Kansas City Regional Biologics R&D Landscape June 2022

Market Research performed by:

Latham BIOPHARM GROUP

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BioNexus | KC

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Executive Summary

The goal of this project was to identify and inventory any life science-related assets within the region that are performing research and development in biologics and create a baseline against which future growth can be measured to allow BioNexus KC, and ultimately the KC region, to further expand their foothold and establish a premier biologics hub in the US. This intentional focus on biologics is part of a broader strategic collaborative being led by BioKansas and KC Rising and represents one possible strategy to fuel post-COVID recovery for the region and ensure that the region's economy is growing at a pace faster than that of peer metros across the country. This report ensures a focused economic development engine that can leverage existing strengths while providing a platform for growth and buildout of key areas of opportunities. LBG collectively supports BioNexus KC and their dedication to promoting, developing, and accelerating the growth of the biologics industry for the benefit of the greater Kansas City region and beyond.

To accomplish these objectives, LBG utilized both primary and secondary efforts **(Figure 1)**. Primary research efforts focused on two distinct cohorts; Cohort I, consisting of regional life science companies and Cohort II, which was made up of biologics industry stakeholders from outside of the region. The main objective of Cohort I was to identify and inventory any life science-related companies within the region that are performing research and development in biologics, while the main objective of Cohort II was to gain a better understanding of the outside perception of various attributes of the KC region bioscience hub from those who do not live or work in the region.

Utilizing a consensus, but broad definition of biologics, developed by LBG SMEs and BioNexus KC, the Cohort I research efforts assembled a clear picture of the capability and capacity of the region. The majority of biologics companies in the region are small businesses and are service providers as opposed to sponsors of biologic pharmaceuticals, for example. Across Cohort I and II, no two definitions of biologics given by respondents were the same, however, the definition provided to Cohort I and II targets by LBG was not disputed. Capabilities in the research and development of therapeutic proteins, vaccine and diagnostics were the most prolific throughout the 135 individual companies identified in the region. Cohort II data elucidated the fact that, though the vast majority of the respondents were experts in R&D of Biologics, few were aware of what the KC region had to offer. That said, Quality of Life and Cost of Living were perceived by Cohort II respondents to be a significant strength of the region.

In an assessment of the regional workforce, given the high prevalence of small business, C-suite & executive level positions were the most frequent and education levels were evenly distributed. Though interest and recognition of Diversity, Equity and Inclusion (DEI) initiatives was high, few Cohort I companies had formal DEI programs in place, perhaps identifying a gap for regional industry groups to provide a solution.

The major certainty of all parties queried by these efforts was that significant growth of the biologics industry was imminent. The question remains however, is the KC region poised to compete with peer metro areas and hubs for this growth? Cohort I and II respondents both provided mixed certainty of this likelihood. Significant capability and capacity does exist, and growth is already occurring, however, if the goal is to make the metamorphosis from a service provider hub to a nucleus for commercialization of biologics-related intellectual property, additional focus and strategic initiatives will be needed.

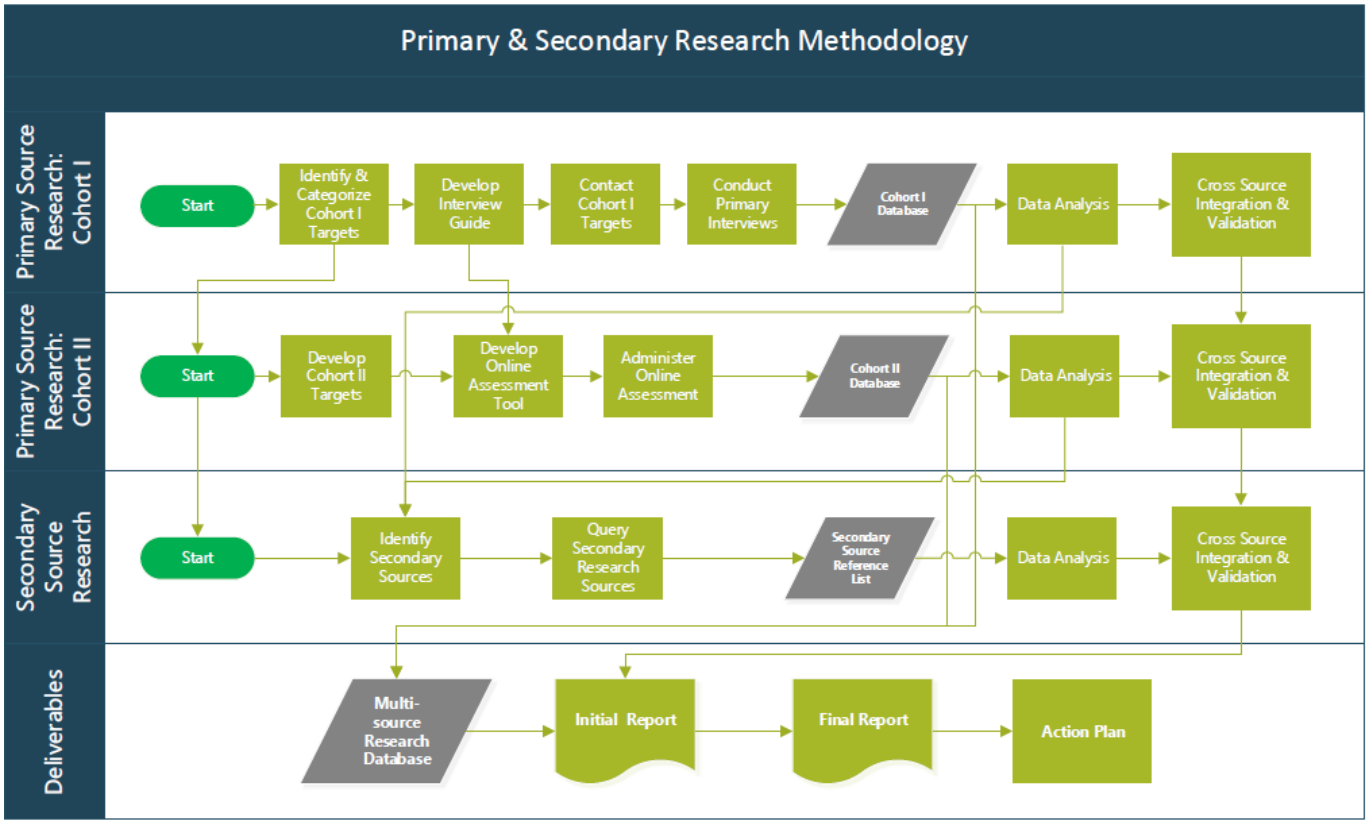


Figure 1. Research Methodology Utilized for Primary and Secondary Research Efforts.

Introduction

The Kansas City region serves as a prominent hub for innovation and growth in bioscience. BioNexus KC's mission is to highlight life sciences resources and their value to the community through collaboration and commercialization. BioNexus KC believes in the value of empowering thinkers from a variety of disciplines to unite their efforts and collectively enhance the future of the region's bioscience ecosystem. To ensure the region's biologics research and development industry is equipped for success, BioNexus KC selected Latham BioPharm Group (LBG) to provide an assessment of biologics R&D assets, capabilities, and capacity in the Kansas City region, extending from Manhattan, KS to Columbia, MO, inclusive of Wichita, and St. Joseph, MO. The goal of this project is to identify and inventory any life science-related assets within the region that are performing research and development in biologics and create a baseline against which future growth can be measured. This intentional focus on biologics is part of a broader strategic collaborative being led by BioKansas and KC Rising and represents one possible strategy to fuel post-COVID recovery for the region and ensure that the region's economy is growing at a pace faster than that of peer metros across the country. BioNexus KC recognizes the region's potential and aims to not only capture the current achievements of the regional's biologics R&D but also to strategize how to capitalize on these successes.

Over the course of several months, LBG developed a comprehensive report that details the current and future projections of the Kansas City region's R&D, including primary and secondary research, to better understand and validate physical capacity, depth of expertise, financial investment (private, government, philanthropic), and past commercialization accomplishments in private sector companies, non-profit research institutes, and academic institutions. Furthermore, LBG investigated the potential to grow capacity, expertise, funding support, tech transfer, and commercialization within the region to allow BioNexus KC, and ultimately the KC region, to further expand their foothold as the premier bioscience hub in the Midwest. This report ensures a focused economic development engine that can leverage existing strengths while providing a platform for growth and buildout of key areas of opportunities. LBG collectively supports BioNexus KC and their dedication to promoting, developing, and accelerating the growth of the biologics industry for the benefit of the greater Kansas City region and beyond.

Cohort I

Industry

The main objective of Cohort I was to identify and inventory any life science-related companies within the region that are performing research and development in biologics. As the field of biologics is relatively broad, a systematic identification and down-selection process was performed with BioNexus KC to ensure that Cohort I primary research targets were appropriate for the scope of the project. LBG conducted secondary research in concert with BioNexus KC to identify the initial, broad list of companies, and performed primary source research with a subset of this group by interviewing the identified KC Regional private companies who are engaged in R&D efforts in the biologics industry.

Methods

Primary Market Research

Primary market research is the output of structured interviews with businesses who support biologics R&D in the KC Region. For this benchmarking effort, this included companies provided by BioNexus KC and additional companies identified by SMEs with in-depth knowledge of the regional landscape, along with secondary research. LBG drafted an interview guide in a collaborative manner with BioNexus KC leadership to support the objectives and scope of the effort. Typically, two LBG team members would attend each interview, one taking notes and the other leading the conversation who had a technical background specific to the interview (e.g., animal health biologics or analytical testing). Interview notes were collected in an electronic format, and the interviewing team utilized a visualization of the questions during the interview to ensure understanding of the questions and correct data collection. Following each interview, the LBG interviewers would review the notes and finalize transcripts for each conversation.

Over 420 companies were originally identified as potential industry interview targets. Of these 420+ companies, 45 were removed for being outside the geographic scope of the Kansas City region, extending from Manhattan, KS to Columbia, MO, and inclusive of Wichita, and St. Joseph, MO **(Figure 2).**

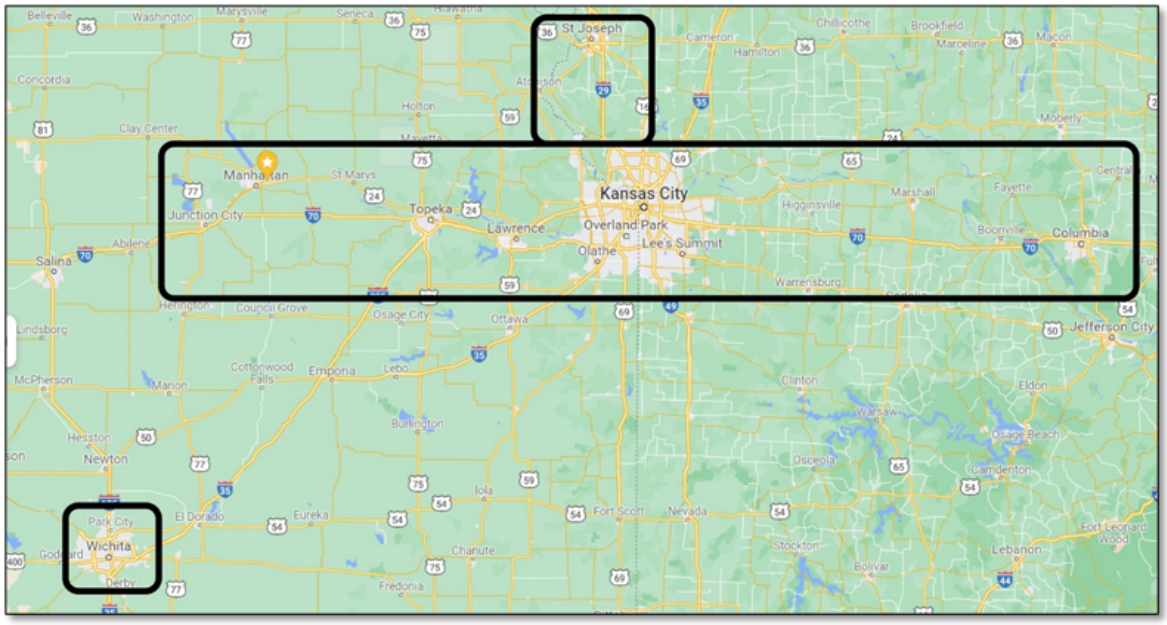


Figure 2. Geographic Scope of Project

Any company not performing biologics-focused work was removed from the potential interview target list. This filter removed approximately 244 companies. The remaining 135 companies, 94 of which were Kansas-based and 41 Missouri-based companies, were identified as the Full Analysis Set (FAS) and potential interviewee targets. After performing secondary research (see methodology below), internal and external contact identification took place resulting in outreach to 80 potential respondents. Email outreach started with the most appropriate point of contact followed by additional forms of outreach (e.g., phone, LinkedIn) and alternative point of contacts

being assessed. A total of 19 companies, the Interview Analysis Set (IAS), agreed to participate in interviews, 15 of which were considered small businesses (based on firm size and number of employees).

