



# AGRICULTURAL TECHNOLOGY

Agricultural technology is a growing field, and Kansas is home to many agricultural technology companies that vary widely in their size and specialization. Entrepreneurs have great ideas and work to implement them to encourage growth in agriculture.

Potential exists for new, innovative ideas to take root in Kansas and develop into successful businesses. Advances in technology that reduce costs and increase productivity are key to long-term agricultural growth in Kansas. Unmanned aerial systems (UAS) technology in particular is increasingly important as farmers and ranchers work to implement precision technologies into their management practices. A strong innovation culture positions Kansas as an excellent area for development.

Kansas is home to multiple manufacturers of agricultural equipment and technology companies that support development of agricultural technology. Institutions of higher education in Kansas offer strong science and technology programs to grow the workforce, including UAS-related degrees which are now available within the state. The state's commitment to water conservation creates a need for new and expanded water-saving technologies to increase efficiency in the region. The strong customer base of farmers and ranchers makes Kansas a prime location for advancements in agricultural technology. Drone imagery is one such advancement which is highly detailed yet limited in its coverage area.

Alongside the vast potential for this industry there exist some challenges which could present barriers to growth, including statewide expanded and reliable connectivity. Establishing a reliable workforce can be challenging in an industry that requires specific technical knowledge. Engaging the agricultural industry in new technologies or new innovative ideas can be difficult, especially with limited data to prove a return on investment for the producers. Similarly, new products and technologies face uncertainty in regard to policies and regulations which might limit their acceptance. Ag tech companies are often brand-new enterprises, and the financing of start-up companies generally occurs outside the traditional finance arena where much of agriculture operates.

The agricultural technology industry offers huge potential for growth, with unlimited possibilities. To foster this potential will require ongoing input and discussion among key partners as a long-term strategy for growth is developed to guide the industry. Additional resources that encourage business growth could be directed toward agricultural companies. A strategic growth plan created out of collaborative efforts from both public and private stakeholders will be key in the growth of this industry.

# STATUS

Kansas is home to agricultural technology companies of all sizes, many led by entrepreneurs who are working to discover the next big idea. Technology companies offer great potential to adapt their products and services to serve the agricultural industry. Nearly 90 percent of Kansas' land mass is devoted to farming and ranching, providing ample customers for agricultural technology applications.

Agricultural technology is a vast industry, present in all agricultural sectors, and includes any advancement — digital or concrete — that leads to increased agricultural production and/or production at the lowest cost and with the most efficient natural resource use. Technology companies may produce the next great application to organize data or a physical product that reduces water use.

Agricultural technology companies encompass numerous agriculture and technology sectors. A majority of these sectors have economic multipliers of 1.75-2, among the highest of all sectors in the Kansas economy. Therefore, growth in these sectors can lead to large economic ripple effects throughout the economy.

Projects such as the relocation to Kansas of both the American Royal and Dairy Farmers of America are strong signals that Kansas is on the frontier for the latest agricultural technology advancements, with strong growth potential in both urban and rural areas.

Pairing the prevalence of the agricultural industry with Kansas' pro-business climate and Midwest values makes Kansas a prime location for entrepreneurs to create or expand their businesses. With expanded reliable connectivity, potential exists to create an environment for growth in technology and a pro-entrepreneurial culture that can establish Kansas as the Silicon Valley of agricultural technology.

# OPPORTUNITIES

In order to develop a strategic growth plan for agricultural technology and entrepreneurship, it is important to understand the areas where Kansas has a comparative advantage and the best opportunities for growth or expansion.

Factor	Implications for Growth and Development Opportunities
<b>Established Tech &amp; Entrepreneurship Industry</b>	<p>Discovery of new technologies and support for start-up enterprises requires funding for research and development and more. The Kansas State University Innovation Partners is dedicated to the start-up and expansion of technology-based, high-growth enterprises and enabling the commercialization of university and underutilized corporate intellectual property.</p> <p>Key communities and regions in Kansas have also taken proactive steps to recruit and support high-tech enterprises to the region. wKREDA is a coalition of individuals in 55 western Kansas counties focused on building strong communities for the common good of the region. E-Communities are another resource devoted to the growth of entrepreneurship and small businesses throughout Kansas. NetWork Kansas is an organization available to those seeking additional information. The Kansas Small Business Development Center network, along with knowledgeable county economic development staff are local resources not to be overlooked.</p> <p>Drone technology is immersed in research projects with K-State Research and Extension in the departments of agronomy, biological and agricultural engineering, and entomology. Projects include wheat phenotypes, thermal mapping and crop scouting.</p>

