

Congress of the United States
U.S. House of Representatives
Committee on Small Business
2361 Rayburn House Office Building
Washington, DC 20515-6315

Memorandum

To: Members, Committee on Small Business Subcommittee on Agriculture, Energy, and Trade
From: Committee Staff
Date: February 13, 2018
Re: Hearing: “Restoring Rural America: How Agritech is Revitalizing the Heartland”

On Thursday, February 15, 2018 at 9:30 A.M., the Committee on Small Business Subcommittee on Agriculture, Energy, and Trade will meet in Room 2360 of the Rayburn House Office Building for a hearing titled, “Restoring Rural America: How Agritech is Revitalizing the Heartland.” This hearing will continue the Committee’s examination of the rapidly developing agricultural technology (agritech, or agtech) industry. In October 2017, the Subcommittee hearing titled, “High-Tech Agriculture: Small Firms on the Frontier of Agribusiness,” highlighted the role of small businesses and the perspective of small family farmers. Subcommittee Members will hear from institutions driving agritech entrepreneurship and innovation activity, which has spurred rural revitalization.

I. Traditional Route for Agricultural Modernization

A. Research and Development

Agricultural research and development (R&D) investment is a major driver of United States agricultural industry strength.¹ Public sector expenditures were 39 percent higher in 2012 than 1970; however, the annual rate of growth for real public R&D expenditures has slowed significantly since 1980.² In contrast, private sector R&D funding has grown rapidly, with an average growth of two percent per year, whereas public sector funding had an average growth of 0.87 percent per year.³

Private sector participation in agriculture R&D surged as a result of four main developments. In the 1970s and 1980s, intellectual property rights were extended to accommodate biotechnology innovations which encouraged enough private sector R&D to make public crop breeding programs obsolete.⁴ In addition to attracting private investment, the field of biology

¹ SUN LING WANG, ET AL., Agricultural Productivity Growth in the United States: Measurement, Trends, and Drivers, Econ. Research Serv., U.S. Dept. of Agric. 1 (Jul. 2015) [hereinafter “Ag. Productivity”], https://www.ers.usda.gov/webdocs/publications/45387/53417_err189.pdf?v=42212

² *Id.* at 47-48.

³ *Id.* at 42-43.

⁴ MATTHEW CLANCY, KEITH FUGLIE & PAUL HEISEY, U.S. AGRICULTURAL R&D IN AN ERA OF FALLING PUBLIC FUNDING, AMBER WAVES, ECON. RESEARCH SERV. U.S. DEPT. OF AGRIC. (Aug. 7, 2017), available at <https://www.ers.usda.gov/amber-waves/2016/november/us-agricultural-rd-in-an-era-of-falling-public-funding/>.

absorbed techniques from physics, engineering, and mathematics and produced significant technologies for agriculture.⁵ Increased access to foreign markets and demand for U.S. agriculture technologies generates greater and faster returns on R&D investments, thus spurring more private R&D.⁶ Finally, the private sector now has a larger share of total agriculture R&D because public funding has declined.⁷

It is important to note that studies have found that private sector research complements, but does not replace, public sector efforts.⁸ Public research investments often trigger private sector investments in similar agricultural programs.⁹ While both sectors share the overall goal of increased productivity, private firms are more likely to pursue research that generates marketable goods for farmers and consumers.¹⁰ Entrepreneurial support mechanisms bridge the gap between labs and farms by turning research into commercial products.¹¹

B. Cooperative Extension Program Activities

In addition to R&D investment, the private sector has also increased participation in extension activities, which facilitate farmers' access to new technologies and methods and improve agricultural productivity.¹² Public extension programs include farm practice demonstrations, workshops, farm visits, publications, and online information.¹³ Established by the Smith-Lever Act of 1914, the American extension system is a three-tiered partnership: U.S. Department of Agriculture (USDA) at the national level, land grant colleges and universities (LGU) and state governments, and local government partners.¹⁴

Due to the decline in public extension funding,¹⁵ coupled with the expansion of precision agriculture, private companies are now the primary source of information for farmers.¹⁶ Private companies have the resources to measure, analyze, and develop products to meet the needs of farmers and train them how to use them.¹⁷ This cycle is the fundamental driver of R&D, innovation, and commercialization. As farmers adopt data-driven strategies, their access to information depends on the capabilities of their equipment and software systems. Technology providers must increase extension activities to demonstrate how to translate data into information that's understandable and valuable to farmers.

