

FOUNDATIONS OF AGRICULTURAL TECHNOLOGY ECOSYSTEMS



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■ FOREWORD

AGTECH HAS BEEN A BUZZWORD IN THE AG WORLD

since 2011, and the industry really began to garner interest after Monsanto's acquisition of Climate Corp in 2013. The market recognized an opportunity within the need to implement new technology to ensure global food security. As such, we need a road map to understand how we can prepare for this opportunity. Given the complexity of our existing agricultural systems, coupled with the ever-evolving layers of the tech world, furthering agtech development & adoption poses a complex problem. This is not a problem that will be solved by a single entity; strong ecosystem approaches are needed. Ag and tech companies, professionals, educators, governments and entrepreneurs must work together to find the multiple solutions that are needed to solve a central human problem: food security.

This whitepaper was commissioned in an effort to begin to define the "Rules of Engagement" for agriculture technology (agtech) stakeholders. We believe that agtech entrepreneurial ecosystems requires different modeling than those exemplified by the traditional "cluster initiatives" often cited in economic development modeling. These ecosystems must enable connectivity between and meet the needs of all of the stakeholders within agtech, from farmers to startups to funders to eaters, and everyone in between.

Many of us have observed the growth of St. Louis, Missouri as an agtech hub over the years, and we think that there have been valuable lessons learned along the way. We recognize that while St. Louis is relatively well established, there is also work to be done here and room for improvement.

In November 2017, we were part of a group of 35 people representing the St. Louis ecosystem went to Rosario, Santa Fe, Argentina to sign a sister city agreement based on its many

geographic, economic and cultural similarities. While there, we observed the early stages of the development of an agtech hub in Rosario. We recognized an opportunity to begin to build bridges with similar ecosystems around the world. Many of the assets in the Santa Fe region mirror those of the St. Louis region, and a group of motivated visionaries, Universidad Austral, in particular, are eager to build a strong ecosystem.

As such, we decided to begin Phase 1 of the process to define the Rules of Engagement by doing an in-depth gap analysis of the greater St. Louis region, highlighting key strengths and inflection points, as well as noting opportunities for improvement. Simultaneously, we took a high-level approach to understanding the ecosystem in the Rosario region. We felt that it was important to define the start point (Rosario), and to then assess St. Louis through that lens. It is our hope that this work is used in a later stage to begin to assess the Rosario ecosystem in greater depth, with an intent to make specific recommendations across the various components of the ecosystem.

In conducting this research, we found that there was more to learn than we could write down. We now hope that a number of follow up projects (see conclusion) are borne out of this work. Ultimately, we hope that we can use this as a launching point to creating a global network of agtech ecosystems. Innovation does not happen in a silo - it requires support from the community. Agtech innovation is crucial for sustainable food production into the future. Thus, we must work together in global collaborations such as this to better communicate and enable the creation of these communities.

Signed,

CONNIE BOWEN, The Yield Lab Institute

ANA GALIANO, Universidad Austral

DANIEL BENTLE, Washington-University in St. Louis - Olin Business School





■ EXECUTIVE SUMMARY

This paper is the product of a collaboration between Washington University in St. Louis, The Yield Lab Institute, and Universidad Austral in Argentina to begin to explore agricultural technology (agtech) ecosystems and what makes them successful. We utilized St. Louis, Missouri, USA and the surrounding region as a model agtech ecosystem which has experienced significant relative success in the space. Rosario, Santa Fe, Argentina and St. Louis share similar geographic features, crop production, and climate. As such, we traveled to and researched the opportunities in Rosario, Santa Fe and greater area in Argentina. While we researched both regions, it is important to understand that our intent here was not to directly compare Rosario and St. Louis. Rather, we sought to build a critical analysis of St. through the lens of the development opportunities in Rosario. Ultimately, our collaboration sought to better understand key drivers of agtech ecosystems, best practices, and key obstacles which need to be overcome to bring about a successful agtech ecosystem. Our hope is that specific drivers correlated with success can be isolated and transposed from one geography to another.

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Rosario, Santa Fe and St. Louis, Missouri share similar geographic features, crop production, & climate

The basis of this collaboration is the partnership and linkage between St. Louis, Missouri and Rosario in Argentina. As “sister” cities, they share many similar qualities especially relevant to the agtech space. Both are already strategic poles for agribusiness, with multiple players and institutions cooperating for sector development. Both regions are major producers and exporters of cereals, oilseeds, flours, oils, biofuels, and animal proteins. In addition, they both share a passionate and proud base of agtech stakeholders who have facilitated great progress in both ecosystems and are actively seeking to continue to build the agtech space on a global scale to address future agriculture-related challenges.

APPROACH

We began our fieldwork by reviewing existing research and thought leadership in the agtech space, including work done by the Brookings Institute and other organizations, in an effort to ensure that this report would

be additive instead of duplicative. Then, we independently reviewed St. Louis as a model which has had relative success in the agricultural technology sector.

We looked to understand why St. Louis has been successful historically, why it continues to grow, where it is going in the future, as well as what could have been improved upon in the past and current issues it faces. We interviewed stakeholders in the agtech space including agriculture experts, startup founders, corporate players, as well as researchers and university experts to understand the ecosystem and build our framework.

We replicated much of this research approach in Rosario at a high level, as our primary objective was assessing St. Louis. Our limited research in Argentina enabled us to speak with the passionate stakeholders in the region, which helped us to understand some of the immediate needs and opportunities in the region. This understanding gave us perspective and

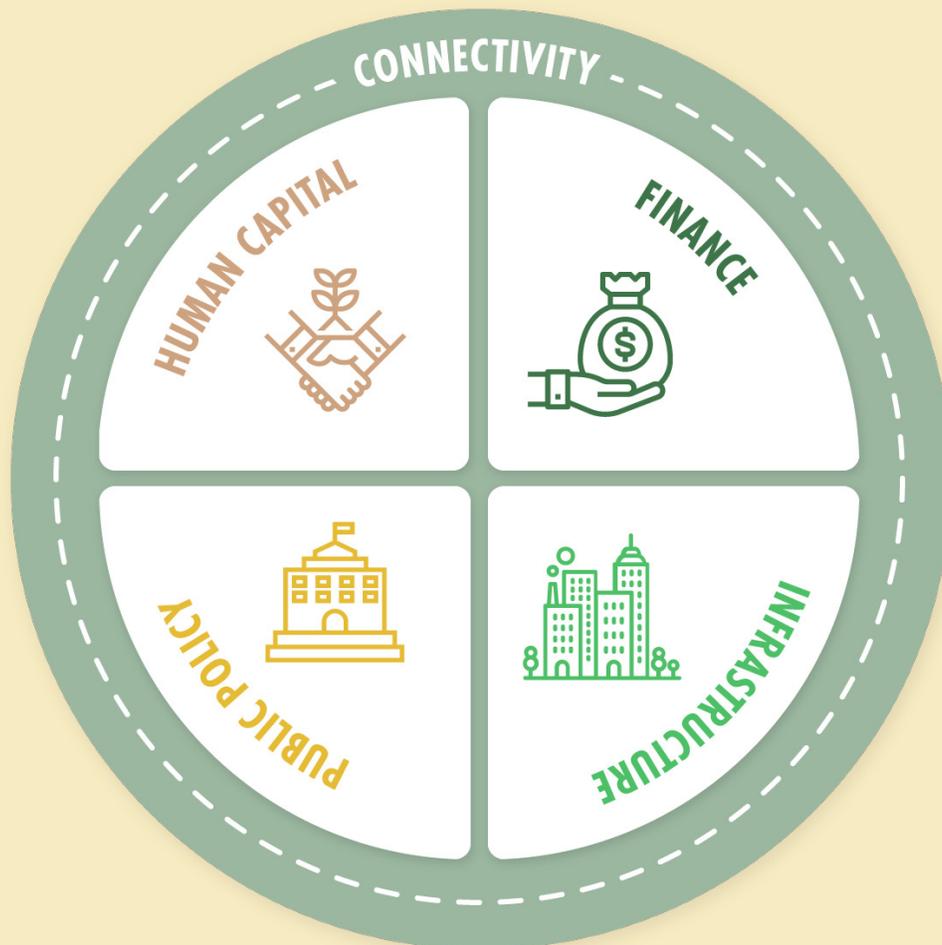
NOTE FROM THE AUTHORS

When we refer to agtech in this paper, we frequently reference row crops and existing traditional agricultural systems. However, we recognize that agriculture is dynamic and evolving in real time, and, as such, we embrace a holistic and inclusive definition of agtech. Anything that touches upon our agriculture and food systems - from biotech seeds to urban hydroponic systems to improved food products - is intended to be included in the agtech ecosystems that we seek to build up.

enabled us to create a lens through which to view the St. Louis ecosystem. We used our high level research in Rosario to better identify and isolate components of the St. Louis ecosystem that are transposable in earlier stage ecosystems.

FRAMEWORK

Based our initial research and interviews with key stakeholders in the agtech space, we developed a framework approach to understand what made St. Louis in promoting agtech. This framework began with four forces: Human Capital, Finance, Infrastructure, and Public Policy, and was later refined to include a fifth sector: Connectivity.



■ HUMAN CAPITAL

Human capital is a foundational piece of any agtech ecosystem. It serves to generate innovative ideas and establish new companies. Three major elements of human capital that contribute to the St. Louis agtech ecosystem are universities, corporations, and interest groups & associations.

DEEP DIVE - HUMAN CAPITAL IN ST. LOUIS

Educational & Research Institutions

The Greater St. Louis Area has 53 schools within 25 miles of the city, making St. Louis a great source of talent, especially in agtech. In the state of Missouri, over 25 colleges and universities have dedicated agriculture programs (Study.com, 2018). St. Louis also benefits from the talent of universities with top-tier agricultural programs located in surrounding states, such as the University of Illinois at Urbana-Champaign.

In this section, we will highlight a few important education institutions with Agriculture related programs. There are many other impactful programs in Missouri and in surrounding states that are not mentioned here for succinctness.

Missouri

University of Missouri

The University of Missouri (MU) is one of the largest universities in the state of Missouri. It makes large contributions to the agriculture and agtech landscape of St. Louis and the state. With over 14,000 research center acres across the state, MU is ranked #15 in the world for Animal and Plant Science Research. MU is a top supplier of intern/entry-level talent for large agriculture companies like Archer Daniels Midland, Monsanto, Cargill, Syngenta, and Dow Agrosciences (U.S. News & World Report, 2018).



Washington University in St. Louis

Located in St. Louis, Missouri, Washington University brings research capabilities and helps to drive biological and genetic innovation in the agtech ecosystem in St. Louis. Washington University does not have any dedicated agriculture programs, but does have world class researchers and facilities. The Plant and Microbial Biosciences program works closely with the Danforth Plant Science Center, and many professors work in the labs at the Danforth Center. (U.S. News & World Report, 2018). Wash U is also ranked 11th for the best program in biological sciences (Washington University in St. Louis, 2018).

St. Louis Community College

The St. Louis Community College runs a number of important programs in St. Louis, most relevantly, its Center for Plant and Life Sciences. Established in 2006, the center works with business and industry to bring STLCC students a cutting-edge education and to provide workforce training in this growing industry. Since moving the Center to the Bio-Research, Development and Growth Park

(BRDG Park), on the campus of the Donald Danforth Plant Science Center, in 2008, nearly \$4 million in externally funded grants have provided the Center's labs with cutting-edge equipment that allows graduates from the Biotechnology program to be trained to go to work immediately, in good paying jobs, and be highly sought after by regional bioscience companies. (St. Louis Community College "Center for Plant and Life Sciences," 2019).

Missouri Future Farmers of America (FFA)

The FFA is an important organization for agriculture and ensuring that youth are interested in agriculture and related fields. The FFA endorses eight major universities in Missouri (Missouri State University, Northwest Missouri State University, University of Missouri, College of the Ozarks, Southeast Missouri State University, University of Central Missouri, Lincoln University, Truman State University), signifying the commitment Missouri universities have to agriculture and related fields.

Surrounding States – Illinois, Kansas, Arkansas, Iowa

University of Illinois Urbana-Champaign

The University of Illinois has 10 departments in agriculture, consumer and environmental sciences (University of Illinois at Urbana-Champaign, 2018).

The University of Illinois is ranked #5 in the for its U.S. Biological/Agricultural Engineering Programs and #20 in the World Best Global Universities for Agriculture Sciences. (U.S. News & World Report, 2018). In addition, the University of Illinois has an extensive network of extension programs in agriculture, many of which are near St. Louis (University of Illinois Extension, 2018). The University has 115 top professors, and is home to the Monsanto Innovation Center, a research center on campus (University of Illinois Extension, 2018).

Other Major Agriculture Universities Surrounding Missouri

Kansas State University, Iowa State University, and the University of Arkansas are all ranked in the top 120 Universities in the world for Agricultural Sciences (U.S. World & News Report, 2018). All of these universities are within 6 hours driving distance from St. Louis and in neighboring states to Missouri. Talent from these universities come to St. Louis upon graduation and add to the agtech ecosystem.

