FOUNDATIONS OF

agricultural technology ecosystems

A collaborative study between
Universidad Austral, Washington University in St. Louis – Olin Business School, and The Yield Lab

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Executive Summary

This paper is the product of a collaboration between Washington University in St. Louis, The Yield Lab, and Universidad Austral in Argentina to explore agricultural technology ecosystems and what makes them successful. We utilized St. Louis, Missouri and the greater area as a model AgTech ecosystem which has experienced significant success in the space. With this model in-place, we researched its sister city, Rosario, Santa Fe and greater area in Argentina, to ultimately build a critical analysis of both ecosystems which share similar geographic features, crop production, and climate 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.

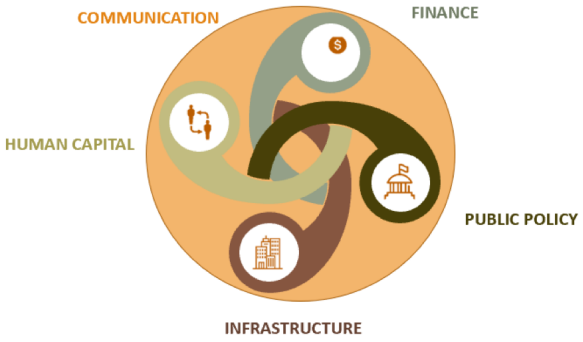
Approach

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 with the goal of being additive to their work. With an understanding of existing research, we began by independently reviewing at St. Louis and greater area as a model which has had significant success in the agricultural technology sector.

We first 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 including agriculture experts, startup founders, corporate players, as well as researchers and university experts to understand the ecosystem and build our framework. We replicated this research process in Rosario to understand how the ecosystem is evolving there to ultimately build our final white-paper analysis of the two 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, Missouri and the greater area successful in promoting AgTech. This framework began with four forces including Human Capital, Finance, Infrastructure, and Public Policy and was later refined to include a fifth sector which includes Connectivity.



HUMAN CAPITAL

Human capital is a foundational piece of the St. Louis AgTech ecosystem that serves to generate innovative ideas and establish new companies. Three elements of human capital which make the greater St. Louis Area a top AgTech ecosystem are universities, corporations, and interest groups & associations.

Human Capital in St. Louis

Universities

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.

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).

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 greater St. Louis area. Bayer, Bunge, Pfizer, Purina, Millipore Sigma, and Rabo AgriFinance all call St. Louis home. Two of the most influential companies in St. Louis' history are Bayer and Pfizer.

Bayer (Monsanto)

Monsanto, recently merged with Bayer, was founded in St. Louis in 1901 and is still headquartered in St. Louis County. 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 Bayer-Monsanto 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. (Volkmann, 2009).

Interest Groups

Various agriculture interest groups are located in or near St. Louis. The National Corn Growers Association is located in St. Louis County, as is the St. Louis Agriculture Business Club (Volkmann, 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, and information sharing.

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 on 69 AgTech companies in or 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

Undergraduate

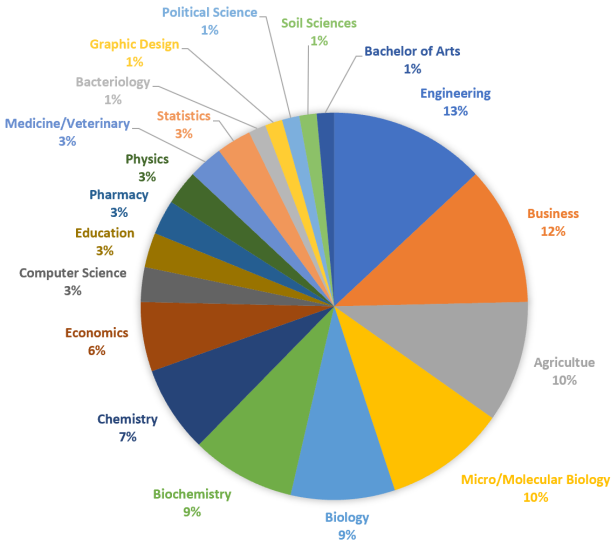
Undergraduate education data was located for 77 of the 95 founders. Founders studied at 54 different universities, with the largest group of founders having studied at Hebrew University, the second largest at the University of Buenos Aires, and third the University of Missouri. The majors (areas of study) of the founders fell into 19 categories, the largest of which are Engineering followed by Business, Agriculture, and Micro/Molecular Biology.