Secondary Market Research

In parallel to the primary market research efforts, the LBG team conducted secondary research. Secondary market research is the review and aggregation of available information which in this effort included public company press releases and websites, proprietary databases, and other sources of public information. This research deepened LBG's understanding of the biologics landscape in the KC region as well as developed profiles for other peer metro areas that were determined to be comparative by BioNexus KC.

Results

Full Analysis Set (FAS): Biologics-Focused Organization Landscape in the Kansas City Region

Of 135 companies in the FAS, 87 were identified as a small business and 48 large business; 87% classified themselves as a private company, leaving 13% of the companies being public **(Figure 3)**. Furthermore, some companies identified with other socio-economic classifications including thirteen women-owned companies, twelve minority-owned companies, four minority and women-owned companies, one LGBTQ+ owned company, and one veteran owned company. Most companies, approximately 69%, identified as a service provider while 31% identified as a supplier/sponsor **(Figure 4)**. Five companies classified themselves as both a service provider and a supplier/sponsor. Approximately 60% of companies focus solely on human health, 27% in only animal health, and 4% in only plant health. Only a few companies identified as having multiple health focuses, including 4% in human and animal health, 3% in human and plant health, and 2% in human, animal, and plant health **(Figure 5)**. No companies identified as focusing on only animal and plant health.

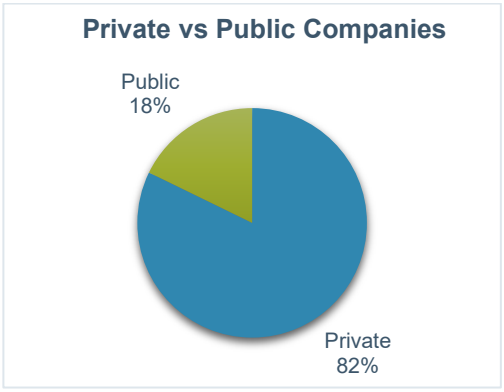


Figure 3. Private vs Public Companies (n=135)

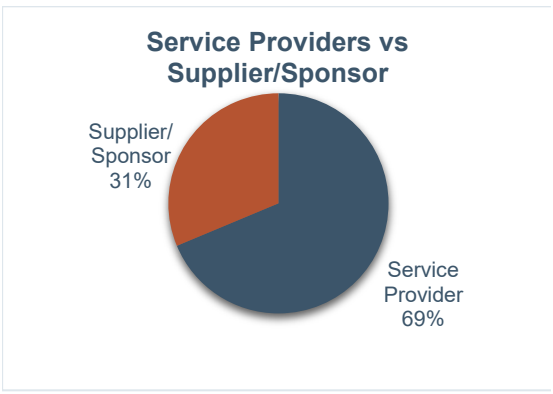
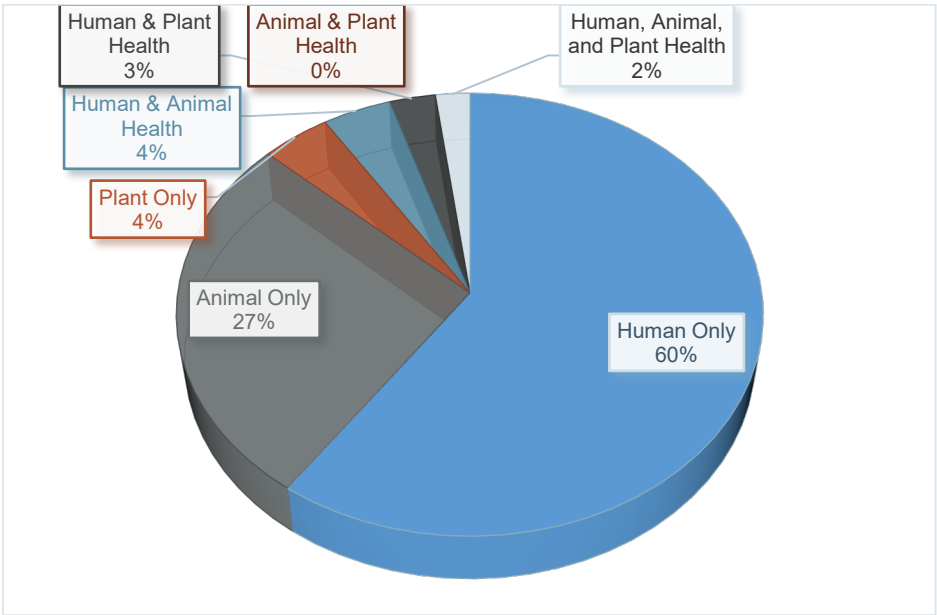


Figure 4. Service Provider vs Suppliers/Sponsors (n=135)

Figure 5. Areas of Research Interest for All Biologics Companies in the Kansas City Region (n=135)



Technology Sector and Core R&D Capabilities Definitions

The FAS organizations were first asked to delineate which Core R&D Capabilities they possessed, namely, they were to identify within service area categories of discovery, *in vitro*/bench, analytical laboratory, nonclinical (*in vivo*), biomanufacturing, clinical research, commercialization, regulatory, sponsor, supplier, or consulting/contract services.

In general, for the purposes of this report, these categories were defined as:

- Discovery – possessing the ability to screen, evaluate, and test new or novel approaches, molecular entities, compounds, etc. generally designed to nourish, protect, or improve human, animal, and/or plant health,
- *In vitro*/bench – engaged in non-*in vivo* laboratory or "bench-top" work to gain further understanding of basic science research or evaluate the advancement of new or novel approaches, molecular entities, compounds, etc. from the discovery phase to the next phase of development (e.g., *in vivo* studies),
- Nonclinical – evaluation of new or novel approaches, molecular entities, compounds, etc. in non-human subjects (e.g., insect or rodent studies),
- Analytical laboratories – a provider of service in the analysis of materials testing services for a broad range of clients, markets, and industries,
- Biomanufacturing – the process of using living systems, particularly microorganisms and cell cultures, to produce biological molecules and materials on a commercial scale,
- Clinical research – providing service in safety and efficacy testing of new or novel approaches, chemical entities, compounds, etc. in a "clinical" setting (used here to represent testing on humans, animals, and/or plants),
- Regulatory – possessing the skills/organizational expertise to ensure all products or services offered meet any governing regulations,
- Commercialization – engaged in activities, directly or indirectly, related to bringing products generally designed to nourish, protect, or improve human, animal, and/or plant health to market,
- Consulting/contract services – a fee for service provider directly or indirectly related in providing service that results in advancing the development of products generally designed to nourish, protect, or improve human, animal, and/or plant health,
- Sponsors – a company that directly "sponsors" the movement of products generally designed to nourish, protect, or improve human, animal, and/or plant health to market,
- Suppliers – providing goods directly or indirectly related to the production of biological products destined to nourish, protect, or improve human, animal, and/or plant health.

The in-house capabilities of the FAS organizations were also assessed by Technology Sector. In order to determine a company's capabilities within each service offering, the interviewees were given a list of technology sectors for which they could identify as having capabilities within, namely, those were vaccines, blood/blood components, allergenics, cell/gene therapy, therapeutic proteins, tissues, and diagnostics.

In general, these categories were defined as:

- Vaccines – substances used to stimulate the production of antibodies to provide immunity against one or several diseases, prepared from the causative agent of a disease, its

products, or a synthetic substitute, treated to act as an antigen without inducing the disease,

- Blood/blood components – the production and/or supply of blood, it components, or byproducts of as a therapeutic,
- Allergenics – the production and/or supply of extracts used for the diagnosis and/or treatment of allergic diseases,
- Cell/gene therapy – the direct production of and/or direct supply of cells/genes or its components used for therapeutic purposes,
- Therapeutic proteins – the production of and/or direct supply of proteins or their components used for therapeutic purposes
- Tissues – the production of and/or direct supply of tissues or their components used for therapeutic purposes,
- Diagnostics – providing, either directly or indirectly, diagnosis services to other sectors in human, animal, and/or plant health.

It should be noted that, as expected, many targets within the FAS possessed multiple Core R&D Capability x Technology Sector combinations, therefore the following results cannot be interpreted in the context of numbers of targets with the Core R&D Capability, Technology Sector or combination thereof, but rather the frequency of the Core R&D Capability by Technology Sector within the FAS.

FAS Core R&D Capabilities & Technology Sector

Therapeutic protein capabilities were the most prevalent, with 162 instances or capabilities in this area, followed by vaccines (143 instances), diagnostics (127), and cell/gene therapy (114).

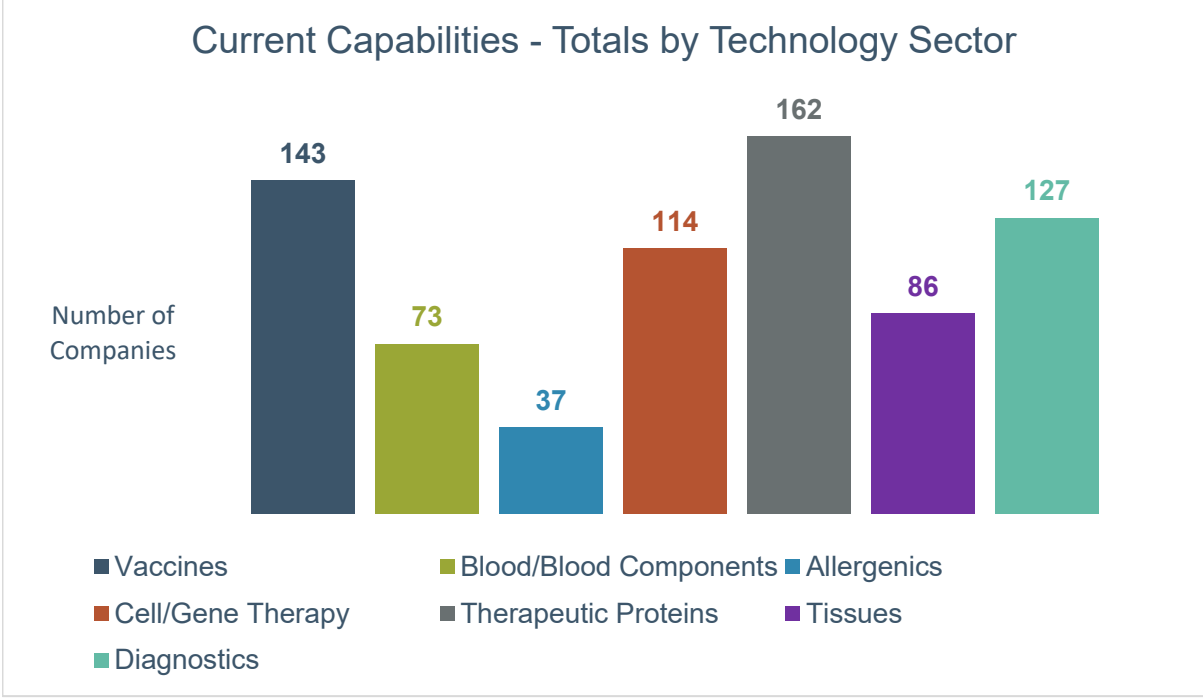


Figure 6. Current Total Capabilities by Technology Sector

Allergenics capabilities were the least prevalent across all stages of development **(Figure 6)** (Note: Many companies service multiple technology sectors.)

For companies that offer products within the discovery, *in vitro*/bench, and biomanufacturing stages of development, there is a strong focus on vaccine and therapeutic protein capabilities **(Figure 7, Figure 8, Figure 11)**.

For companies that offer products within the nonclinical (*in vivo*) stage of development, there is a strong trend towards vaccine and therapeutic protein capabilities, but also a larger amount of cell/gene therapy capabilities **(Figure 9).** This remains true for the companies that offer analytical laboratory and commercialization products/services, but in these stages of development, there is a larger prevalence of diagnostics **(Figure 10, Figure 14)**. A similar scenario is seen in companies that offer consulting/contract services **(Figure 15)**.

