

IOWA STATE UNIVERSITY

OF SCIENCE AND TECHNOLOGY

FY20 ANNUAL ECONOMIC DEVELOPMENT AND TECHNOLOGY TRANSFER REPORT TO BOARD OF REGENTS, STATE OF IOWA

PRESENTED BY:

David Spalding
Raisbeck Endowed Dean, Debbie and Jerry Ivy College of Business
Interim Vice President, Office of Economic Development and Industry Relations

November 2020

Iowa State University Annual Economic Development and Technology Transfer Report – FY2020

As the land-grant institution in the very first state to adopt the Morrill Act, Iowa State University wholeheartedly supports the land-grant ideals of putting science, technology and human creativity to work. Economic development is a top priority for Iowa State, and the university is very proud of the impact it has on both the lives of its students and the state economy. Iowa State's **economic development programs, services and initiatives** contribute to the overall positive net impact the university creates on Iowa's business community and return on investment it generates for students, taxpayers, and society. Through President Wendy Wintersteen's **Innovation and Entrepreneurship Initiative**, we are embedding innovation and entrepreneurship more deeply into our culture and curriculum. By doing so, we are cultivating the next generation of innovators and entrepreneurs while responding to the needs of our communities and state.

Iowans can count on Iowa State to serve as a trusted resource, using our core strengths—innovation, science-based extension and outreach, and education. In response to the ongoing COVID-19 crisis, units within the **Office of Economic Development and Industry Relations (EDIR)** have adapted their normal business operations to better meet Iowans' needs. The units continue to remain very engaged across the entire state, providing outreach and assistance in support of Iowa businesses.

EDIR consists of the following key university economic development units that provide integrated and comprehensive business, technical, entrepreneurial support, and educational services to Iowa State's clients and partners:



- The **Center for Industrial Research and Service (CIRAS)** works with business and industry across all 99 counties to enhance their performance through service offerings in five general areas: technology, growth, productivity, leadership, and workforce. CIRAS leads three federal business outreach programs and two state-based programs, with staff and partners located across campus and across the state.



- The **Small Business Development Center (SBDC)**, administered by Iowa State, consists of 15 regional centers serving all 99 counties in Iowa. SBDC assists individuals interested in starting new companies and provides business services and counsel to existing small companies across Iowa to solve management problems, to improve operations, to seek financing, and to pursue new opportunities. Iowa State also operates two of the regional centers.

IOWA STATE UNIVERSITY

Pappajohn Center for Entrepreneurship

- The **Pappajohn Center for Entrepreneurship** serves entrepreneurs on campus and in our community, provides entrepreneurial opportunities for students including a student accelerator, hosts statewide and local business plan and pitch competitions, and participates in university-wide academic programs in entrepreneurship ranging from a cross-campus minor to a PhD program.

IOWA STATE UNIVERSITY

Research Foundation, Inc.

IOWA STATE UNIVERSITY

Office of Intellectual Property
and Technology Transfer

- The **ISU Research Foundation (ISURF) and Office of Intellectual Property and Technology Transfer (OIPTT)** protect, manage, market and license the intellectual property of ISU researchers. The licensed intellectual property rights, in ISU developed innovative technologies, provide rights which may improve the business's manufacturing costs, become a new product line, increase revenue streams or advance product market share. OIPTT negotiates and implements nondisclosure agreements, material transfer agreement and the industry and commodity agreements related to ISU's research collaborations with industry.



- **ISU Research Park (ISURP)** provides a resource-rich environment WHERE INNOVATORS FLOURISH. It includes close proximity and easy access to Iowa State University for our tenant partners, which include start-ups and established companies that range from growing entrepreneurial ventures to global corporations. The Research Park offers high quality labs and office space, as well as numerous community events, services and amenities that support the efforts of science- and technology-based organizations.

In June 2016, EDIR moved into the new **Economic Development Core Facility**, which houses these units under one roof. EDIR serves as the gateway to the university's expertise, capabilities, resources, and facilities that support and enhance economic development throughout the state. EDIR works very closely with other university units that contribute to the university's economic development efforts and impact, including the Office of the Vice President for Extension and Outreach, the Office of the Vice President for Research, and the academic colleges.

Iowa State **pioneered the first statewide Extension Service** in 1906. The extension experiment—universities actively transferring their research and expertise to every corner of every state—was immensely successful across America and remains so today. **Iowa State University Extension and Outreach**, in collaboration with ISU colleges, impacts economic development in the state through all of its programs—Community and Economic Development

(CED), as well as Agriculture and Natural Resources, Human Sciences, and 4-H Youth Development.

ISU promotes economic growth in Iowa in a number of ways. We provide business and technical assistance to existing companies, we support the creation of new companies, we help attract new companies and entrepreneurs to Iowa, we create intellectual property and help move research ideas to the market, and we contribute to workforce and entrepreneurial development.

Business and Technical Assistance

SBDCs - The SBDCs were able to bring additional resources quickly to Iowa businesses when COVID-19 impacted our state. **In a typical year, the SBDC sees approximately 4,000 clients. Due to COVID-19, the Iowa SBDC has seen over 72,000 businesses and clients.** They were able to do this by quickly developing a Triage Team that utilized an additional 20 staff and students from all across the ISU campus that were trained to triage each business call and do additional outreach to existing businesses within the state. This Triage System was



also replicated in six other states across the nation from the Iowa Model. The Iowa SBDC is also currently going out to the rural communities to help Iowa's small business community in multiple areas. The most popular currently is the assistance to small businesses wanting to get online to be more competitive and increase their sales. The SBDC team will go into a business and help them with their marketing strategy, product placement and product photos for sales. The second area of great need is the accounting assistance to help these same businesses stabilize in uncertain times.



During the most recent full year for the program (data based on federal year reporting timeframe), **America's SBDC Iowa** provided business assistance to individuals and companies **in all 99 counties totaling 72,803 clients and 15,244 counseling hours.** As a result of this counseling, 197 new businesses were started and 1,869 jobs were created. Additionally, SBDC assistance was **credited by clients with increasing their capital infusion by more than \$161.9 million and increasing their sales by more than \$263.22 million.** This translates into 156 new jobs every month, 16 new business every month and sales increases of \$22.0 million every month.

The **ISU SBDC regional center and the Mid Iowa SBDC regional center** provided 2,251 hours of counseling assistance to startup and existing companies; served 1,191 clients with one-on-one counseling; provided advice to several hundred clients via telephone and e-mail; and advised a number of technology companies in the areas of licensing, equity-based financing, market entry, and numerous operational areas. The centers documented **43 new business starts with 222**

new jobs created that have generated \$37.15 million in capital infusion and \$34.76 million in sales increases.

CIRAS - CIRAS was created in 1963 to improve the quality of life in Iowa by helping businesses and their communities prosper and grow. **CIRAS' individually tailored strategy, Engage. Educate. Embed. means we work with companies to fashion solutions specific to their individual needs.** CIRAS offers services in five main areas: growth, productivity, technology, leadership, and workforce.

A vast network of university and industry experts brings years of professional experience to CIRAS, making us a leading integrator of solutions in Iowa. **Over the past five years, CIRAS and its partners have reported impact from companies totaling more than \$2.8 billion (sales gained or retained \$2.3 billion, new investments \$0.4 billion, costs saved or avoided \$0.1 billion) and over 29,000 jobs created or retained** as a result of the assistance they received.

In 2019 alone, **1,664 businesses from 95 counties in the state received assistance on projects or attended educational workshops from CIRAS staff or partners.** Companies responding to surveys reported \$678 million in total economic impact (\$554 million in sales gained or retained, \$93 million of new investment, and \$31 million in costs saved or avoided) and over 8,500 jobs created or retained as a result of the assistance they received from CIRAS and its partners.

- The **CIRAS Manufacturing Extension Partnership (MEP)** program helps small to mid-sized manufacturers grow by implementing new technical and management practices.
- The **CIRAS Procurement Technical Assistance Center (PTAC)** assists companies from all industries and skill levels in navigating the contracting processes for federal, state, and local governments.
- The **CIRAS Economic Development Administration University Center Program (EDAUCP)** develops workforce management plans for rural communities clustered near metropolitan areas.
- The **CIRAS Technology Assistance Program (TAP)** provides expertise to Iowa businesses to reduce their risk of deploying technologies.
- The **Iowa Lean Consortium (ILC)** is a member-driven program dedicated to advancing Lean in all sectors of the economy.

Appendix 1 provides some illustrative examples of CIRAS, SBDC, and ISURF projects with Iowa companies and entrepreneurs during the past year.

ISU Extension and Outreach - The CED program within ISU Extension and Outreach has multiple community development specialists in place with expertise and/or experience working with minority-owned businesses and community business leaders. During the past year, these specialists helped 13 minority-owned business owners start or improve their own businesses and assisted with the creation and the retention of 9 jobs for minority employees. In FY2020 the updated **Iowa Retail Initiative (IRI) program** provided coaching, training, and technical assistance to 35 small-town independent retailers in 4 communities.

This past year the **Agriculture and Natural Resources (ANR) program made over 201,000 contacts with farmers and agribusinesses through 1,961 meetings, 7,842 face-to-face consultations, and 40,762 phone and email discussions.** ANR specialists present research-based information and answer technical questions to help Iowans **grow the economic base of Iowa agriculture.** ANR provides farmers, policy makers, regulators, and agribusiness professionals the opportunity to learn from research-based education to inform their decisions, which leads to sustainable environments, profitable farms, thriving communities, and a more secure food system.

Appendix 2 provides some illustrative examples of this work.

ISURP - ISURP, WHERE INNOVATORS FLOURISH, is a growing technology community and incubator for innovators at new and expanding businesses, providing access to the vast array of resources available at Iowa State University. The ISURP has a history of success because companies find value in a close physical presence and connection to the university as it facilitates working with faculty and graduate students on research, tapping into and recruiting the graduate and undergraduate student talent pool, and accessing university facilities. ISURP tenants include companies of all sizes and industry focus, though engineering and technology, and bioscience/ag tech comprise the largest proportion, reflecting Iowa State's strength in STEM. Tenants include companies incubated at ISURP as well as established global brands. **Five Iowa companies that had an IPO started at ISURP; today two remain at ISURP and one additional is located elsewhere in Ames.** In addition, multiple ISURP companies have enjoyed significant liquidity events, with two startups being acquired by global brands just this year.

In June 2016, EDIR launched the **ISU Startup Factory** (originally reporting to the ISURP; as of August 2020, reporting to the ISU Pappajohn Center) to provide a stronger support system for students, faculty and staff wanting to create scalable businesses that address technical, societal or other challenges. Entrepreneurs in the Startup Factory receive formal training, resources, and access to a network of business mentors, advisors, counselors and investors in two 26-week blocks: the first a formal curriculum centered on business validation, and the second, customized to their individual business needs. To date, **seven cohorts have completed the program and two are currently in the program for a total of 123 new startup companies.** Companies that are currently participating in or have graduated from the program have **raised nearly \$33 million in private and public capital,** including 23 SBIR or STTR Phase I grants, five SBIR Phase II grants, twelve Proof of Commercial Relevance awards, nine Demonstration Fund awards, twenty angel investment rounds and sixteen institutional investment rounds. **SmartAg, a member of the inaugural ISU Startup Factory cohort, was acquired by Raven Industries in November, 2019,** representing the first exit for a graduate of the program. SmartAg was integrated into Raven Industries' Applied Technology division, which currently has operations in Ames, IA.

