readily available at limited cost to the business itself. Providing business with a comprehensive—and customized—suite of support services offers the best means to help companies pursue and achieve faster growth rates.

- Link cluster and entrepreneurship strategies.

Danish policymakers have long been strong advocates for industry strategies that target public investments and support to Denmark's leading industry clusters. While early strategies focused on issues like R&D funds and university-business collaboration, newer approaches dig deeper into innovation and entrepreneurship. Today, food and sustainability are top national priorities, and, as such, are also viewed as top industry cluster targets as well.

- Connect agbioscience to other policy goals.

Danish policymakers also directly link support for the agricultural and food sectors to other prominent national and regional policy goals. Bioenergy development, food waste reduction, and sustainability more generally are all examples of where programming to support agbioscience entrepreneurship also supports larger policy goals. Similar linkages to state goals, such as rural development, sustainability, or the development of new innovation districts, could be applied in Indiana as well.

⁷¹ To learn more, visit <https://scale-updenmark.com/2017/05/26/denmarks-first-food-tech-accelerator-takes-trailblazing-startups-to-the-next-level/>

- Think global.

Denmark's small size has meant that its agriculture and food producers must always look to foreign markets in order to succeed. This global focus continues today, and Danish ecosystem programs place great emphasis on preparing Danish entrepreneurs to succeed outside of the domestic market.