⁵ *Id.*

⁶ *Id.*

⁷ *Id.*

⁸ Ag. Productivity, *supra* note 1, at 47-48.

⁹ *Id.*

¹⁰ *Id.*

¹¹ Ag. Productivity, *supra* note 1, at 40.

¹² AGThENTIC, "A Guide to Startup Resources for Agriculture & Food Technology Innovation" 2 (Nov. 4, 2016) [hereinafter Startup Guide], available at <http://agthentic.com/reports/>.

¹³ Ag. Productivity, *supra* note 1, at 2.

¹⁴ *Id.* at 47-48.

¹⁵ *Id.*

¹⁶ "From 1915-1949, public extension funding grew at the rate of 6.7 percent per year; from 1950-1980 it grew at the rate of 2.39% per year; since 1980 funding has decreased annually." Rayda K. Krell, et al., *A Proposal for Public and Private Partnership in Extension*, 7 J. OF INTEGRATED PEST MGMT. 2 (2016).

¹⁷ *Id.*

¹⁷ *Id.* at 3.

II. The Agritech Industry

A. The Technologies

The agritech industry derives its power from necessity -- everyone needs food -- and the diversity of actors, strategies, and technologies tackling challenges along the food chain. Because it is a relatively new, complex, and dynamic field, there is no standardized method of categorization.

Many of these technologies fall under the umbrella of precision agriculture, which “is a suite of technologies that may reduce input costs by providing the farm operator with detailed spatial information that can be used to optimize field management practices.”¹⁸ Investment activity by number and volume of deals varies considerably across the sectors. In 2016, biotechnology, data-enabled agriculture, alternative business models, and supply chain technologies received the most investment funding.¹⁹

B. The Players

Given the diversity of technologies within the industry, agritech has attracted a wide variety of participants.

1. Farmers

As the creation and commercialization of technological solutions accelerates, farmers are hesitant to assume the risks of investment in new technologies. Investing in precision agriculture includes costs for purchases of equipment, installation charges, as well as the time and effort spent learning how to use and maintain the technologies.²⁰ Studies have identified the influence of “farm size; costs reduction or higher revenues to acquire a positive benefit/cost ratio; total income; land tenure; farmers’ education; familiarity with computers; access to information (via extension services, service provider, technology sellers); and location.”²¹ The top three factors for technology adoption are level of education, farm size/income, and location.²² Large farms

AGTECH CLUSTER	TECHNOLOGY
AGRICULTURAL BIOSCIENCE	Biologics
	New chemicals
	New crops
	Genetics
	Seeds
DATA-ENABLED AGRICULTURE	Sensors and connectivity
	Data storage and aggregation
	Optimization hardware
	Software platforms
	Big data and analytics
AUTOMATION AND ROBOTICS	Electrification
	Autonomous equipment
	Drones
	Robotics
SUPPLY CHAIN AND LOGISTICS	Crop storage
	Packaging and shelf life
	Food security and traceability
	Asset and fleet optimization
AGRICULTURAL PROCESSING	Processing
	Biofuels and bioenergy
	Biomaterials
	Biochemicals
ALTERNATIVE BUSINESS MODELS	Alternative foods
	Indoor agriculture
	Technology-enabled sharing
	E-commerce
	Farming as a service

¹⁸ DAVID SCHIMMELPFENNIG, FARM PROFITS AND ADOPTION OF PRECISION TECHNOLOGY, ECON. RESEARCH SERV., U.S. DEPT. OF AGRIC. 1 (Oct. 2016), <https://www.ers.usda.gov/webdocs/publications/80326/err-217.pdf?v=4266>.

¹⁹ AGFUNDER, *AgTech Investing Report, Year in Review 2016* 16 (Jan. 31, 2017), <https://agfunder.com/research/agtech-investing-report-2016>.

²⁰ Ag. Productivity, *supra* note 1, at 13.

²¹ EMANUELE PIERPAOLI, ET. AL., *Drivers of Precision Agriculture Technologies Adoption: A Literature Review*, *PROCEDIA TECHNOLOGY* 64 (2013), available at <https://doi.org/10.1016/j.protecy.2013.11.010>.