Corporations

Agricultural organizations have a great presence in the St. Louis. Bayer Crop Sciences, Bunge, Pfizer, Nestle-Purina, Millipore Sigma, Rabo AgriFinance, Anheuser-Busch/InBev, and many others call St. Louis home. Two of the most influential companies in St. Louis' history have been Monsanto (now Bayer Crop Sciences) and Pfizer.

Bayer (Monsanto)

Monsanto, recently merged with Bayer, was founded in St. Louis in 1901 and is still headquartered in St. Louis. Monsanto started as a chemical firm and over time grew its portfolio from chemicals to include genetically modified seeds. (Monsanto, 2018). Bayer, a German company with a large pesticide division, merged with Monsanto in 2018, creating the second largest crop chemical business in the world. With the merger, the company now has more than 25% of the combined world market for seeds and pesticides (Roumeliotis & Burger, 2018).

Pfizer

Pharmaceutical company Pfizer restructured starting in 2009. Due to this restructuring, 600 jobs were cut in St. Louis from 2009-2011, flooding the job market with talent. (Volkman, 2009).

Interest Groups

Various agriculture interest groups are located in or near St. Louis, including, but not limited to: American Angus Assoc., American Soybean Assoc., Farm Equipment Manufacturers Assoc., Mid-America Organic Assoc., National Corn Growers Assoc., Pesticide Stewardship Alliance, The Poultry Federation, United Soybean Board, U.S. Animal Health Association, St. Louis Agriculture Business Club, U.S. Farmers & Ranchers Alliance, and the Farm Journal Foundation (Volkman, 2009). Additionally, the National Center for Soybean Biotechnology is located in Columbia, Missouri (St. Louis Agri-Business Club, 2018). Special interest groups like these in the ecosystem help to shape public policy, farming practices, information sharing, and attract an additional stream of human capital to create and work with agtech startups.

ST. LOUIS AGTECH STARTUP FOUNDER PROFILE

New agtech startups are forming and moving to St. Louis, the founders of which are a key part of learning about human capital in the ecosystem. A study was conducted with 69 agtech companies with offices in and near St. Louis to investigate founders' professional and educational backgrounds in relation to the region. This study looked at both undergraduate and graduate institutions and former employers of those 69 agtech founders.

Methodology

95 founders of startups from the St. Louis area or with a presence in the St. Louis area were analyzed. CEOs were utilized in the occurrence that founder names were not identified by the company website, LinkedIn or Crunchbase. Both CEOs and founders will be referred to as "founders" for the remainder of this document. LinkedIn and Crunchbase were the primary sources for gathering data. These online platforms were utilized to gather information because LinkedIn is self-reported data about people's education and careers, therefore knowledge could be gleaned from founders' profiles on LinkedIn, and Crunchbase is a well-known database of company information that is updated regularly. The goal of this study is to learn the background of a typical agtech founder in St. Louis. Demographics studied include: founder undergraduate institution and major, graduate studies institution and area of study, and former or current employers. This information is useful in understanding where human capital comes from.



Results

Graduate Studies

Graduate education data includes master's degrees and doctoral studies. The highest level of education for each founder is recorded in this analysis, therefore if a founder had multiple degrees e.g. a master's degree and a PhD then the PhD is represented in the data, but the master's degree is not. Graduate education data was located for 55 founders. Founders attended 40 different universities, the largest group of founders (18%) having attended Washington University in St. Louis. The next largest percentage of founders (5%) attended either the University of California System or Hebrew University. No other significant portion of founders attended similar Universities. The largest category of graduate studies is business/management (25%), followed by biological sciences and medicine/veterinary (16%).

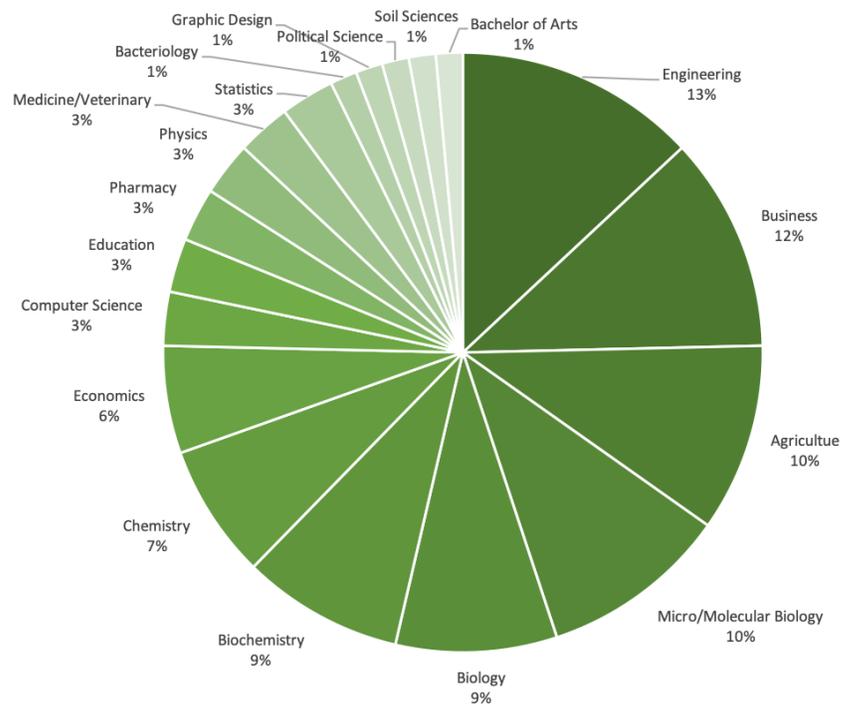


Figure 1 - Categories for Undergraduate Majors of St. Louis Agtech Founders

Current or Former Employer Results

Employer data was collected for 69 of the 95 founders employed at 31 organizations in a variety of industries. A large portion of founders worked in academia (38%) before or during the founding of their agtech company. Additionally, 20% of founders worked for Monsanto/Bayer and 6% for Pfizer. Over 80% of founders/CEOs worked at universities or corporations located in St. Louis Area.

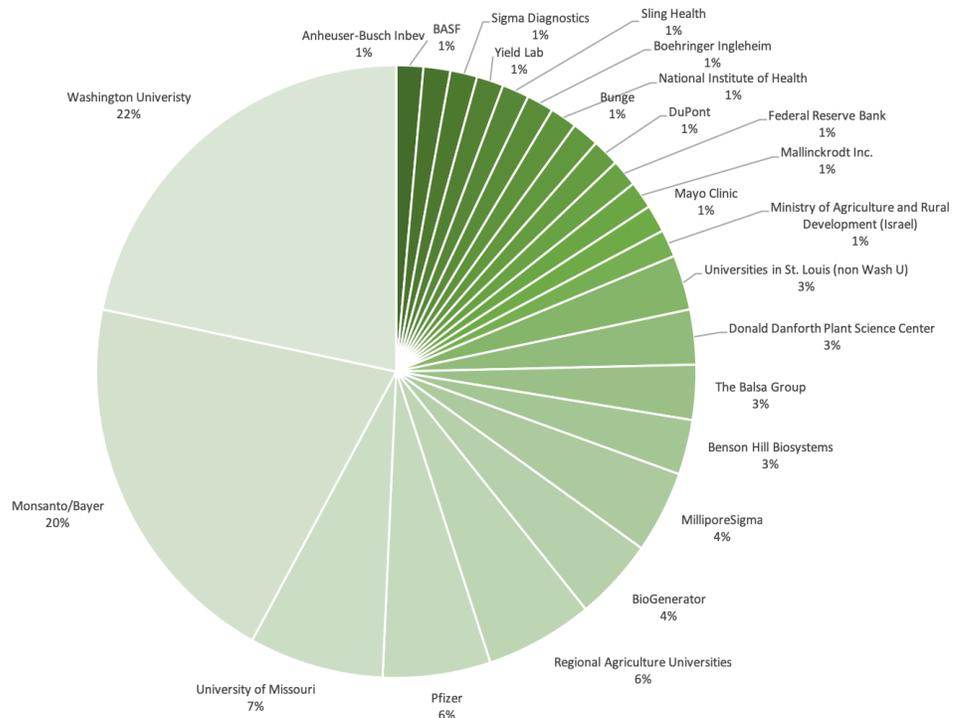


Figure 2 - Current or Former Employers of St. Louis Agtech Founders



HIGH LEVEL - HUMAN CAPITAL IN ROSARIO

Human capital is very important in the agtech ecosystem of Rosario and the Santa Fe Province in Argentina. It helps drive innovation and adoption of new technologies. Research and interviews with industry experts indicate that universities, corporations, and interest groups play an important role, like in St. Louis but in different ways. Additionally, serial entrepreneurs have a role to play in the ecosystem. The following explores those categories of human capital in depth.

Universities

Public Undergraduate Studies

Public universities were created from a National Congress Act and account for the majority of all universities in the country. Since 1946 the Ministry of Education has financed these universities (Study.com, 2018). Additionally, there is no tuition fee for students to attend universities (U.S. News & World Report, 2018). Looking towards agriculture, Lopez, et al. state that there are two agriculture universities in the Santa Fe Province; Universidad Nacional de Litoral and Universidad Nacional de Rosario (U.S. News & World Report, 2018). In the neighboring province of Cordoba, another major university, Universidad Nacional de Cordoba, provides talent to the Rosario region.

Public Graduate Studies

Graduate studies at public universities can restrict options for doctoral studies. The National Commission for University

Evaluation and Accreditation regulates the degrees that are accredited at public universities (Washington University in St. Louis, 2018). Some founders interviewed indicated that there may be additional constraints to those seeking doctoral program as they are often unable to find employment outside the university systems and government agencies.

Private Universities

Private universities in Rosario and the surrounding area include Universidad del Centro Educativo Latinoamericano, Instituto Universitario del Gran Rosario, Instituto Universitario Italiano de Rosario, Universidad Católica de Santa Fe, and Universidad Austral. Private universities were authorized to operate in 1958[vi].

Corporations

Multinational corporations do not interact with universities in Argentina as much as they do in the U.S. Local companies are more influential in the agtech ecosystem.

Interviews with industry experts indicated that although local companies have some influence on agtech, they typically have a more hands-off approach when it comes to startup companies in the industry. They will utilize the technology, but do not typically invest in the incubation process. An interview with Molinos Agro echoed the sentiment of taking a backseat in the agtech start up scene. They did, however, note that they have a lab and innovation department working on new technology for their specific work. An exception to this is the investment by Sancor Seguros for the CITES business incubator.

Interest Groups

Farmer Interest Groups play a major role in idea generation and adoption of new technology in Argentina. Consultations with local farmers indicated that farmer associations and groups, such as AAPRESID and ACREA, have a big influence over agtech. Many of these groups create technology or bring problems that they struggle with to entrepreneurs to create new technology.

INTELLECTUAL PROPERTY (IP) ISSUES

Intellectual Property is a significant part of many innovative technology companies including companies operating in the agtech space. Further, the ownership of IP is a big concern for many researchers and startup founders. In Argentina, researchers cannot easily take their technology and IP outside of the universities. Further research is needed to identify if this means that academics and researchers are the founders of agtech startups.



ROSARIO FOUNDER DATA

In Rosario and Santa Fe Province agtech startups are growing. As in St. Louis, the founders of these startups come from various backgrounds, therefore a survey similar to the one done in St. Louis was taken of 35 individuals identified as founders of agtech startups in Rosario and the surrounding region. The self-reported survey asked founders to identify their educational and professional backgrounds.

Methodology

Founders of agtech startup companies in and around Rosario, Argentina were contacted to be a part of this study. The goal of this study is to learn more about the background of a typical agtech founder in Rosario. Demographic categories surveyed include: founder undergraduate institution and major, graduate studies institution and area of study, and professional history, including former employers. This information is useful in understanding where human capital comes from in Rosario.

Results

Undergraduate

Undergraduate education data was provided for 32 of the 35 founders. The founders studied at 18 universities. A quarter (8) of the founders attended Universidad Nacional de Rosario, a large public university located in Rosario. The next largest groups (4 each) attended Instituto Tecnológico de Buenos Aires and Universidad de Buenos Aires. Undergraduate majors of founders were placed into 11 categories. The largest groups of founders studied either engineering, 41%, or agronomy, 16%.

Graduate Studies Results.

Graduate studies include both master's degrees and doctoral studies. The highest level of education has been recorded for each founder. Data for 16 founders was provided for graduate studies. The largest group of founders attended Universidad Nacional de Rosario at 19%, followed by Universidad de Buenos Aires and IAE Universidad Austral which both account for 13% of founder graduate studies. Graduate areas of study were put into 7 categories, the largest category is MBA at 31%, followed by Agriculture at 25%.