Factor	Implications for Growth and Development Opportunities
<p><b>Existing Customer Base</b></p>	<p>Over 45 million acres are devoted to farming and ranching in Kansas, nearly 90 percent of the state’s total land mass. Kansas has an abundance of potential customers for agricultural technology companies and support of entrepreneurs.</p> <p>Kansas is also home to multiple agricultural equipment manufacturers, which serve as potential customers for agricultural technology companies to develop strategic partnerships to enhance equipment with the latest precision technologies.</p>
<p><b>Human Capital</b></p>	<p>Kansas Regents institutions boast strong science and technology opportunities and unique experiences for a wide variety of educational opportunities. Kansas has strong technical, 2-year and 4-year institutions to support Kansas initiatives. These educational programs contribute to the development of a workforce that is trained and prepared for growth in the technology sector.</p> <p>Kansas State Polytechnic boasts a strong aviation component and offers one of the nation’s first bachelor’s degree programs in unmanned aircraft systems. Kansas State Polytechnic is nationally recognized for its expertise in the UAS field. Specific areas of study include UAS design and integration and UAS flight and operations.</p>
<p><b>Industry Relations</b></p>	<p>“Big data” within agriculture has led to many new collaborative opportunities. Small and large companies routinely work with each other to solve problems and increase profitability within Kansas agriculture. Public, private and university partners are more often the norm than in previous years.</p>
<p><b>Natural Resources</b></p>	<p>Kansas is recognized nationwide for implementing proactive practices of conserving water, allowing farmers and ranchers to manage their own water while still preserving the aquifer for generations to come. The number of water technology farms, in cooperation with the Kansas Water Office, continues to grow throughout the state. Water-saving irrigation technologies can assist in addressing key challenges in other agriculture sectors, such as reducing water usage by increasing efficiency of water application.</p>
<p><b>Policy Environment</b></p>	<p>Kansas tax law allows sales tax exemption for farm machinery and equipment and various ag-based inputs. These state tax code provisions make Kansas a more attractive state for growth or expansion.</p> <p>At the state level, Kansas works closely with the agricultural industry to ensure its protection from overreaching federal regulation.</p> <p>At the federal level, Kansas is fortunate to have elected members of Congress who strongly support the agricultural industry. The Kansas congressional delegation plays an important role in influencing positive changes related to federal regulations or legislation, international trade, federal taxes, transportation rules, natural resources and more.</p>

Factor	Implications for Growth and Development Opportunities
<p><b>Supporting Infrastructure</b></p>	<p>Whether by highway, rail or air, Kansas offers excellent transportation and marketing advantages. Kansas' strategic location, at the convergence of I-35 and I-70, places it at the crossroads of America. The central location and excellent transportation network with access to interstate rail, trucking and air corridors put businesses within next-day freight service of 70 percent of the United States.</p> <p><b>Highways:</b> Kansas' highway system ranks 3rd in the nation in overall cost-effectiveness and condition and third nationally in total road mileage with more than 140,000 total road and street miles and more than 10,000 highway miles. (Annual Highway Report by Reason Foundation)</p> <p><b>Rail Service:</b> Kansas ranks in the top 10 in the U.S. in railroad mileage with more than 4,800 miles of track.</p> <p><b>Air Service:</b> According to the Kansas Department of Commerce, Kansas has 137 public use airports that offer convenient access to local communities, and direct routes to all national air service hubs. Within Kansas, passenger service is offered at eight commercial airports. Wichita Dwight D. Eisenhower National Airport (ICT) is the only airport that handles substantial freight movements.</p>
<p><b>Weather and Natural Resources</b></p>	<p>Agricultural technologies, to include the Kansas Mesonet with its 74 environmental monitoring stations throughout the state, can assist in addressing key challenges in other agriculture sectors with scientific-based data.</p>

# CHALLENGES

While Kansas is poised for potential expansion in the agricultural technology and entrepreneurship sector, the following factors represent challenges serving as barriers to achieving the objective of the strategic growth plan.