Today, ISURP is a 400-acre development just south of campus with approximately 800,000 square feet of building space. **Thirteen new companies and affiliates, and 40 pre-incubator companies joined ISURP in FY20,** bringing the **cumulative total to 467 companies and 6456 employees for current and former tenants that are still in existence world-wide.** Currently, there are **92 companies and research centers and 13 affiliates located at ISURP, employing 2041 and 106 people, respectively.** There are 23 pre-incubator companies that remain in ISU

Startup Factory space, and 20 pre-incubator companies involved with the CYstarters and Ag Startup Engine programs.

In choosing to locate at ISURP, businesses are doing more than simply occupying a building. They are joining a thriving community focused on driving innovation, researching and developing solutions to complex challenges, creating a pipeline that offers easy access to world class talent, and supercharging the state economy.

- In the past seven years, **ISURP has increased its tenant base by more than 100%, has increased square footage by 75% and significantly increased the number of employees.** In addition, commercial amenity and infrastructure projects have brought ISURP an additional 38 build ready acres for portfolio company growth so we are well positioned for the next generation of workforce solutions.
- ISURP contributes more to local property taxes than any other entity in Story County (\$1.5 million annually).
- In 2019 ISURP opened a standalone sprayer technology facility for John Deere, in addition to already housing one of its Global Technology and Innovation Centers.
- Collaborated with Story County Conservation to bring the first of its kind nationally, urban demonstration and shared 38 acre Community Park for tenants and community.
- Headquarters for the AgStartup Engine, a private systematic program to fund AgTech entrepreneurs and help them towards success through mentorship and financial support.
- 200+ student interns work at ISURP at any given time
- 53 corporate locations throughout the state, in addition to ISURP presence
- \$68,000 average salary for ISURP company employees
- An additional 2,500+ are employed throughout Iowa from ISURP graduate companies

COVID-19 brought our tenant base and programs unprecedented change and challenge, but it also represents an opportunity for thoughtful growth. While ISURP never missed a day of in person business operations, nearly all of our tenants have been forced into remote working situations, and many of those tenants, in particular the larger, international companies have not yet returned. The absence of workforce has created strain on ISURP based amenities as childcare censuses shift for our child care provider, our restaurant provider can no longer provide catering services for events, and our gym has many members that are unable to utilize its services. Our events, community-based programming and the ISU Startup Factory and I-Corps programs have all shifted to an online environment. **Tenant acquisition has slowed but activity remains high and on the contrary, tenant retention has remained steady and vacancy rates are within traditional industry averages pre-COVID.** While much of the aforementioned is negative and mimics the greater economic pressures many of our businesses continue to face, we also have had some bright spots emerge and see opportunities in our scope as we look forward.

The physical absence of our tenant base allowed ISURP to upgrade and enhance shared spaces in several of our multi-tenant buildings to bring them to a higher standard. We enhanced exterior spaces and have held outdoor events. We launched a new co-working and affiliate program to address the needs of those workers that are still remote, but that might need temporary or drop in space outside of their homes. We also have engaged multiple companies with opportunities across colleges at Iowa State University utilizing Zoom and online services

that have positively scaled the decision-making processes and are realizing collaboration and research agreements at a faster velocity than ever before.

Looking forward, we believe ISURP will continue to represent a world class location for companies and corporations as they look to re-think their strategy around workforce. We hope to target our services to our traditional markets, but also to cultivate relationships with a new cross section of companies looking to train large groups of employees, such that they could either stay at ISURP, or work in remote environments indefinitely. Our experience in the creation of beachhead offices for our large, Iowa based manufacturing companies will uniquely position us to help these companies rethink their workforce strategy. Our proximity to Iowa State and a ready-made talent base of graduating students will allow us to offer them a talented, ready-made workforce.

Workforce Development

A key component of the university's value proposition related to economic development, and its primary mission, is **providing a world class education that provides students with the technical, analytical, problem-solving, communications, and social responsibility skills required in today's workplace.** Iowa State is the largest university in Iowa with nearly 33,400 students, and despite our Midwest location, our student body is quite diverse. Our graduates are in high demand and we have a **campus wide placement rate of 95%** (i.e., 95% of undergraduate students are employed in their field or are pursuing graduate education within six months of finishing their undergraduate studies).

Iowa State is well known for providing students with professional development activities on campus that give great opportunities for companies to utilize our students' talents. Iowa State's recognition in 2017 with the Association of Public and Land Grant Universities (APLU) Innovation and Economic Prosperity (IEP) University "Talent Award," which honors an institution with **exemplary initiatives in education and workforce development,** illustrates our university's reputation on a national stage.

We have excellent entrepreneurship programs in every college as well as "experiential learning" centers that provide opportunities for cross functional teams of students to work on business projects. **Each year more than 500 Iowa State students intern at ISU Research Park companies (200+ in the Park at any given time) and at university centers.** Additionally, engineering students complete a senior capstone project, and several faculty across campus integrate company projects into their courses.

With the growth of academic programs in entrepreneurship at Iowa State and the university now offering comprehensive courses of study including an interdisciplinary minor in entrepreneurship, major in entrepreneurship, updated graduate certificate in entrepreneurship and innovation, and a PhD program in entrepreneurship, Iowa State is recognized nationally as a top entrepreneurship program. A nice stamp of approval was its **#26 ranking in the 2019-20 Princeton Review of the Top Undergraduate Entrepreneurship Programs** in the country.

During the summer of 2020, the Pappajohn Center for Entrepreneurship sponsored its fifth cohort of **CYstarters**, an 11-week summer accelerator program for students and recent graduates from

across campus. Twenty students on 14 business teams were selected to spend the summer in a hands-on mentoring environment to launch and grow their companies. Although the program was nearly 100 percent virtual this summer, students participated in educational sessions, received mentoring from close to 60 professionals, entrepreneurs and educators, and worked with Pappajohn Center staff on a daily basis in accountability sessions over the course of the summer. **All 14 teams successfully launched their business or are continuing to make progress. Forty-four of the 64 total businesses over the past four years are still active and have gone on to be successful in state and national competitions.** This year alone, 21 of these former student businesses combined raised money or had sales totaling \$5,532,000.

Over 270 students competed in the Pappajohn Center's campus wide pitch and business plan competitions. Top performers in those events received financial support totaling more than \$80,000 for their fledgling concepts.

The Pappajohn Center partnered with the Ivy MBA Program to prepare to host its second national MBA case competition, featuring an ISU technology startup as the live case. Eight universities from 2019, including Baylor, Purdue, Illinois, Washington, Wisconsin, Missouri, Kansas, and Texas Tech, are standing ready waiting for the next live competition post COVID-19 (scheduled spring 2021). The MBA students really enjoyed meeting the company founders, learning about the company's technology and then competing to provide the best market strategies for the company.

The Iowa State Pappajohn Center works collaboratively with the other four JPEC programs to host a statewide student competition, a statewide Iowa entrepreneur competition, a weeklong entrepreneur summer boot camp in Okoboji at the Lakeside Lab, and a fellowship with Entrepreneurs Organization Iowa. **Through these programs and support again this year from IEDA, the JPECs awarded \$120,000 in incentives for entrepreneurial ventures.** One-third of the twelve finalists in 2020 were Iowa State University ventures. The top winners were announced at a virtual event in September 2020.

The Pappajohn Center for Entrepreneurship **placed 38 student interns in startup companies located at the ISU Research Park, provided more than \$40,000 in match funding to startups, and reported over 16,500 students taking at least one course with an entrepreneurship component at the university.** Over 24,000 individuals participated in programs and classes focused on entrepreneurship, startups and small business.

The Center hosted two conferences this past year that focused on the target segments of women and arts entrepreneurs. The now popular **Women Who Create Conference and SheTalks community events drew 163 people to support women-owned ventures.** Additionally, the ISU Pappajohn Center hosted the international conference of the Society for Arts Entrepreneurship Educators (SAEE), bringing together more than 80 people to celebrate arts entrepreneurship education, share best practices, and celebrate musicians, artists, playwrights, writers, and other arts entrepreneurs.

The **CyBIZ Lab** interdisciplinary student consulting program offers business solutions to companies of all sizes as well as supports faculty commercialization efforts through the Regents Innovation Fund (RIF) program. The improved performance resulting from these interactions

allow businesses to retain and often expand their workforce. **Fifty-nine CyBIZ Lab students working part-time completed 36 consulting projects that gave students the opportunity to work with actual businesses to solve business problems.**

As part of normal operations, CyBIZ Lab works with clients that include startups, non-profit organizations, government agencies, communities (partnership with ISU Extension), college administrators, national professional organizations, small and medium sized businesses, and large global companies. CyBIZ Lab is unique in that teams are interdisciplinary and include both undergraduate and graduate students working together; projects also have a flexible timeline outside the classroom schedule, which allows teams to be highly responsive to company needs.

CIRAS helps connect students to real-life experiences that provide benefits to businesses across Iowa through the engineering capstone program. **Last year, engineering students worked on 132 projects, 106 of them with Iowa companies. This included 88 different Iowa companies across 38 Iowa counties.** Companies responding to surveys reported **impacts of more than \$53 million** for these projects.

Iowa State University Engineering Community Outreach works to create a future talented workforce to positively impact economic development in Iowa and the nation through ongoing innovation of STEM programming to K-12 youth, educators and the public since its inception in 2002. Trainings, events and awareness initiatives impact communities and industry talent expansion through partnerships and engagement to increase the diversity of STEM students and their exposure to career pathways. **Programs directed include FIRST® LEGO® League and FIRST® LEGO® League Jr. where over 700 teams across the state participated in 60 events throughout the academic year supported by over 1,000 volunteers.** Virtual summer kids camp activities and family-centric STEM programming were delivered throughout the spring and summer in order to provide innovative approaches to outreach to Iowa families during the pandemic. Leadership of Manufacturing Day resulted in over 100 events with communications out to over 5,000 education and industry stakeholders to promote Iowa manufacturing and the many state organizations working in partnership to share best practice. Programming continues to expand to meet the needs of educating and inspiring Iowans into high-skill, high-demand STEM careers.

In addition to professional development opportunities on campus, **ISU's career services offices work closely with companies to assist them in establishing internships for our students.** Internships provide students the opportunity to apply what they are learning on campus as well as the opportunity to experience firsthand the type of work environment they will be entering after completing their studies. Companies and other organizations benefit from the interns' work output (many companies calculate a return on investment for their internship programs, and the returns are impressive), and they use the internship as a testing ground for prospective new employees. This past year our career services offices were able to document **nearly 2,500 ISU interns who were employed by more than 960 different Iowa employers located in 260 communities in 91 counties.** These numbers do not include students who did not register their internship nor do they include students who had non-internship jobs related to their field of study.

The **Rising Star Internship Program** gives Iowa State students a unique, multi-disciplinary opportunity to learn while living and working in rural Iowa communities. **The experiential work**

opportunities aim to increase students' potential for employability and promote awareness of ISU Extension and Outreach. It is a cooperative effort between Iowa State University academic units and ISU Extension and Outreach at both the campus and county levels. Students apply their academic knowledge in work settings, examine their personal career interests, assess their professional attributes, and gain knowledge of extension career opportunities. Requirements for the program include status as an undergraduate student at or above the sophomore level, with a minimum grade point average of 2.5. The summer 2020 program was canceled due to the COVID-19 pandemic. However, ISU Extension and Outreach remains committed to providing this opportunity for ISU students.