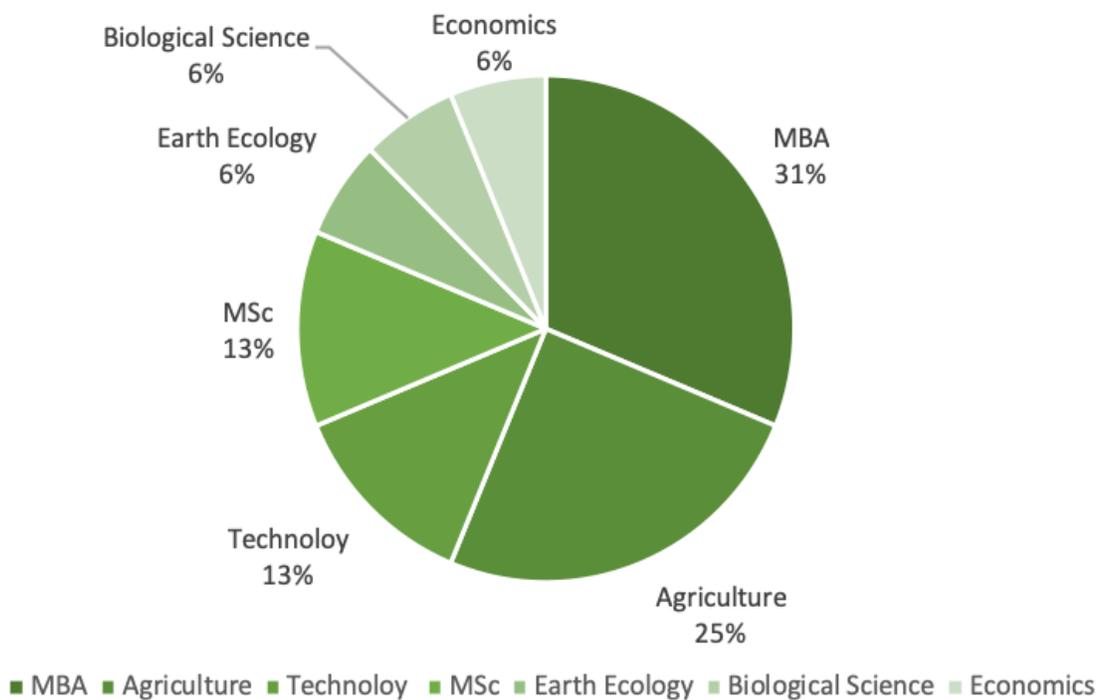


Figure 3 - Graduate or Doctoral Areas of Study of Rosario agtech Founders

Former Employer Results

The survey asked founders to identify their former employers so that more could be learned about agtech founder experience in Rosario. The results showed 35 companies where founders had previously worked. Over 30% of founders had work experience in research institution and universities.

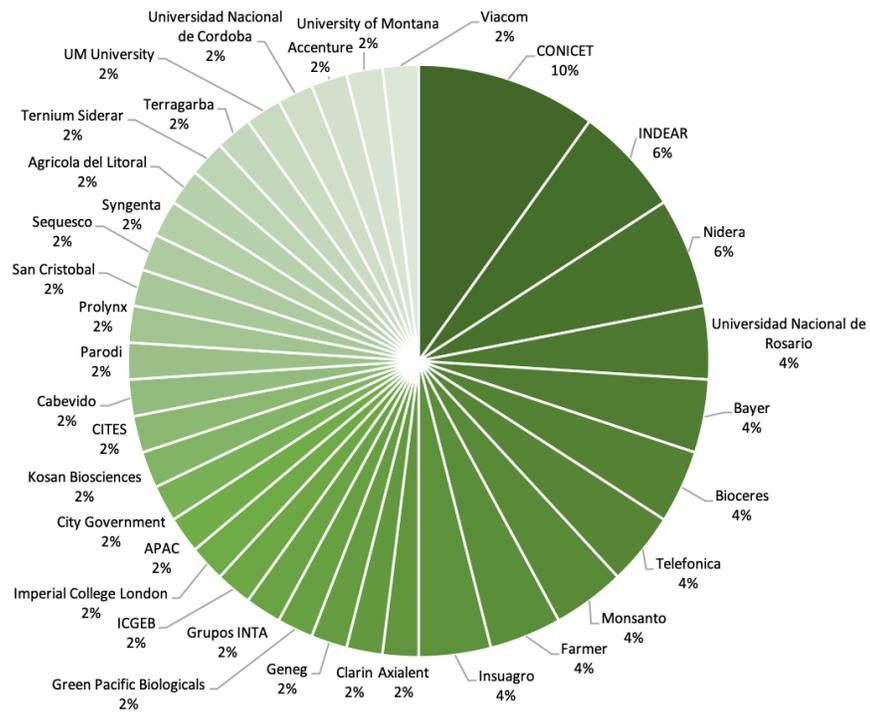


Figure 4 - Current or Former Employers of Rosario agtech Founders

KEY INSIGHTS: HUMAN CAPITAL IN ROSARIO & ST LOUIS

St. Louis Take Away

- Major universities and corporations in the St. Louis region play a critical role in generating the human capital that currently engages in agtech. Employers serve as the largest suppliers of talent to the agtech ecosystem, and universities serve as the largest employers of agtech startup founders. These researchers and professors are the products of universities, and they have the greatest influence on the ecosystem.

St. Louis Recommendation

- More comprehensive research should be done to map the many major agribusiness groups (both associations, co-ops, and corporations) in the St. Louis region. Anecdotal evidence suggests that many of these groups have a great interest in working with and supporting early stage agtech products, but right now, there is a gap in connectivity between these groups.
- Continued work should be done in ensuring that Universities are facilitating connections between researchers and agtech stakeholders – the work of collaborative groups like BioSTL and Washington University have been instrumental in getting St. Louis to where we are today, but it is clear that there is a high concentration of human capital available in the region that isn't plugging in to the agtech community as effectively as could be done. Existing convening groups (ie: BioSTL, St. Louis Agribusiness Club) are in an excellent position to broaden their scope and begin to pull in missing stakeholders.

KEY INSIGHTS: HUMAN CAPITAL IN ROSARIO & ST LOUIS

Rosario Take Away

- There is a popular belief that farmers and entrepreneurs are most often the founders of agtech startups in Rosario. However, the survey results indicate that founders are researchers and academics about one third (1/3rd) of the time. More research needs to be conducted to verify/nullify either claim.

Rosario Recommendation

- Further research and investigation on AgTech founders should be conducted in order to make stronger assumptions with a larger sample size.

FINANCIAL CAPITAL

Financial Capital validates startups' ideas and enables them to commercialize products. Thus, capability to attract inside and outside investors is a key factor in building a strong ecosystem. In the past, St. Louis lacked the capital that cities on the coasts had access to. "St. Louis could not initially bring in external resources and had to start with fundamentally St. Louis driven capital", said Luke Blackburn at Global STL in an interview with Washington University in St. Louis (WashU). Rosario's ecosystem is in an earlier phase of development, and currently faces some significant (but, we believe, surmountable) issues with access to financial capital.

DEEP DIVE - FINANCIAL CAPITAL IN ST. LOUIS

In recent years, there has been a significant increase in investment in St. Louis biotech and agtech industries from various sources, namely: venture capitalists, angel investors, corporate ventures and government funding. In addition, St. Louis has historically been a key hub for agriculture-related financing. Rabobank Agrifinance, U.S. Trust, Co-Bank, Wells Fargo, and others have a strong presence in the area and play central roles in financing actual agricultural operations.

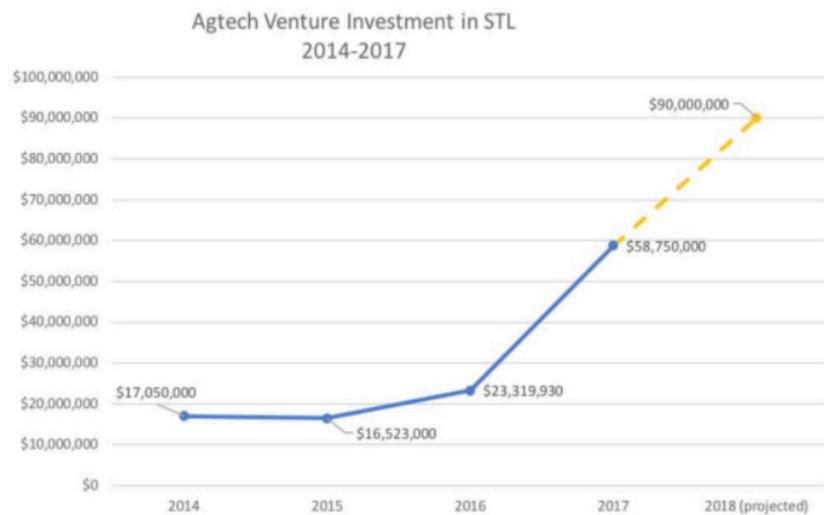


Figure 6 - Agtech Venture Investment in St. Louis, Missouri

Venture Capital

Increase of investment: From 2014, venture capital investment in agtech rapidly increased from \$17.1M in 2014 to a projected \$90M in 2018 (Andrew G. Smith, 2017). Venture capital firms invest in all stages of startups- seed stage (3.1%), Series A (18.0%), Series B (23.2%), and Series C & Venture stage (55.7%) (Crunchbase, S&P Capital). In terms of total venture capital investment, St. Louis ranked 19th among metro areas in the U.S. and accounted for only 0.55% of total amount in 2016 (Andrew G. Smith, 2017). In terms of agtech venture capital investment by states, however, Missouri ranked 4th and accounted 4.5% of overall amount, which proves agtech is a primary industry in St. Louis and Missouri (Agthentic, 2018). Even though St. Louis agtech firms succeeded in getting funded in general for recent years, investment in California startups continues to exceed that in Missouri, with \$2000M and \$172M respectively. This shows there is still room for more equity-based venture capital investment in St. Louis and Missouri.

The recent trend of venture capital strategy in the U.S. is shifting from early stage startup investment to later stage companies, preferring less risky ventures. This national trend also can be seen in St. Louis economy. The number of deals invested by venture capitals in St. Louis has fallen by 2/3rds since 2015, but the average deal size grew from \$2.75M in 2014 & 2015, \$5.5M in 2016 to \$7M in 2017 (Andrew G. Smith, 2017). The trend of fewer and high-valued investment could be a real threat that cuts off future growth potential in St. Louis if there are not many investors who are willing to take risk into early startups with innovative ideas.

Notable Venture Capital Firms

BioGenerator

BioGenerator, founded in 2002, is an investment arm of BioSTL, an organization focused on fueling innovation in BioSciences. BioGenerator de-risks commercially viable innovations by advising startups' leadership teams and by providing free access to wet lab space and research equipment (Missouri Partnership, 2018). BioGenerator is also known for its rigorous due-diligence process, and after providing \$21M in funding across 112 startups, those same startups raised follow-on capital of \$560M (Andrew G. Smith, 2017). BioGenerator was originally founded as an incubator that mainly invested in the seed stage, but after realizing that early-stage investment was not sufficient for building a successful startup ecosystem, BioGenerator evolved to provide a wider range of investments, from grants to final bridge rounds.

The Helix Fund

The Helix Fund was Founded in 2010 with \$3M from the St. Louis County Port Authority, and is operated by the St. Louis



St. Louis has been a key hub for agriculture financing. Rabobank Agrifinance, U.S. Trust, Co-Bank, Wells Fargo, and others have a strong presence in the area and play central roles in financing actual agricultural operations



Economic Development. The Helix Fund is an investment arm of the Helix Center, which is a non-profit incubator focusing on providing affordable laboratory space to earlier stage firms. The Helix Fund invested in 20 startups with a maximum investment size of \$250K (Emprendedor y Semilla, 2017).

The Yield Lab

The Yield Lab was founded in 2014 as the first agtech accelerator in the United States. The companies that The Yield Lab invests in take part in its non-residential accelerator program, which focuses on access to customers, collaborators, and capital. The Yield Lab's first accelerator fund invested \$2.7M over 3 years across 17 startups who have since raised over \$100M in follow-on funding. The Yield Lab also has accelerators operating and investing in Ireland (The Yield Lab Europe), Argentina and Brazil (The Yield Lab Latin America), and Singapore (The Yield Lab Asia-Pacific.) The Yield Lab founded the Yield Lab Institute in 2017 in order to drive agrifoodtech innovation through collaborative, research driven initiatives.

Cultivation Capital

Cultivation Capital, founded in 2012, is dedicated to healthcare information technology, medical devices and biosciences technology. Cultivation Capital was recognized as one of the nation's most active seed investors in 2015 (Kelly Hamilton, 2016).