Challenge	Details of Challenge
<p><b>Access to Capital</b></p>	<p>Many agricultural technology companies are new, entrepreneurial enterprises, and the financing of start-up companies generally falls outside of the traditional agricultural lending arena. Therefore, financing options need to be sought outside of traditional lenders and inside the venture capital and start-up financing environments.</p>
<p><b>Critical Infrastructure</b></p>	<p>The lack of consistent, reliable broadband access limits the ability of some farmers and ranchers to utilize technological advancements fully.</p> <p>There is a lack of adequate workspaces in rural areas to provide flexible office and meeting solutions.</p> <p>A lack of affordable, livable housing in rural areas compounds the issue of a shortage of agricultural workers.</p>
<p><b>International Trade</b></p>	<p>Access to international markets for technology products is a great potential revenue stream, but resistance to free trade agreements at the federal level can hinder this access.</p> <p>Trade tariffs can serve as a barrier for agricultural technology UAS hardware in production.</p>
<p><b>Policy</b></p>	<p>Though not unique to Kansas, there exist significant challenges due to federal laws and regulations that affect technology. State and federal laws and regulations impacting the agricultural community as a whole could have an impact on opportunities in the agricultural technology sector and discourage the entrepreneurial spirit.</p> <p>Current FAA restrictions limit use of unmanned aerial vehicles and create challenges.</p>
<p><b>Research and Information</b></p>	<p>While there are many useful methods for capturing digital data and advanced analytics related to crop production, there is a dearth of information and algorithms to actually interpret the data in a way that is helpful for a producer looking to make management decisions. Kansas producers can grow human and animal food and researchers should provide science-based data on how they can grow more with less by taking the guesswork out of production agriculture.</p> <p>There is a lack of user-friendly systems in place to leverage the data created through UAS technology. Producers want to be able to add value to their farms and farm operations with new and emerging technology</p>

<p><b>Retention of New Businesses</b></p>	<p>Other regions in the country have established reputations as strongholds for technology entrepreneurs; Kansas must provide an enticing alternative to keep these individuals in the state, as a great place to live, work and start a business.</p> <p>Marketing and technical assistance is also challenging, particularly when it comes to finding sufficient support to make an economic impact on marketing efforts outside of Facebook and social media to allow businesses to remain viable and thrive in local communities.</p> <p>Assistance with grant applications is essential. A grant “circuit rider” would be beneficial in assisting new and emerging businesses, as well as small communities throughout the state.</p>
<p><b>Small Entrepreneurs</b></p>	<p>The speed at which technology research and development grows can make business development difficult for tech companies. It is difficult for small entrepreneurs to have ready access to additional capital as a new company grows. Marketing assistance is valued and will assist in the growth of this sector.</p>
<p><b>Uncertainties of Industry</b></p>	<p>Entrepreneurial endeavors in the field of agricultural technology are often forging new ground, testing new products and concepts. This may mean uncertainty in the regulatory environment, as policies adapt to new ideas and new businesses. It can also mean uncertainty in the return on investment for untested products, which can be difficult for entrepreneurs seeking investors and capital.</p>
<p><b>Workforce Development</b></p>	<p>Graduates with technical knowledge in engineering, agriculture, computers and technology will be necessary to fill the workforce needs of the technology industry. In addition to the technology workforce, the UAS industry needs engineers, operators and data interpreters.</p> <p>Community and technical colleges should be forward-thinking about working with industry to design appropriate associate degrees and certificates to meet future industry demand, to include data collection and interpretation.</p> <p>In-state and out-of-state high-tech graduates do not think of Kansas as a place to go for full-time jobs. Marketing efforts should continue to promote the benefits of living in Kansas.</p>

Policies in this document are a reflection of industry discussion and not a representation of state government.

# SUCCESSSES

Key recent successes in the ag technology, entrepreneurship and UAS industry:

- Hitch Pin, a real-time network created to connect farmers who need products and services to those who can provide them, chose Manhattan as their home in 2020. They selected Manhattan by placing a high priority on being located in the heart of agriculture.
- In January 2021, AgEagle, a UAS company based in Wichita, acquired MicaSense. MicaSense is a highly respected sensor company which is at the forefront of advanced drone sensor development.
- Ag Partners Cooperative, with locations in northeast Kansas, is teaming with the Rantizo network on technology advances. Rantizo obtained an FAA waiver in July 2020 to allow a remote pilot to operate more than one small UAS at a time. Data from this waiver will be extremely important for the Kansas UAS industry in the years to come.
- The Wichita Youth Entrepreneurship Challenge had a good turnout for the 2020-2021 school year even though the numbers were down, as accessibility to youth in Wichita was hindered due to the pandemic and schools being remote and then a hybrid model. There were three winners from the competition and the organizers are looking forward to future competitions.
- Camp Destination Innovation continued in 2021. A total of 22 youth participated, which was down, to allow for ease of the staff and participants to get back into programming. The focus for 2021 was Power in the Pivot of Entrepreneurship. The camp explored 2020's pandemic and the impact it had on business. The youth participants met with businesses to discuss how they pivoted to survive the pandemic.
- The Kansas Department of Commerce created a video on the Kansas agribusiness industry to assist with marketing our state for growth.
- Technology is growing in prominence in many sectors across Kansas agriculture, from increased use of precision agriculture in irrigation to the addition of robotic milking in dairies to the use of ultra-high frequency tags and readers as part of the CattleTrace pilot program.

Key past successes in the ag technology, entrepreneurship and UAS industry:

- In 2018, Kansas was selected as one of 10 partners in the UAS Integration Pilot Program, with a proposal that seeks to leverage a statewide unmanned traffic management system to facilitate precision agriculture operations.
- Kansas has increased our national presence in the UAS industry by annual participation in Xponential, the annual trade show of the Association for Unmanned Vehicle Systems International.
- Northwest Kansas Technical College has been actively engaged with local schools in recruiting as well as promoting UAS/ precision agriculture as an academic and career option to students from K-12 through postsecondary.
- Partnerships have been developed between several interested companies and either Kansas State Polytechnic and/or Northwest Kansas Technical College in order to complete testing of UAS equipment.
- Kansas State Polytechnic became the first entity in the nation to achieve statewide access during flight operations. It has received a "beyond visual line of sight" waiver from the FAA.
- The Kansas Department of Transportation named a director of UAS.

# Ag Technology & Entrepreneurship

## GROWTH OBJECTIVE:

Establish Kansas as a premier state for start-ups in agricultural technology and entrepreneurship by fostering a business environment that supports new and expanding enterprises.

## OUTCOMES & ACTION ITEMS

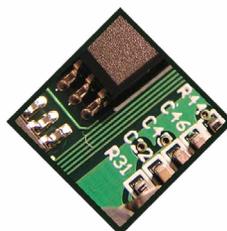
Leaders from throughout the Kansas agricultural technology industry will continue to collaborate in the development and implementation of a long-term strategic growth strategy with input and discussion among key partners. Industry-identified desired growth outcomes, initially developed in 2016 and expanded to include action items, will be implemented by industry and key partners and updated annually at the Kansas Governor's Summit on Agricultural Growth. Following are the proposed action items to continue building on the achievement of the agricultural technology sector desired outcomes.

### High Priority Outcomes

**Programs of study in agricultural technology and data management available at Kansas high schools and colleges that meet the needs of start-up companies. Continued support of apprenticeships, internships and mentorships, which lead to an increase in workforce-ready students.**

#### ACTION ITEMS:

- Reach out to nonagricultural students interested in technology and encourage them to consider a program of study focusing on agricultural technology. Industry partners could provide support to the Kansas Science Olympiad for grades K-12, which includes remote sensing as a topic area.
- Broaden messaging of diverse professions held in food and agriculture to attract urban youth involved in 4-H and FFA (e.g., information technology, engineering and communications).
- Collaborate with Board of Regents and Regents schools to place a priority on current, relevant agriculture education in postsecondary programs across the state, to include minor and certificate programs
- Establish exact needs of technology companies and communicate to secondary and postsecondary levels addressing current skills gap.
- Develop education-to-business partnerships on secondary and postsecondary levels that address needs of both the classroom and the workplace.
- Determine if blockchain technology is applicable as a program of study for data management.
- Utilize existing resources in middle schools and high schools to offer exposure and hands-on experiences demonstrating the diversity of agriculture careers (e.g., Seed to Stem, Ag in the Classroom).
- Integrate agriculture with apprenticeships, internships, projects and mentorships held in other professions (e.g., information technology, engineering and communications).
- Market availability of technology-related positions in the agriculture field.
- Leverage Rural Opportunity Zones for student loan repayment opportunities.