- This program is not a conventional internship. The Colleges of Design, Human Sciences, and Agriculture and Life Sciences have helped recruit their students to live and work in interdisciplinary teams of two or three. Students are placed in rural Iowa communities. Since the program's inception, interns have been placed to work in 22 Iowa counties.
- The Rising Star Internship Program gives Iowa State students a greater understanding of the land-grant mission through extension and outreach work and provides a quality experience that improves their career opportunities upon graduation. Some interns use the Rising Star Internship to complete a requirement for their field of study. Interns also are gaining an understanding of rural Iowa's strengths and challenges.
- **Since 2014, when the program was developed, 60 students have completed the internship.** The work of the students in each region will always be focused on a locally identified need with supervision from the regional director and supported by extension professionals and other identified community members. Interns have raised the awareness of local foods and healthy living as they have assisted communities, schools, underserved audiences, producers, farmers markets, and community and economic development entities. Students tailor projects using knowledge gained in the classroom with real world work experiences that match their skills and interests.
- Following the conclusion of the experience, interns are invited to become members of the Rising Star Galaxy Club, which helps them stay connected to ISU Extension and Outreach and provides links to job opportunities. Past interns often volunteer to assist with recruitment and orientation of new applicants.

Iowa State also contributes to workforce development in the state by supporting students' learning and skill development even before they get to the university. For example, Iowa State University's North Central STEM Hub, one of six regional hubs of the Iowa Governor's STEM Initiative, has been connecting education and business to increase student interest and ability in STEM. Through the STEM BEST@ (BUSINESSES ENGAGING STUDENTS AND TEACHERS) Program, \$55,000 was awarded to school districts in North Central Iowa to grow community collaborations involving school and business partnerships. **The North Central STEM Hub supported more than 350 educators and more than 17,000 PK-12 students** in the region with STEM Scale-Up programs. The North Central STEM Hub hosted STEM festivals at Mason City and Fort Dodge, where over 1,500 attendees and families engaged in hands-on STEM activities hosted by formal and informal educators, community colleges, businesses, and economic development organizations. ISU Extension and Outreach professionals play a significant role in each region through representation on each of the six Regional Advisory Boards.

4-H Youth Development prepares Iowa's young people for careers. By participating in 4-H educational experiences, youth develop STEM, communication, leadership, civic engagement, healthy living, and general life skills. Youth are challenged to actively pursue careers and education beyond high school and build skills. In fact, annually about 91 percent of 4-H seniors report they intend to pursue trades or post-secondary education within 12 months of graduation. **4-H programs reached more than 150,000 Iowa youth in 2018-2019.**

- Over the past three years, 4-H has added **FLEx2Go** (part of the Forward Learning Experience) field-based kits containing Oculus Rift Virtual Reality sets, a 3-D printer, and a 360-degree camera. The camera captures video in 360 degrees, which when combined with Virtual Reality, allows the viewer to be right in the environment. The first 4-H 360 videos immersed youth in agriculture production experiences to better understand practices in modern agriculture. This past year, **4-H partnered with the Northwest Iowa Manufacturing Sector Hub**, formed through a consortium of manufacturers, to demonstrate career possibilities within modern manufacturing in youths' backyards. Now there is 360-degree tour of a manufacturing plant in Rock Valley, Iowa. This video has been used in multiple ways to introduce youth to what it is like to work in a modern facility and to challenge youths' preconceived notions about manufacturing. The 4-H 360 sector hub partnership was featured in a panel session at the Governor's Future Ready Iowa conference and has led to work with the local Future Ready Iowa work team.
- **FLEx** also has partnered with the Iowa State University Women in Science and Engineering (WiSE) Program this year to expand the reach of FLEx programming to youth across Iowa. WiSE recruits, trains, and deploys collegiate student role models majoring in STEM fields to lead experiential STEM programming in K-8 classrooms and educational events across Iowa.
- **AgOvation** is a new program at Iowa 4-H that helps youth develop 21st century skills through a year-long competition. In 2019, teams in Northwest Iowa competed in the summer with finals in the fall. Currently teams in Sac, Story, and Linn counties are participating. Each team identifies a problem in modern agriculture, researches it, develops a solution, tests their solution, and presents their work in a "Shark Tank" type experience to industry professionals. Each team has a mentor and industry advisers to help them as they prepare for the finals, slated for September 26.
- **Iowa 4-H and NASA Iowa Space Grant STEAM Academy** is a new collaboration supporting the development of Science, Technology, Engineering, Art, and Math skills for youth in grades 4-12. Goals of the program include strengthening the nation's STEAM future workforce, attracting and retaining youth in STEAM, and engaging youth in NASA's mission.

Finally, several ISU units provide training and related educational activities to a wide variety of individuals, occupations, and industries across the state. **Appendix 2** provides several such examples.

Technology Transfer

In FY20 ISU researchers submitted **132 disclosures of intellectual property**, and our technology transfer office filed 102 patent applications. In calendar year 2019, ISU had 38 utility US patents issued, tied at 78th on the list of the top 100 institutions with U.S. patents issued. **In FY20, ISU had 56 U.S. patents issued and 98 total patents issued** (all countries issued patents). **Additionally, last year ISU technologies resulted in 46 license and option agreements worldwide with 22 in Iowa.** ISU currently has 154 license and option agreements yielding income. Iowa companies earned \$5.4 million revenue from ISU licensed technologies in calendar year 2019, and four startup companies based on ISU technologies were formed in Iowa. Globally, total sales revenues from ISU licensed technologies were \$99.8 million. In addition, 99,000 bushels of ISU developed soybean varieties were planted across the Midwest.

The **Regents Innovation Fund** program at Iowa State has a competitive research component that pairs ISU faculty members with Iowa industries (primarily new to young startups) to create economic benefit for the companies. Please see **Appendix 3** for a complete report on Regents Innovation Fund uses and results.

Research

Iowa State received \$494.7 million in **total external funding** in FY20. The university reaffirmed its position as one of the nation's leading research-intensive land-grant institutions by receiving \$253 million in **external sponsored research funding**, the second-highest total in the past five fiscal years. Iowa State set a new record for **federal research funding** in FY20 with \$186.0 million in funding received, up 2.7% from FY19's total of 181.1 million which was the previous record level. The university also received a total of \$222.2 million in **non-federal external economic development and research funding** from a variety of sources including – but not limited to – commodity groups, corporate and industry sponsors, non-profit organizations and individual donors. A total of \$51.2 million in research and economic development funds for FY20 came from commodity groups and corporate and industry sources. Non-federal sponsored **research** funding for FY20 totaled \$67 million, of which \$11.8 million came from companies headquartered in Iowa or that have a significant footprint in the state.

Sponsored research funding is critically important in placing Iowa State faculty at the forefront of innovative discoveries and economic opportunities that make our state more competitive and help improve lives in Iowa and beyond. This has never been more evident than during the 2020 fiscal year that was impacted so profoundly by the global coronavirus pandemic. Case in point is the ongoing work spearheaded by Nigel Reuel, assistant professor of Chemical and Biological Engineering. Reuel is leading a multi-institution team in developing a **diagnostic platform that is well-suited for widespread monitoring of infection during pandemics, such as the current COVID-19 crisis.** It consists of a low-cost mailer that can be used at home, returned in the mail in a safety-sealed, confidential envelop and quickly scanned upon receipt, without opening, to diagnose the infection. This approach would off-load the burden of diagnostics from health workers, eliminate the increased use of limited personal protective equipment and provide a better overall response to outbreaks. Reuel is commercializing the technology behind this diagnostic platform through a startup company called Skroot Laboratory, Inc.

Also very much worth noting are the **significant positive contributions** the Iowa State University **Veterinary Diagnostic Laboratory (VDL)** has made to Iowans during the **pandemic**. The VDL has long been a standard bearer for disease surveillance in the U.S. food animal industry. In the spring, the facility stepped into the coronavirus fight when it first loaned diagnostic equipment to the State Hygienic Laboratory to help with Iowa's COVID-19 testing program. Soon after, the VDL received the laboratory accreditation necessary to provide clinical testing services to human healthcare providers. The lab is accredited to run the extremely sensitive and highly accurate COVID-19 polymerase chain-reaction (PCR) tests, as well as COVID-19 serology tests, which are capable of detecting viral antibodies. In the first half of August, the VDL quickly and efficiently processed test results for nearly 8,100 students prior to moving into university residence halls and campus apartments, helping facilitate a safe return to on-campus instruction starting with the fall semester.

A robust agricultural industry is essential to the overall economic wellbeing of the state of Iowa. Here, too, sponsor-funded research is keeping Iowa State on the leading edge of discovery of new solutions that help our state and nation:

- Produce crops and animal proteins more abundantly and efficiently;
- Generate renewable and sustainable energy that benefits our environment and the state's economy; and
- Identify and adopt biobased alternatives to conventional petroleum-based chemicals, compounds and products.

With grants and awards totaling \$47.8 million in FY20, the U.S. Department of Agriculture (USDA) more than doubled its investment in research at Iowa State compared to FY19. Leading the way was a \$10 million award extended to the **Consortium for Cultivating Human and Naturally reGenerative Enterprises (C-CHANGE)**, led by director, Lisa Schulte Moore. These funds will be used to explore and develop a new biobased value chain to aid agricultural producers based on the production of renewable natural gas from livestock manure and other agricultural-based feedstocks.

Another significant USDA award in FY20, was the \$2.9 million Pat Schnable, director of the Plant Sciences Institute, received to build on and extend the ongoing multi-institution **Genomes to Fields** initiative by:

- Deploying, evaluating and using field sensors and imaging technologies;
- Creating data management, sharing and analytics platforms; and
- Training the next generation of agricultural researchers.

The research of Schnable and many of his colleagues is critical to advancing the discovery and, ultimately, technology transfer in the area of **Digital and Precision Agriculture**, one of three key Iowa-advantaged bioscience platforms the state has identified as crucial economic development opportunities now and into the future. The other platforms are **Biobased Products** and **Vaccines and Immunotherapeutics**.

The Iowa Legislature allocated \$825,000 in FY20 funds to support bioscience initiatives at Iowa State. The university strategically invested this allocation to support efforts designed to

help establish and reinforce innovation ecosystems around each platform. ISU earmarked a larger percentage of the initial allotment to the Biobased Products platform to create additional momentum for the already well-established programs in this category. The state funds enabled the university to hire Dr. Sundeep Vani to serve as Chief Technology Officer for its Biobased Products research efforts. Dr. Vani – who has more than 20 years of industrial biotechnology experience and a track record of translating research concepts into commercially successful products – is working to connect academic researchers and Iowa industry to help commercialize ISU technologies in the Biobased Products category. In addition, ISU provided four research seed grants that supported collaborations with key industry partners that included ADM, Cargill, Dickinson Industries, Kemin Industries, Kent Corporation, Pella Corporation, Puretein Bioscience and Siegwirk USA.

The university also issued seed grants to support public-private research projects in the Vaccines and Immunotherapeutics platform in conjunction with industry partners, Boehringer Ingelheim Vetmedica and LEAH Labs. Lastly, Iowa State invested a portion of the initial state allocation to support a market research/intelligence effort to identify needs and priorities of companies in the Digital and Precision Agriculture space. This information will prove valuable in cross-referencing Iowa State's research expertise and interests to identify the strongest options for future private-sector partnerships.

These seed grants are fueling technology transfer and economic development through industry partners with strong ties to Iowa. But the product of Iowa State's bioscience-focused research is also supporting economic development through the **formation of new Iowa-based startups and by sustaining ongoing innovation among other small companies** that have been formed in the state over the past few years:

- Sumatra Biorenewables, LLC, awarded the National Corn Growers "Corn Challenge" award in 2019, is currently negotiating a Joint Development Agreement with a major multinational nylon manufacturer for the company's enhanced ISU-developed nylon technology;
- SoyLei Technologies, LLC, was founded in 2020 to help commercialize soybean-based asphalt modifier technology developed at Iowa State. Production at the BioCentury Research Farm pilot plant was scaled up to accommodate more public demonstrations in sites in multiple states;
- EnGeniousAg, LLC, an ISU spinout that licensed nitrate sensor technology from the Iowa State University Research Foundation (ISURF), secured two competitive Small Business Innovation Research (SBIR) grants from the National Science Foundation (NSF) and USDA. EnGeniousAg will offer low-cost, instant-readout, high-performance, field-deployable nutrient sensors for crops, soils and water. The data and insights these sensors generate enhance agronomic decision-making, increasing grower profitability and sustaining the environment; and
- Iowa State and University of Iowa researchers launched a new startup, ImmunoNanoMed, Inc., with business interests in developing nano-based vaccines to combat infectious diseases.