Lewis & Clark Ventures

Lewis and Clark Ventures was founded in 2014 and focuses on agtech, digital healthcare and business enterprise solutions. Since inception, Lewis & Clark has invested \$25M in agtech startups (Ryan Donahue, 2018).

iSelect Fund

iSelect Fund provides accredited clients of financial advisors with access to a diversified portfolio of promising early-stage private ventures. iSelect invests in four verticals: Agriculture, Healthcare, Resource Efficiency, and B2B.

Angel Investors & Grants

In St. Louis, active angel investors networks usually provide seed and series A funding, but, in some instances, they invest in later stage rounds.

St. Joseph Angel Capital Group

St. Joseph Angel Capital Group is a highly respected investor group utilizing experienced professionals. The group is located in Kansas City and is affiliated with Mid-America Angel Investors, which allows the organization to expand its investment opportunities.

Billiken Angels

Billiken Angels invested in a company located in St. Louis and owned by current or former St. Louis University students, faculty, or staff. Billiken Angels provides capital in all industries and at all stages.



The trend of fewer and high-valued investment could be a real threat that cuts off future growth potential in St. Louis.

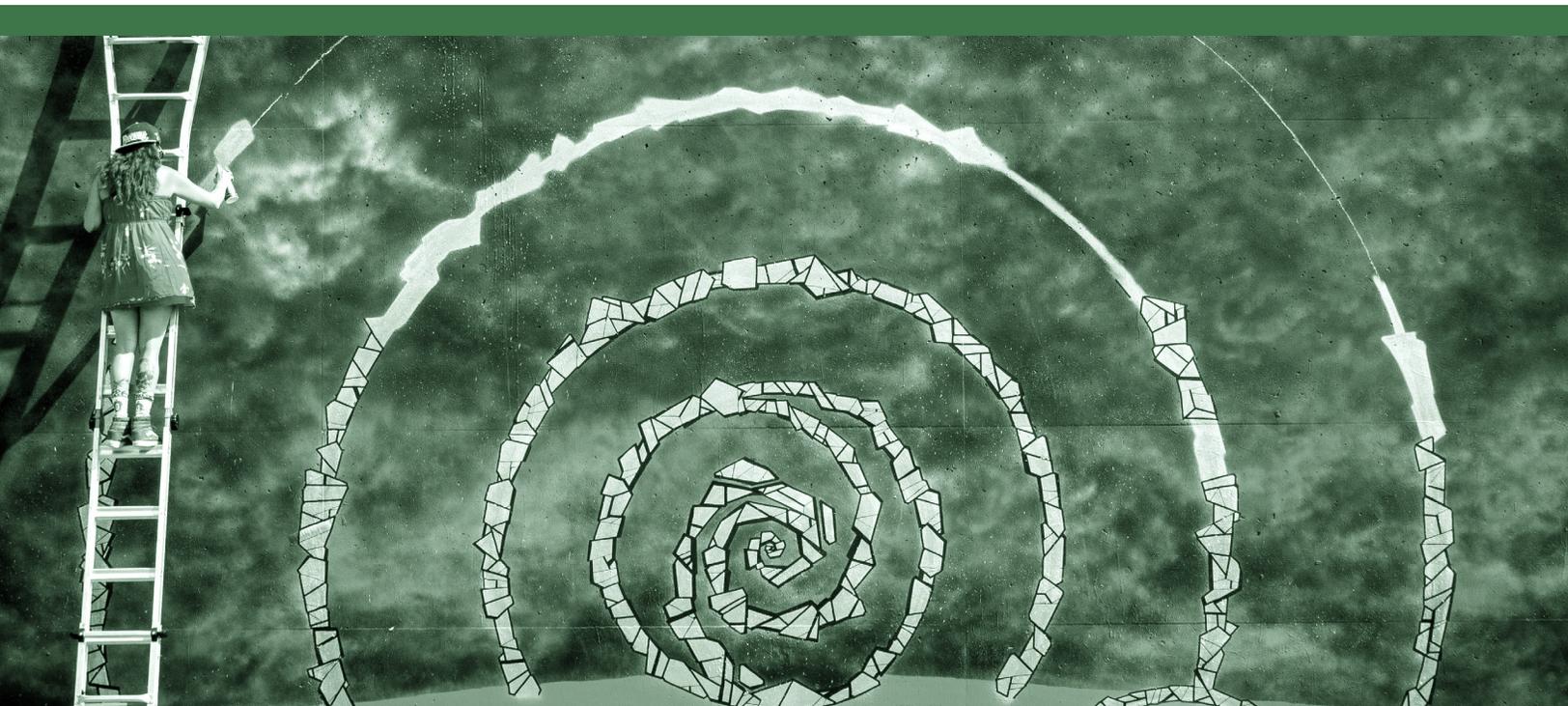
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**Thus, the capability
to attract inside and
outside investors is a
key factor in building
a strong ecosystem**

Arch Grants

Arch Grants, founded in 2012, is a local non-profit organization that provides \$50K in equity-free grants to 20 firms (Arch Grants annual report, 2017). Since its inception, Arch Grants provided \$6.2M to 114 innovative startups, 88% of which are still operating in St. Louis and 83% succeeded on raising additional funding (Andrew G. Smith, 2017). Due to the high rate of survivability and scalability, receiving an Arch Grant is regarded as one of the best predictors of being a successful startup. The percentage of Arch Grants' investment in bioscience firms is 26% on average and more than 97% of the organization's revenue comes from donations (Brian Feldt, 2017).

Corporate Ventures

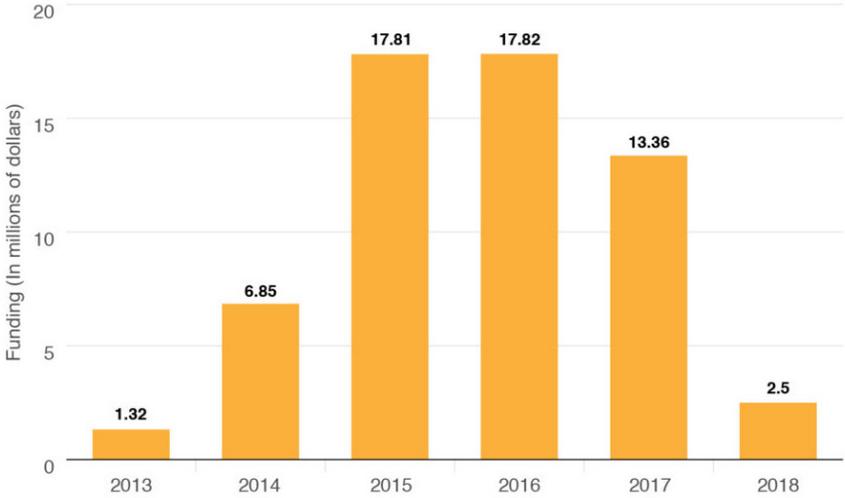
Multinational Bio/Chemical firms headquartered in St. Louis used to buy innovative ideas and fund early-stage startups. While Bayer (formerly Monsanto) still invests in early stage startups through its venture capital arm, Monsanto Growth Ventures (MGV), most other firms rely more on major acquisitions of small firms that have already de-risked technologies. MGV, founded in 2012, invests in a variety of startups in the biotechnology, pharmaceutical, and software industries (among others) across the globe, and currently holds a portfolio of 14 firms (Monsanto Growth Ventures, 2018). MGV led a \$2.5M investment into Arvegenix in 2015 and \$18M into New Leaf Symbiotics in 2017 (David Nicklaus, 2015). MGV's existence and activities in the future, however, are not certain with a recent merger with Bayer.



Government Funding

“Historically, government funding in St. Louis has been insufficient in supporting an ecosystem”, said Ginger Imster at SLEDP in an interview with WashU. She added that the government should play a role as a security net by building infrastructure and by de-risking early stage technologies so that the private sector can be attracted to invest in the St. Louis region.

State funding for Missouri Technology Corporation



Source: Missouri Office of Administration

Huiqi Xu / Missouri Business Alert

Figure 7 - State funding for Missouri Technology Corporation. Note: MTC makes investments in high technology areas outside of agtech - only a portion of the funding on this chart actually goes to agtech startups in Missouri. We've included it here to demonstrate the significance of the funding cuts that took place in 2018 and continue into 2019 (Missouri Business Alert, 2018)

Missouri Technology Corporation (MTC)

MTC, founded in 2011 is a public private partnership created by the Missouri General Assembly to foster the growth of new and emerging high-tech companies, especially in the Bioscience industry (Missouri Technology Corporation, 2018). MTC has invested more than \$80M as a direct investor in startups, and as an indirect investor to BioGenerator, Arch Angels and others.

In 2018, the Missouri government drastically reduced the budget of MTC from \$13.4M in 2017 to \$2.5M in 2018 and the amount of funding in 2019 is uncertain. Since MTC has its own revenue stream from its portfolio, MTC still plans to cultivate the St. Louis ecosystem. However, its impact as a de-risking investor in early stage startups and eco-system builder will inevitably decrease if the budget reduces.

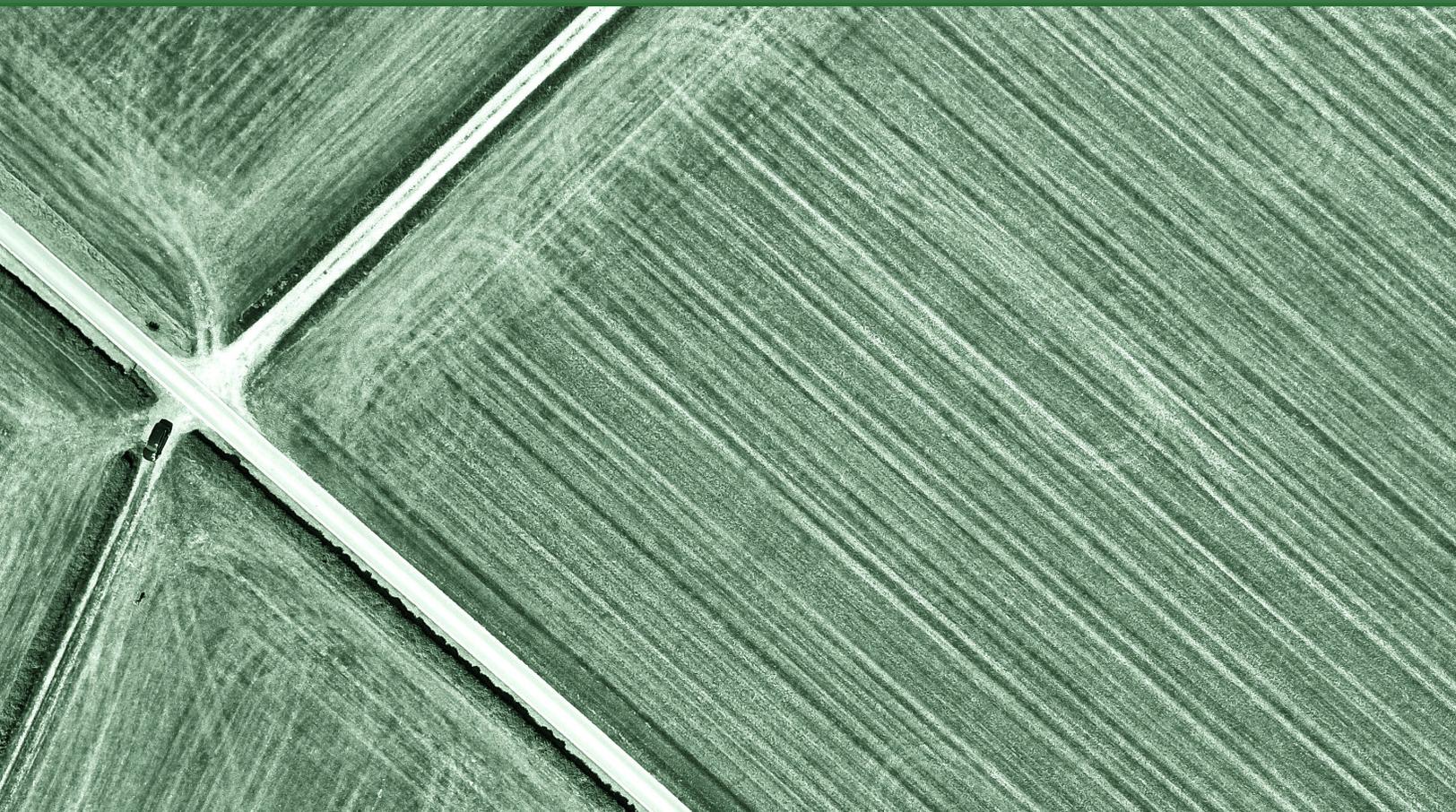
Late Stage Startups

New Leaf Symbiotics

Founded in 1999, New Leaf raised \$17M of Series B in 2014 and \$24M of Series C in 2017. The company is commercializing a university-developed patent for symbiotic bacteria that boosts crop yields. The New England founders moved to St. Louis in 2012 and, with support from BioGenerator and Monsanto scientists, were able to triple their space and grow to 40 employees.