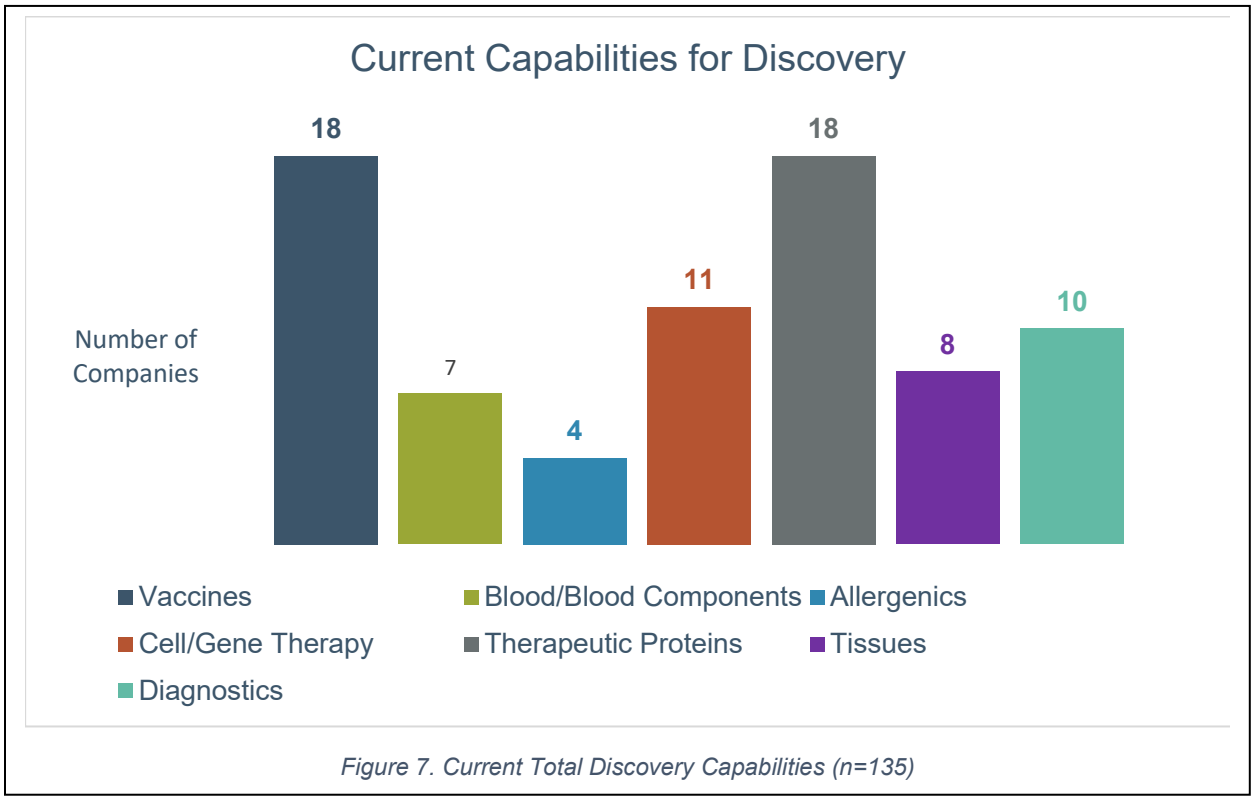


Figure 7. Current Total Discovery Capabilities (n=135)

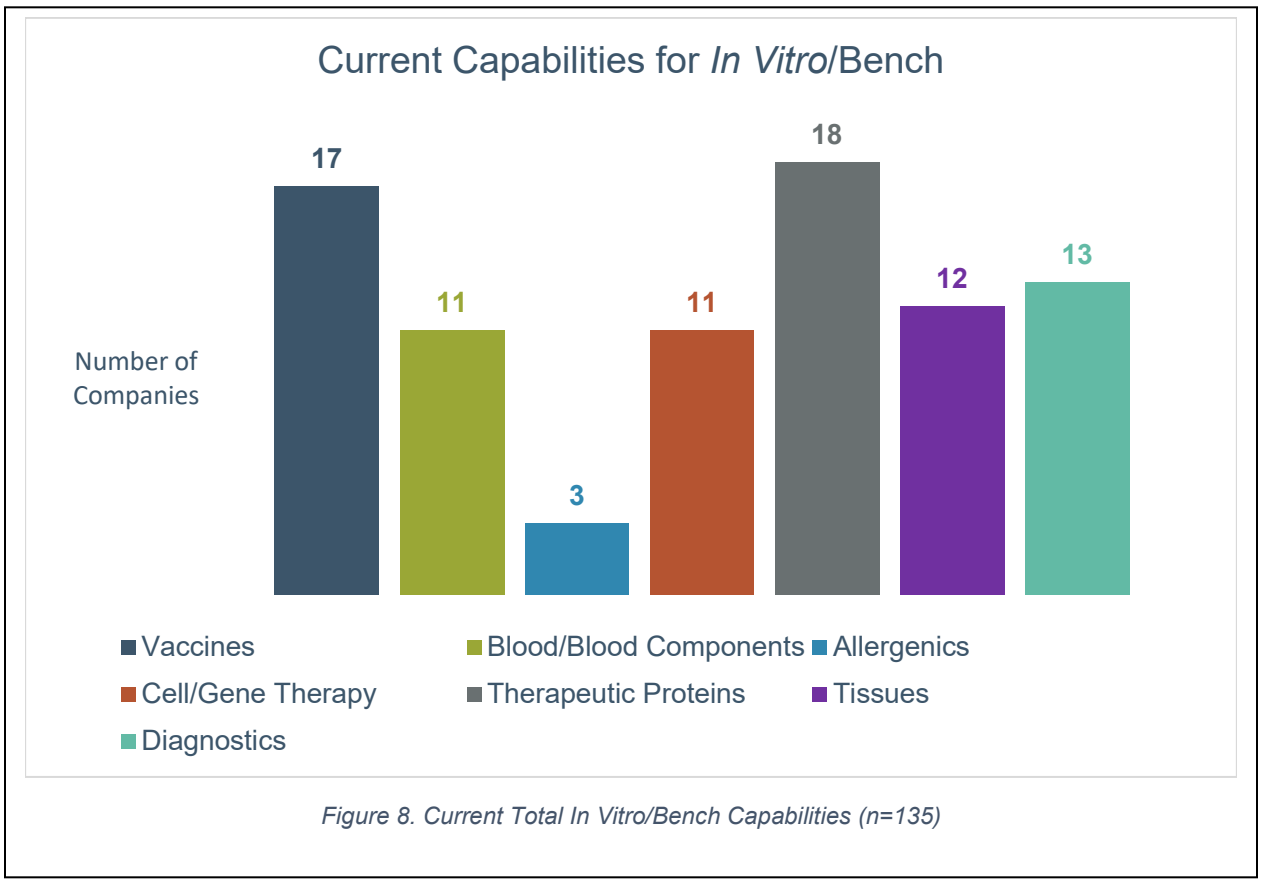


Figure 8. Current Total In Vitro/Bench Capabilities (n=135)

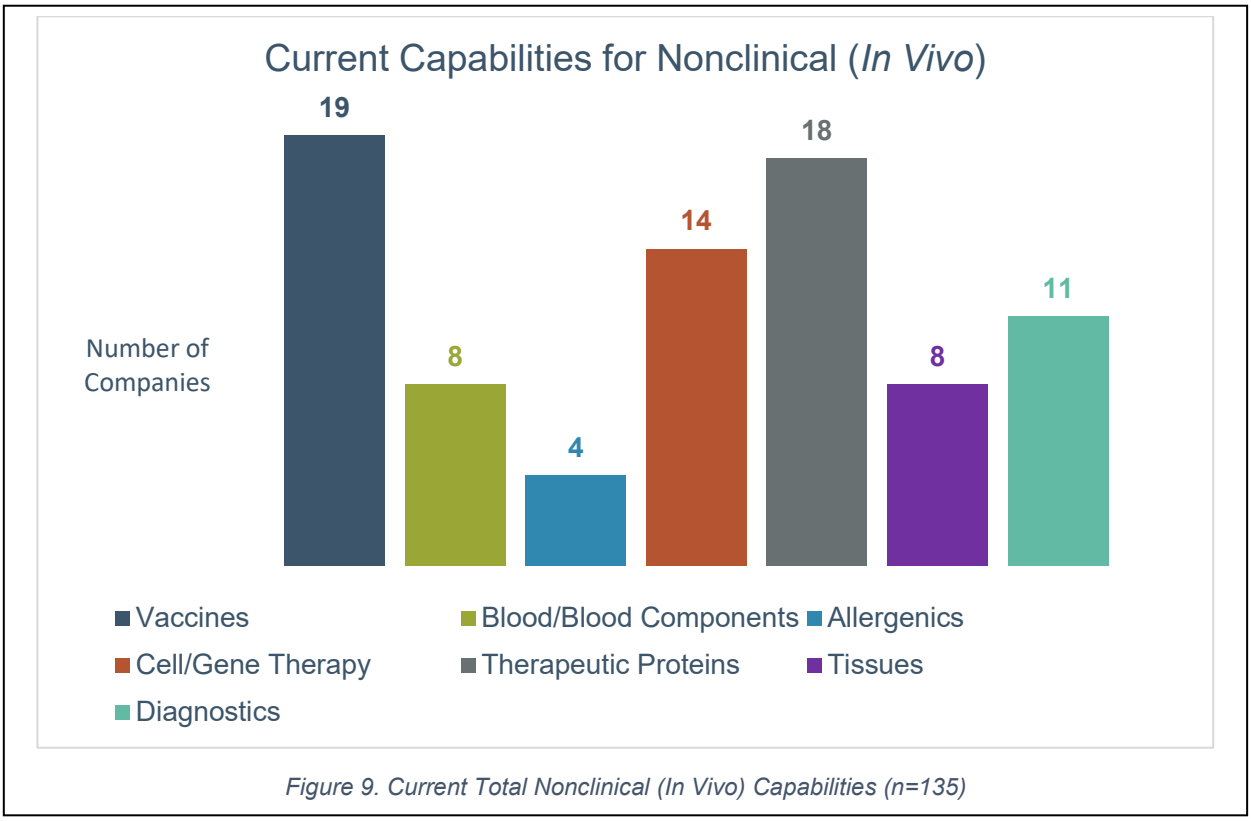


Figure 9. Current Total Nonclinical (In Vivo) Capabilities (n=135)

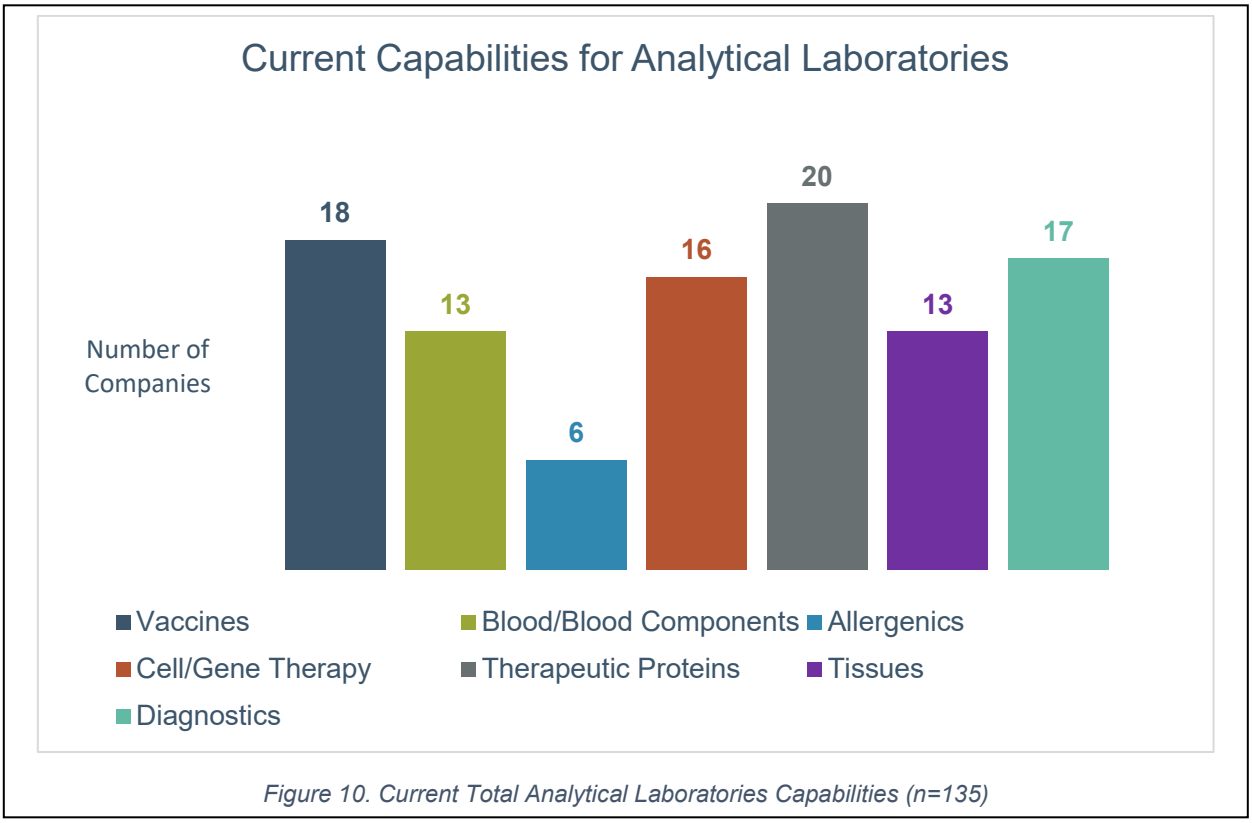


Figure 10. Current Total Analytical Laboratories Capabilities (n=135)