One of the most dynamic and impactful research facilities associated with Iowa State is the **Critical Materials Institute (CMI)**, a U.S. Department of Energy (DOE) Innovation Hub led by

Ames Laboratory. The mission of CMI is to assure supply chains of materials critical to clean-energy technologies, enabling innovation in U.S. manufacturing and enhancing U.S. energy security. Since its formation in 2013, CMI has published more than 285 refereed publications in leading scientific journals, issued 120 invention disclosures, received 10 U.S. patents and licensed eight technologies. CMI's industrial collaborators are working to incorporate the institute's developments in products and processes in the key manufacturing areas of source diversification, materials substitution and improved stewardship of existing resources.

Finally, two additional NSF programs are helping fuel research that will further support Iowa's economy. NSF launched the **Innovation Corps (I-Corps)** program to help prepare scientists and engineers to extend their focus beyond the university laboratory to accelerate the economic and societal benefits of NSF-funded basic-research projects that are ready to move to commercialization. **Since Iowa State became an I-Corps site in 2017, the program has launched 11 new companies and raised more than \$3.2 million in venture financing.** These companies have also engaged with the pioneering ISU Startup Factory, receiving formal training, resources and access to an invaluable business network.

Iowa State has taken the lead in a statewide effort in applying for **EPSCoR (Established Program to Stimulate Competitive Research)** funding. **The \$20 million in EPSCoR funds, if awarded, would be invested to support *Biobased Chemicals and Products* technology development and transfer, workforce development and economic development.** In addition to Iowa State, the project team encompasses the University of Iowa, University of Northern Iowa, Dordt University, and would also engage private and community colleges as well as K-12 STEM education and industry partners within the state.

Assistance to Communities

Through a partnership with ISU Extension, the **CyBIZ Lab student teams supported five community projects** performing market research and economic analysis efforts for these small, rural communities in Iowa.

Pappajohn Center staff **spent more than 3,800 hours** visiting classrooms, community groups, and conducting training programs to share entrepreneurial and small business resources.

Assistance to Iowa communities is the focus of many of the programs managed by ISU Extension and Outreach. Some examples of direct economic development assistance to Iowa communities are provided below.

CED specialists provide skills training each year for **nearly 10,000** community leaders, local government officials, business owners, entrepreneurs and volunteers.

Local Government Programming

In 2019, the CED unit, in collaboration with the Iowa League of Cities, assumed the activities conducted by the University of Iowa Institute for Public Affairs, including strategic planning and goal setting for local and regional governments and training on a wide variety of legal, fiscal, and policy topics related to good government best practices. In FY20, CED specialists provided strategic planning and goal setting assistance to 2 county extension offices, 5 local

governments, and 1 nonprofit organization. In collaboration with the Iowa League of Cities, the CED unit **trained 290 municipal professionals at the Municipal Professionals Institute and Academy, and 280 municipal professionals at the Municipal Leadership Academy.**

Student Involvement in Community Development

In spring 2020, 24 upper-level Community and Regional Planning students developed a comprehensive plan for the City of Alleman, with assistance from a CED specialist. The Office of State and Local Governments employed a student intern to assist in organizing and carrying out the 2019 Municipal Professionals Institute and Academy in July 2019. In fall 2019, CED hired a Latino Studies intern to assist with a Latino Community Needs Assessment for Pottawattamie County. From May 26 to August 7, 2020, Iowa State University **Data Science for the Public Good (DSPG) Young Scholars Program taught 9 student interns and 3 graduate fellows** to apply data science skills to solve local community problems through the identification and discovery of datasets that can be used to better analyze, visualize, and understand the problems and their potential solutions. The program is led by a coalition of land-grant universities in three states—Iowa State University; Oregon State University; Virginia Tech; Virginia State University—and the University of Virginia.

Iowa's Living Roadways Community Visioning Program

For the past 24 years, the Community Visioning Program has helped rural communities plan transportation enhancements using state funds from the Iowa DOT. To date, 244 Iowa towns have completed the process and collaborated with design teams to create conceptual transportation enhancement plans. The program continues to make a significant impact throughout the state. In spring 2020, The Iowa's Living Roadways Community Visioning Program employed **12 student interns to assist in assessments and analysis in 10 communities.**

New Programming Initiatives

- In August 2019, the Centro Latino of Iowa invited CED to conduct an investigation into the needs of the Latino community in Pottawattamie County. The goal of the study is to aid the Centro Latino of Iowa in planning and developing programming, as well as strategically being able to assist their clients and the community with emerging issues in the county. The **Latino Community Needs Assessment** report focuses on four key themes: community belonging, housing, workforce development and entrepreneurship, and education.
- The CED program is partnering with the Iowa Economic Development Authority through the Empower Rural Iowa grant and CDBG technical assistance program to conduct **Rural Housing Readiness Assessments (RHRA)** for Iowa communities. CED created the RHRA to help communities self-assess their housing needs, educate community members about housing decision points, guide them in creating a common vision for housing in their community, and create a 3- to 5-year action plan to accomplish that vision. In FY20, 7 communities started the RHRA program. To help business owners and entrepreneurs reopen following closures caused by COVID-19 and to help Iowans understand the many resources available, the CED program and the Farm, Food, and Enterprise Development program developed a podcast in both English and Spanish, in partnership with the Iowa Small Business Development Centers. The series **Back to Business Iowa** has explored topics such as the Small Business Relief Fund for Iowa,

evaluating customer segments, revolving loan funds, SBA financial programs, human resources, the Iowa Retail Initiative, restaurant reopenings, and tourism strategies, as well as social media best practices. **Virtual Programming:** In response to the COVID-19 pandemic, the CED unit converted many of its programs from an in-person to a virtual format, including the following: Introduction to Planning and Zoning Workshops, Grant Writing 101, Iowa Retail Initiative, Strategic Planning and Goal Setting, Rural Housing Readiness Assessments, Leading Communities, Data Science for the Public Good, Community Visioning, Municipal Leadership Academy, Municipal Professionals Institute and Academy, and Business Model Canvas.

- **COVID-19 Resources:** In response to the COVID-19 pandemic, the CED unit created informational materials for businesses, local governments, and nonprofits, including the following: Retail Design Creative Practices; Retail Ready to Open Resources; Restaurant Ready to Open Resources; the *Back to Business Iowa* podcast; a five part series on Business Model Planning, Building Team Capacity, Systems, Contingency Planning, and Wellness; Travel-maggedon Survival Kit; Small Business Best Practices; CARES Act and SBA Programs FAQs; Nonprofit Fundraising during and after COVID-19; Pandemic Checklist for Local Governments (with Iowa League of Cities); and COVID-19 Relief and Recovery Dashboard.

Community Food Systems Team

The Food Systems team is housed within the Farm, Food, and Enterprise Development unit of Agriculture and Natural Resources Extension and Outreach (ANR). Within the Food Systems team, there are two programs: Community Food Systems and Farm to School. The Community Food Systems Program is a joint effort with ANR and CED extension professionals **helping communities develop their place-based food systems**. The program is offered as a fee for service for communities to participate in for a multi-year, multi-phased project. In addition, three different certification programs are offered: Local Food Leader, Community Food Systems, and Mapping 101. The Farm to School program partners with several state and local organizations, early care and K-12 schools, teachers, farmers, and other individuals to support local food procurement, school gardens, and nutrition education within early care and K-12 schools.

In FY2020 the following were accomplished:

- During the summer and fall of 2019, four national "hub" Local Food Leader and Community Food Systems certification workshops were held in Iowa, Nebraska, Massachusetts, and Oregon with a total of 176 participants (99 in Local Food Leader and 77 in Community Food Systems). The [final evaluation of impacts](#) is available online.
 - Due to COVID-19, the team has developed virtual workshops that will be launched in fall 2020 to support on-going work in food systems development.
- The team received a Cooperative Agreement of approximately \$100,000 with USDA AMS to facilitate discussions with over 30 national partner organizations to understand, assess, and create a core-competency platform for food systems practitioners. Links: [final report](#), current [curricula matrix](#), and [learning objectives for each competency](#).
- In January 2020, the CFS program celebrated its fifth year of collaboration with four different states represented nationally, and approximately 70 partners: planners, food corps service members, farmers, local food coordinators, nonprofit organizations,

professionals, public health, and many more organizations across the state gathered to share success stories of community food systems development and implementation.

- Local Food Leader and Business Model Canvas pre-conference workshops were held, with approximately 40 participants between the two workshops.
- In May 2020 the [Linn County Food Rescue Assessment](#) was completed. This project assessed food rescue practices and opportunities for food donation throughout the county, including meeting with food businesses that distribute food, organizations that can accept donated food, and surveys with individuals who receive donated food. This project was funded by Linn County Public Health.
- In spring 2020 the Farm to School Coalition and the Iowa Farm to Early Care and Education Coalition merged, leading to elevated commitment and future direction for partner organizations.
 - The coalition supports the annual Farm to School and ECE Conference, held each summer. This year, in light of COVID-19, the conference had an overwhelming interest, with over 200 registrations. The conference was held virtually.
- Due to the dramatic impact that COVID-19 has had on the communities and partners, the FFED unit developed a resource page for information related to general [farming, business and food systems](#), and [farm to school related resources](#). Additionally, the food systems team created a [technical assistance request](#) form in the spring of 2020 to support communities, organizations, and individuals in their efforts to conduct business during the pandemic. These continue to be updated and available.

Major Economic Development Collaborations

Iowa State University takes great pride and pleasure in its collaborations with both private and public sector partners. These collaborations are essential to achieving the university's and the state's economic development goals. The first five sections below identify new collaborations begun or formalized this past year. The remaining sections describe on-going significant state and regional collaborations-

Lowa State, University of Iowa John Pappajohn Entrepreneurial Centers partner on Kauffman Challenge Grant

The Iowa State University and University of Iowa John Pappajohn Entrepreneurial Centers collaborated to submit and were awarded a Kauffman Foundation Challenge Grant providing \$100,000 to focus on increasing the number of SBIR and STTR grants awarded to faculty in Midwest institutions. The Challenge Grant will involve units at Iowa State University and economic development staff at U of I, to reach out to institutions in Iowa, Nebraska, Kansas and Missouri to share best practices and put together a 2021 entrepreneurship and investor conference event. Additionally, as a requirement of the grant, participants will also be interacting with grant recipients in two other challenge grants awarded by the Kauffman Foundation that focus on both rural entrepreneurship and supporting and increasing the number of businesses owned by persons of color.

CIRAS Collaborates to Help Iowa Industry Respond to COVID-19

On February 13, 2020, CIRAS activated our disaster response plan to help manufacturers respond to the supply chain disruptions caused by COVID-19. A month later, CIRAS

transitioned 100% of our team to virtual operations focused on helping Iowa industry through the pandemic. Some of the major collaborative efforts include:

- Supported PPE needs identified by the **Iowa Department of Homeland Security and Emergency Management (HSEMD)** through connecting existing suppliers to officials and helping manufacturers retool to produce PPE. Among the many successes include a partnership between CIRAS, Dimensional Group, and Angstrom Precision Molding to produce over 1 million face shields.
- Collaborated with the **Iowa Economic Development Authority (IEDA), and the Iowa Department of Agriculture and Land Stewardship (IDALS)** to assess and recommend actions to respond to shortages of food-grade carbon dioxide driven by the reduced production of ethanol.
- Collaborated with the **Manufacturing Extension Partnership National Network** on a variety of critical emerging issues in healthcare supply chains and in creating clear guidance for manufacturers in Iowa.
- Published weekly updates on the current capabilities and concerns of Iowa manufacturers through the pandemic. At its lowest point in early June, only about 40% of manufacturers were running at full capacity.