Benson Hill Biosystems

Founded in 2012, raised \$25M of Series B in 2017 and \$65M of Series C led by Google Ventures in 2018. The St. Louis-based company is providing decision support to accelerate crop improvement and enhance the sustainability of food and fuel production.



HIGH LEVEL – FINANCIAL CAPITAL IN ROSARIO

Financial Capital is a major issue in Rosario and Argentina in general, as it is a crucial factor in the development of entrepreneurial ecosystems.

Venture capital investment in Argentina has been low and highly volatile over the past ten years. In recent years, thanks in large part to the Entrepreneurship Law and other regional efforts, the number of deals by venture capital firms have increased considerably, but VCs mainly focus on early stage investments (seed rounds). Funding Series A to C rounds are still lagging. To overcome these challenges, the capability to attract outside investors may become a key factor in building a strong ecosystem in this region. Since many international investors are eager to look for opportunities in Latin America, there may be an opportunity for local agtech start ups to attract outside capital.

Venture Capital

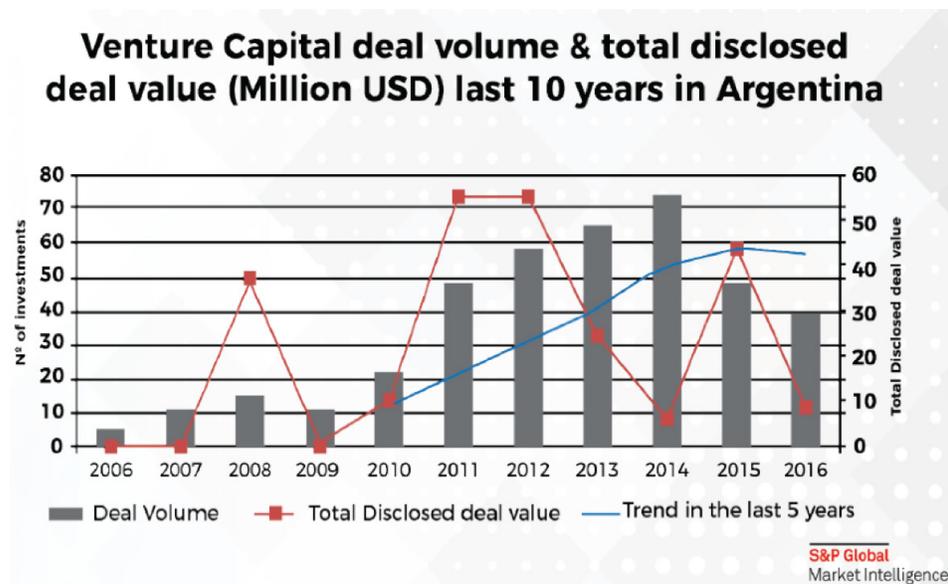


Figure 8: Venture Capital deal volume & total disclosed deal value (Million USD) last 10 years in Argentina

Lack of Investment

According to Sancor Seguros at CITES, “Startups in Rosario face challenges in finding venture capital funding since startups are in the early development and high risk stages.” Bernardo Milesy at Glocal observes that “Rosario has different players needed to construct the ecosystem, but lacks connectivity to gather those players together.” Venture capital investment in Argentina has been low and highly volatile over the past ten years. The amount of total venture capital investment was \$12M in 2016 and the agtech industry accounted for less than 1% (Emprendedor y Semilla, 2017). Most of those investments went to startups located in the Buenos Aires area. The current agtech venture capital investment activity in Rosario appears to be insufficient for building a strong ecosystem.

In recent years, thanks in large part to the Entrepreneurship Law (see Policy section) and other regional efforts, the number of deals by venture capital firms has increased considerably, but VCs mainly focus on early-stage investments. “An increasing number of accelerators and incubators provide funding for seed rounds, but funding Series A to C rounds are still lagging”, explained Federico Trucco at Bioceres (Louisa Burwood-Taylor, 2018). This lack of additional capital creates a “Valley of Death”, which refers a period of time spanning from when a startup receives an initial funding to when it begins generating revenues, leaving the firm vulnerable to cash flow requirements (Investopedia, 2018).

Opportunity for International Investors

For the last five years, investment in Latin America has increased exponentially, exceeding \$1.1 Billion in 2017 (LAVCA, 2017). While Brazil is the biggest recipient

of investment (52%), Argentina accounted for 11%. Since many international investors are eager to look for opportunities to invest in Latin America, once agtech startups in Rosario succeed in providing commercially viable products and services, startups will find it less-challenging to attract investment.

Angel Investors

Angel investors have not been active in Rosario in the past. However, various new angel network groups have emerged, possibly signifying an impending increase in angel investments. There are two active angel groups in the greater Rosario area - “Business Angels Club & Ventures”, launched in 2016 in Cordoba, and “Nest”, launched in 2017 in the Santa Fe area. Two additional groups screened 5 and 60 projects, respectively, but had not made any startup investments as of 2018 (Louisa Burwood Taylor, 2018).

Notable Accelerator and incubator

Glocal

Glocal, based in Rosario, is an accelerator for startups and mid-sized agtech, biotech and agri-fintech companies. Glocal funds 10 startups per year with up to \$100K per company and provides access to a 5-month acceleration process. Glocal scouts promising firms, validates the business model and helps the firms’ market entry and investors rounds (Glocal, 2018).

Cites

Cites, founded in 2013, is an incubator located in Sante Fe and committed to fintech, agtech and health/insurtech. Cites provides various programs, including Cites Ideas, Incubation, and Cites Startups, and helps companies to grow with capital of up to

\$500K and professional mentoring services (Cites, 2018).

Corporate Ventures

There are several multi-national Agriculture/Bioscience corporations located in Buenos Aires (Bayer) and Rosario (Bunge, Dow Dupont). While those corporations participated in investing agtech startups, like Bioceres, they are not main players in agtech ecosystem in the region. "There is a lack of corporate venture capital activity, not only in Rosario but also across the Argentina", said Camila Petignat at The Yield Lab Latam (Emprendedor y Semilla, 2017).

Government funding

Since 2016, the government initiated several funding/supporting programs through public-private-partnerships. One of them is the FONDCE program, initiated in 2017, which gives funds to venture capital and accelerators to cultivate a vital investment environment (LAVCA, 2017). The FONDCE program selected 10 technological or social

accelerators and 3 scientific accelerators to receive funds to cover part of their operational costs. These accelerators are then required to invest in a minimum number of projects per year. For each dollar invested in each startup, the government will provide matching funds (Access the Acceleration Fund Program)

The perception, among entrepreneurs with whom we spoke, was generally positive. "Argentina's government is doing a great job to promote agtech and attract foreign capital", explained Maximiliano Landrein and Alejandro Larosa at Agrofy (Louisa Burwood Taylor, 2018).

As seen in St. Louis, however, government funding is highly unpredictable and uncontrollable. While agtech players in Rosario should take full advantage of current government support, private sectors should not solely rely on it and need to develop the ability to survive and thrive without public assistance.

LATE STAGE STARTUP

Bioceres, founded in 2001, develops higher-yielding crop varieties. The firm was founded by a group of 23 Argentinians who reached an agreement with Union Acquisition Corp. The firm is set to list on the New York Stock Exchange in early 2019 through a reverse listing. The expected enterprise value is approximately \$456M.

KEY INSIGHTS: INVESTMENT IN ST LOUIS & ROSARIO

St. Louis Take Away

- Investment in AgTech startups in St. Louis has increased significantly over the past decade, solidifying St. Louis' importance as an AgTech hub.

St. Louis Recommendation

- Early stage investors should continue to invest in high-risk technologies, as investments from groups from BioGenerator, Arch Grants, and the Yield Lab accelerator have already been demonstratively effective in attracting and sustaining agtech companies in the region.
- Something is needed to replace the decrease in MTC government funding – that can be public or private capital, but it is essential that the gap is filled. We would recommend that the state of Missouri strongly consider the economic benefits that investing in high risk technology, particularly agricultural technology, can bring to the region in the long term.
- Closer collaboration and better communication with St. Louis ecosystem stakeholders (who exist both in and outside the region) will enable St. Louis to grow further as a leading agtech region.

Rosario Take Away

- Currently, investment in the Rosario AgTech industry is not sufficient to cultivate a robust entrepreneurial ecosystem.

Rosario Recommendation

- There is already an opportunity for investment in Rosario and the Santa Fe region. However, more needs to be done to highlight this opportunity, and thus draw investment to the space.

■ PUBLIC POLICY

The political landscape in St. Louis has long supported the agricultural and agtech industries. Through legislation such as the Farm Bill, tax incentives, government grants, and building infrastructure, federal, state, and local governments have demonstrated support for the agricultural industry in St. Louis. The government understands that agriculture is a key industry in the state of Missouri and makes an effort to incentivize and support technology as an important part of the future of agriculture and other industries in the state.

DEEP DIVE - PUBLIC POLICY IN ST. LOUIS

Missouri has a long history of supporting the agricultural industry and, in turn, agricultural technology. Various regulations recognize the importance of both agriculture and agtech federally (such as the Farm Bill) and in Missouri.

The Farm Bill, sponsored by the House Agriculture Committee, promotes the well-being of farmers throughout the country by protecting farmers against price fluctuations, promoting world trade and resource conservation, strengthening access to credit, and more. "Title VII – Research, Extension, and Related Matters" of the Farm Bill is carved out to keep "American agriculture at the forefront of innovation and productivity through cutting-edge research and support of the nation's land grant and non-land grant colleges of agriculture to provide the safest, most abundant, most affordable food supply in the world" (Farm Bill, 2018). While the federal Farm Bill does aim to increase security for America's farmers, Title VII explicitly recognizes the importance agtech plays in America. Out of the Farm Bill comes funding to support research in the agtech space, which includes research grants, equipment grants, infrastructure grants, and tuition scholarships (monetary information on this below) in areas such as plant genomics, pest management, hens and turkeys, specialty crops, forestry, cattle, and a laundry list of other areas. The Farm Bill ensures that hyperlocal areas of the United States all receive some type of support in their food space – the

Bill both supports St. Louis specialty crops (e.g. corn, soybeans) and non-St. Louis specialties (e.g. nuts) (United States House of Representatives, 2018).

At the state level, Missouri has a bill that establishes an “advisory council on agriculture science and technology” (2016 Bill Text MO S.C.R. 63; §620.1500). Farmers are also protected from “nuisance lawsuits” that may arise when neighbors attempt to stop farming operations (Weldon & Rumley, 2018). Indeed, one may argue that the role of government is to ensure that they and others do “not get in the way” – and the Missouri government certainly does not.

Financial Assistance

Assistance from the government is often most felt financially. Government assistance impacts both those with agtech talent (researchers, startups) but who lack money, and those with money seeking an investment. Grants support the former. Federal grants are most often given to Universities (through researchers at those Universities) to pursue research in agtech, though businesses and centers such as the Danforth Plant Science Center are also eligible to receive grant money. It is complex to track the exact amount of grants related specifically to agtech, as grants may technically be able to fit in multiple categories. For example, while most agtech related grants come out of the Farm Bill and through Federal Agriculture and Food Research Initiative (AFRI) Funding, others, such as a \$6.2 Million grant to the Danforth Plant Science Center for “Using systems approaches to improve photosynthesis and water use efficiency in sorghum” come through the Department of Energy. The Danforth Center is the recipient of over \$40M in grants over the past 20 years (Spending by Prime Award, 2018).

Looking at AFRI funding specifically, we see near \$35M in funding in Missouri in 2018, a slight decrease over the past two years – in fact, AFRI funding is back to its 2011 levels.

Tax Incentives

Tax incentives impact everybody in the agtech space. Venture Capitalists in the US feel the support of government through tax incentives. Consider the qualified small business stock gain exclusion, which allows VCs to realize a tax-free gain of up to \$10M if stock in the small business is held for at least 5 years.



While the federal Farm Bill does aim to increase security for America’s farmers, Title VII explicitly recognizes the importance agtech plays in America



This provides incentives for high risk venture investment. At the local level, Missouri and St. Louis offered KWS, a German seed company, around \$2M in tax incentives to locate to St. Louis (Barker T. , 2014). Surely this was not the only reason KWS opened an office in St. Louis, however this does serve as a strong signal that the public policy will shape to support the agtech ecosystem. Other tax policies establish that agricultural property will be taxed at a fraction of its actual land value (0.5% for grains) (State Tax Commission, 2017), serving to encourage farmers to keep their land for agricultural use. Accordingly, a strong network of nearby farmers enables producers of agtech products to more easily test their products on farms.

Infrastructure

Finally, public policy supports the creation of infrastructure that enables citizens to foster easy communication amongst one another.