Graduate Studies

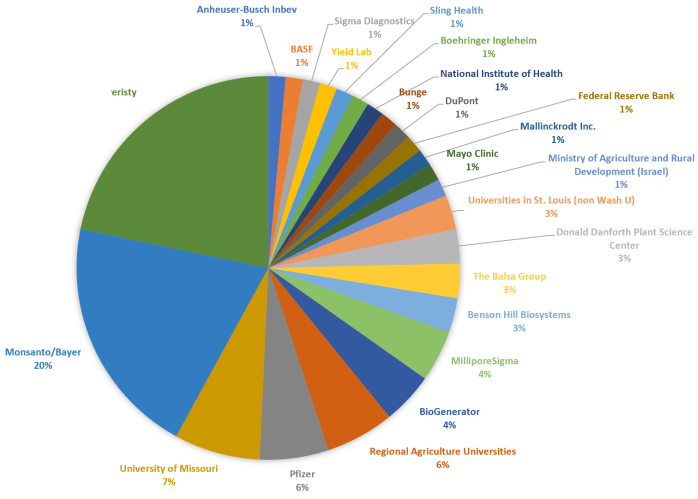
Graduate education data includes master's degrees and doctoral studies. The highest level of education for each founder is recorded in this analysis, therefore if a founder had multiple degrees e.g. a master's degree and a PhD then the PhD is represented in the data, but the master's degree is not. Graduate 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 gradute studies is business/management (25%), followed by biological sciences and medicine/veterinary (16%).

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 the Greater St. Louis Area.



Categories for Undergraduate Majors of Founders



Former or Current Employers of Founders

Conclusion

Human Capital in the AgTech ecosystem of St. Louis comes from the major universities and corporations in the St. Louis Area. This study indicates that these institutions are very important for supplying founders of startups. Former and current employers of these founders have a strong connection to St. Louis, with 80% of founders being employed in or near St. Louis. Employers are the largest suppliers of talent to the AgTech ecosystem and universities are the largest employers of the founders. Undergraduate studies and even graduate studies are not the biggest creators of talent in the AgTech ecosystem; researchers and professors are the products of universities that have the greatest influence on the ecosystem.

Human Capital in Rosario

Human capital is very important in the AgTech ecosystem surrounding 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 National de Cordoba, provides talent to the Rosario region. Public universities are often plagued with strikes and political issues (University of Missouri, 2018).

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). There are additional constraints to those seeking doctoral program as they are often unable to find employment outside the university systems and government agencies due to a law that requires employers to pay higher taxes on employees with PhDs (need citation and couldn't find the law).

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 Catholica de Santa Fe, and Universidad Austral. Private universities were authorized to operate in 1958[vi].

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. This means that academics and researchers are not often the founders of AgTech startups.

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 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.

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 Argros 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.

Rosario Founder Data

In Rosario and Santa Fe Province AgTech startups are growing. The founders of those startups come from various backgrounds, therefore a survey of 35 individuals identified as founders of AgTech startups in Rosario and the surrounding region was conducted. 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. Demographics inquired about include: founder undergraduate intuition 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

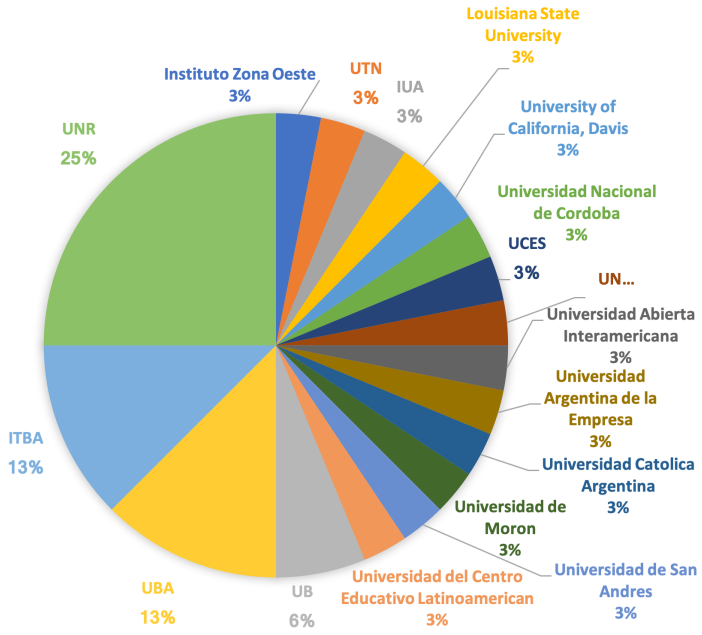
Undergraduate education data was provided for 32 of the 35 founders. The founders studied at 18 universities. A quarter (8) of the founders attended Universidad Nacional de Rosario, a large public university located in Rosario. The next largest groups (4 each) attended Instituto Tecnologico de Buenos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

Graduate Studies Results.