CIRAS' COVID response is partially funded by the Coronavirus Aid, Relief, and Economic Security (CARES) Act totaling \$595,000 from the NIST Manufacturing Extension Partnership Program and \$300,000 from the Economic Development Administration. CIRAS will use this funding to help small- to medium-sized manufacturers assess, respond and recover from COVID-19 and communities better address workforce needs as they recover.

CIRAS Participates in Iowa Economic Development Authority (IEDA) Manufacturing 4.0 Initiative

This initiative is intended to help build out strategies and recommendations that will be brought forward to help Iowa manufacturers continue to remain competitive on a global scale through the usage and adaptation of Industry 4.0 Technologies, which is now more important than ever in light of COVID-19. IEDA launched this initiative with the support of TEconomy Partners. CIRAS continues to support this initiative in several ways, including participating on the focus groups and providing advice to IEDA and TEconomy throughout the process.

CIRAS Opens Digital Manufacturing Lab Powered by Alliant Energy

The Digital Manufacturing Lab, made possible by generous support from Alliant Energy and the Iowa Economic Development Authority (IEDA), is a place where Iowa manufacturers can experiment with cutting-edge Industry 4.0 technologies in a risk-free environment. CIRAS provides education and implementation assistance to Iowa businesses statewide about technologies such as collaborative robots, 3D scanners, and advanced vision systems and to help them explore ways that automation might improve their companies. "We're here to celebrate something pretty cool," said Joel Schmidt, vice president of business development for Alliant Energy. "It's more than a lab run by great minds with some really cool machines. We're celebrating a great partnership that we know will leave a lasting impression on the future of this state."

CIRAS Partners with Purdue University and Illinois Manufacturing Excellence Center to expand Industry 4.0 Efforts.

Implementing Small Manufacturer Assistance with Robotic Technologies (I-SMART) is an innovative approach to providing technical assistance services to small U.S. manufacturers via project-level engagements to increase the adoption of robotics, flexible automation, and related Industry 4.0 technologies that will help address the critical shortage of skilled manufacturing labor. CIRAS will leverage this partnership to increase our ability to host regional activities across Iowa to help manufacturers experience emerging technologies and assess opportunities at businesses for implementation.

Iowa State University Collaborates on Technology Transfer Services

Iowa State University and the University of Northern Iowa (UNI) continue to partner in technology transfer. The partnership allows UNI to access Iowa State resources for technology transfer. UNI has the option to manage the protection and commercialization of their innovations, or they can opt to have the ISU Research Foundation provide these services. In addition, Iowa State has entered into an agreement with Drake University to provide technology transfer services. This partnership with UNI and Iowa State University has begun to see success. ISU Research Foundation has licensed UNI's intellectual property and the first sales of the licensed product began in FY20.

ISU Partnership with Cultivation Corridor

Iowa State University has representatives on the Board of Directors of the Cultivation Corridor, a regional economic development initiative to attract ag-bioscience firms to Iowa that was launched in April 2014. Other board members include Iowa Economic Development Authority, leading Iowa companies in the ag-bioscience industry, and Iowa commodity groups. ISU also serves on the Advisory Cabinet of the Executive Director of the Cultivation Corridor. ISU's Office of Economic Development and Industry Relations works closely with the Cultivation Corridor, providing university expertise and services to support the Corridor's efforts.

Statewide Committees, Councils, and Task Forces

Many representatives from ISU serve on committees that promote economic development programs. Those committees include the following: the Iowa Business Council's Business-Education Alliance, the Iowa Innovation Corporation, the Biosciences Alliance of Iowa, Association of Business and Industry Advisory Council, the Iowa Lean Consortium, Professional Developers of Iowa, the Iowa Business Council, Innovate Iowa, Technology Association of Iowa, the IEDA Advanced Manufacturing Working Group, Capital Crossroads, the Cultivation Corridor, and the Iowa Chamber of Commerce Executives. SBDC additions: Iowa Economic Development Authority Board, Future Ready Iowa, Renew Rural Iowa Entrepreneurial Roundtable, Iowa Rural Development Council.

Midwest Grape and Wine Industry Institute

The Midwest Grape and Wine Industry Institute, supported by the College of Agriculture and Life Sciences and ISU Extension and Outreach, was formed in 2006 by the Iowa Board of Regents as a result of the state's evolving grape and wine industry.

The goals of the Institute are to:

- conduct research to evaluate cold-hardy grape varieties that can thrive in the Midwest;
- conduct enology research and develop vinification techniques;

- assist with implementation of the Iowa Quality Wine Consortium program, a quality assurance stamp of approval;
- establish an outreach program to the industry by offering training opportunities to cellar workers and winemakers;
- form partnerships to develop job training programs specific to growing grapes and wine making

Iowa has 98 licensed wineries and 245 commercial vineyards. At the end of 2019, total wine, cider, and mead production totaled 329,283 gallons, down slightly from 2018. Sales were reported at 301,508 gallons. Wine sold at wineries represented 40.6 percent of sales, while the remaining 59.4 percent was sold at wholesale. The grape and wine industry in Iowa is maturing but continues to grow. According to a 2012 study by Frank, Rimerman + CO. LLP, the economic impact of the Iowa wine and grape industry on the state's economy is \$420 million.

Future Plans

Iowa State University greatly appreciates the resources and support that it receives from the Board of Regents and the legislature to carry out its economic development initiatives and activities. The primary purpose of this report is to show the huge economic and quality of life impacts we have been able to achieve for the state with the resources entrusted to us. The following sections identify how we plan to use additional resources to enhance the impact of university technology transfer and service on the creation of jobs and wealth in Iowa.

Small Business Development Centers

By helping its clients improve and grow their businesses the SBDC generates new tax dollars for the Iowa treasury in the form of sales tax revenue from increased client sales and income tax revenue from new jobs created by clients. In federal fiscal year 2020, SBDC clients generated an increase of \$263.22 million in sales, \$161.01 million in capital invested in Iowa businesses, and created 1,869 jobs. These rather large numbers were driven by the SBDCs COVID-19 response, as mentioned earlier in this report. All information reported by the SBDC is verified and attributed to the assistance of the SBDC by the client through the client milestone collection process. SBDC is a good investment for the State of Iowa!

SBDCs across the state helped their clients achieve the following success for the state.

- **Over \$21,935,200 in sales EVERY MONTH**
- **Over \$441,123 in capital investment in Iowa Companies EVERY DAY**
- **72,000 businesses and clients counselled in 2020 to help them continue moving forward and navigating COVID programs – in a typical year, the Iowa SBDC will see over 4,000 clients.**

The SBDC also has a technology center designation allowing us to provide more in-depth counseling to entrepreneurs who have ideas or innovations that have potential for commercialization. Another advantage the SBDC provides for businesses is the cyber assessment for businesses. A business owner may visit www.iowacyber.com to learn about cybersecurity and their risk. Working together, we can create a stronger foundation of small businesses.

The SBDC is also providing training to our rural areas across the state to help build and create wealth for Iowa businesses that may not typically have access to additional resources. The training program consists of both in-person and virtual trainings and assistance to develop stronger brands and assist businesses in commercializing their products.

It should be noted that SBDC is working diligently to collaborate and partner with other organizations throughout the state, both public and private, to ensure that we are not duplicating efforts and to leverage each other's resources and efforts.

ISU Pappajohn Center for Entrepreneurship

The Center for Entrepreneurship is working diligently to expand opportunities for entrepreneurial learning and business support as part of President Wintersteen's campus-wide initiative in entrepreneurship. The center has worked with faculty and staff in all of the colleges to support the development of programming and experiential learning opportunities for the growing number of students interested in pursuing entrepreneurship as an academic area of study or because they want to pursue their ideas, inventions, or product creations as a business venture. The center has partnered with the director of the Student Innovation Center to bring Pappajohn Center programs and services to campus for more convenient delivery and the opportunity for students to collaborate across disciplines in this new collaborative space that opened fall 2020.

CyBIZ Lab will continue to partner with faculty in the Regents Innovation Fund program to help validate business opportunities stemming from university research discoveries with the goal of increasing the number of startups at the ISU Research Park, providing potential employment opportunities in Iowa for students and graduates from across disciplines.

The Pappajohn Center for Entrepreneurship and ISU Startup Factory have been aligned together organizationally to better integrate educational training and support for entrepreneurs of all types and to provide business support and resources for entrepreneurs across campus.

Support is needed to educate and provide engaging experiences for a growing number of students from all disciplines across campus who are drawn to entrepreneurship and innovation as well as providing support for fledgling entrepreneurs so that they can move past the idea stage and into business launch. Resources that seed new business concepts and help match expertise and skill sets for startups and Iowa businesses will continue to be a need at Iowa State.

Iowa State University Research Park

ISURP underwent a significant expansion in recent years which doubled the developable acreage and included commercial amenities such as a restaurant, fitness center, child care facility, walking and biking paths and a 38-acre park that are expected by young professionals today. Projects in the last year have largely focused on expansion of infrastructure: the third phase of the demonstration park (Tedesco Environmental Learning Corridor) developed in partnership with Story County Conservation, was completed in August. This connects the trail infrastructure at ISURP and Ames to the High Trestle network near Kelley/R38. In addition, as part of the expansion of John Deere's 33,000 square foot sprayer facility, ISURP in partnership with the City of Ames was awarded a \$1.8 million infrastructure grant from EDA to provide

infrastructure to support expanding city services to 38 additional acres of buildable lots. The construction on this project will be complete this year.

ISURP's recent growth and the shift in our tenant base from largely startups to a mix of both startups and well established international companies has assisted the financial viability of the research park and positioned the organization to weather the challenges associated with the pandemic. Long term leases with well-established companies allows ISURP to assist startups with a greater operational risk tolerance. We have dedicated staff full time to connecting research park innovators and prospects to Iowa State University, and largely, aside from non-pandemic associated churn, our tenant base remains stable.

Like much of the campus and surrounding community, it is imperative to our long term success to keep students on campus, as increasingly our tenant base relies on student workers to fuel recruitment strategies and long term growth initiatives. Positioning ISURP staff full time working towards connecting tenants to the resources available at Iowa State (aside from talent acquisition) is an intentional strategic effort to broaden the engagement strategies of our largest tenants into research and infrastructure investments to maintain a tenant-base with interests that include research/infrastructure in addition to talent acquisition.

Iowa State is renowned as a research institution. From veterinary science to agricultural related pursuits, to a robust engineering program, there are new developments coming out of the University on a daily basis. And companies large and small are paying attention and the opportunity for the ISURP to initiate connections between the two offers robust opportunities. Travel restrictions, work from home orders and all of the havoc caused by COVID-19 have represented a unique opportunity for Iowa State researchers to share their work with corporate interests with speed and efficiency not previously recognized. We feel optimistic that while most of our tenant companies are not yet fully back at work, most are doubling down their efforts to explore new research and development opportunities with Iowa State and that we are able to deliver these engagement meetings with unparalleled efficiency.

In recent years, a number of companies with an international reach have opened innovation hub/offices at ISURP, each of them sharing a common interest in the benefits of having a physical presence in close proximity to the university.