Highway construction programs fueled the rapid growth of Creve Coeur, the area home to the Danforth Center and the envisioned 39 North. Roadways enabled larger, more inexpensive tracts of land to be available with lower development costs in the suburbs than in the city. Open land near highway intersections coupled with the rail line made 39 North become a desirable location for “light industrial uses” (39 North, 28). The St. Louis Economic Development Partnership’s collaboration with public officials comes out of a desire to increase access and walkability (Barker J., 2016). Nearly \$5M in combined local, state, and federal grants will support the initiative to transform the current roadways into a design that is more easily accessible for drivers coming from all directions (Barker J., 2018). All parties view these initiatives as key to future success of the 39 North area.

HIGH LEVEL - PUBLIC POLICY IN ROSARIO

Note: Most of this policy research pertains to Argentina on a national level. Further research needs to be conducted to assess opportunities for agtech support through public policy in Rosario and the Santa Fe province.

Background

One of Argentina's most significant economic sectors is agriculture, having exported USD \$15.4B, or 26.5% of exports, in soybean products alone in 2017 (The World Trade Organization, 2018). Given the importance of agriculture in Argentina's economy, one might expect the government of Argentina to play a large role in developing this space, including assisting companies in developing technologies to proliferate the growth of exports, and to generate products that would solidify Argentina as a global leader in Agricultural Technology. While Argentina has made great strides in the public policy arena recently and we have high hopes for the future, we do not see public policy developed as much as one would expect in the agtech space in Argentina, especially compared to agtech ecosystems in other locales (such as St. Louis).

Recent Changes

Recent public policy changes have enabled start-ups to materialize much quicker than in the past. Realizing Argentina lacked the foundation to support a successful new business environment, legislature began crafting



a law to turn this around. Perhaps, part-inspired by the 2013 Chilean “Ley de empresas en 1 día” (The Law of Businesses in One Day), the 2016 Argentine Ley de Emprendedores (Entrepreneurship Law) is the most important driver of the change to grow new businesses in the last several decades, and it impacts Argentina in six major ways:

1. Create a business in 24 hours.

In the past, entrepreneurs spent 6 months – 1 year incorporating their business legally, spending time and money dealing with red tape on issues unrelated to the success of their business.

2. Tax incentives for Argentine investors to invest in Argentinian ideas.

For instance, investors can deduct 75% of investments in a business from their income tax, up to a cap of 10% of net annual profit (Financiamiento para emprendedores, 2018).

3. Recognize and legally protect companies committed to solving social and environmental problems.

4. Enable public crowdfunding, supervised by the National Securities Commission.

In the past, public internet crowdfunding was illegal in Argentina, whereas sites such as Kickstarter have helped numerous companies achieve success in the United States.

5. Promote accelerators and incubators to help entrepreneurs from seed to growth stages.

Over 400 accelerators and incubators have been registered under the new government program as of the time of this writing.

6. Created the Trust Fund for the Development of Entrepreneurial Capital (FONDCE). Public funds will work with investments of private companies to finance projects.

Government is “investing \$12M in three early-stage venture capital funds each and also \$600k in 13 accelerators each” (Burwood-Taylor, 2018), (Ministerio de Producción, 2018).

At first glance, it seems impressive that over 400 accelerators and incubators are already registered through the new government program established in point (5) above. While this seems like an enormous accomplishment, the incubators do not all behave in the way incubators are traditionally viewed in the USA. Whereas incubators are supposed to assist in the growth and development of new businesses, ensuring businesses have a clear vision, the right strategy, are developing key relationships, and also provide funding opportunities, anecdotal evidence has told us that many of those sites that are officially registered are primarily a channel of funding



The 2016 Argentine Ley de Emprendedores (Entrepreneurship Law) is the most important driver of the change to grow new businesses in the last several decades



(albeit small amounts), and do not necessarily contribute to the development of new businesses in other ways. This is a key distinction between traditional incubators in USA and those in Argentina. Not all incubators in Argentina have this type of hands-off approach, but it is important to acknowledge that a large percentage of “incubators” act more like small business grant givers.

Tariffs

External relationships, however, can be challenged. Many companies, such as Rosario’s BioHeuris, mentioned the difficulties of importing necessary goods, such as lab equipment and chemicals, from the United States. Not only can goods be delayed for several months, mostly stuck at customs, high import taxes discourage imports in the first place. For example, according to a report from the World Trade Organization, ITC, and UNCTAD, the average tariff on imported electrical equipment is 14.8%-34.9% in Argentina, but merely between 1.4%-1.7% in the United States (WTO, ITC, UNCTAD, 2017). While the Argentine government may have high import taxes to encourage internal production, today’s economists have long realized and argued the benefits of easier trade among nations.

KEY INSIGHTS: PUBLIC POLICY IN ST LOUIS & ROSARIO

St. Louis Take Away

- Public policy has given the AgTech ecosystem the shove it needs to grow, and we are at a point now where private funding has surpassed government funding in this sector, signaling the private sector's interest and shifting risk appetite in this developing space.

St. Louis Recommendation

- Concerns about the significant reduction in publicly available funding (most notably, MTC funding) indicate that additional research in this area ought to be done around the potential regressive effect that these cuts might have on ecosystem development. What type of private funding is needed to fill in the gap, and is that funding available?

KEY INSIGHTS: PUBLIC POLICY IN ST LOUIS & ROSARIO

Rosario Take Away

- Argentina's Entrepreneurship Law is an important piece of legislation that is likely to radically shift the start-up landscape in Argentina.
- It seems that Argentina does not provide very much public support in the way of scientific research-based grant funding.
- The tariff landscape in Argentina serves as another barrier to startup success; the additional tax on necessary equipment is likely to hinder the growth of budding companies.

Rosario Recommendation

- Even with the push from the Entrepreneurship Law, Argentina could likely accelerate the development of agtech regionally if they did more in providing grants to researchers and scientists within companies to grow from the pre-seed to the seed and growth stages of their companies.
- To the extent possible, it would be highly valuable to reduce tax pressure and to take into consideration the positive economic impact of agtech startups, in terms of imports/exports of goods and, most importantly, services.

INFRASTRUCTURE

Infrastructure is critical to the existence of any startup ecosystem because it provides the facilities needed to inspire ideas, build on them, and scale their existence to reach a wider audience. In the context of agriculture, infrastructure is even more critical, as agricultural production is inherently reliant upon geography and climate, and agricultural trade is reliant upon infrastructure to facilitate the movement of goods.

In agtech, the list of critical facilities covers a broad range of amenities, from laboratories for prototype development and testing, to events and venues that can facilitate greater collaboration and connect key assets in the ecosystem to ensure connectivity. In this way, infrastructure is the way to ensure physical connectivity is in-place to facilitate growth.

St. Louis's ability to support agtech is greatly boosted by its close proximity to both the Mississippi river, a major transportation vein of the United States, as well as rich fertile farmland. Further, the city has strong agricultural productivity and logistical solutions that make its agricultural landscape accessible to greatly benefit thinkers and entrepreneurs. Today, the St. Louis area has over 200 agtech resources—from research institutes to shared workspaces—the catalysts of which are rooted in the city's history and strengths.

DEEP DIVE - INFRASTRUCTURE IN ST. LOUIS

While it is easy to attribute the success of the startup ecosystem in St. Louis to the modern infrastructure available at known locations like the Danforth Plant Sciences Center, the city's key resources are the product of its early history and identity. In the 1900s, the topography of Missouri was characterized by sustenance farming and row crops, much like its neighboring states. However, unlike other agrarian economies, St. Louis prioritized the development of key waterways, both for trade and for the movement of residents and visitors. The Eads bridge, for instance, facilitated the construction of roadways that made



**In this way,
infrastructure is the
way to ensure physical
connectivity is in-place
to facilitate growth**

St. Louis accessible and navigable, helping the city leverage its location near the Ohio and Mississippi rivers. By 1901, the combination of the city's agricultural landscape and infrastructural strength drew in big businesses including Monsanto and Pfizer, further spurring urbanization in and around the city center. In 1904, St. Louis was the 4th largest city in the United States, with national prominence that rose after it hosted the World Fair and the Olympics.

Although St. Louis managed to maintain its status as a leading hub for agriculture and business for the coming decade, it struggled with a population decline during the the 20th century. Suburbanization saw families moving outside of the once densely populated city into the urban periphery. During the height of industrialization in the United States, St. Louis failed to compete with the rising populations and faster-growing infrastructure and technology in other cities. 1950 marked the start of businesses moving outside the region. In the early 2000's, companies including Ford, Chrysler, and Pfizer closed operations in the region and St. Louis continued to lose its place as one of the United States' largest urban areas. At the end of the decade, the downsizing of key businesses contributed two very important elements: a wealth of trained, professional human capital and an urgent need to retain them in the region.

Economic Impact of Infrastructure

Despite the challenges, St. Louis faced during this period, the city's continued to reinvention of its role in the modern American landscape. Even as businesses moved away, Missouri still had many influential academic institutions with thinkers like William Danforth. By institutional endowments, personal relationships with businesses, and incentive to draw talent, Universities became key mobilizers of economic change in the St. Louis region during this interim period. In the late 1990's, William Danforth, the chancellor of Washington University in St. Louis, emerged as a key advocate of agriculture technology in the region, undertaking a series of investments to develop the Danforth Plant Sciences Center. As an academic, Danforth recognized that universities had an important role to play in translating research to meaningful economic impact. He recognized that while the challenges the St. Louis economy faced



**St. Louis is uniquely
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Mississippi river, a
major transportation
vein of the US, as well
as rich fertile farmland**

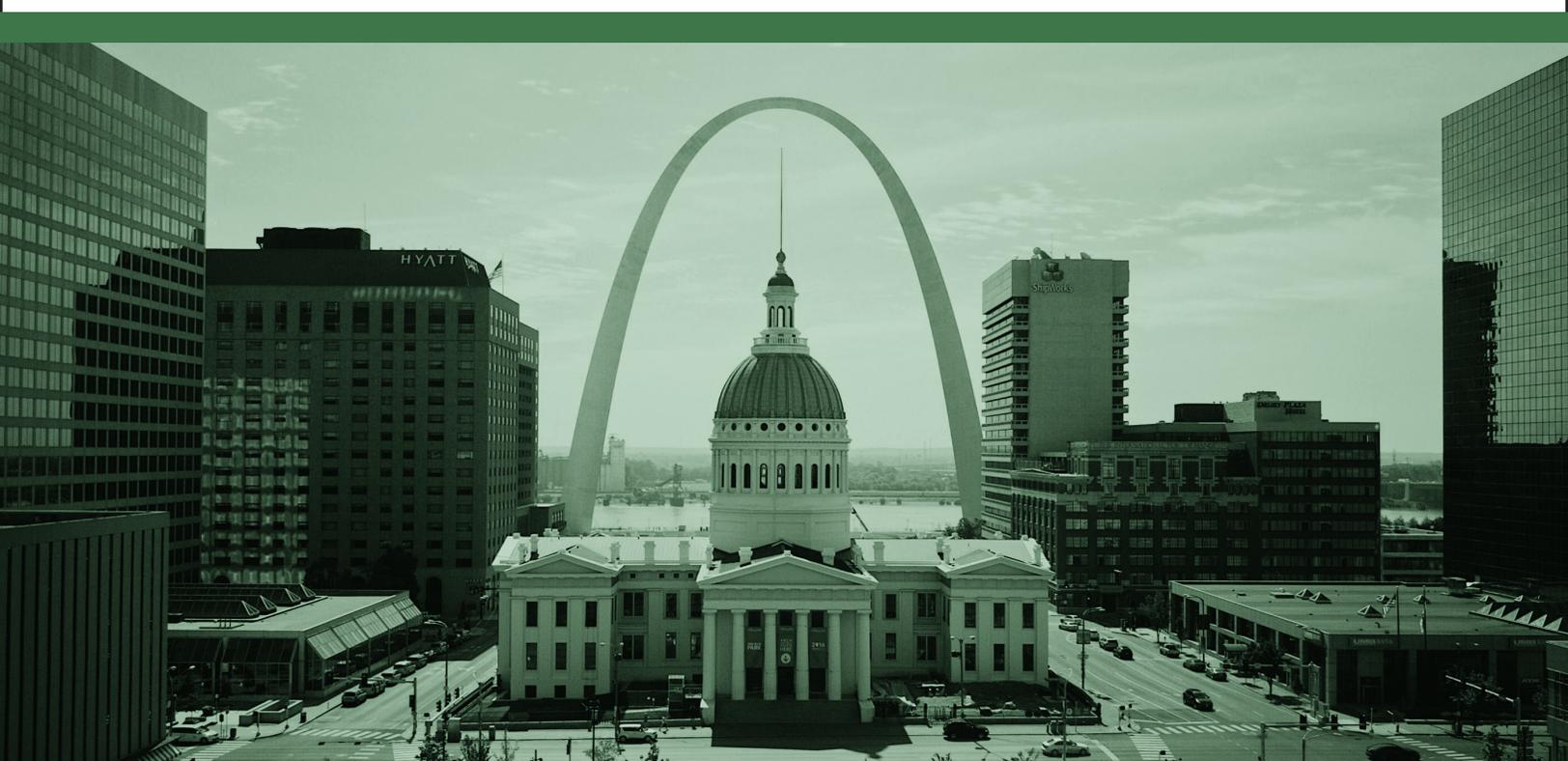
were significant, the professionally trained surplus of talent from the downsizing created meaningful opportunities. If St. Louis were to re-emerge as a catalyst for business growth, it would need to blend this talent with facilities that could grow and retain it. The Danforth Center was the product of this thought, bringing together diverse stakeholders with a shared mission. The creation of the Center was funded in part by the Danforth Foundation and Monsanto, but also benefited from land and tax credits from the government.