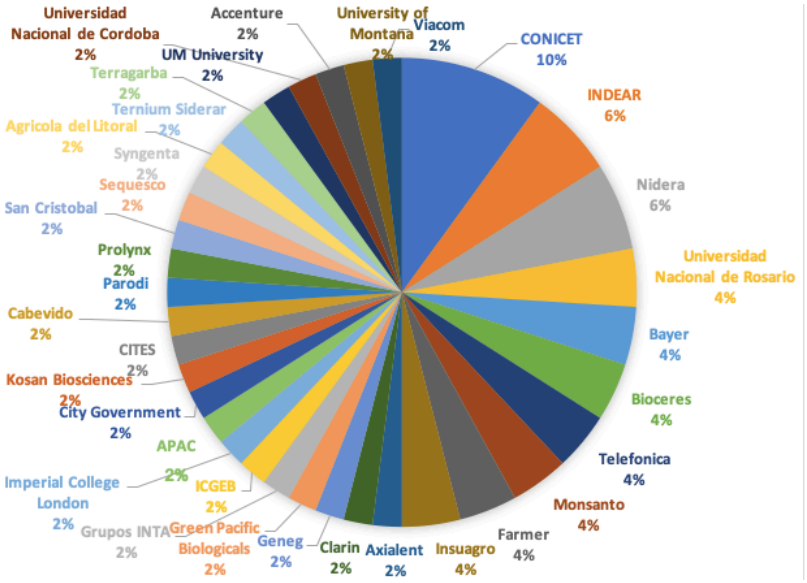
Graduate studies include both master's degrees and doctoral studies. The highest level of education has been recorded for each founder. Data for 16 founders was provided for graduate studies. The largest group of founders attended Universidad Nacional de Rosario at 19%, followed by Universidad de Buenos 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%.

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.



Founder Undergraduate Universities



Founder Former Employers

Conclusion

Human capital generates the ideas for new AgTech technology. It is an essential part of the AgTech ecosystem in any region, and the Rosario and Santa Fe Province region is no exception. Universities produce research, although they have trouble getting IP outside of the universities to use in AgTech companies or products. In discussions with industry experts, it seemed that farmers and entrepreneurs are often the founders of AgTech startups in Rosario, but the survey indicates that founders are often researchers and academics not unlike in St. Louis.

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. According to Luke Blackburn at Global STL, St. Louis could not initially bring in external resources, and had to start with fundamentally St. Louis driven capital.

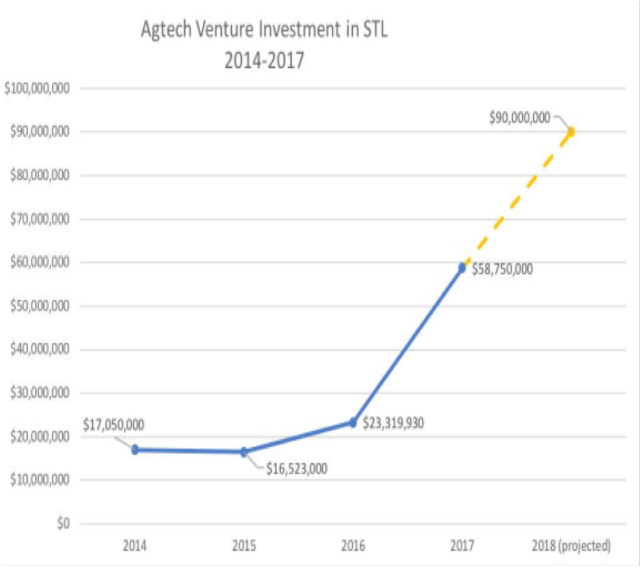
Financial Capital in St. Louis

In recent years, there has been a significant increase in investment in St. Louis Biotech and AgTech industries from various resources. The main sources of funding are venture capitalists, angel investors, corporate ventures and government funding.

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%) (Crunch base, S&P Capital). Even though the amount of capital invested in St. Louis sharply increased in recent years, St. louis only accounts for 0.55% of total venture capital investment in the U.S. and its investment per capita is $133, while San Francisco accounts for 34.3% and investment per capita is $5,001 (Andrew G. Smith, 2017). According to Sam Fiorello at the Danforth Center, there still exists a negative perception of the St. Louis region, which is a barrier in attracting resources necessary to build an even stronger ecosystem.