### **Enhanced emphasis on entrepreneur resources. Focus to be placed on:**

- Start-up capital available to agricultural technology entrepreneurs through investor-funded programs or state programs such as JumpStart Kansas Entrepreneur.
- State-sponsored economic development incentives which meet the needs of agricultural technology start-ups.
- Dynamic network between small and mid-sized technology companies, agricultural entrepreneurs, investors and mentors, including investment forums to encourage networking of start-ups and potential investors, and an agricultural technology incubator network to support faster company timelines.
- Effective array of “soft” incentives (e.g. mentorships, internships and training on interaction with financiers) which are accessible to agricultural companies to ensure they have the information, workforce and financing they need to economically grow and thrive in Kansas communities.

#### **ACTION ITEMS:**

- Develop a network that can help identify and market available programs (e.g., angel tax credits, SBA loans). Pursue the creation of programs that provide training to start-ups on interfacing with the investment community.
- Establish workshops for entrepreneurs and new businesses on giving “pitches” to investors.
- Create a business incubator that offers incentives to start a business and that provides an avenue for entities to invest in those businesses.
- Enhance marketing of current availabilities that Network Kansas and Midwest Venture Alliance has to offer. Distribute resources through seminars, onsite trainings and webinars.
- Develop a newsletter with information for entrepreneurs and investors to share success stories and availability of opportunities across Kansas. Utilize successful agricultural entrepreneurs for marketing and training of potential start-ups through newsletter and social media outlets.
- Encourage a business-friendly climate to support agriculture technology and agriculture entrepreneurship, to include the development of a mentoring program similar to the Pipeline Entrepreneurs program.
- Author a review of current state economic development benefits and pursue legislation to alter existing programs and/or create new programs to support this sector.
- Develop a coordinated effort between economic development directors, agriculture entrepreneurs, technology companies, Kansas Department of Commerce, and Kansas Department of Agriculture to approach the Kansas Legislature for funding to create incentives to attract potential businesses.
- Develop economic impact studies of agricultural technology companies to show the importance of funding incentive programs.
- Increase partnerships between state and local entities to expand available incentives.

### **Seamless connectivity from mobile networks across all of Kansas. This is critical to adoption and implementation of UAS technology statewide.**

#### **ACTION ITEMS:**

- Work with mobile companies to highlight potential for collaboration in expanding seamless connectivity statewide.
- Explore connection between existing cell infrastructure as well as nontraditional structures to serve as “towers.”

### **Imagery interpretation systems and algorithms in use with UAS systems that provide useful recommendations to farmers. With current UAS technology farmers and ranchers are not able to effectively use the data generated by UAS, nor create solutions and management decisions, such as fertilizer application plans.**

#### **ACTION ITEMS:**

- Advocate for and secure funding for advanced research in algorithm development.
- Develop methods for best development of algorithms.
- Disseminate information to agriculture technology companies.
- Determine what applications are currently needed.
- Establish a public GPS base station network.
- Beneficiaries of the network will include UAS (navigation and data), autonomous vehicles, construction and surveying industries and many more, including Kansas state agencies.

**Kansas presence at regional and national UAS events in an effort to attract and establish unmanned aerial vehicle manufacturing, assembly operations, flight testing infrastructure and flight spaces to Kansas.**

**ACTION ITEMS:**

- Continue participation at national UAS Summit & Expo.
- Continue participation at UAS Cluster Initiative events.
- Continue active participation and leadership at UAS Summit in Kansas.

**Information showing a demonstrated return on investment from incorporating UAS technology into farm management decisions. Evidence of return on investment would promote farmer adoption of UAS, assist farmers in becoming more comfortable in utilizing the technology, and result in greater farm profitability.**

**ACTION ITEMS:**

- Quantify return on investment based upon research and extension activities.

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## **Medium Priority Outcomes**

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**Research on applications in animal agriculture through collaborations between Regents institutions and industry, an area that remains largely untapped.**

**ACTION ITEMS:**

- Research and create animal herd tracking systems that would track health and nutrients. Conduct additional research on drone imagery to count cattle in feedlots and pastures.

**Business-friendly environment that attracts further expertise and innovation to the state.**

**ACTION ITEMS:**

- Promote the Strategic Growth Initiative process, a pilot program to help counties and communities proactively seek potential business growth opportunities, working with KDA, the Kansas Department of Commerce and the Kansas Department of Transportation.
- Market the benefits of Kansas' business-friendly environment.
- Educate lawmakers on current infrastructure and policies that successfully create a business-friendly environment.
- Engage with legislators when proposed legislation threatens a pro-growth business environment in order to rectify negative results that may occur.