Also, this past year several more Iowa-based companies established operations in the Research Park to get better connected with the research expertise and infrastructure at the university as well as the workforce talent being developed on campus. We believe innovation "hubs" will continue to be an emerging opportunity for tenant attraction. As we look to the future and the new order that will inevitably become new workforce solutions, partnerships with companies as they retool and rethink work strategies in the wake of the pandemic will include remote training facilities and operations as an emerging area of interest, in particular as they align with Iowa State's strengths. To that end, we recently retooled our affiliate program to include a co-working option.

Pre-pandemic, ISURP was finding great enthusiasm from corporate partners on the shared vision of an agricultural technology hub facility where companies with aligned interests in agriculture/technology could locate with shared communal space and high bays. COVID-19 has largely put most of those discussions on hold, but our partners tell us they remain interested in

pursuing as the economic conditions stabilize. Any new funds to the ISU Research Park would be utilized to support costs associated with the expansion of ISURP and the region in the area of agriculture/technology to establish Iowa as the center of gravity for all things ag tech, as well as to increase our efforts to attract and retain tenant companies and the highly skilled workforce necessary to fill those jobs.

The Center for Industrial Research and Service

CIRAS has been supporting the growth of Iowa industry since 1963. The lack of workforce available for growth, combined with decreasing population throughout rural areas has created a significant need to grow capacity with no additional people. The rise of the COVID-19 pandemic has magnified these problems. Emerging “Industry 4.0” technologies such as cobots, big data, and artificial intelligence offer significant opportunities, but also create complexities and introduce cybersecurity risks.

New funding of \$1 million per year for expanded services can be leveraged to bring in an additional \$1 million of federal grants and fees to help Iowa businesses navigate recovery from the COVID-19 and implement real solutions to solve their workforce problems. Historically, funding at this level has led to companies reporting \$100 million of new sales and investments and 1,000 jobs created or retained.

ISU Research Foundation (ISURF)

ISURF has been self-supportive since 1992 and over the past 10 years has returned more than \$14 million to ISU and Ames Lab, in support of growing the research enterprise. New funds generated by ISURF will continue to be distributed according to the royalty sharing policy and funds in excess of what is needed to support the operation will be utilized to support the research enterprise, as recommended and approved by the ISURF Board.

ISU Extension and Outreach

Extension and Outreach works across ISU colleges and with external partners to provide technical assistance, research-based education, and access to the resources of ISU to improve the quality of life in the state. Iowans want an economy that can form new businesses, grow existing industry, enhance communities, and recruit companies to the state. Iowa’s STEM jobs are expected to grow 10% by 2027, with median earnings in Iowa STEM jobs at \$32.98/hour. Iowans see the need to stop the “brain drain” and take steps to develop the state’s future workforce, connecting youth with opportunities here in Iowa.

With additional funding, ISU Extension and Outreach will expand economic development projects to broaden Iowans’ entrepreneurial aspirations with education and technical assistance. Extension and Outreach also will address the distinct needs of minority populations, as well as a burgeoning local foods industry and many struggling rural downtowns. These are only a few of the basic needs and urgent trends facing this state.

Summary of ISU Economic Development and Innovation Data	
a. Number of disclosures of intellectual property (excluding data sets)	132
b. Number of patent applications filed	102
c. Number of patents awarded: U.S. issued patents	56
total issued patents (world-wide)	98
d. Number of license and option agreements executed on institutional technologies:	
in total	46
in Iowa	22
e. Number of license and option agreements yielding income	154
f. Revenue to Iowa companies as a result of licensed technology (CY19)	\$5.4 million
g. Number of startup companies formed (through licensing activities)	
in total	4
in Iowa	4
h. Number of companies in research park and incubators	
pre-incubator companies	43
private	72
university related	20
i. Number of new companies in research park and incubators	
pre-incubator companies	40
private	11
university related	2
j. Number of employees in companies in research park and incubators	2,041
k. Royalties and license fee income	\$3.0 million
l. Total sponsored funding received	\$494.6 million
How much of this is for research	\$253.0 million
m. Corporate sponsored funding received for research and economic development:	
in total	\$51.2 million
in Iowa	\$11.8 million
n. Iowa special appropriations for economic development, in total	\$2.424 million
SBDC	\$0.936M
CIRAS Technology Assistance Program	\$1.365M
ISU Research Park	\$0.122M
Regents Innovation Fund	\$1.050 million
o. Research expenditures (federal, state and local; business; nonprofit; institution funds; all other sources, FY19):	\$236.7 million
p. Licenses and options executed per \$10 million research expenditures (FY18 AUTM Survey)	1.3
q. Sales of licensed products by Iowa-based companies (CY19)	\$5.4 million
r. Number of employees for current Research Park tenants and incubators, as well as former tenants that are still in existence in basic form world-wide	6,456
Note: Unless noted, the data provided above are FY20 data.	

Appendix 1: CIRAS, SBDC, and ISURF company and community projects

Kimberly Construction, an offshoot of Kimberly Development, a 41-year old Ankeny home building company, took its first major steps into government contracting after CIRAS helped the company understand the intricacies of selling to the government. Staff with the CIRAS Procurement Technical Assistance Center (PTAC), helped Kimberly take its long history of residential success and transfer that to a new sales channel. After one unsuccessful bid, Kimberly Construction's second attempt ended in a \$245,000 contract to remodel flooring at a Des Moines elementary school. The company continues pursuing government projects, and Kimberly project manager, Troy Sydow believes that "2020 is going to be an extremely active year for us in the government sector. CIRAS has been just a huge help to us in this entire process. The biggest thing is just knowing that I have a resource to go to if I need to ask questions."

Ag Leader, an Ames-based precision agriculture company, worked with CIRAS to formalize and grow their innovation capabilities. Results from this process include several promising new products in development, more than 10 pending patents, and large amounts of time and money saved by recognizing idea shortcomings early. Innovation is just one part of the link between CIRAS and Ag Leader. CIRAS is working with the company to understand the regulations and requirements for selling in foreign markets, the company regularly sponsors capstone design projects in ISU classes and also hires students as interns and employees. Marketing development manager Mike Myers states "It's nice to have somebody you can call who's either dealt with it before or has the connections to say, 'We don't know, but we can get you an answer'".

Softronics Ltd., a maker of sophisticated aircraft radios in Marion, escaped a financial and customer relations disaster after CIRAS created parts to help the company finish a sensitive job. The company had \$1 million tied up in inventory when a vendor for a key supplier shut down unexpectedly, eliminating the main source of filters to block interference for its radios. "We couldn't deliver anything, because we had no parts," said Softronics president Robert Sternowski. The filters are designed to be 0.005 inches thick, making them difficult to produce, several firms told him the job couldn't be done without drastic thickness increase (significantly compromising performance), so Sternowski turned to CIRAS. CIRAS quickly printed eight sets of filters that were 0.008 inches thick, prompting Sternowski's praise. "You guys are at the top of the game in that you tweaked more performance out of your 3D printer than anyone else." he said.

Iowa Lean Consortium Mentors Help Put Lean Training into Practice. John Magnussen, continuous improvement manager for Pella Corporation, likes to compare Lean management techniques to riding a bicycle: getting trained is great; but at some point, you just have to grab the handlebars and go. To assist, the Iowa Lean Consortium (ILC) earlier this year began offering its members a mentor service. Magnussen was tapped to mentor Brandon Dodgen, a plant manager for Humboldt-based Hawkeye Leisure Trailers while Jeff Terrell, a state of Iowa lean leader, mentored Emma Knapp of Des Moines Public schools. Magnussen and Dodgen met regularly for several months, then Dodgen spent five days at Pella participating in a Kaizen event. "Relationships are what it's all about," Magnussen said. "Just knowing that you have

someone you can call and roll stuff off of and ask questions ... We've both benefited from the relationship."

Tiefenthaler Quality Meats, a Holstein-based meat producer, charted a path for family succession with the help of CIRAS. After growing the business for 38 years, John Tiefenthaler and his wife Shelly have finalized plans to step down from their roles and pass control to their children. Preparing for the looming handoff involved walking through all the obvious technical and legal aspects of a succession. But it also required some fundamental discussion about the minute, day-to-day details of John and Shelly's jobs at the company. CIRAS experts helped the family better understand and operationalize the day-to-day business operations. Overall, the company has reported more than \$950,000 in impact from working with CIRAS over the past three years. "The biggest thing is that for us not to be here, somebody has to be able to do all of the jobs we do," John said. "Some of the jobs we do, the kids don't see. So they're starting to get their minds wrapped around that."

Sue Tyrrell awarded the 2020 Deb Dalziel Woman Entrepreneur of the Year. Sue understood the need for translation and interpretation services in the market and knew she had to step forward to fill that need. She worked with the Kirkwood SBDC on financial analysis and business model planning. Sue started Hands Up Communications initially in her basement. With the assistance of the SBDC, her company has now grown to more than 20 employees and over \$2 million in sales. Hands Up Communications is a translation and interpretation company that offers sign language and foreign language services across the state. They believe that hello in a language that makes sense lets the whole world experience the comfort of belonging.

Dr. Martin Gross awarded the 2020 Neal Smith Entrepreneur of the Year. Gross-Wen Technologies uses its patented wastewater treatment technology known as the revolving algal biofilm system (RAB), to cost-effectively recover nutrients such as nitrogen and phosphorus from wastewater. With the help of the ISU SBDC, Gross-Wen has secured \$6.4 million through both grant, debt and equity financing. They are currently in a \$5 million series A investment round. They have also created 12 full-time and 4 part-time jobs with plans for additional hiring in the near future. Dr. Gross said, "The ISU SBDC helped us save time while helping to push things along and make everything go much smoother. I would encourage any new startup to sit down with the business advisors at the SBDC. The startup ecosystem in Iowa and particularly Iowa State University is outstanding."

Gene Editing Companies. ISURF co-owns with the University of Minnesota a suite of over a dozen groundbreaking U.S. and international gene-editing patents. These pioneering technologies, known as "TALENS," are being used in plant and animal agriculture and have enabled the development of a Phase I clinical pipeline of Universal Chimeric Antigen Receptor T-cell (UCAR- T) therapies to treat white blood cell cancers including; acute myeloid leukemia, acute lymphoblastic leukemia, multiple myeloma, and non-Hodgkin's lymphoma. On January 15, 2020, a licensee added to its pipeline the first patient dosing in a Phase I dose escalation clinical trial, evaluating a new UCART123 product candidate for use in relapsed/refractory acute myeloid leukemia. In anticipation of additional product testing and commercial use, the licensee is building an 82,000 square foot manufacturing facility to be operational by 2021.

Wilson's Disease. A collaboration involving ISU, the University of Michigan, and Helmholtz-Munchen Institute (Germany) has resulted in an innovative treatment for Wilson's disease, a genetic disease that results in an accumulation of copper in the body. Leveraging an existing ISURF technology, researchers from the three institutions developed a clinical usage for methanobactin which has shown promise for not only treating Wilson's Disease but also for reversing the effects of accumulated copper in organs. This technology has been licensed to an international pharmaceutical firm, which is leading further development and clinical trials of the compound.

Fighting COVID-19 Iowa State University Researchers are doing their part to address the global pandemic. Dr. Michael Cho is developing a vaccine candidate for COVID-19. Three research groups are developing innovative tests for the virus: Dr. Robbyn Anand and her team are leveraging an ISURF technology to more quickly enrich samples for the virus particles in order to decrease the time needed to test for very low titers of the virus; Dr. Liang Dong's group is developing a breathalyzer-like device to test for virus particles without the need for invasive sampling procedures; and Dr. Nigel Reuel is developing an inexpensive mail-in test for saliva that could be read by a machine without further handling the sample in any way. In a collaboration, several ISU faculty members and others, are developing new face mask technology that would not only reduce the number of virus particles that permeate the mask but also inactivate such particles.