²² *Id.*

with money to invest are more likely to integrate new technologies if they are useful, easy to use, and profitable.²³

2. *Entrepreneurs*

According to the Kauffman Foundation, the U.S. economy is in the early stages of the “Third Wave” of entrepreneurship ignited by increased access to the Internet and decreased barriers to entry.²⁴ In this era, entrepreneurs can transcend traditional geographic limitations by accessing online opportunities and support mechanisms for innovation.²⁵ Entrepreneurs have greater flexibility in choosing the right environment and funding strategies for their business. Startups benefit from having industry-specific and generalist options for resource vehicles and investors. Reflecting the diversity of technologies, the agritech industry has attracted a variety of investors, averaging 100 unique active investors per year.²⁶ Since 2015, global agritech funding activity per year has topped \$200 million through more than 68 deals.²⁷

3. *Industry Giants*

Corporations have developed a variety of strategies to keep up with agritech industry changes. Internal efforts include reorganization, addition of new R&D offices, and creation of venture arms.²⁸ To meet the needs of data-driven modern farms, John Deere adopted a new operating model that prioritizes “process optimization – reduced costs, increased yield and increased sustainability – through data-centric technologies and improved information flow.”²⁹ The company formed a new office, the Intelligent Solutions Group, to lead precision agriculture R&D efforts.³⁰

External efforts include partnerships with universities and accelerators, as well as investments in startups. The partnerships are opportunities to recruit new talent, promising technologies, and potential acquisitions. In 2013, Monsanto acquired The Climate Corporation for \$1.1 billion, and triggered a surge in agritech investments.³¹ Corporate acquisitions, most often carried out by Monsanto and Syngenta, currently account for 25 percent of all agritech investment.³²

²³ *Id.* at 64-65.

²⁴ ARNOBIO MORELIX, E.J. REEDY & JOSHUA RUSSELL, 2016 KAUFFMAN INDEX GROWTH ENTREPRENEURSHIP 4 (May 2016), available at http://www.kauffman.org/~media/kauffman_org/microsites/kauffman_index/growth/kauffman_index_national_growth_entrepreneurship_2016_report.pdf.

²⁵ *Id.* at 5.

²⁶ CB Insights, *Research Briefs, Betting The Farm: Agtech Is Small, But Funding Is Rising Fast* (Mar. 20, 2017), available at <https://app.cbinsights.com/research/agtech-startup-funding>.

²⁷ CB Insights, *Ag Tech Heats Up: 5 Trends Shaping The Future Of Farming & Agribusiness* (Dec. 12, 2017) [hereinafter “Agtech Heats Up”], available at <https://www.cbinsights.com/research/agtech-trends-shaping-the-future-of-farming-expert-intelligence>.

²⁸ *Id.*

²⁹ Emily Brockway, Harvard Business School, *Started from the Plow Now We’re Deere: John Deere’s Transformation from an Equipment Manufacturer to a Tech Firm* (Nov. 17, 2016), available at <https://rctom.hbs.org/submission/started-from-the-plow-now-were-deere-john-deeres-transformation-from-an-equipment-manufacturer-to-a-tech-firm/>.

³⁰ *Id.*

³¹ “Agtech Heats Up,” *supra* note 26.

³² *Id.*

4. Universities

Most public sector agriculture R&D funding is channeled to the nation's Land Grant University (LGU) system which includes more than 100 institutions.³³ In a 2012 report, the Kauffman Foundation recommended LGUs utilize the resources of their business schools to support startups looking to commercialize university research.³⁴ Most businesses formed from university research remain in the state.³⁵

As public support declines, universities have increased research collaboration with private sector partners. In 2017, John Deere opened a Strategic Technology Office at the Iowa State University (ISU) Research Park which will conduct research, develop future leaders of the industry, and will add to the company's extensive global innovation system.³⁶ This type of partnership is mutually beneficial; ISU students and faculty will have access to industry-leading resources. By creating a talent and innovation pipeline, ISU and the surrounding areas will be more likely to retain talent and attract the best of the agritech industry from coastal tech hubs.

5. Venture Firms

Venture capital (VC) interest in agritech spiked between 2016 and 2017, likely triggered by a series of \$300 million corporate acquisitions.³⁷ As more startups take on capital intensive projects, such as software platforms, more businesses will be ready and available for acquisitions and VC-scale returns.³⁸ In addition to acquisitions, venture capital firms are investing in agritech by participating in startup support resources. Investors often serve as mentors, board members, and financial backers for accelerators and incubators.³⁹ Some venture firms, such as SOSV, offer intellectual and financial capital through their own accelerator programs.⁴⁰

C. Startup Resources

Today there are over one hundred different resource vehicles to support agritech entrepreneurs and develop successful businesses: nearly half are accelerators.⁴¹ There are seven types of resources, and each use unique methods to achieve the industry goal of bringing scientific innovations to market and scale.⁴²

1. Accelerators

Accelerators involve a set duration program where a cohort of selected early-stage companies receive access to a business development curriculum and mentor and/or an investor network. On average, accelerators retain 4-9 percent equity in exchange for \$50,000, in addition to the in-kind

³³ Ag. Productivity, *supra* note 1, at 48.