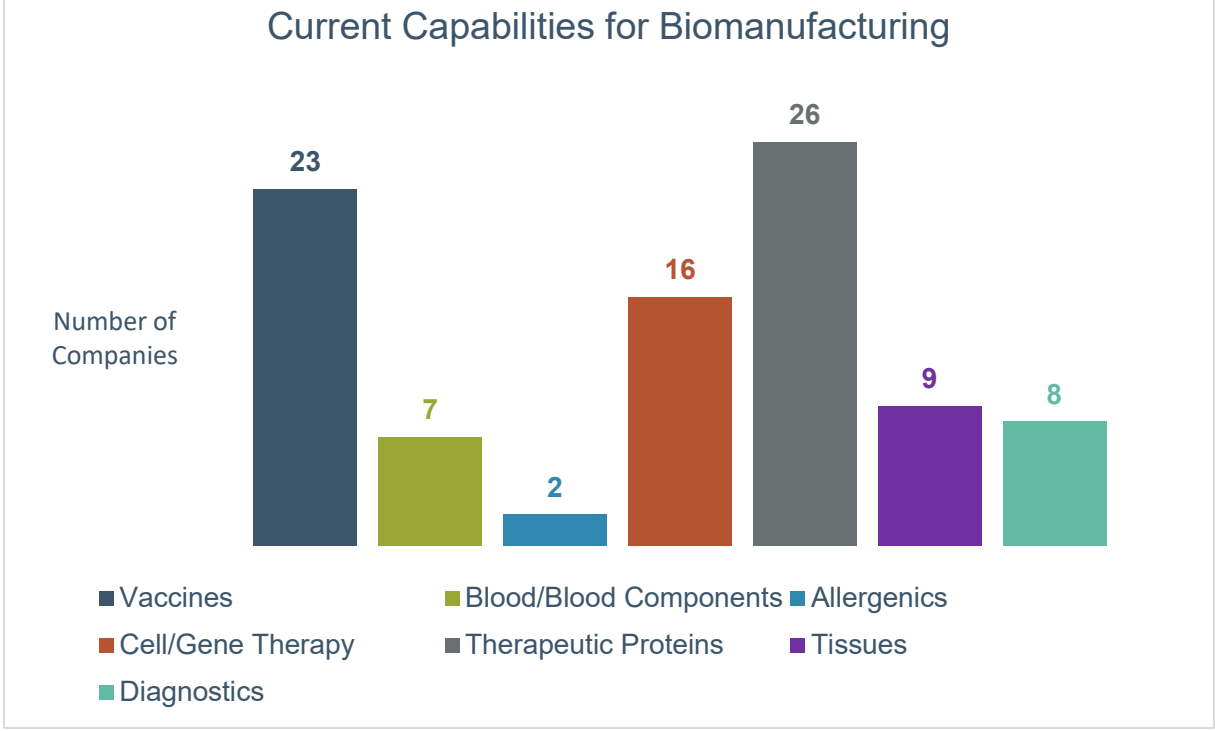


Figure 11. Current Total Biomanufacturing Capabilities (n=135)

For companies that offer products/services within the clinical research stage of development, the cell/gene therapy technology sector pulls ahead (15 instances), with therapeutics proteins coming in a close second (14 instances), followed by vaccines (12 instances) **(Figure 12)**.

For companies that offer products/services in the regulatory space, therapeutic protein capabilities have the largest prevalence, with 11 companies have capabilities in this technology sector **(Figure 13)**.

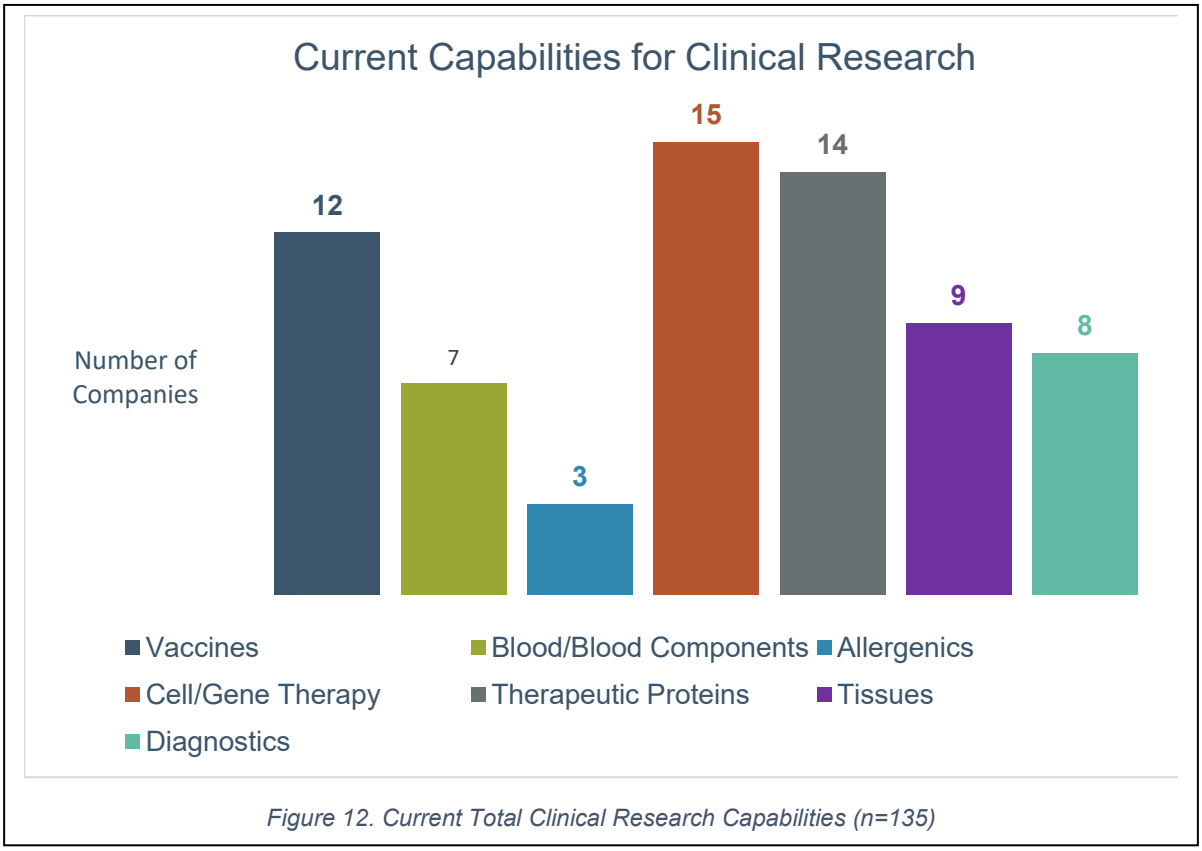


Figure 12. Current Total Clinical Research Capabilities (n=135)

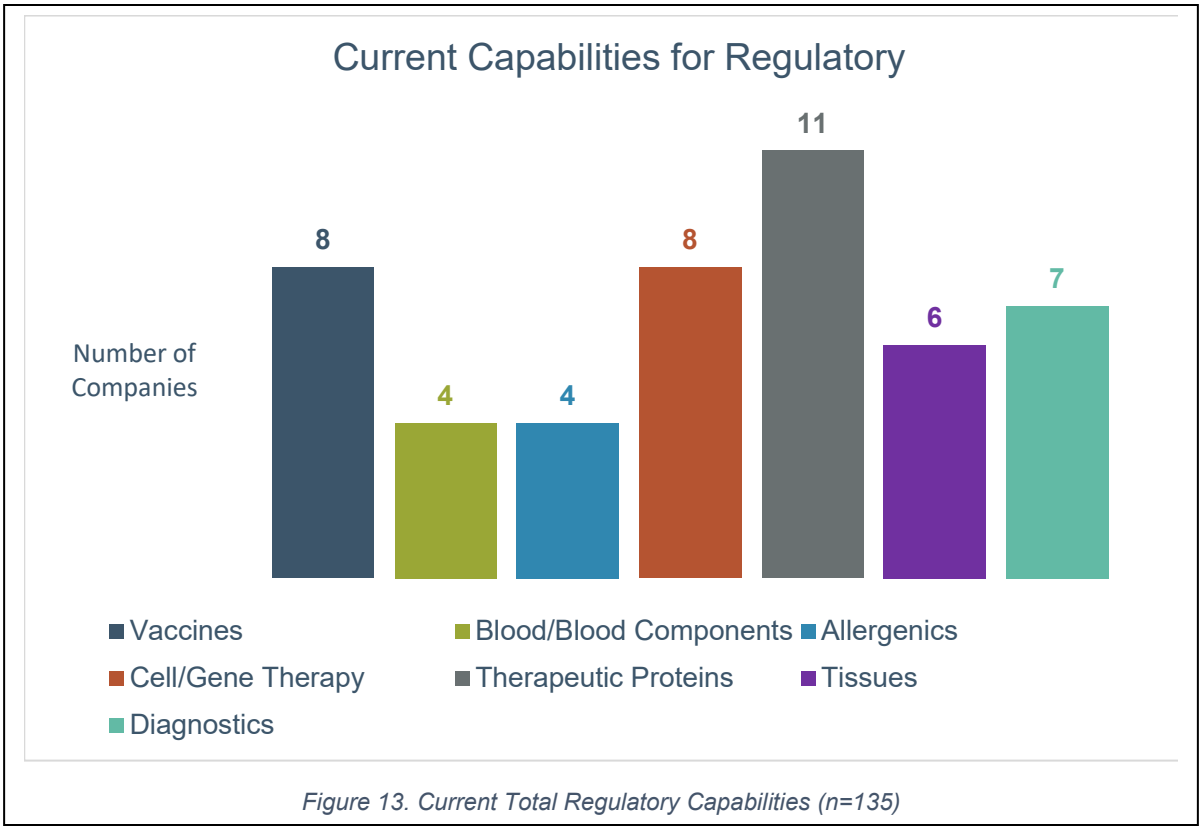


Figure 13. Current Total Regulatory Capabilities (n=135)

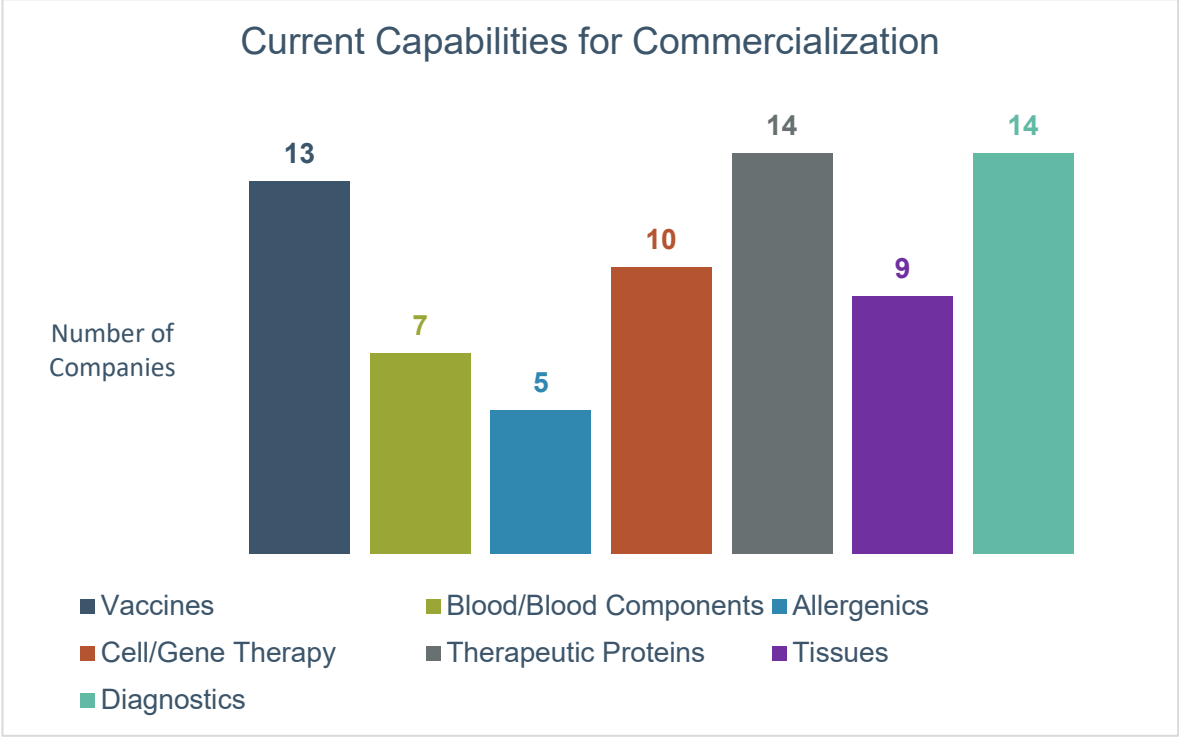


Figure 14. Current Total Commercialization Capabilities (n=135)