Recent trend of low risk preference: The recent trend of venture capital firms in the U.S. is shifting investments from early stage startups to later stage firms, preferring less risky ventures. The number of deals invested by venture capitals 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 deals could be a real threat that cuts off future growth potential in St. Louis. For the last several years, startups in St. Louis were more likely to receive initial seed funding (Missouri Partnership, 2018). In the near future, however, there may be less investors willing to invest in risky and 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 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).

Yield Lab

The Yield Lab was Founded in 2014 as an accelerator that invests up to $100K in early stage AgTech firms. Until 2017, Yield Lab invested $4.1M in 19 startups who have raised over $90M in follow-on funding, and supported the startups by providing accelerator programs and networking opportunities with relevant stakeholders (Andrew G. Smith, 2018). Yield Lab also has operations in Ireland and Argentina.

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).

Angel Investors & Grants

In St. Louis, active angel investors networks usually provide seed and series A funding, but if necessary, 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.

Arch Grants

Arch Grants, founded in 2012, is a local non-profit organization that provides $50K of equity-free grant 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).

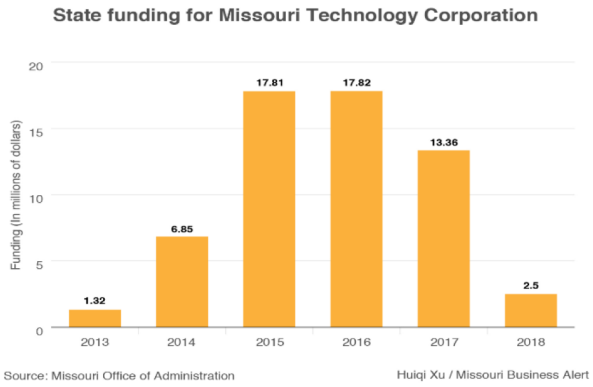
Corporate Ventures

MuMultinational 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). Recently, MGV led a $2.5M investment into Arvegenix in 2015 and $18M into New Leaf Symbiotics in 2017 (David Nicklaus, 2015).

Government Funding

Historically, government funding in St. Louis has been political driven and insufficient in supporting an ecosystem, according to Ginger Imster at SLEDP. Imster believes 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.



One of the programs initiated by the Missouri government is the Missouri Technology Corporation (MTC). Founded in 2011, MTC 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, a significant downward trend. 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 ecosystem builder will inevitably decrease with its budget.

Successful Startups

New Leaf Symbiotics

Founded in 1999, New Leaf raised total capital of $54M. 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 total capital of $94M, $25M of Series B in 2017 and $60M of Series C led by Google Ventures in 2018.19 The St. Louis-based company is providing decision support to accelerate crop improvement and enhance the sustainability of food and fuel production.

Conclusion

Investment in AgTech startups in St. Louis has increased immensely over the past decade, solidifying St. Louis' importance as an AgTech hub. However, AgTech firms in St. Louis still face challenges in appealing to investors located outside of St. Louis. Also, investors' preference in less-risky technologies and decreased government funding are barriers St. Louis needs to overcome.

Financial Capital in Rosario

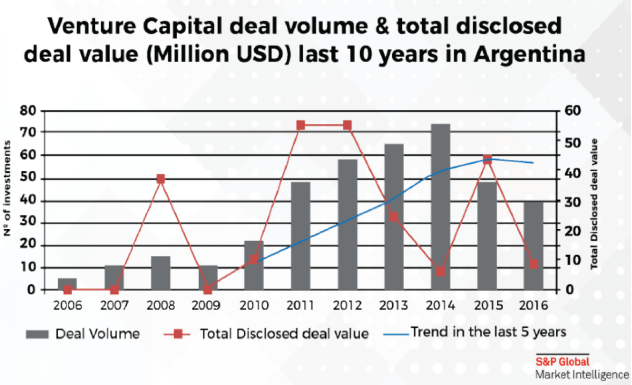
With an innovative mindset and entrepreneurial spirit of Argentine farmers, Argentina has been a regional center for AgTech innovation. To promote Argentina's strengths in AgTech, various public and private organizations are collaborating. In Rosario, there are several government funding opportunities and institutional investors, including international/local venture capitals, accelerators, and corporate ventures. Overall, however, the number of deals and size of investment remains considerably low.

Venture Capitalists

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. Also, Bernardo Milesy at Glocal mentioned that Rosario has different players needed to construct the eco-system, but lacks connectivity to gather those players together. Total investment by venture capitals in Argentina has not been active and highly volatile for recent 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). Considering most of those investments went to startups located in the Buenos Aires area, it is certain that investment in Rosario AgTech is not sufficient to build a strong ecosystem.