³⁴ MAGGIE THEROUX FIELDSTEEL, BUILDING A SUCCESSFUL TECHNOLOGY CLUSTER, OFFICE OF RESEARCH AND DVMT, U.S. EPA 5 (Mar. 12, 2013) [hereinafter "EPA CLUSTER"], available at https://www.epa.gov/sites/production/files/documents/building_a_successful_technology_cluster.pdf.

³⁵ *Id.* at 22.

³⁶ John Deere to Open Strategic Technology Office at Iowa State University, IOWA STATE UNIV. (Feb. 22, 2017), <http://www.econdev.iastate.edu/news-events/news/john-deere-to-open-strategic-technology-office-at-iowa-state-university>.

³⁷ "Agtech Heats Up," *supra* note 26.

³⁸ *Id.* at 26.

³⁹ "Startup Guide," *supra* note 10, at 26.

⁴⁰ ABOUT SOSV, SOSV, <https://sosv.com/about/> (last visited February 12, 2018).

⁴¹ "Startup Guide," *supra* note 10, at 1.

⁴² *Id.* at 2.

value of the services given to the startup.⁴³ Accelerators share a basic model but compete for talent with unique perks such as demo days and field trials. This is the most common private sector resource available for small agritech businesses.⁴⁴

2. Corporate Incubators

Corporate incubators provide the access to capital and resources of a corporation, usually with the intention of acquiring participating startups. These provide up to ten times more funding than accelerators but have a limited focus: the companies are looking for new products.⁴⁵

3. Incubators

Geared to help early stage startups, incubators are physical workspaces or labs that provide support such as technological expertise and mentorship.⁴⁶ They are often collaborative ventures among universities, grower organizations, and business development organizations.⁴⁷

4. Network/Ecosystems

Networks and ecosystems are virtual networks that provide access to peers, mentors, investors, and industry insight through trainings, hackathons, and newsletters.⁴⁸ Online communities fill the gaps for entrepreneurs that lack access to traditional business assistance centers.

5. Pitch Competitions

Pitch competitions are one-time events that give entrepreneurs the opportunity to pitch their ideas to industry experts and investors, but no prize money is awarded.⁴⁹ Startups are usually judged based on technological viability, market opportunity, idea originality, team strength, and overall presentation.⁵⁰

6. Prizes

Prizes are multi-stage selection processes that provide businesses access to mentors and culminate with a pitch competition and prize money from corporate sponsors.⁵¹ This is the second most common option for startup capital with more than a dozen programs operating internationally.⁵²

7. Venture Development Organizations (VDO)

VDOs accelerate commercialization for technologies, including those developed within agricultural research institutions.⁵³

⁴³ *Id.* at 4.

⁴⁴ *Id.* at 9.

⁴⁵ *Id.* at 5.

⁴⁶ *Id.* at 6.

⁴⁷ *Id.*

⁴⁸ *Id.*

⁴⁹ *Id.*

⁵⁰ *Id.* at 7.

⁵¹ *Id.* at 8.

⁵² *Id.* at 9.

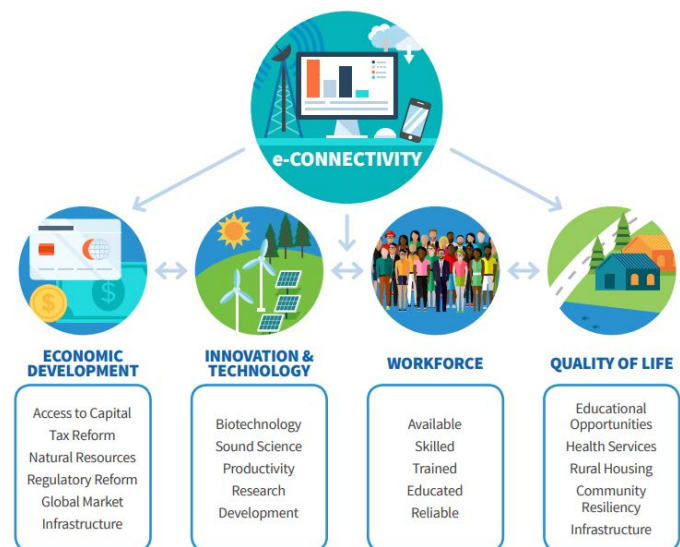
⁵³ *Id.* at 8.