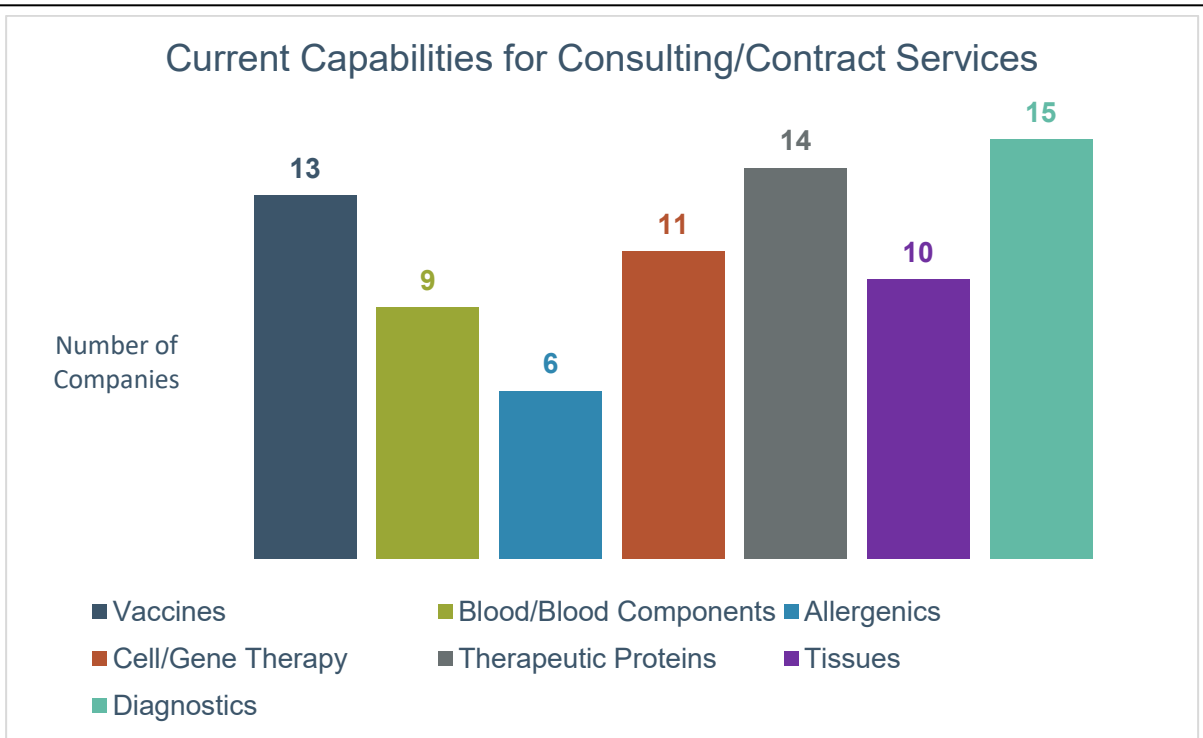


Figure 15. Current Total Consulting/Contract Services Capabilities (n=135)

The suppliers are concentrated in the diagnostics technology space with 24 instances of companies having diagnostic capabilities **(Figure 16)**.

Biologics-Focused Organization Landscape by Business Type

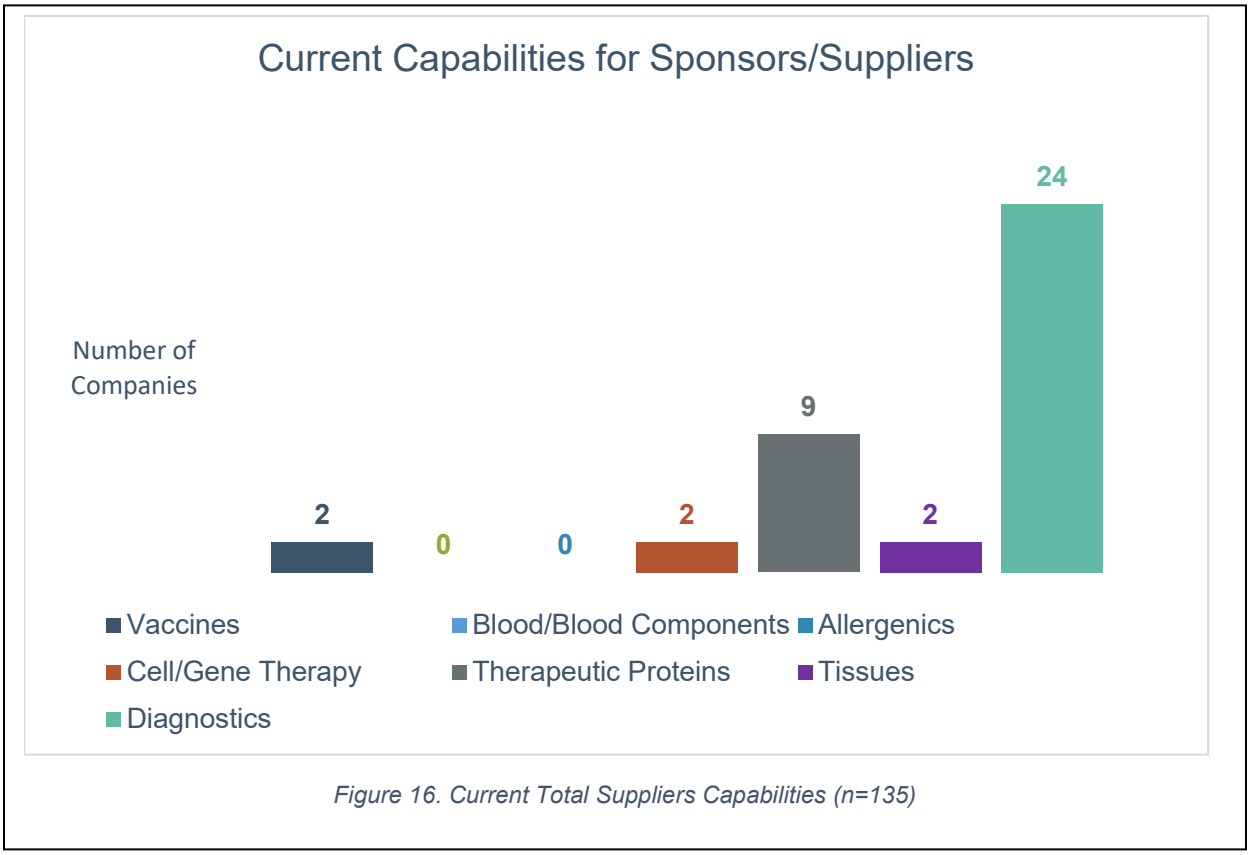


Figure 16. Current Total Suppliers Capabilities (n=135)

The in-house capabilities of the FAS organizations were also assessed by business type (i.e., what portion of the product development lifecycle they support). Nearly all companies fell under the analytical laboratory business type (~100 instances), followed closely by biomanufacturing (~90), with the *in vitro* / bench (~85) and nonclinical *in vivo* (82) having the third and fourth most prevalence, respectively **(Figure 17)**.

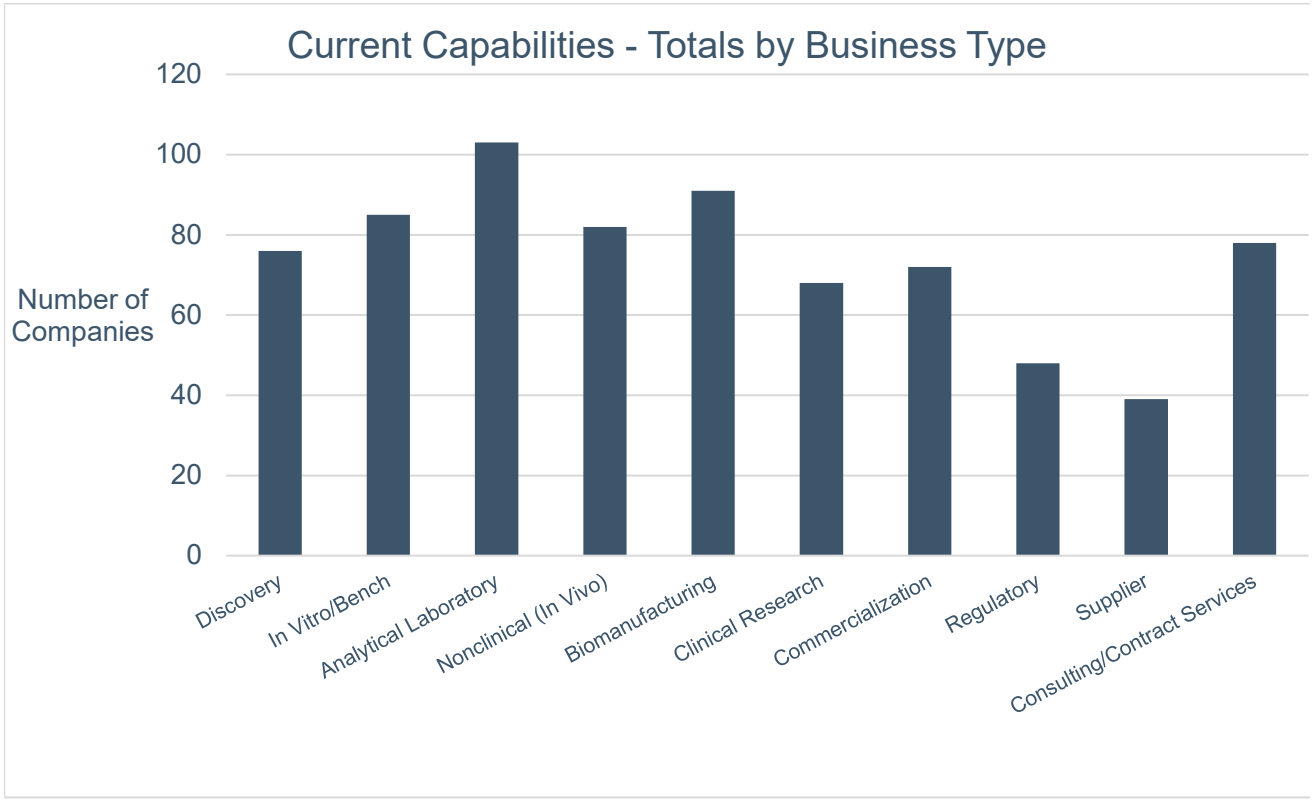


Figure 17. Current Total Capabilities by Business Type (n=135)

Companies with biomanufacturing capabilities were the most prevalent in the vaccine space (23 instances), followed by nonclinical (*in vivo*) (19), discovery (18), analytical laboratory (18), and *in vitro*/bench (17) **(Figure 18)**. A similar scenario was observed for companies with therapeutic protein capabilities – 26 instances of biomanufacturing capabilities, 20 instances of analytical laboratory capabilities, and 18 instances each with nonclinical (*in vivo*), discovery, and *in vitro*/bench capabilities. The therapeutic protein space does have a higher number of supplier business types in comparison to others **(Figure 19)**.