Although the Danforth Plant Sciences center is often the lone University effort highlighted in the space, other Universities in the region, including St. Louis University—with its Chaifetz center for entrepreneurship—were also spearheading initiatives to promote innovation during the late 90's. What made the Danforth Center unique in this context, however, was—and is—its ability to converge stakeholders across academia, business and government. Since the facility's opening in 2001, it has continued to expand its infrastructural resources through investment

from the biggest players in the region. Direct funding from corporate ventures including the Boeing Company and Millipore Sigma, alongside larger government grants to promote initiatives, have helped the center attract scientific and startup talent. This human capital combination enables affordable access to key technology for early stage startups that can test their ideas, interact with academics and better understand business. Today, the center employs over 260 individuals from over 20 countries, with 193 scientists who have produced over 1100 publications. The Danforth Center was the first of many players in the region that provided an infrastructure base that today hosts 700 life sciences and agtech firms, of which 300 are startups.

Agriculture Infrastructure Needs

While the Danforth Plant Sciences was a catalyst in the creation of an agtech ecosystem, the combination of topography and agricultural infrastructure is also important to the city's foundational strengths. Today, St. Louis has over 100,000 farms



covering almost 30 million acres of farm land that produce soybean and corn, alongside many other agricultural commodities. Moreover, the city has the highest grain barge handling along the Mississippi, lending it the title of America's "Ag Coast" (St. Louis Regional Freightway, 2018). For established businesses like Monsanto and for industry groups, this proximity to members key suppliers, customers and intermediaries is immensely valuable for operational and organizational efficiency.

As Missouri's terrain supports agri-resource growth, investment in the railways, interstate highway and port development contributes to their greater access and mobility, which in turn benefits In the context of agtech, the ability of a region to support agriculture and provide meaningful logistics solutions enables thinkers and entrepreneurs to physically see the challenges the agricultural sector faces, develop meaningful business ideas that can resolve them, test their success and leverage entrepreneurial-infrastructure productively.

Business Infrastructure Needs

The correlation between infrastructure and business development—of all forms—is not incidental. When viewing St. Louis' history, it is important to realize that big companies like Monsanto chose to establish headquarters in the city because of its connectivity and access. Businesses at different points in their lifecycle can benefit from different elements of infrastructure facilities, and to start and retain businesses in a geographic region requires a host of resources that can cater to these diverse and growing needs.

The formation of infrastructural hubs is a cyclical process, which is often driven by access to key natural or physical resources,

growth of large scale and operating business, and furthering of existing resources through established business contribution. St. Louis' historic roots that drew in large corporate players and universities provided the foundation and initial funding for the diversity of key resources we see today. Today, St. Louis has evolved to provide the critical elements startups need at all stages. From large research and government institutions to private collaborative work spaces, below are some infrastructural facilities of prime importance to the agtech ecosystem.

Institutions

Danforth Plant Science Center

The Danforth Plant Science Center was Founded in 1998 by William Danforth to create a research institute that could promote collaborative science and businesses rooted in agriculture and life sciences. The Center has a plethora of technological facilities including research-grade greenhouses, microscopy equipment, bioinformatics systems, shared workspaces and expert operators. In addition to the inexpensive space and equipment, different players including Enterprise Rent-A-Car and Institute for International Crop Improvement have their independent research institutes at the center, undertaking specific areas of research. For entrepreneurs looking to test, build out or explore their technology, this research base is particularly useful.

- ***Size & Composition*** – Employees 250+ including 193 scientists
- ***Funding*** – Total of \$30M – “44.4% research grants and contracts; 40% draw from endowment appropriated for spending; 6.7% donor gifts; 4.7% core

facility fees; 4.2% other income from U.S. Department of Energy, U.S. National Science Foundation and Bill & Melinda Gates Foundation” (Danforth Center, 2018)

- **Key features** – Research institutes, equipment, events

St. Louis Economic Partnership

The St. Louis Economic Partnership is the economic development team for the region which provides business knowledge and resources for startups and established companies, particularly those seeking to expand nationally and internationally. The partnership consists of many different committees formed by different organizations in the region that can help with development, financing, collaborations expansion issues for businesses in the region. It actively helps with workforce development, making global connections, and securing state benefits. The partnership also has 5 innovation centers across the city called STL VentureWorks

- **Key features** – Business area expertise (site selection, tax credits, expansion, networking), shared workspaces, networking events

World Trade Center St. Louis

The WTC St. Louis serves St. Louis, Missouri and Southern Illinois Market, and is a licensed part of the 300 global World Trade Centers working to promote economic growth and development. It is a key player in providing international market research and data systems, hosting events, connecting businesses with local and global partners, and curating educational opportunities for employees and management within companies. The WTC is a particularly valuable resource for those businesses that have foreign operations, or deal with global economic factors in their manufacturing and supply chain. The WTC in St. Louis also spearheaded the Sister Cities network, connecting St. Louis with 16 of its global sister cities.

- **Key features** – Proprietary research and advisory, events, global network

St Louis Chamber of Commerce

The St. Louis Chamber of Commerce is an association of 30% of all employees of the St. Louis region, that works to convene

stakeholders and address their needs in attaining professional success by overcoming regional challenges, The Chamber provides a collaborative space and organization for all members to share ideas and advocate for infrastructural, policy and economic solutions. Additionally, the Chamber recently launched Accelerate St. Louis, “an initiative lead in collaboration with the St. Louis Economic Development Partnership...to amplify authentic communications about St. Louis’ dynamic startups, expand the supply of capital available to startups and the entrepreneur support infrastructure, stimulate connectivity, and advocate for policy that favors economic development and job creation through entrepreneurship.” (St. Louis Chamber of Commerce, 2018).

- **Key features** – Founding investments in companies, Green Business Challenge, and Honor Awards for entrepreneurs

Hubs

Cortex Innovation District

The Cortex Innovation hub is in the central west end of the city, and was, “formed in 2002 by Washington University in St. Louis, BJC Healthcare, University of Missouri – St. Louis, St. Louis University, and the Missouri Botanical Garden to capture the commercial benefits of university and regional corporate research for St. Louis.” (Cortex STL, 2018). It hosts the Center for Emerging Technologies, BioGenerator, Cambridge Innovation Center, Venture Café, providing a space for entrepreneurs to work, access capital and also socialize. The Cortex hub is highly accessible by public transportation and has been funded by a \$2.3 billion masterplan.

- **Key features** – Amenities include access to research, trained workforce, venture capital offices

Cambridge Innovation Center

The CIC offers space and valuable resources for bio and agriculture technology startups. In addition to equipped conference rooms, wet labs and high-end technology, the CIC has a host of mentors, entrepreneurs, investors and sources of capital through the center’s network. This space and resources are critical for early and middle stage startups initially testing their ideas and building out their companies

- **Key features** – Conference spaces, wet labs, technology support

39 North

39 North is a 600-acre district encompassing the Plant Science Center, BRDG Park, Helix Incubator, Yield Lab and Monsanto. Since its announcement in 2016, the area has been funded by a \$500,000 grant from the U.S. Department of Commerce to make the region easily accessible and more connected for the institutions and startups based in it. 39 North is a model ecosystem that showcase the collaborative effort of public, private and institutional partnerships. Today, both the federal and state government are working to further build the walkways and roads around the hub.

- **Key features** – Office space for lease, on-site work force training, events for entrepreneurs, access to researchers and business professionals

Incubators, Accelerators & Amenities

BRDG Park



The Bio Research & Development Growth Park is an 8-acre area located next to the Danforth Center designated as a wet lab space for small companies. It focuses on life sciences and green technology startups and opened in 2009. The Park is an extension of the Danforth Sciences Center and facilitates “interactions between top scientists and access to state-of-the-art core facilities such as research grade greenhouses, growth rooms and chambers, a microscopy suite, a proteomics facility and a tissue transformation complex” (Danforth Center, 2018). The park prides itself on having strengths across the 3 R’s of research, resources, and relationships.

- **Key features** – Office space for lease, on-site work force training, conference room, auditorium

Helix Center

The Helix Center is a Bio incubator established by the STL Partnership, to provide “more than 33,000 square feet of affordable wet labs, dry labs, office space, financing and collaboration” (STL Partnership, 2018). It is strategically located near the plant sciences center, providing access to academic resources and infrastructure. The center allows its clients access to shared equipment, business expertise and opportunities to access financial capital. Its key clients include leading startups in the region, including Arvegenix, and also venture capital firms like Yield Lab

- **Key features** – Business area expertise, shared workspaces and equipment

HIGH LEVEL - INFRASTRUCTURE IN ROSARIO



In the mid 1900s under Juan Perón a sequence of macroeconomic shocks created an industrial-focused economy within Argentina – specifically within Rosario. The city provided significant support for Perón and was rewarded with heavy investment in industrial production infrastructure in the 1950s. Though Rosario experienced economic volatility over the course of the 20th century, its industrial infrastructure remained strong. However, during the economic crisis of the 1990’s, the economy collapsed, experiencing hyperinflation of over 3000%. Rioting and looting destroyed infrastructure, and cheap imports had a compounding negative effect on the agricultural sector. In the early 21st century, specifically since 2006, Rosario’s infrastructure has begun to grow anew – specifically increases in agricultural exports have led to an economic turnaround for the city and region, that has significantly improved infrastructure.

“
While the St. Louis ecosystem needs to focus on connecting... Rosario is at a stage where elements of infrastructure themselves need to be built up further.

Today, Rosario’s history has allowed it to emerge as a hub for agriculture and trade, building a foundation for a strong agtech ecosystem in the coming few years. Our first look at the Rosario and Santa Fe region indicates that Rosario has some key organizations that provide access to resources, space and mentorship for startups in the region. Unlike St. Louis, Rosario infrastructure is not concentrated around nodes. Instead, key players are dispersed around the province and country, leading to unique hurdles and opportunities. Although there are a host of different accelerators and institutions in the region, below are some key infrastructure providers and the challenges they face.

Rosario already serves as a strategic pole for agribusiness. Santa Fe is the main world exporter of soybean meal and oil, and is responsible for 75% of Argentina’s total exports in

cereals, oilseeds, flours, oils, and biofuels. The region is home to the most important milk basin of Latin America, and exports Argentina's largest share of beef. It is also already known for specialization in agricultural machinery production.

Infrastructure Players

CITES

CITES is a technology incubator that focuses on cultivating early stage global technology startups, primarily in biotechnology. With 12 incubation spaces, leading biotechnology equipment, and team of business development experts and mentors, the incubator boasts unparalleled resources in the entrepreneurial technology space of Rosario and aims to "transform science into business". With the ability to invest up to \$500,000 USD in each startup, the organization has the power to provide significant financial assistance to young companies. Major challenges for CITES include a lack collaboration with University academics, especially because of limited intellectual property protection for researchers, and high international service fees.

Indear at the National Scientific and Technical Research Council (CONICET)

CONICET is a government agency that coordinates the efforts of scientific and technical entities in Argentina. Through research partnerships established with 13 institutes—both corporate and academic— it has driven the creation of two technology companies, and 12 patents. The organization is spearheaded by the Ministry of Science as a collaborative effort that aims to enhance the performance of startups in Rosario. The following section highlights some of the institutes that are partners of CONICET.

Indear is the research and development unit of Bioceres located at CONICET. It has over 40,000 square feet of laboratory and green house space, alongside other state of the art technology for biotechnology development (Indear Website, 2018). The R&D undertaken at Indear benefits Bioceres, but also other entrepreneurs in the region.

Endeavor

Endeavor is a US based accelerator network, with established operations in Argentina, including the Santa Fe province. The accelerator focuses on supporting high impact entrepreneurs by providing business development, networking and strategic support. Endeavor hosts events that connect mentors with business entrepreneurs. Endeavor is sponsored by large tech companies, including Facebook and Google, and it continues to grow its international network.

Polo Tecnológico-Zona i

Polo Tecnológico-Zona i is a public private partnership that was formed through initiative of the Santa Fe province government. The hub is currently headquartered in an area known as "zone 1," where over 70 partner companies come together to help to create technology solutions for startups through growth of informational technology, communications, and biotechnology capabilities. With a strong position in the domestic and regional market for informational technology, the organization promotes investment in technology-based startups. Through offerings of leasable office space, and event hosting capabilities, it has gained widespread name recognition and engages many valuable stakeholders. It is looking to improve upon its own funding, diversify its

audience, and build a broader partnership base.