III. Agritech for Rural Revitalization

On April 25, 2017 President Trump issued Executive Order (EO) 13790, Promoting Agriculture and Rural Prosperity in America.⁵⁴ The EO established the Interagency Task Force on Agriculture and Rural Prosperity administered by the Department of Agriculture.⁵⁵ Secretary of Agriculture Sonny Perdue is Chair of the Task Force; its membership is comprised of the heads of twelve executive departments, agencies, and offices, including Small Business Administrator Linda McMahon.⁵⁶ The Task Force mission is to determine legislative, regulatory, and policy changes that will promote agriculture, economic development, job growth, infrastructure improvements, technological innovation, energy security, and quality of life in rural America.⁵⁷

A. Report to the President of the United States from the Task Force on Agriculture and Rural Prosperity

The Task Force identified more than 100 recommendations in its first report released on October 21, 2017.⁵⁸ Recommendations were organized into five indicators of rural prosperity: achieving e-connectivity, considered the essential ingredient of all initiatives; improving quality of life, measured by economic and social indicators; supporting a rural workforce through training and education; and harnessing technological innovation and developing the rural economy which both rely on modernizing STEM education, regulatory structures, and infrastructure.⁵⁹



Indicator map.⁶⁰

B. Collaboration

According to the Task Force, an ideal rural America has “world-class resources, tools, and support to build robust, sustainable communities for generations to come.”⁶¹ The mission of the Task Force requires a collaborative approach between Task Force members (over two dozen officials); state, local, and tribal governments; legislators; and key stakeholders.⁶² The report

⁵⁴ Promoting Agriculture and Rural Prosperity in America, Exec. Order No. 13790, 82 Fed. Reg. 20237 (Apr. 23, 2017).

⁵⁵ *Id.*

⁵⁶ *Id.*

⁵⁷ *Id.*

⁵⁸ *Id.*

⁵⁹ U.S. DEPT. OF AGRIC., REPORT TO THE PRESIDENT OF THE UNITED STATES FROM THE TASK FORCE ON AGRICULTURE AND RURAL PROSPERITY 2-3 (2017), <https://www.usda.gov/sites/default/files/documents/rural-prosperity-report.pdf>.

⁶⁰ *Id.* at 16.

⁶¹ *Id.* at 2.

⁶² *Id.* at 13.

proposed a Commission on Agriculture and Rural Prosperity based on Task Force membership, a Stakeholder Advisory Council, and a Managing Director to oversee both offices.⁶³ Coordination among participating agencies will be essential for preventing duplication of programs and spending. Enlisting private sector leaders will be equally important for planning and implementation success.

IV. The Cluster Approach

There are a variety of holistic revitalization initiatives that can serve as models for the Task Force on Agriculture and Rural Prosperity.

A. The Next Silicon Valley?

Communities across the United States are trying to develop tech-focused business clusters and become the next Silicon Valley. For example, Utah has become a top destination for entrepreneurs because it offers top research universities, a variety of public, nonprofit, and venture funding options, and mentorship initiatives from local business leaders.⁶⁴ The surging tech economy mixed with a unique blend of state city support, culture, and community has transformed Utah's Wasatch Front corridor into a destination known as the "Silicon Slopes."⁶⁵

Clusters are "dense regional networks of interconnected companies and institutions involved in a single industry"⁶⁶ that "drive job and wage growth, new business creation, and innovation."⁶⁷ Many regional hubs target industries that the region already specializes in and capitalize on available infrastructure and transportation routes. Newer industry hubs include Austin's technopolis, Massachusetts' biotechnology cluster, Kansas City's Animal Health Corridor, and Milwaukee's water technology cluster.⁶⁸

Clusters require collaboration among diverse industry stakeholders: research universities, start-ups, large universities, state and local governments, federal agencies, and support groups.⁶⁹ Support groups are individuals and organizations that create social capital, promote collaboration, and advocate for cluster initiatives.⁷⁰ Formal clusters and other industry-specific regional environments take a holistic approach to entrepreneurial support by offering a variety of resource vehicles and exposure to diverse industry stakeholders. Agritech ecosystems that are modeled after Silicon Valley have enabled researchers to connect with, or even become, the entrepreneurs and investors that can turn basic scientific insights into transformative businesses.⁷¹

⁶³ *Id.* at 14.