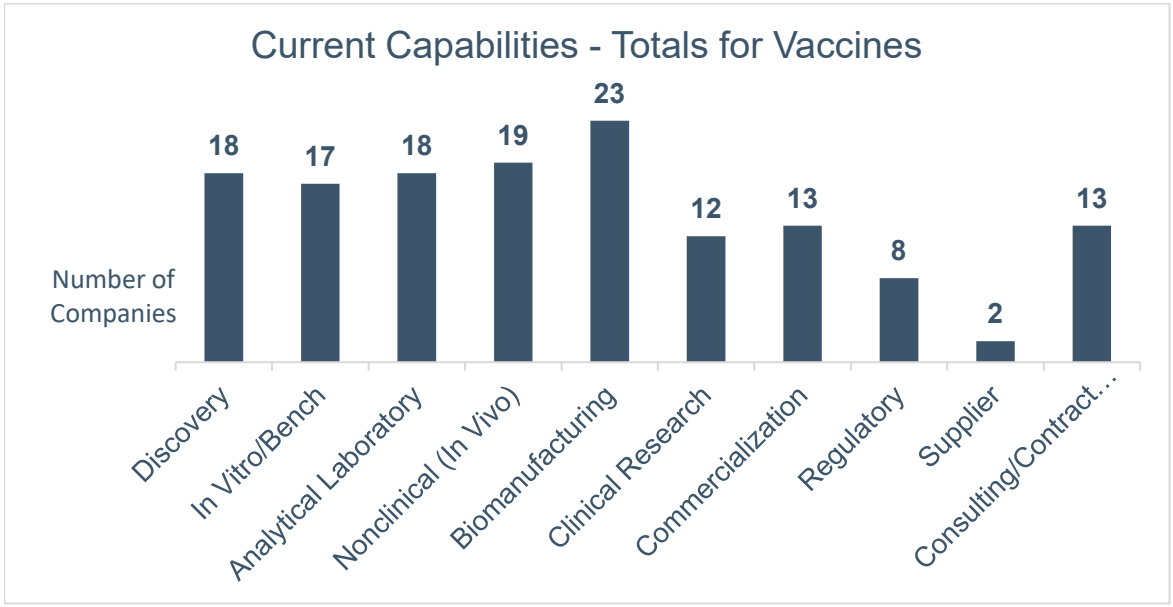


Figure 18. Current Total Vaccine Capabilities (n=135)

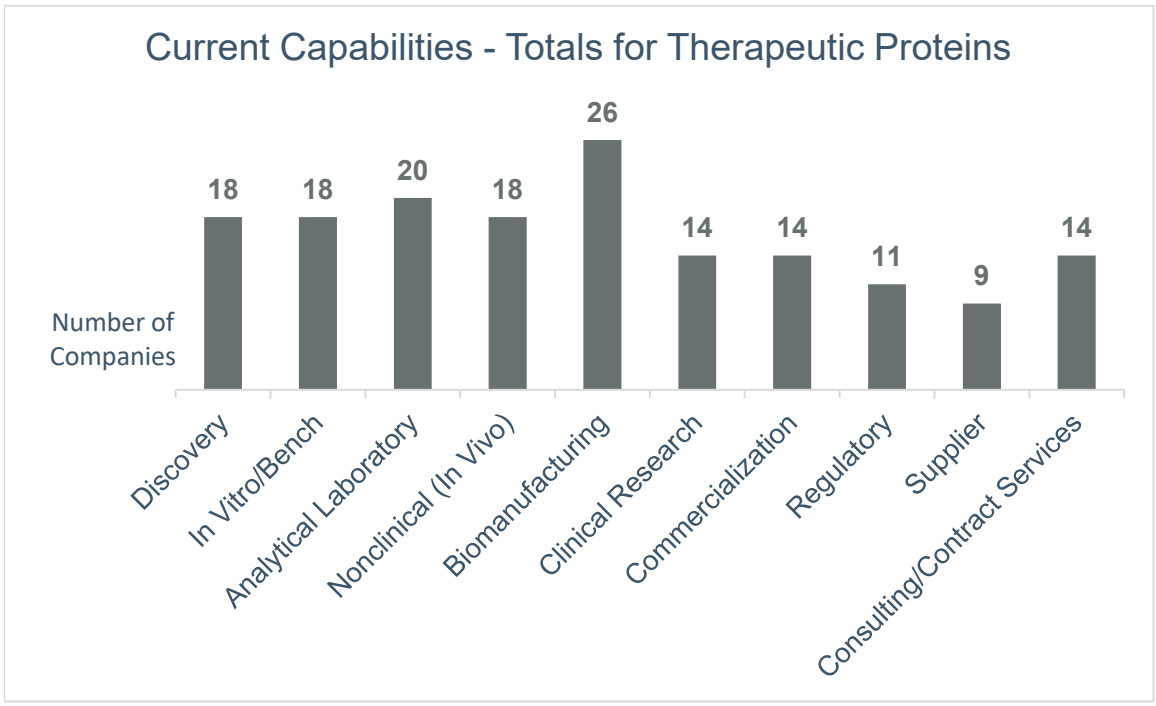


Figure 19. Current Total Therapeutic Protein Capabilities (n=135)

The current capabilities for companies in the blood/blood components space are listed in **Figure 20**. The leading capabilities within this space were analytical laboratory, *in vitro*/bench, and consulting/contract service with 13, 11, and 9 companies offering those services, respectively. There are four companies that offer regulatory service, and no companies offering supplier service for blood/blood components. The remaining categories are nearly equally represented with a range from 7 – 8 companies across those capability offerings.

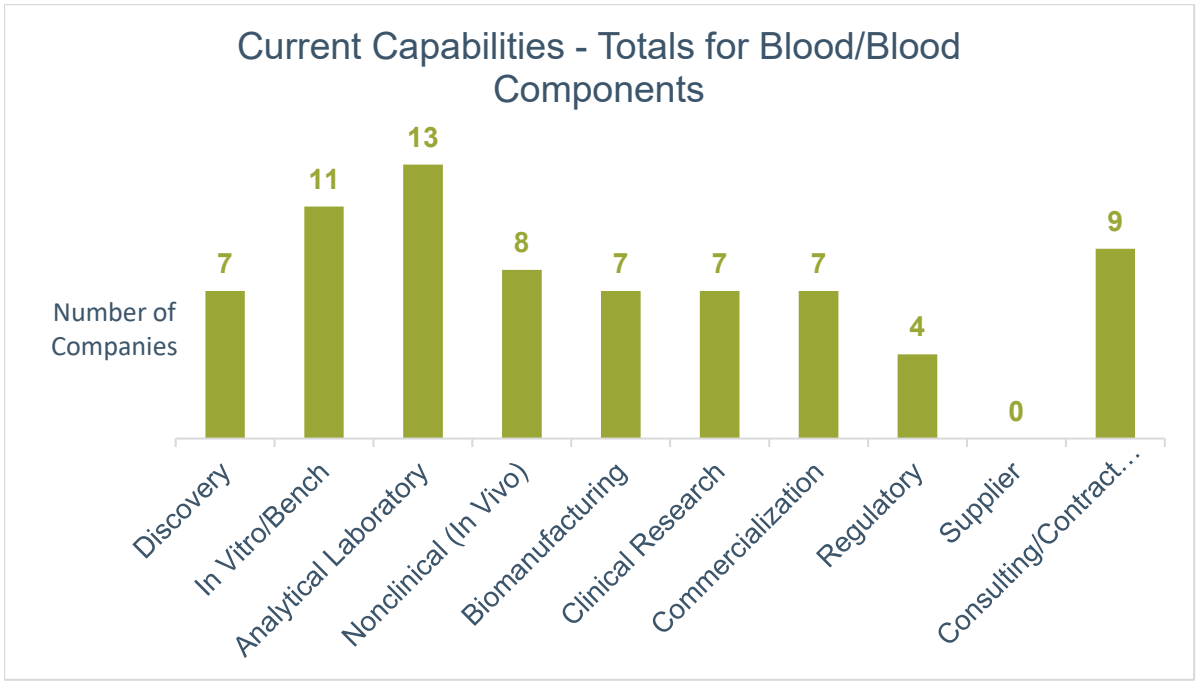


Figure 20. Current Total Blood/Blood Component Capabilities (n=135)

Within the allergenics space, analytical laboratory and consulting/contract services were the most popular. There were no identifed suppliers with allergenic capabilities **(Figure 21).**

For companies with tissue capabilities, the analytical laboratory business type pulls ahead (13 instances), with in vitro/bench coming in a close second (12), followed by consulting/contract services (10). There is an even split between biomanufacturing, clinical research, and commercialization business types (9 instances each) **(Figure 23)**. For companies with cell/gene therapy capabilities, there is no clear trend or focus in regards to the buisness type. There are, however, only 2 instances of companies in this space that identify as a supplier **(Figure 22).**

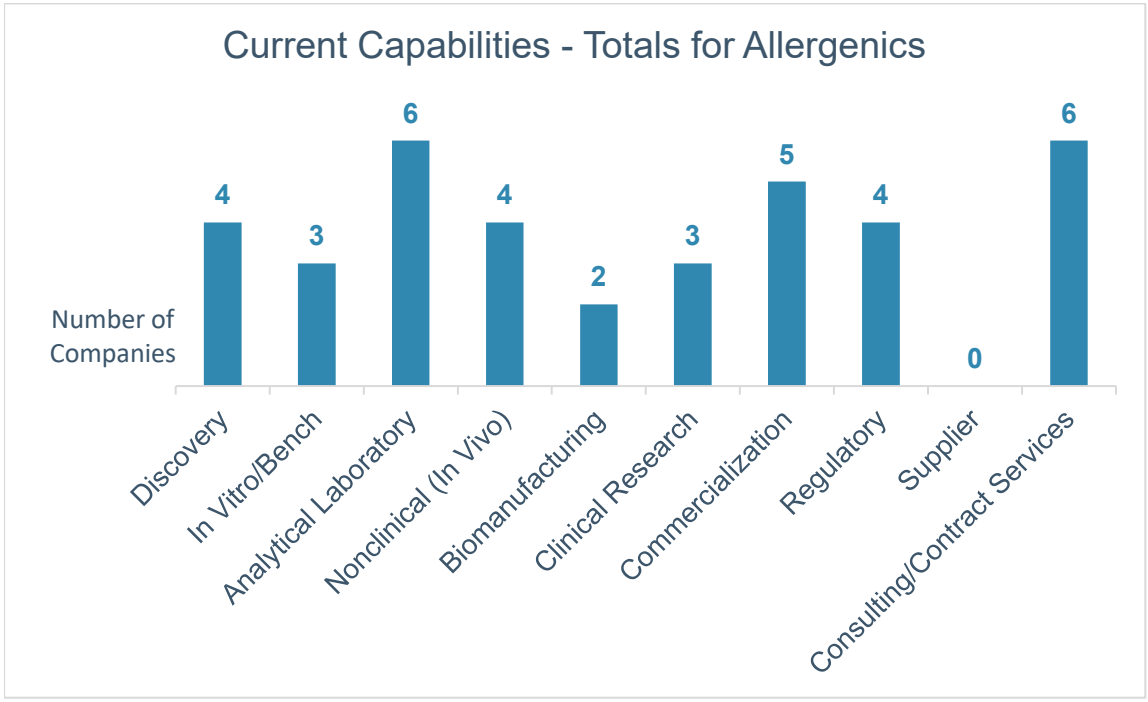


Figure 21. Current Total Allergenics Capabilities (n=135)

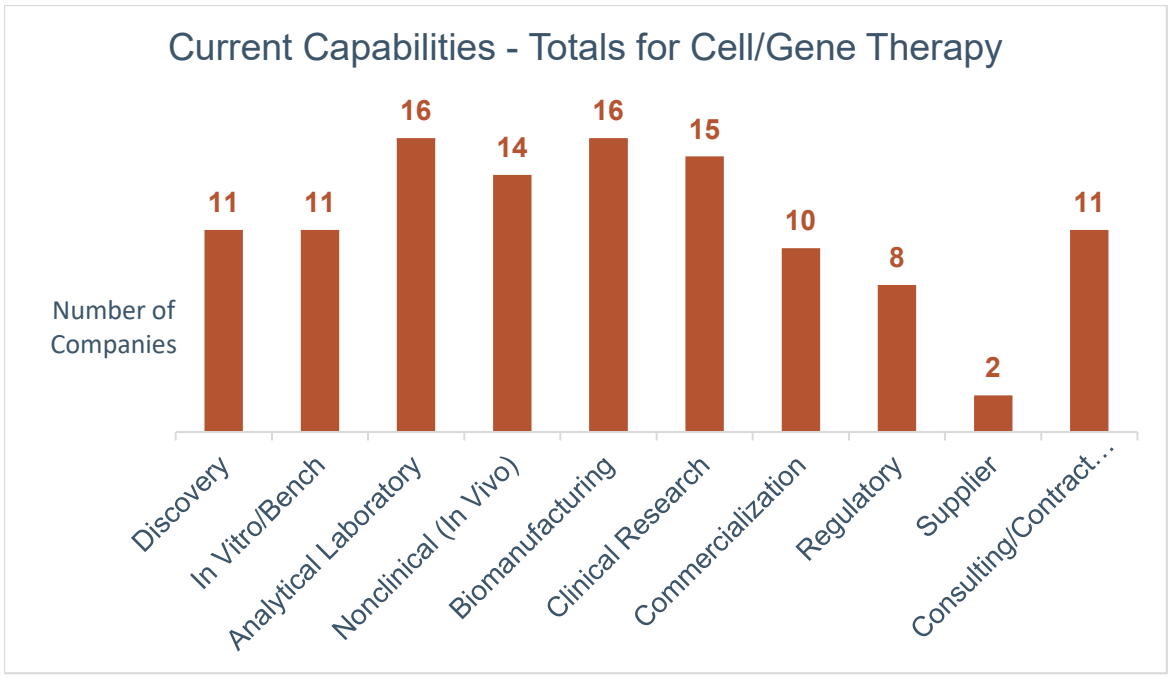


Figure 22. Current Total Cell/Gene Therapy Capabilities (n=135)