In recent years, due to the Entrepreneurship Law and other regional efforts, the number of deals by venture capital firms has increased considerably, but VCs mainly focus on early-stage investments. According to Federico Trucco at Bioceres, an increasing number of accelerators and incubators provide funding for seed rounds, but funding Series A to C rounds are still lagging (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 areas increased exponentially, reaching more than $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 find proper investors.



Angel Investors

Angel investors have not been active in Rosario in the past. However, various new angel network groups have emerged, signifying perhaps interest in Angel investor funding soon. There are two 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 have not invested in any firms yet (Louisa Burwood Taylor, 2018).

Corporate Ventures

There are several multi-national corporations located in Buenos Aires (Bayer) and Rosario (Bunge, Dow Dupont). While Bayer is a main investor of Bioceres, overall, there is a lack of corporate venture capital activity, not only in Rosario but also across the Argentina, according to Camila Petignat at Yield Lab (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). Argentina's government is doing a great job to promote AgTech and attract foreign capital, according to 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.

Successful 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 $456 million.

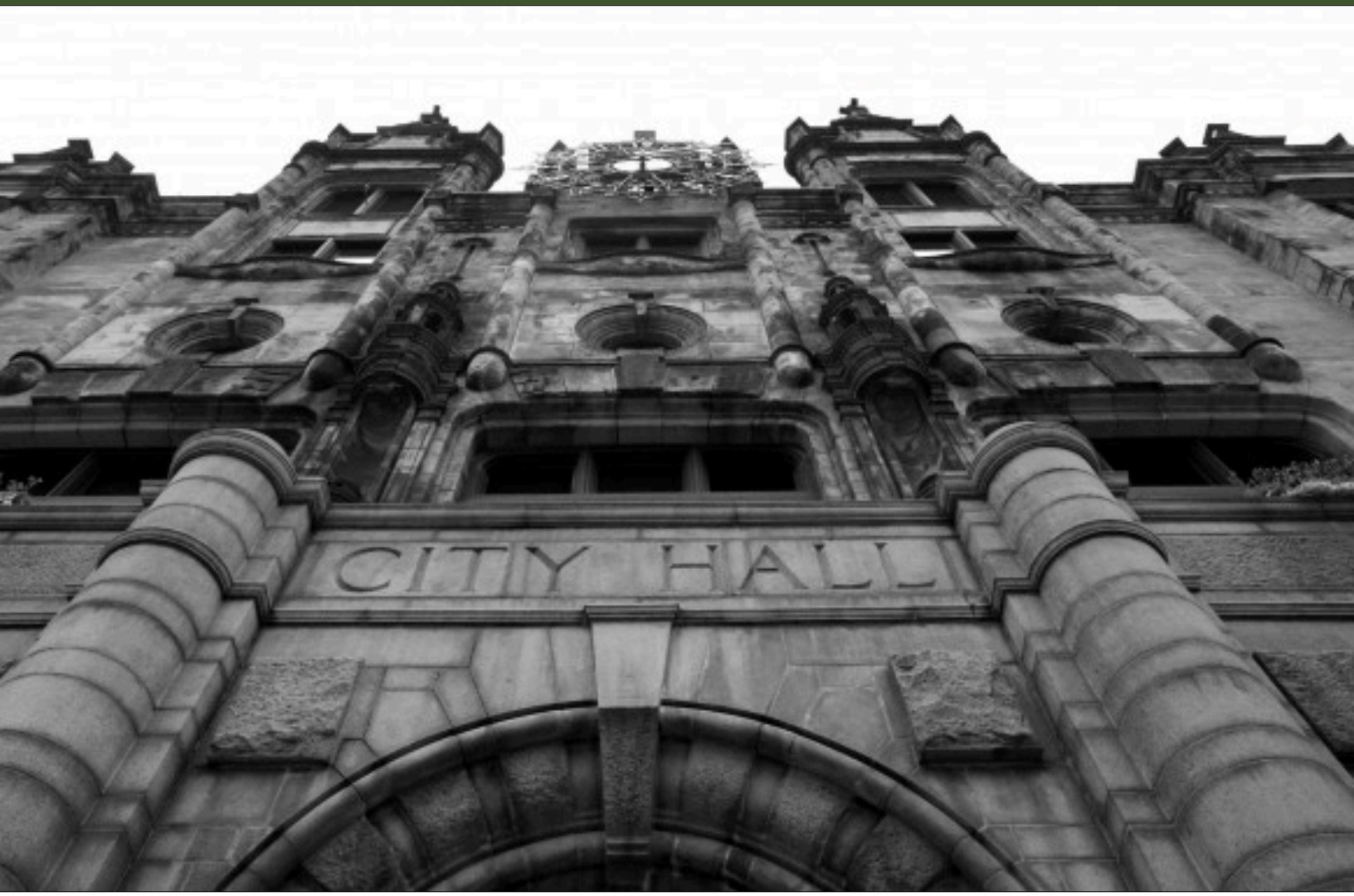
Conclusion

Currently, investment in the Rosario AgTech industry is not sufficient to cultivate an entrepreneurial ecosystem. However, with increasing international venture capital, angel network groups, and government support, Rosario will have various sources of funding opportunities soon. Rosario has the potential to be a successful cluster of AgTech if commercially innovative ideas can be de-risked, and if connectivity among stakeholders can be increased.

Connectivity

Finance, Human Capital & Infrastructure

One of the great examples of connectivity between the finance, human capital & infrastructure sectors in St. Louis is Missouri Innovation Center (MIC). Founded in 1984, MIC is a non-profit organization focused on providing support for business ventures that improve human life and sustainability. In 2009, MIC was selected by the University of Missouri (MU) as a Life Science Incubator of MU at Monsanto Place. MIC supports the business school of MU by providing commercialization advice and assists Centennial Investors, a Missouri based angel investor network, by pre-screening potential start-up companies. In 2016, MIC created the Accelerator Fund to help entrepreneurs flesh out a business model and create an initial product/service. Monsanto Innovation Center at University of Illinois at Urbana-Champaign (2018) is another example of the finance sector collaborating with human capital.