New Uses for Soybean Oil An ISU startup company, has licensed ISURF patent-pending technologies to improve the performance of asphalt paved roads and provide additional markets for soybean oil. Using partially epoxidized soybean oil, this company has formulated maintenance products for asphalt roads that combat crack formation in roadways, thus extending the lifespan of the roads. Other products in development include additives that will allow for increased use of recycled material in new pavements, decreasing the amount of material consigned to landfills without compromising the performance and durability of the new roadway.

Appendix 2: Training and Related Educational Activities

Center for Industrial Research and Service (CIRAS)

CIRAS hosted the annual **Iowa Lean Consortium conference, with over 425 attendees from 98 Iowa organizations**. Attendees learned leading-edge ways to engage their workforce and improve productivity, a critical component to solving Iowa's workforce shortage. Globally known speakers, national experts, and Iowa leaders, provided multiple ways for companies to experience Lean, including hands-on workshops and tours.

CIRAS and our partners joined forces to offer 26 different trainings across the state of Iowa focused on Industry 4.0 technologies. **Over 325 people attended technology specific trainings** with topics including: 3D printing, digital scanning, automation, digital design, and cyber-security.

CIRAS hosted **20 different government networking events** across the state of Iowa, reaching **over 550 people**. Networking events provided opportunities for companies to build partnerships with like industries (construction, manufacturing), connect and learn from potential buyers (from the U.S. Navy to the Iowa Department of Transportation), and hear about upcoming bid opportunities (such as the Des Moines Federal Courthouse project).

In the face of the global COVID-19 pandemic, CIRAS was able to pivot to virtual education in days. While the pandemic forced the cancellation of in-person trainings, the majority of them were moved online, and dozens of new COVID-related trainings were developed and launched. Between March 13 and June 30, **CIRAS hosted 81 online trainings with 1,961 attendees**. Many of these trainings were recorded and remain available online at no cost.

CED in ISU Extension and Outreach empowers communities to shape their own futures through research, educational programming, community engagement processes, data analysis, and data synthesis. CED has multiple community development specialists in place with expertise and/or experience working with minority-owned businesses and community business leaders. The unit facilitates countless meetings and workshops annually through which organizations and individuals discuss issues and reach consensus on solutions and action steps. CED serves as an essential conduit between Iowa's communities and the resources of Iowa State University, creating partnerships with private and public sectors for the betterment of Iowans.

In FY20, CED offered **Health Data Literacy Workshops** to help Iowans learn the skills needed to understand, visualize, interpret, and practice with health data relevant to communities, organizations, and counties. Two workshops were conducted for 52 ISU human resources extension specialists and a workshop was presented to 60 people at the Iowa Governor's Public Health Conference.

In FY20, CED offered **Introduction to Planning and Zoning Workshops** to 176 planning officials throughout the state. Of the attendees, 50 participated in virtual workshops during the COVID-19 pandemic.

The **Geospatial Technology Training Program** conducted three **ArcGIS** two-day short courses for 46 planners and local officials from throughout the state, as well as two QGIS workshops for 22 individuals.

CED partnered with Western Iowa Advantage and MidAmerican Energy to present the **Western Iowa Advantage Housing Conference** on November 13, 2019, in Carroll. At the conference, CED specialists presented the Rural Housing Readiness Assessment and a session on planning and zoning.

Agriculture and Natural Resources Extension and Outreach (ANR) provides research-based information and resources to educate Iowa's farmers, producers, and agribusinesses. Much of Iowa's economy thrives on the state's rich agricultural heritage. ANR programs impact all Iowans, whether they live in rural or urban areas, and have been developed to improve quality of life. ANR specialists are engaged with farmers, researchers, organizations, agencies, agribusiness, and communities at state, regional, and national levels.

"Growing Together" promotes healthy food access for families with low income through a partnership of ISU's SNAP-Ed (coordinated through Human Sciences Extension and Outreach), Master Gardener volunteers, ISU Research and Demonstration Farms, and Iowa food pantries. In 2019, Master Gardener volunteers and their partners grew, harvested, and donated 115,000 pounds of fresh produce throughout the growing season, which equates to more than 345,000 servings of fruits and vegetables for food pantries.

The **On-Farm Food Safety Team** (from College of Agriculture and Life Sciences, Human Sciences Extension and Outreach, and the Department of Food Science and Human Nutrition) have been leading two, million-dollar Food and Drug Administration grants and one, million-dollar USDA grant focused on food safety for fruit and vegetable growers in Iowa and the North Central Region. Food safety educational information has been delivered to more than 4,300 growers in this region during the 2019-2020 growing year. Within Iowa, eight Produce Safety Alliance training sessions were held, as well as 30 Technical Assistance sessions and dissemination opportunities, and 17 on-farm food safety assessments. Through these efforts, the On-Farm Food Safety Team has directly impacted 580 Iowa growers. The team also runs the North Central Region Center for Food Safety Modernization Act Training, Extension, and Technical Assistance, and conducted an additional 73 Produce Safety Alliance trainings, educating 1,300 growers in the region. To further educate growers, the team published two peer reviewed papers in Water and Food Control and developed four videos on how to test water, pest management, infiltration, and best practices for reducing field contaminants. This team also had national impact by hosting a two-day session in September 2019 with the Food and Drug Administration in Des Moines, Iowa, about how to safely handle biological soil amendments within produce farms. This drew 50 people from throughout the United States. To assist with COVID-19 response, this team helped ANR Extension and Outreach develop materials for a COVID-19 webpage for the food industry. Members also developed 16 press releases and interviews to ensure the food industry was aware of best practice to operate their business with a food safety emphasis.

A **statewide, food hub managers working group** has been meeting quarterly for the past four years to better understand the logistics and economics of moving locally grown and produced food from farms to institutions. The ISU Extension and Outreach Farm, Food, and Enterprise program and Iowa Valley RC&D co-facilitate the group. Meeting topics range from food safety and production planning to sales, logistics, and economics. Food hubs create opportunities for farmers to grow their production and access larger markets and are critical players in developing Iowa's local food system.

Ag Decision Maker website, www.extension.iastate.edu/agdm, provides farmers, landowners, financial lenders, farm managers, and agriculture educators with the current, unbiased agricultural economics and business information they need to make sound farm management decisions that directly impact Iowa agriculture. This web-based resource supports ISU Extension and Outreach farm management programs and averaged 7651 visitors per day from July 2019 through June 2020. Over 15,000 users received monthly updates highlighting the materials on the Ag Decision Maker site, with another 2,378 followers receiving information through social media (an increase of 210 from the previous year). The AgDM Twitter feed received 134,704 impressions during the 12-month period.

Iowa Pork Industry Center, with specialists in the field and on campus, works to promote efficient pork production technologies in Iowa, maintain Iowa's pork industry leadership, and strengthen rural development efforts. For example:

- The swine extension specialists partnered with agricultural engineering to deliver hands-on **ventilation training and education to pork producers** throughout the state, using a portable trailer to demonstrate state-of-the-art technology. In 2019, nine workshops were held and attended by nearly 180 people, who influence on-farm decisions about more than 63 million pigs finished and marketed, and over 1.2 million sows.
- More than 350 swine producers attended biosecurity training through the Iowa Pork Industry Center during 2019, learning how to minimize common biosecurity mistakes. Changes made by producers after receiving the training was valued at \$6,361 per producer, or a cumulative value of over \$2.2 million.

Iowa ranks fourth nationally in number of cattle on feed and produces over 2,000,000 head of feedlot cattle on 6,000 individual operations annually. Resources provided by the **Iowa Beef Center** give producers the information necessary to increase their herds and update their operations.

- Consumers are asking how the beef they eat is produced, and packers are listening. Several of the major beef packers will be purchasing cattle only from beef producers who are **Beef Quality Assurance** certified. The BQA program is designed to educate beef producers on the best management practices to produce cattle that are safe, wholesome, and healthy. The Iowa Beef Center has contracted to provide the educational component of the BQA program in Iowa since 2017. In 2019, 73 BQA trainings were offered either as a part of other extension beef programs or independently sponsored by industry partners, with six additional trainings offered by Iowa Beef Center staff. More than 3,600 producers were certified in the BQA program in 2019. These producers now have access to additional markets for fed cattle.

- A **four-year study** was completed by the Iowa Beef Center in 2018 that assessed emerging beef cow management technologies, evaluated production, and developed decision tools. The results of the study were disseminated in 2019 through bus tours, regional conferences, and workshops, with participants noting an average economic impact of the information at \$16.46 per cow, or a \$158,674 total for all attendees.

ISU Extension and Outreach annually trains representatives from about 595 businesses and 2,100 employees who come from 97 counties in Iowa and the six surrounding states in the **commercial manure applicator program**. These businesses annually handle and apply about 1.5 million tons of solid manure and 3 billion gallons of liquid/slurry manure that has a fertilizer value of about \$250 million, while doing about \$70 million of business. The curriculum has focused on state rules, land application and separation distances, safety precautions, reading manure management plans, proper stockpiling for dry manure applicators, water quality, and biosecurity. With biosecurity being very important to the livelihood of their business and their clients, more than 84 percent said they have a biosecurity practice in place to keep farms bio-secure, and more than 82 percent of commercial applicators reported this information was useful to their business.

Fifty-three percent of Iowa's farmland is operated under a lease agreement. Iowa non-farming landowners include retired farmers as well as individuals who invested in or inherited farmland but never farmed (Farmland Ownership and Tenure Survey). ISU Extension and Outreach offers a variety of tools to assist landowners and tenants in **determining fair cropland and pasture rental rates**. In 2019, ISU Extension and Outreach farm management specialists conducted 76 leasing meetings across the state, with more than 1,444 landowners, operators, and ag business professionals attending. A post-meeting survey found that two-thirds of respondents would be making a change to their lease agreements based on information from the program. **The ISU Extension and Outreach Cash Rent Survey** was downloaded 159,078 times in 2019. Sample cash lease forms were downloaded 22,286 times.

The Pesticide Safety Education Program (PSEP) provides information through a variety of venues on the safe and effective use of pesticides. The PSEP provides recertification programs throughout Iowa and in 2019 trained 11,195 Commercial/Noncommercial/Public Pesticide Applicators and 13,831 Private Pesticide Applicators through Continuing Instruction Course (CIC) programs. Based on 2020 wage information from Iowa Workforce Development, the PSEP directly supported commercial pest management jobs with an estimated annual base salary of over \$420 million. The PSEP also develops study manuals and other educational publications. In FY19, over 20,000 pest or pesticide-related educational publications were distributed to the public and the PSEP website had over 39,000 unique site visits seeking pest management or pesticide safety information. The PSEP is also involved in the EPA Worker Protection Standard (WPS) education with over 160 individuals completing WPS training courses through ISU Extension and Outreach.

ISU Extension and Outreach Natural Resources program revived its **Master Conservationist Program** across Iowa, providing information that helps rural communities benefit from improved water quality, outdoor recreational opportunities for economic development, and improved quality of life. The program is directed to landowners, farmers, and community members who are concerned with water quality, wildlife habitat conservation, and soil health. During 2019,

nine Master Conservationist Program offerings were provided across the state, reaching 145 participants. The hybrid in-person/online learning modules will be provided again in 2020 across Iowa.

While thistle caterpillars are not rare in Iowa, injury is usually minimal so little information is readily available about the insect. After discovering **an unusual influx of thistle caterpillars in Iowa crop fields in 2019**, members of the ISU Extension and Outreach Crops Team undertook a coordinated campaign that included social media alerts, phone calls, and field calls to producers and crop advisers to help them make decisions on appropriate treatments. Near the end of the growing season, field agronomists shared a survey with those farmers and crop advisers to determine the value of their assistance during the growing season. Respondents were asked to estimate the value of the field call provided by ISU Extension and Outreach, with the average estimated value of the call being placed between \$11-15 per acre, for a total estimated value of the field calls in the range of \$700,000 to \$1,000,000.