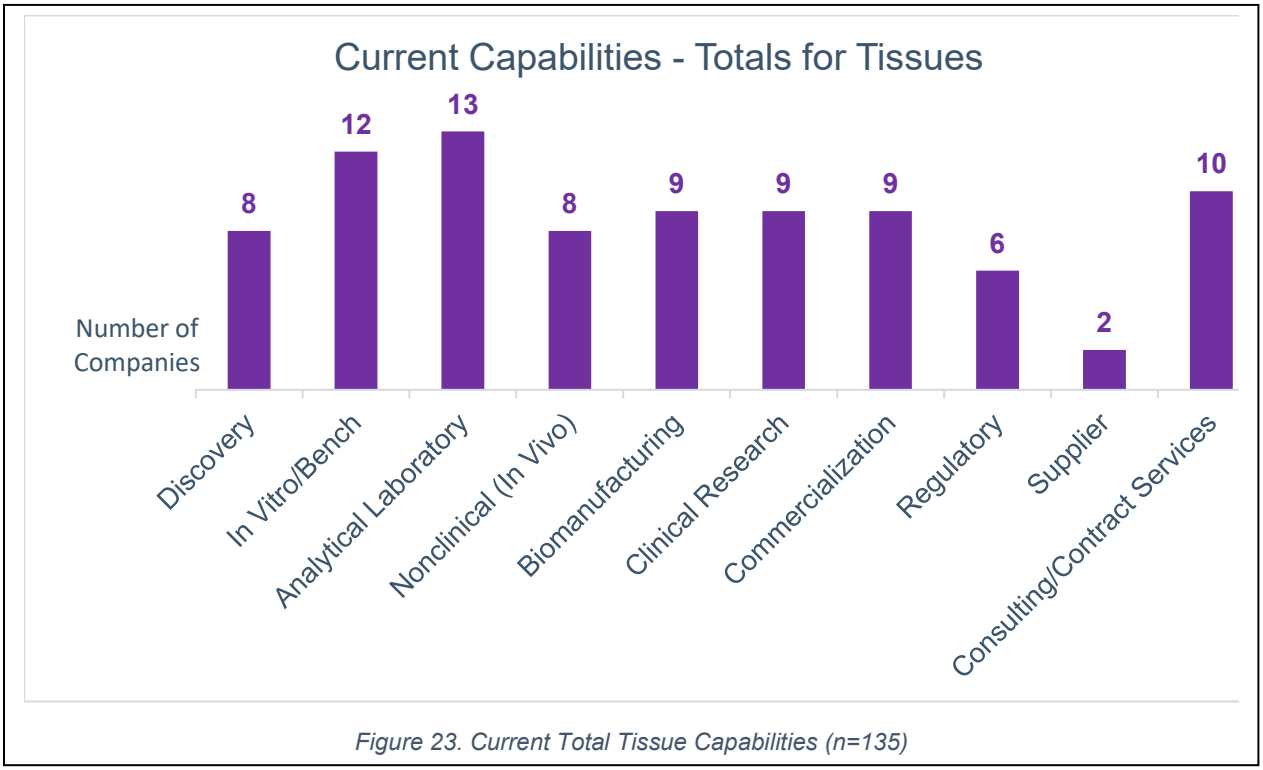


Figure 23. Current Total Tissue Capabilities (n=135)

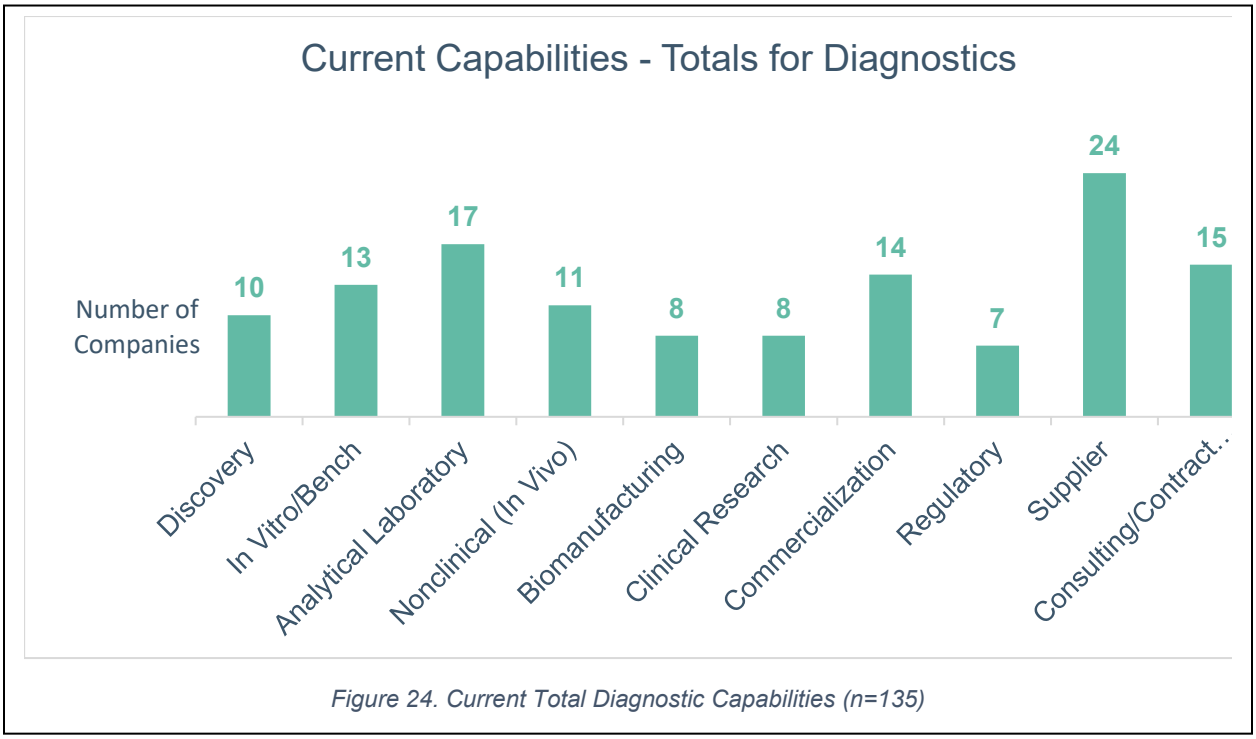


Figure 24. Current Total Diagnostic Capabilities (n=135)

There is a clear strength in diagnostic technology types within the supplier business type (24 instances) **(Figure 24)**.

Interview Analysis Set (IAS)

Biologics Definition Word Cloud

The interview began with a general introduction to the scope of the interview and overarching goals of the project. Additionally, the interviewee was asked to define a biologic, in their own words, prior to the interviewer sharing the consensus definition. **Figure 25** displays a word cloud representing the most commonly used words or phrases to define a biologic. Most interviewees provided a coherent, spoken definition of a Biologic which are listed below in **Table 1**.

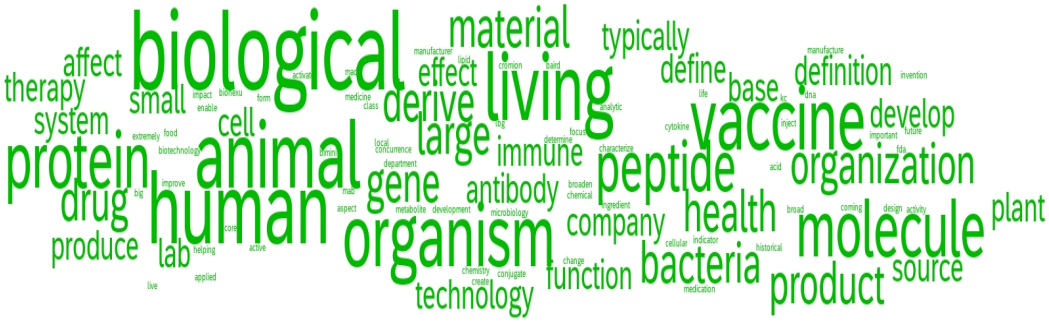


Figure 25. Word Cloud of the definition of' Biologic' provided by Cohort I Respondents (IAS)

Listing of Definitions

Table 1. Written definition of the term 'Biologic' provided by Cohort I respondents (IAS).

Interviewee Definition of a Biologic
The company does not have a working definition of biologics within their organization but is in concurrence with the definition of Biologic as defined by BioNexus KC & LBG.
Biologics relates to creating medicines or doing research that relates to helping people.
A biologic is produced by a living organism.
Biologics are peptides, proteins, mAb, drug antibody conjugates, and vaccines.
Anything that is medication that is made using cellular material, human or bacteria - any living organism.
A biologic is either a vaccine or a monoclonal antibody – something that has an impact on the immune system and is a large molecule.
Historically, focused on vaccines but at this point, is broadened to therapeutics (gene therapy, etc.)
Gene and protein-based product that uses living organisms, such as bacteria, that can be used for animals and humans (cytokines, drugs, etc.).
Large molecules that affect human function (proteins, cell & gene therapy, peptides)
It is a broad class – anything from living organism that is a core aspect of human and animal health
Proteins, vaccine
Live, living, derived from live or living materials that are plant or animal based as opposed to synthetic
Pharmaceutical that has biological effect, not taken orally typically, needs to be injected
A biologic will have physiological effect on human and animal cells, biological molecule - protein, nucleic acid, peptide, something biologically response, lipid, secondary metabolite. This definition is extremely important - plant or animal products, need to know active ingredients in the source - changes regulatory processes.
Anything that is not chemically synthesized or comes from biological or DNA technology.
A biologic is a vaccine, therapeutic, treatment, or technology derived from living sources designed to protect or improve human or animal health.

Biologics-Focused Organization Landscape in the Kansas City Region

Of the 19 companies that were interviewed, only 2 of the companies interviewed are public companies. All others are private companies **(Figure 26)**. Thirteen companies consider themselves suppliers/sponsors and 6 as service providers **(Figure 27)**. There is 1 company that is veteran owned, 1 company that is minority owned, 1 company that is women-owned, and 1 company that is minority *and* women owned.

For those companies that were interviewed, there was a variety of different offerings spread across the stages of the product development continuum. Most companies are consultants or contract service offerors with analytical (average percent analytical focus: 30%), biomanufacturing, clinical, and commercialization being the most prevalent capability categories.

Figure 28 shows the areas of research interest for interviewed companies – most companies interviewed were in the animal and human health sectors of the biologics industry. Of those interviewed, the highest number of biologics companies that have a focus on both human and animal health (39%), with a secondary focus on animal health only (22%).