Rosario Board of Trade

The Rosario Board of Trade sits in the heart of Argentina's premier agro-industrial region, and has worked to grow resilient markets in grains, futures, capital, and livestock in and around Rosario. The organization aims to facilitate trade promotion and economic development through research, trading, events, and infrastructure projects. The organization has remained in place for over 100 years, and boasts significant resources including a trading floor, conference rooms, large auditoriums, event management services, researchers, and publication capabilities. It is looking to grow its offerings in proprietary news, educational materials, and technology.

Parque Tecnológico del Litoral Centro (PTLC)

PTLC forms part of the agtech ecosystem in Rosario, providing a point of contact between different scientific, governmental, educational and academic organization. It focuses on bringing thinkers and entrepreneurs access to sectoral expertise that can help develop impactful ideas into businesses. It provides infrastructural facilities including meeting spaces, office spaces, laboratories, internet connectivity and equipment for businesses across pre-incubation, incubation, and pre-established stages. PTLC currently has 15 companies in the pre-incubator and incubation stages, and 6 others in different phases of registration.

St. Louis and Rosario are well placed, in the central Midwest and Santa Fe province, respectively. This enables each city to serve as a strategic center for large agribusinesses,



KEY INSIGHTS: INFRASTRUCTURE IN ST LOUIS & ROSARIO

which in turn enables large players and institutions to cooperate for agtech sector development. Each is a major export of major agricultural commodities, with an especially strong focus on row crop and animal protein derived products. The Santa Fe province has a potential additional advantage in the agri-robotics arena, as it already specializes in agricultural machinery production.

St. Louis Take Away

→ As highlighted above, St. Louis has a host of resources that enable it to be a hub for agricultural technology startups in the region, but there is a lack of connectivity between the different infrastructural hubs, as well as between the hubs and the various stakeholders in the region. One of the biggest challenges St. Louis faces is the issue of physical accessibility to the city itself and navigability between different infrastructure hubs. This lack of seamless mobility has led the startup ecosystem in the region to be concentrated around different nodes i.e. hubs, which creates a risk of limited exposure to communities and ecosystems outside of St. Louis.

St. Louis Recommendation

- Infrastructure can and should be developed to promote cohesion, resource sharing and communication within the existing ecosystem nodes to establish a more consistent image of what the region offers. The St. Louis government is moving towards playing a more active role in building up public goods and facilities that promote startup growth, and there is immense potential for government involvement in furthering the region's connectivity to this extent.
- St. Louis is in a position to broaden its regional connectivity. The scope of this paper did not include interaction with agricultural extension, nor did it include interaction with other cities, both local and global. That said, both of these

KEY INSIGHTS: INFRASTRUCTURE IN ST LOUIS & ROSARIO

elements came up in research. International connectivity (international flights) and rural/urban connectivity are pain points in the St. Louis ecosystem that should be explored in future research.

Rosario Take Away

- Based upon our initial examination, there appears to be a relative lack of infrastructure to support startups in Rosario. While various organizations exist to provide amenities and resources to startups and entrepreneurs in the region, there is a lack of collaboration within these resources, and a lack of avenues to connect key stakeholders across them. There is a lot of potential in Rosario, through programming and networking, to bring these players together and create points of connections. If key institutions, Universities in particular, take a lead role as connectors, Rosario could emerge as a key hub for ideas, capital and infrastructure.

Rosario Recommendation

- Key institutions, Universities in particular, should take a lead role as connectors. There is a lot of potential in Rosario, through programming and networking, to bring existing players together and create points of connections, which would enable Rosario to become as a key hub for ideas, capital and infrastructure.

INFRASTRUCTURE

This collaboration was initiated because of the similarities between St. Louis, Missouri and Rosario in Argentina. Both cities share similar geographical features that have facilitated the growth of similar agricultural and logistic economic activity; both feature major rivers and an abundance of farmland. Further, the stakeholders in each ecosystem are passionate and proud of the success they have experienced in the agtech space and are invested in growth and moving agtech forward to address the agriculture-related needs of the globe.



During our interviews with stakeholders in both St. Louis and Rosario, we came to understand that connectivity of the four sectors discussed above is equally if not more important than the other sectors themselves in bringing about a successful agtech ecosystem. Specifically, having each sector aware of the others including each of their resources, requirements, and goals in the ecosystem facilitates growth and collaboration.

For example, to be successful, sectors such as human capital, infrastructure, and finance must communicate to understand the needs and resources each of them has. In this case, human capital players such as universities must understand what the ecosystem demands including skilled labor such as lab technicians to fill talent gaps, a key concern for companies growing and seeking to scale their operations. Likewise, the finance sector must communicate and seek to understand the needs of infrastructure investment to continue to expand facilities and fund expensive equipment including growth chambers, greenhouses, and spectrometry equipment to name a few. We see a successful example of this communication at the Donald Danforth Plant Science Center where there is high tech equipment at the disposal of ecosystem players, as well as networking events where scientists and startup founders can interact with investors, political stakeholders, and other stakeholders to understand each other's roles in the space, what they are looking to achieve, and key challenges they are working to overcome.

PUBLIC POLICY & HUMAN CAPITAL

Public Policy and Human Capital have a unique connectivity within the agtech ecosystem framework. This connectivity is exemplified by the National Institute of Food and Agriculture (NIFA) which provides funding and support to research institutions in exchange for targeted research initiatives. This symbiotic relationship helps foster the development of new research, build research teams, and train skilled labor to ultimately drive forward thought leadership and research in the agriculture space. Further, NIFA has a tangible impact on early education including kindergarten through high school as it also funds and promotes education and awareness of agriculture services and technology. This symbiotic relationship between public policy and human capital is crucial and necessary to support a robust agtech ecosystem.

INFRASTRUCTURE, RESEARCH, & HUMAN CAPITAL

BIOSTL was founded through the collaboration of several major businesses in the St. Louis area. William Danforth, the founding Chairman of the Donald Danforth Plant and Science Center, was the creator of bio generator and continues to serve as the chairman of the organization. BIOSTL's core competency lies in its ability to engage local entrepreneurs through training and capability building. Its broad ties extend outside of the community, as it has worked to create national audience for St. Louis biosciences among investors, bio scientists, and lawmakers. The organization has worked to build regional capacity in capital development, significantly increasing venture capital investment and investing more than \$5 million in companies, while leveraging more than \$140 million in corporate partnerships. BioSTL also has an investment arm, BioGenerator, that supports early stage biotech companies, which includes agtech, but does not focus primarily on the space.

■ OPPORTUNITIES MOVING FORWARD

Based on our research, interviews, and synthesis of data gathered from our resources, we have recognized the following opportunities for agtech ecosystems, generally:

Human Capital

Rosario

Improved transferability of intellectual property from universities and academic institutions to entrepreneurs and business is essential to high rates of startup creation.

Both

Universities should be leveraged to use their curricula, research, reputation and network to draw students into the agtech sector and to facilitate “buzz” around the high-potential space.

Finance

Both

It is critical to address gaps in funding, wherever those might exist.

Investors need to be educated in the opportunity that agricultural technology presents in order to incentivize more investment in the space.

Rosario

Support is most needed for early stage companies after initial funding but prior to Series A rounds.

St. Louis

Support is most needed between Series A and Series B funding rounds.

Public Policy

Rosario

To the extent possible, it would be highly valuable to reduce tax pressure and to take into account the global impact of agtech startups in terms of imports/exports of good and, most importantly, in terms of services.

Both

It is crucial that local government understands the high potential of agtech to drive new business and economic activity.

Infrastructure

Both

Addressing the need for high end equipment and cost-effective work spaces is important in ecosystem establishment.

Accessible networking opportunities, programming, and agtech events help to facilitate connectivity and collaboration, enabling more efficient use of available resources.

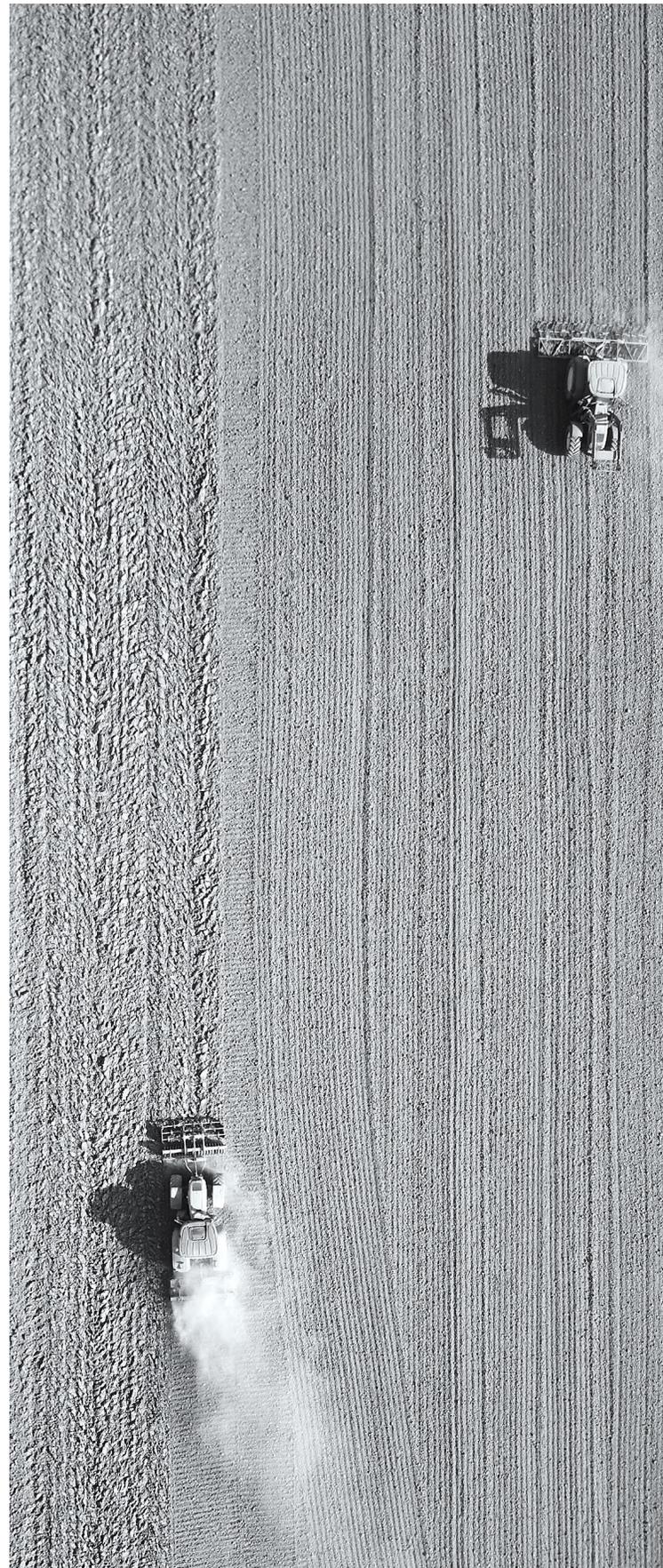
The ability to interact with other hubs, regionally, nationally, and internationally is highly valuable for strengthening local ecosystems and enabling the sharing of ideas.

Connectivity

Both

It is critical that the community understands the importance of intentionally facilitating intersection between the various components of agtech ecosystem framework.

Further, any agtech ecosystem must provide accessible opportunities for collaboration and interactivity between stakeholders in and not-yet-in the space.





MOVING FORWARD

There is high growth potential within agtech which will create a rising global demand for the sector. To meet these needs, it is critical that the Human Capital, Financial Capital, Public Policy and Infrastructure sectors continue to expand and collaborate with one another. St. Louis is an established agtech hub that continues to step into its room for growth, and Rosario, Santa Fe is in the early phases of putting the pieces together to build an attractive agtech hub of its own.

**To meet these needs,
it is critical that
the Human Capital,
Financial Capital,
Public Policy and
Infrastructure sectors
continue to expand
and collaborate with
one another.**

This paper has been the result of research and generous contributions of time & knowledge from stakeholders in the global agtech ecosystem. We thank everyone who took the time to meet with our team over the past year, and we regret that time limited the number of these conversations that could be had and recorded. While we think that this paper is representative of both the St. Louis and Rosario agtech ecosystems, it is by no means all encompassing. There is more work to be done and many more stakeholders to work with.

We hope that our work in this collaboration is setting the stage for further discussion and collaboration between stakeholders in the agtech space. We look forward to engaging parties in the space and further driving insights and building on the work we have completed to this point. We welcome all feedback and suggestions from readers as we seek to grow existing agtech ecosystems and initiate new ones.

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