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 of roads, time and time again, federal, state, and local governments have expressed support for this thriving ecosystem. The government understands the success of this space will play a large role in the success of America and of the globe in the future.

Public Policy in St. Louis

Background

Missouri has a long history of supporting the agricultural industry and, in turn, agricultural technology. Federal, state, and local governments have long been aware that the success of farmers is paramount to the success of a community, a nation, and in the last few decades, the globe. For instance, the Midwest was hit with a serious drought in the early 1930s, where the federal government provided immediate assistance to farmers to buy necessities, satisfy debts, to survive, and to help keep livestock alive; food was conserved, and feed was transferred from areas of excess to areas lacking feed to keep cattle alive. Farmers became educated to know which breeds of cattle could bring them profit in varying conditions (Murphy, 1935).

Without government support, many farmers would have been forced to sell their stock at low, unsustainable prices, and would have incurred serious costs from having to start over. Flash forward to today, and 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).

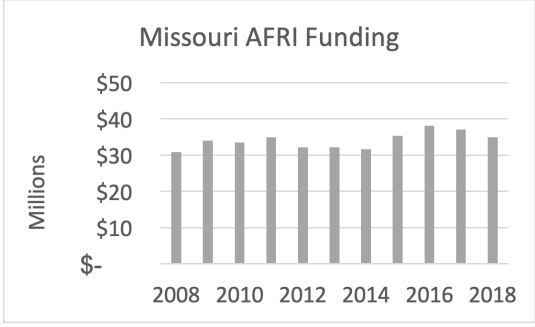
Down to the state level, Missouri has a bill that establishes an "advisory council on agriculture science and technology" (2016 Bill Text MO S.C.R. 63; §620.1500). Farmers are also protected from "nuisance lawsuits" that may arise when neighbors attempt to stop farming operations (Weldon & Rumley, 2018). 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.* While funding is stagnant, since the AgTech space has developed as much as it has, it means that while helpful, when startups have access to VC and angel funding, government grants are not a key factor in the advancement of AgTech.



Tax Incentives

Tax incentives impact everybody in the AgTech space. Venture Capitalists 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. This provides massive incentive for VCs to put investment funds in startups. 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.

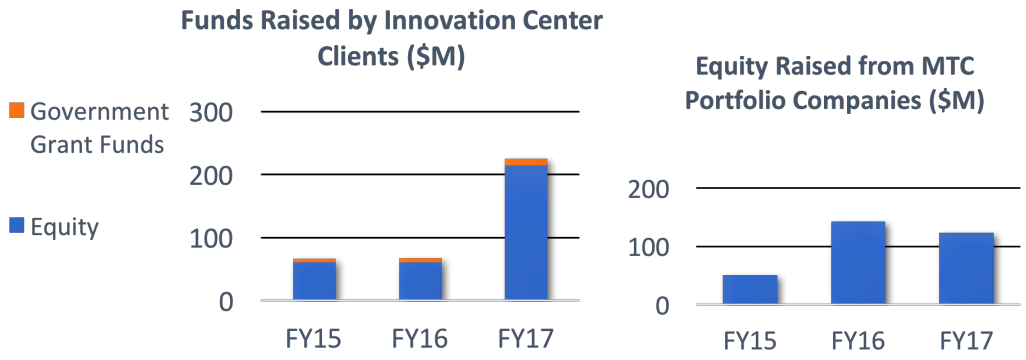
Conclusion

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. More grants would be useful to assist burgeoning startups in St. Louis, as this would help startups de-risk their companies for later stage investments by venture capitalists.