As retailer consolidation continues in agriculture, retailers are covering more and more acres. A total of 145 ag retailers, seed dealers, and crop consultants attended two **Agricultural Chemical Dealer Update sessions** in 2019, with those attendees having an impact on 1.1 million acres of crops. This model of train-the-trainer information allows for an efficient delivery of information that attendees can in turn provide to farmers and other clients.

Iowa 4-H Youth Development programs are headquartered at Iowa State University and available through ISU Extension and Outreach offices in all Iowa counties. 4-H is the premier youth program of the United States Department of Agriculture and Cooperative Extension and is the nation's largest youth development organization. Highlights from the past year include the following:

- **Checkout STEM** is a curriculum partnership between Iowa 4-H, Human Sciences Extension and Outreach, the ISU School of Education, and the Ames Public Library. [Checkout STEM](#) focuses on literacy and STEM knowledge for youth in grades K-3 and their families. It is part of a learning kit available for families to check out in libraries across Iowa.
- **Crops Feed the World** is a set of online learning modules designed for youth in grades 4-12 to learn more about crop sciences and crop production.
- **STEM Lit to Go Iowa** is a curriculum focusing on literacy and STEM knowledge for grades K-3. Each lesson includes children's books written by or focused on Iowa authors. STEM Lit to Go connects literacy development with STEM concepts. All 100 extension offices have a kit with all of the books featured and materials for each lesson.

Almost 10,000 youth were exposed to the mobile **Forward Learning Experience bridging 21st Century Skills, STEM, and creative problem solving**. Youth saw and experienced first-hand emerging design technologies such as virtual reality, 3D digital and physical prototyping, and circuit bending. This provided 4-H youth throughout the state a vision of their future as 21st century citizens, positively impacting their communities and world around them using STEM skills and creative thinking. The Forward Learning Experience was a part of almost 90 events,

visiting school classrooms, 4-H camps, STEM festivals, science nights, county fairs, and maker fair events across Iowa.

Human Sciences Extension and Outreach provides research-based information and education to help families make decisions that improve and transform their lives. Specialists work with Iowa State's College of Human Sciences and in partnership with other organizations and agencies to meet the needs of Iowa families.

The **Volunteer Income Tax Assistance (VITA) program** trains community volunteers to provide free tax preparation to families with low and moderate income. The service is provided in local communities. During the 2020 tax season, Human Sciences Extension and Outreach worked with community partners to recruit and train 38 volunteers who helped 1,279 Iowans with low and moderate income to file their 2019 income tax returns. Extension-community partnerships in 13 counties supported volunteers at VITA programs. Free tax preparation saved money for these Iowa families. Special efforts were made to increase awareness of the Earned Income Tax Credit (EITC) and VITA programs in rural Iowa. As a result, trained volunteers helped 423 filers claim the EITC they were qualified for, receiving refunds of \$1,031,472. The EITC augments the wages of workers earning low- and moderate incomes and, in turn, this flow of income makes a substantial economic impact in local communities. The credit encourages and rewards work, as well as offsets payroll and both state and federal income taxes. EITC recipients circulate their refunds through the local economy, creating a ripple effect that exceeds the size of the original refund. This money bolsters family financial well-being, strengthens neighborhoods, assists small businesses, and spurs local economic development.

Every week in Iowa, an estimated 202,698 children are in paid child care. Iowa's families need reliable and skilled child care to be able to work and contribute to Iowa's economy. Iowa's child care industry has an annual economic impact of \$953 million. Prior to the Coronavirus pandemic, about one-fourth of Iowans lived in an area undersupplied with child care options. During the pandemic this situation has steadily worsened, with some communities reporting child care availability losses of over 50 percent. Human Sciences Extension and Outreach has responded to high workforce turnover and the increasing demand for **training and professional development for early care and education professionals**. Many educational opportunities were quickly moved online. During FY20, a total of 23,531 early care and education professionals participated in 109,538 hours of online educational programming. An additional 1,364 individuals attended in person workshops. Post training evaluations from 20,338 individuals showed significant increases in improved skills and knowledge of child development, early learning, managing children's behavior, nutrition, and health and safety practices.

Human Sciences Extension and Outreach specialists have taught the **ServSafe® food safety certification** program for more than 25 years as registered instructors for the National Restaurant Association Educational Foundation's internationally recognized food safety certification program. In the past year, 1,625 Iowans participated in ServSafe® classes taught by extension specialists, with 79 percent successfully earning the Certified Food Protection Manager credential. (Iowa's Food Code requires at least one supervisory employee in licensed foodservices be certified in food safety through an approved program.) Eight classes in Spanish were offered at various locations around the state.

The Pappajohn Center for Entrepreneurship partnered with the Ivy College of Business to support initiatives to encourage young women to consider business as a career option. The Ivy Women in Business Program hosted one-day high school events for Iowa high school women. The Pappajohn Center provided hands-on learning activities in entrepreneurship to foster interest and engagement in entrepreneurship and innovation, as well as boosting participants' problem solving and presentation skills.

The Pappajohn Center, in partnership with the Ames Chamber of Commerce, initiated bringing the popular 1 Million Cups entrepreneurial ecosystem development program to Ames for weekly interactions among students, entrepreneurs, and professionals to support entrepreneurial development and networking activities in the community.

The Pappajohn Center, again in partnership with the Ames Chamber of Commerce and the ISU Business Development Center, trained more than 50 community members through a bi-annual Saturday workshop program, Smart Start for Business.

Appendix 3: Regents Innovation Fund Program

RIF Commercialization Infrastructure and Campus-Wide Entrepreneurial Culture Program

The RIF commercialization infrastructure and campus-wide entrepreneurial culture program received \$635,656 of Iowa State University's \$1,050,000 RIF allocation, and is administered through the Office of Economic Development and Industry Relations (EDIR). The funds provide support for units that contribute to building and enhancing the innovation and entrepreneurial ecosystems at Iowa State. A summary of the RIF funding received by each unit is provided below, while their achievements and activities provided elsewhere in this report.

Summary of FY20 RIF Commercialization Infrastructure and Campus-Wide Entrepreneurial Culture Program

Unit	FY20 RIF Commercialization Infrastructure and Campus-Wide Entrepreneurial Culture Program (\$635,656 of \$1,050,000 RIF Allocation)	Award Amount
ISU Research Park	Support for operations of the ISU Research Park	\$245,000
ISU Startup Factory	Support for operations of the ISU Startup Factory	\$155,656
Small Business Development Center	Support for operations of the Small Business Development Center	\$105,000
ISU Pappajohn Center	Support for entrepreneurial programs at ISU	\$80,000
CyBIZ Lab	Support for student consulting services to assist with primary and secondary market and industry research and business planning for RIF commercialization projects	\$25,000
Office of Economic Development and Industry Relations	Support for industry relations functions at Iowa State and other technology transfer activities across campus.	\$25,000

RIF Commercialization Program

The RIF commercialization program, which is administered in EDIR, received \$420,000 of Iowa State's RIF allocation and pairs ISU faculty with Iowa companies on projects to create or improve products or processes. One year after the completion of the project, the Iowa companies are surveyed for impact by the Center for Industrial Research and Service (CIRAS). These funds are a **critical source of gap funding**. They represent a unique resource that can be applied toward the success of Iowa companies. A summary of the survey results from projects funded to date and project outcomes is below, followed by the list of FY20 projects. Since its inception, 163 projects have been funded and completed through the Commercialization Program, and many show excellent progress in improving the competitiveness and profitability of the Iowa companies involved. For example, one industry partner reported that participation in an RIF project enabled rapid redesign of its product,

facilitating a more successful product launch. Fifty five startup companies have been assisted, including **35 new companies that were started as a direct result of RIF and its predecessor program Grow Iowa Values Fund (GIVF) funding. Over the past 12 months, several of these startups have attracted significant private, state and federal funding, raising over \$3.5 million in early stage investment to facilitate commercialization and first sales.** In total, **more than 100 Iowa companies have participated** in the program.

Surveys are conducted by CIRAS one year after project completion (Note: full impact takes a minimum of 5-10 years).

Survey Results for FY09-10 through FY18-19 Projects

Project Dates	Survey Year	Companies Surveyed	Jobs Created or Retained	Total Sales Increase or Sales Retained	Total Investment & Cost Savings	Average Impact per Company
FY18-FY19	FY20	5**	2	N/A	\$512,360	\$102,472
FY17-FY18	FY19	8**	10	\$121,200	\$2,056,000	\$272,150
FY16-FY17	FY18	9**	9	\$32,600,000+	\$2,440,750	\$3,893,417
FY15-FY16	FY17	4*	4	N/A	\$1,120,000	\$280,000
FY14-FY15	FY16	5**	3	N/A	\$454,500	\$90,000
FY13-FY14	FY15	2	3	N/A	\$1,167,000	\$583,500
FY12-FY13	FY14	6**	21	\$750,000	\$1,315,000	\$344,167
FY11-FY12	FY13	12**	13	\$2,470,000	\$2,571,000	\$420,083
FY10-FY11	FY12	6**	6	\$1,750,000	\$1,730,000	\$580,000
FY09-FY10+	FY11	7**	13	\$675,000	\$967,000	\$234,571

**Surveys were not completed for all projects (not everyone chooses to participate in the survey).

*All surveyed companies were start-up companies. +The sales increase was primarily from 1 successful project, but the jobs impact was spread. Many companies indicated it was too early to tell the sales impact (this is a frequent comment through the years).

Project Outcomes for FY11 through FY20

Year Project Completed	Number of Projects	Number of Publications & Presentations	Number of Invention Disclosures	Number of External Funding Applications	Number of Applications Awarded	External Funding Received*
FY20	9	11	6	18	5	\$965,402
FY19	11	5	2	8	6	\$1,117,663
FY18	16	12	2	16	7	\$1,375,000

FY17	9	12	8	9	4	\$450,000
FY16	15	10	3	18	5	\$1,070,000
FY15	14	12	2	3	2	\$384,999
FY14	7	19	1	16	4	\$370,000
FY13	4	6	2	12	5	\$795,000
FY12	11	50	4	12	6	\$6,364,000
FY11	11	46	3	20	6	\$940,000

*A number of external funding applications were still pending at the time of reporting and not all award amounts were reported.

Summary of FY20 RIF Commercialization Program Projects

Principal Investigator	FY20 RIF Commercialization Program Projects (\$414,344 of \$1,050,000 RIF Allocation)	Award Amount
Shan Jiang	"Smart" Ink for Package Printing – a New Way to Detect Predator Drugs (Phase II)	\$50,000
Michael Bartlett	Smart Bushings for Advanced Vibration Reduction in Vehicles	\$50,000
Eric Cochran	Development of poly(acrylated glycerol) as a Wood Composites Adhesive	\$50,000
Greg Curtzwiler	Bio-based hybrid polyurethane-epoxy adhesives for the food packaging industry (Phase I)	\$39,646
Chao Hu	Physics-Based Deep Learning and IIoT Platform for Massively Scalable Predictive Maintenance of Industrial Equipment	\$50,000
Carolyn Lawrence-Dill	Developing a Platform for Expert Data Curation	\$24,698
Meng Lu	Development of Optical Fiber Thermometer with Nanomaterial Cladding Coating for Extreme Environment Applications	\$50,000
Ikenna Nlebedim	Acid-free Recycling of Rare Earth Elements from Terfenol-D and Magnets in E-wastes	\$50,000
R. Chris Williams	Compatibilization of Ground Tire Rubber with Asphalt through Density Matching	\$50,000

*Full report can be provided upon request.