⁶⁴ John Rampton, ENTREPRENEUR, *The 4 Ingredients of Utah's Startup 'Secret Sauce,'* <https://www.entrepreneur.com/article/246583> (last visited Feb. 12, 2018).

⁶⁵ *Id.*

⁶⁶ EPA CLUSTER, *supra* note 33, at 1.

⁶⁷ *Id.* at 7.

⁶⁸ *Id.* at 1.

⁶⁹ *Id.* at 21.

⁷⁰ *Id.*

⁷¹ *Startup Guide*, *supra* note 10, at 2.

B. Salinas Valley

Located less than an hour south of Silicon Valley, the world's most famous agritech hub, is the Salinas Valley, known as the "Salad Bowl of the World."⁷² The region has an \$8 billion agricultural industry, but its dependence on produce production has resulted in a seasonal, low-income, and poorly educated population.⁷³ To embrace shifts in the agriculture industry and strengthen the local economy, the City of Salinas led an initiative to create an agritech ecosystem, the Steinbeck Innovation Cluster.⁷⁴ It is an innovation network focused on the development of agritech businesses and products within the Salinas Valley that utilizes the power of civic, academic, technological, corporate and philanthropic partners from the Salinas and Silicon Valleys.⁷⁵

This ecosystem's objectives included entrepreneurial development and access to capital and next generation workforce development, as well as a marketing campaign to rebrand the city as an agritech hub.⁷⁶ The Salinas agritech cluster is a unique case because the city did not have an entrepreneurial culture or a local research university; instead, it relied on a technology consulting firm, a marketing firm, and regional community colleges.⁷⁷ In five years the initiative has achieved the following results:

- 32 companies have participated in the THRIVE accelerator and created 50 local jobs
- 45 entrepreneurs are based in the Western Growers Center for Innovation and Technology
- 3,300 students trained to code through the CoderDojo program, a global network of free community-based programming clubs
- 130 student members at Digital Nest, a collaborative training and work space
- 3 Forbes agtech summits.⁷⁸

The agritech innovation system in Salinas is now a model for industry clusters and public private partnerships.

C. Agritech Hubs in the Midwest

St. Louis, Missouri looks like a natural hub for agtech because it is home to nine Fortune 500 companies, nearly 100,000 farms, top ranked university programs in agriculture and life sciences, industry leading research facilities, and a growing number of startup resources.⁷⁹ In St. Louis, agritech entrepreneurs have access to necessary inputs such as talent, infrastructure, and capital.⁸⁰ The region also offers "intangible Midwestern friendliness" and enthusiasm for locally

⁷² Andrew Myrick & Rachel Deloffre, *Planting the Seeds for an Agtech Innovation Ecosystem*, 16 ECON. DEV. J. 5, 5 (Jan. 2017) [hereinafter "Planting Seeds"].

⁷³ *Id.*

⁷⁴ Joe Gunter, *Salinas Fosters Ag Tech Innovation*, WESTERN CITY (Jan. 2016), <http://www.westerncity.com/Western-City/January-2016/Salinas-Fosters-Ag-Tech-Innovation/>

⁷⁵ *Id.*

⁷⁶ "Planting Seeds," *supra* note 67, at 8.

⁷⁷ *Id.* at 9.

⁷⁸ *Id.*

⁷⁹ Louisa Burwood-Taylor & Emma Cosgrove, AGFUNDER, *Is St. Louis the Silicon Valley of Agtech?* (Nov. 2, 2017) <https://agfundernews.com/stlouis-silicon-valley-for-agtech.html>

⁸⁰ *Id.*

produced technologies,⁸¹ which encourages local graduates and entrepreneurs to remain in their local communities.

V. Conclusion

Cities, states, and regions are developing business-friendly environments tailored to attract and retain the agritech industry as a catalyst for community revitalization. Agritech initiatives have sprouted in traditional agricultural areas such as Des Moines, Cedar Rapids, St. Louis, Durham, Fargo, Memphis, and Salinas. The heartland has the ingredients for technological innovation and prosperous communities, and it is now focused on offering resources to support entrepreneurial development in the region.⁸² These efforts can also serve as models of public-private collaboration for the Interagency Task Force on Agriculture and Rural Prosperity.

⁸¹ *Id.*

⁸² Suren G. Dutia, Ewing Marion Kauffman Foundation, *AgTech: Challenges and Opportunities for Sustainable Growth* 5 (April 24, 2014), <http://www.kauffman.org/what-we-do/research/2014/04/agtech-challenges-and-opportunities-for-sustainable-growth>.