Connectivity

Public Policy & Finance

Another example of a collaboration between the government and the private sector is the Missouri Technology Corporation, established 1994 by the Missouri legislature, a public-private partnership whose aim is to "foster the growth of new and emerging high-tech companies" (Hall, 2017). MTC invests in Missouri's infrastructure and entrepreneurs, and one of their five areas of research is Plant Science. The Missouri Building Entrepreneurial Capacity (MOBEC) grant program gives "grants to public and private non-profit Missouri research institutions as well as entrepreneurial support organizations", and the Innovation, Development, and Entrepreneurship Advancement (IDEA) Funds "promote the formation and growth of business that engage in the transfer of science and technology into job creation" (Hall, 2017). MTC provides pre-seed capital, seed capital, venture capital, and expansion-stage debt to entrepreneurial companies in the AgTech ecosystem, including Benson Hill Biosystems, Edison Agroscience, Arvegenix, and more. MTC also oversees Missouri's ten innovation centers, which include establishments such as T-REX, BioGenerator, Cortex, ArchGrants and more.



Public Policy in Rosario

Background

One of Argentina's main production sectors is agriculture, having exported USD $14.4B in foodstuffs, another $13.9B in vegetable products, and another $4.14B in soybean oil in 2016 alone. These three sectors accounted for 55% of Argentina's exports in 2016 (AJG Simoes, 2016). 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 locals (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 perhaps the most important driver of the change to grow new businesses in the last several decades, and it impacts Argentina in six major ways:

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.

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).

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

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.

Promote accelerators and incubators to help entrepreneurs from seed to growth stages.
This is vital to a growing business – does the business have the right competitive strategy to succeed? The right people? The right growth and exit strategy? A capable accelerator and incubator should answer these questions and more.

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).

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). Importing services (such as patent lawyers) from the United States faces an even higher cost, with tariffs exceeding 70%, as mentioned by residents at Santa Fe incubator CITES. 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.

Conclusion

Argentina's Entrepreneurship Law is an important piece of legislation that is likely to radically shift the start-up landscape in Argentina. While this is a positive shift, Argentina could still do 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. Additionally, the tariff landscape in Argentina is not conducive to success of startups, given startups need to conserve funds as it is – adding an additional tax on necessary equipment only serves to hinder the success of budding companies.

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 technology, infrastructure facilities cover a broad range of amenities, from laboratories for prototype development and testing, to events and venues that can facilitate greater discussion. In startup ecosystems, while infrastructure is consistently useful, it is particularly effective in generating sustainable business when established in regions with strong human and financial capital pipelines. 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 rich history.

Infrastructure in St. Louis

Background

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 the1900s, 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, like the Eads bridge. This bridge facilitated the construction of roadways that made 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 could not scale with its population. The rising number of people congested within the small area pushed families to the suburbs of the county. 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 Unites States' largest urban areas. At the end of the decade, 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 virtue of 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 trailblazer of entrepreneurship 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 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.

It is interesting to note that although the Danforth Plant Sciences center is often known to be the lone University effort in the space, other Universities in the region, including Saint 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 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.

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 Saint 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 in collaboration with the St. Louis Economic Development Partnership has launched Accelerate St. Louis, "an initiative lead in collaboration with the St. Louis Economic Development

Partnership, the Chamber works 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

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

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

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

BioSTL

BIOSTL was a bio generator 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 at 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.

- Key features: venture capital, corporate partners and meeting spaces

Helix Center

The Helix Center is a Bio incubator established by the STLPartnership, 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

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 resource is critical for early and middle stage startups initially testing their ideas and building out their companies

- Key Features: conference spaces, wet labs, technology support

Conclusion:

As highlighted above, St. Louis has a host of resources that enable it to be a hub for agricultural technology startups in the region. Despite its strengths, the city and county have room to improve. 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 to further this. One of the biggest challenges St. Louis faces is the issue of physically 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. From an infrastructure perspective, a lot can be done to promote cohesion, resource sharing and communication within these nodes of the ecosystem to establish a more consistent image of what the region offers.

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 received significant support after their strong push for Perón and were endowed 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 much of the industrial infrastructure in place, and cheap imports had a very negative effect on the sector. In the early 21st century, specifically since 2006, Rosario's infrastructure has begun to grow anew – specifically increases in agricultural exports have lead to an economic turnaround for the city and region, that has significantly improved infrastructure.

Today, Rosario's history has allowed it to emerge as a hub for agriculture and also trade, building a foundation for a strong AgTech ecosystem in the coming few years. From a infrastructure perspective, 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 a node and 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.

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 investment ability of up to $500,000 USD in each startup, the organization has the power to provide significant financial assistance to young corporations. Major challenges for CITES include a lack collaborate with University Academics, especially because of limited intellectual property protection for researchers, and high international service fees.

Conicet:

Conicet is a biotechnology accelerator in Rosario that benefits from its extensive connections: through research partnerships established with 13 institutes, 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 company is struggling with inability to assist startups significantly in funding, educate startups on entrepreneurial law, and incite knowledge sharing among farmers.

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.

Polo Tech.

Polo Technologico is a public private partnership that was formed through initiative of the province mayor. The hub helps 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 has many valuable stakeholders. It is looking to improve upon its own funding, diversify its audience, and build a broader partnership base.

CONCLUSION

While the St. Louis ecosystem needs to focus on connecting different elements of its infrastructure, Rosario is at a stage where elements of infrastructure themselves need to be built up further. While different organizations exist to provide amenities and resources to startups and entrepreneurs in the region, there is a lack of collaboration on these resources, and 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, particularly universities take a lead in spearheading these touchpoints, Rosario could emerge as a key hub for ideas, capital and infrastructure.

Connectivity

Infrastructure & Human Capital

The natural landscape of Missouri provides an excellent foundation for AgTech innovation. The greater St. Louis area has been an agricultural region for hundreds of years and the state of Missouri now has almost 100,000 farms with over 20 million acres of farmland (Missouri Department of Agriculture, 2018). This extensive farmland and long history led to major agriculture universities being established in Missouri and the surrounding states. The University of Missouri currently has 14,000 research acres for agriculture across the state (Burden, 2013), which leads to groundbreaking discoveries and advancements in AgTech. This connectivity of human capital through research talent and infrastructure through the natural landscape as well as the research facilities and major institutions helps to propel the AgTech sector forward.

Connectivity

Finance & Infrastructure

Another example of the interactivity between sectors is the connectivity of Finance and Infrastructure. In the St. Louis area, there are key hubs which provide researchers, scientists, and other technical experts with the resources they need to grow their companies and drive forward new innovations. These include the 39 North innovation district with the Danforth Plant Science Center, Bio Research & Development Growth (BRDG) Park, and the Helix Center Biotech Incubator where infrastructure is in-place for employees, researchers, colleagues, and visitors to work and interact. These key players which provide the physical resources for further research and development are complimented by their close geographic proximity to key players providing financing such as Bayer-Monsanto, BioSTL, and BioGenerator. Having this close proximity between the two sectors facilitates communication and understanding of new agricultural technology and connects leading research with financial backing. Venture Café is an example of this symbiotic relationship where stakeholders in the AgTech space including but not limited to investors and researchers are brought together in a social atmosphere to interact and take in industry presentations with the goal to build stronger networks and further the AgTech space

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.

CONCLUSION

Connectivity

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.

Summary Recommendations

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

Human Capital

- Enhance transferability of intellectual property from universities and academic institutions to entrepreneurs and businesses with the goal of driving forward to agricultural technologies and innovative applications

- Drive interest and awareness in AgTech by influencing university and academic curriculums to draw students into the sector and facilitate “buzz” around the high-potential space

Finance

- Build support apparatus for early stage companies after initial funding but prior to Series A rounds as well as between Series A and Series B funding rounds to address gaps in funding
- Educate investors in agricultural technology to building understanding and incentivize investment in the space

Public Policy

- Push local government to understand the high potential of AgTech and its ability to drive new business and economies forward to ultimately spurn public investment as well as public-private partnerships

Infrastructure

- Address needs of early stage AgTech companies for high end equipment and cost-effective work spaces in a business model that incentivizes startup growth
- Foster events, opportunities and programming in facilities to connect startups and entrepreneurs with each other and available amenities in the region

Connectivity

- Understand the need to intentionally facilitate collaboration between sectors of the AgTech framework and provide opportunities for collaboration and interactivity between stakeholders in the space

Moving Forward

There is a high growth potential of AgTech that 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. Missouri is an established AgTech hub and has achieved significant growth in the space and Rosario, Santa Fe is well on the way to building an even stronger foundation in the AgTech space.

With this in mind, we understand 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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