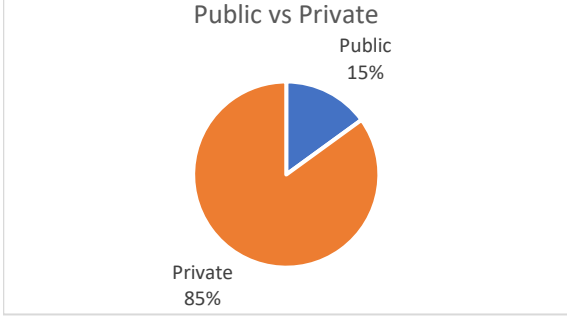


Figure 26. Incorporation Type of Companies Interviewed

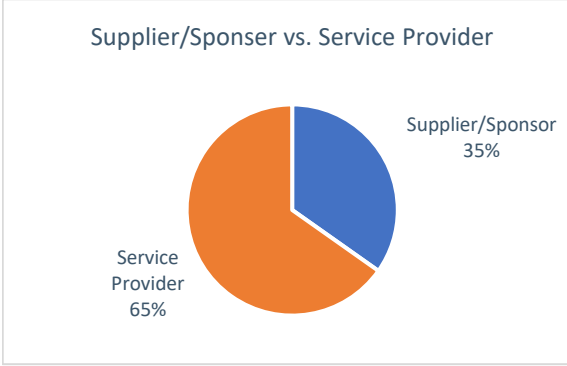


Figure 27. Percentage of Suppliers versus Service Providers

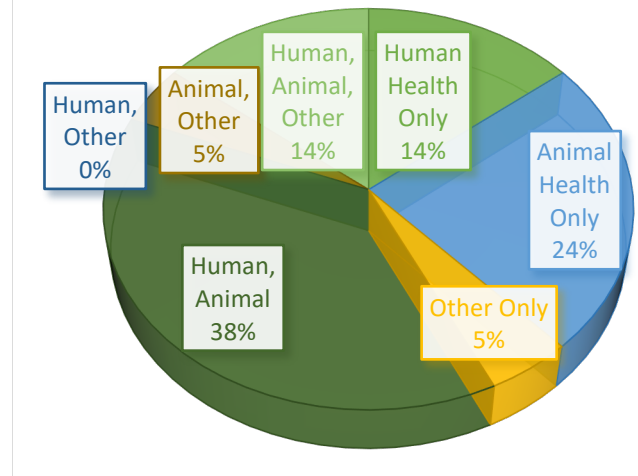


Figure 28. Areas of Research and Capabilities Interviewed Within the Biologics

Dedicated Facility Space

These same categories demonstrated to have the most dedicated facility space **(Figure 29)**. The most popular product types were vaccines, cell/gene therapy, and therapeutic proteins **(Figure 30)**. The highest amount of facility space dedicated was for cell/gene therapy products, with vaccine products ranked second and therapeutic proteins ranked third **(Figure 30)**. While the average facility space for diagnostic products is high (100%), there was only one company that has a fully dedicated diagnostic product facility and thus is an outlier and is not shown in further data analysis.

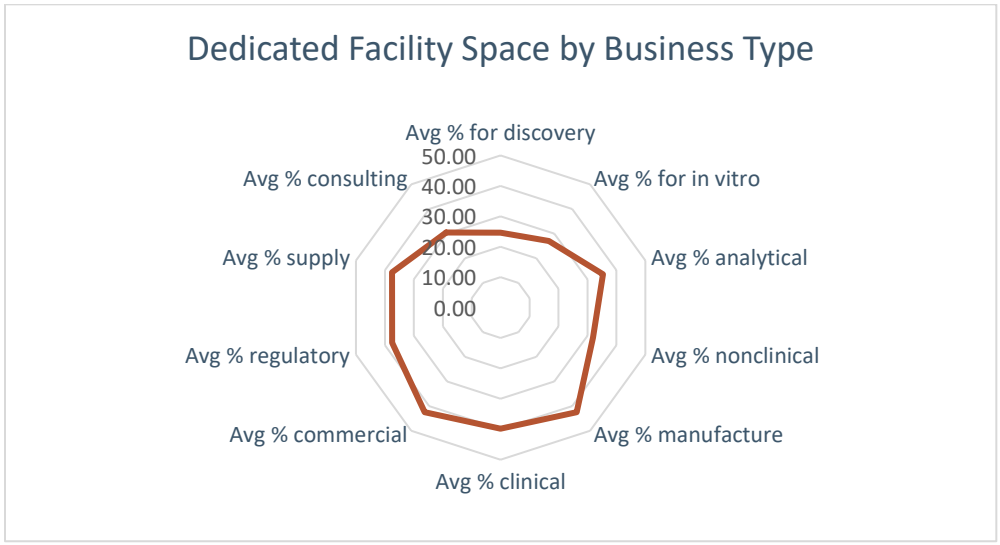


Figure 29. Average Percentage of Facility Space Dedicated to Current Capabilities

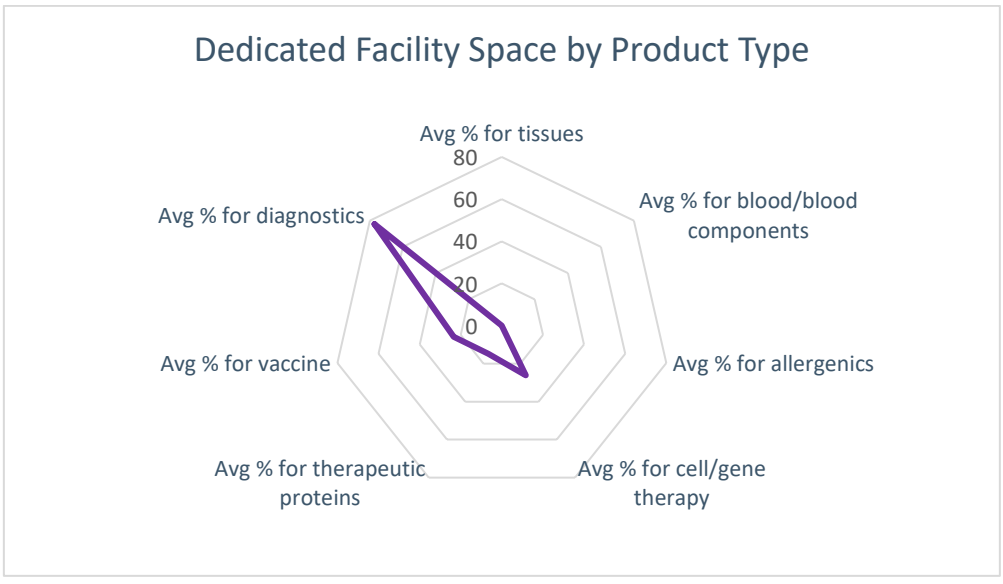


Figure 30. Average Percentage of Facility Space Dedicated to Business Type

Outsourcing

Of the 13 companies that outsource work in some capacity, 7 of them outsource to both inside and outside of the KC region, 3 outsource only inside the KC region, and 1 company outsources solely outside of the KC region **(Figure 31)**.

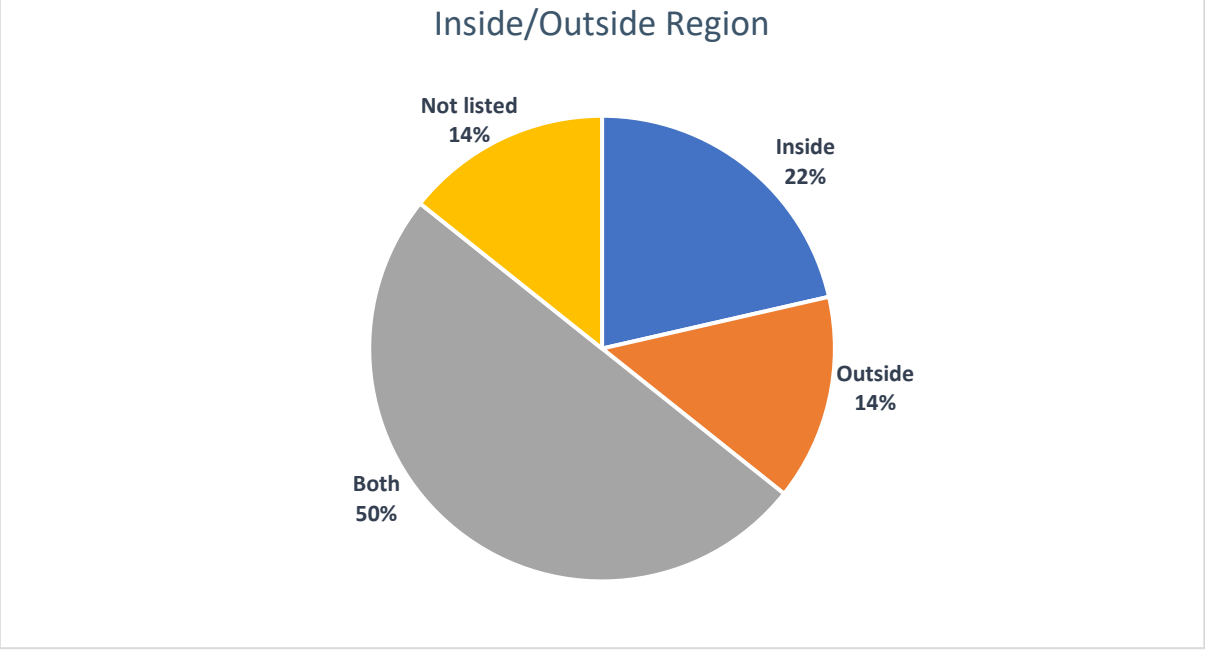


Figure 31. Outsourcing Inside versus Outside the Region

Expertise and Workforce of Interviewed Organizations

When reviewing interviewee workforce profiles, the majority of respondents were C-suite level, including chief executive officers, vice presidents, chief scientific officers, and executive directors **(Figure 32)**. **Figure 33 and Figure 35** show that while there is a fairly even distribution of males and females in these organizations across education levels, there is not an even distribution of males and females across levels within the organizations. Men occupy more of the workforce at all levels (based on average reported percentages), although the gap between males and females in business support roles is less than other levels/titles.

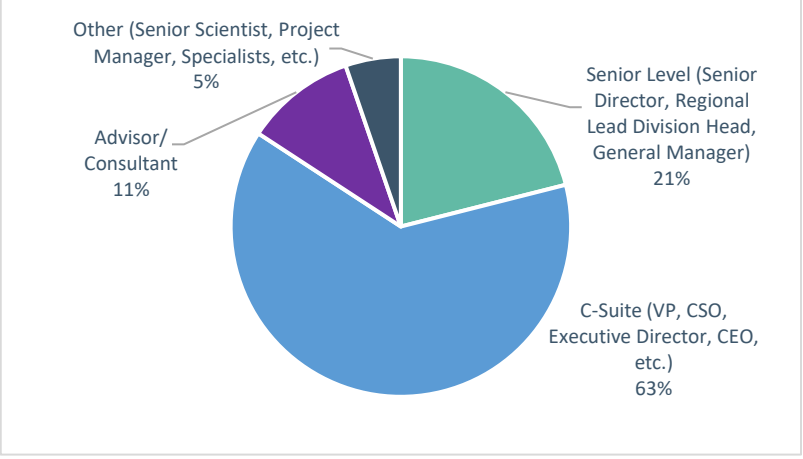


Figure 32. Workforce Demographics by Organization Level/Title

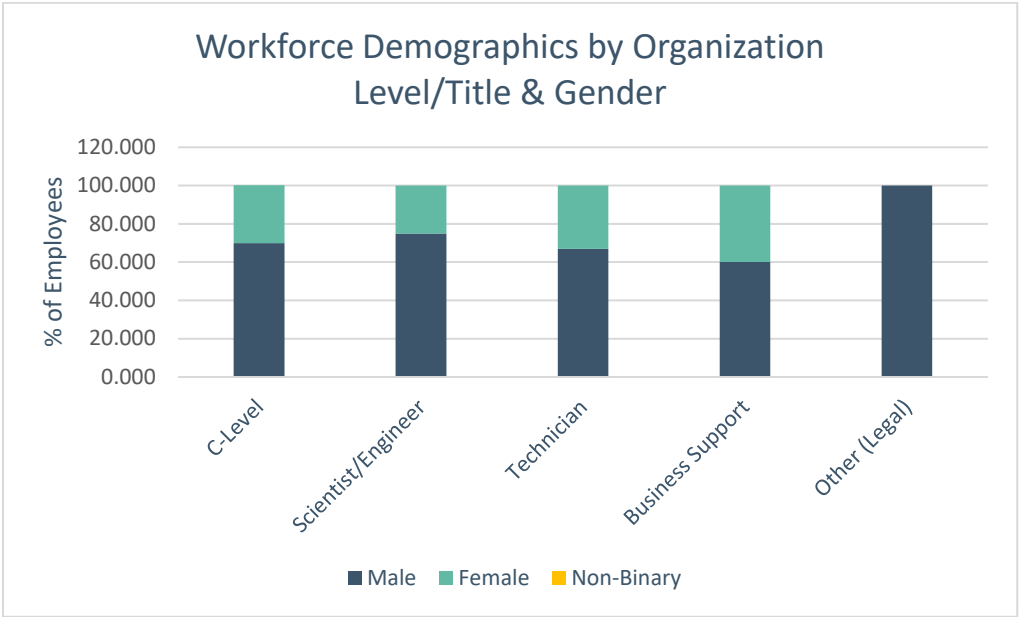


Figure 33. Workforce Demographics by Organizational Level/Title and Gender

As expected in biologics- focused companies (due to the scientific nature of the work), educational profiles of the workforce were evenly split amongst the doctorate, master's, and bachelor's degrees **(Figure 34)**.

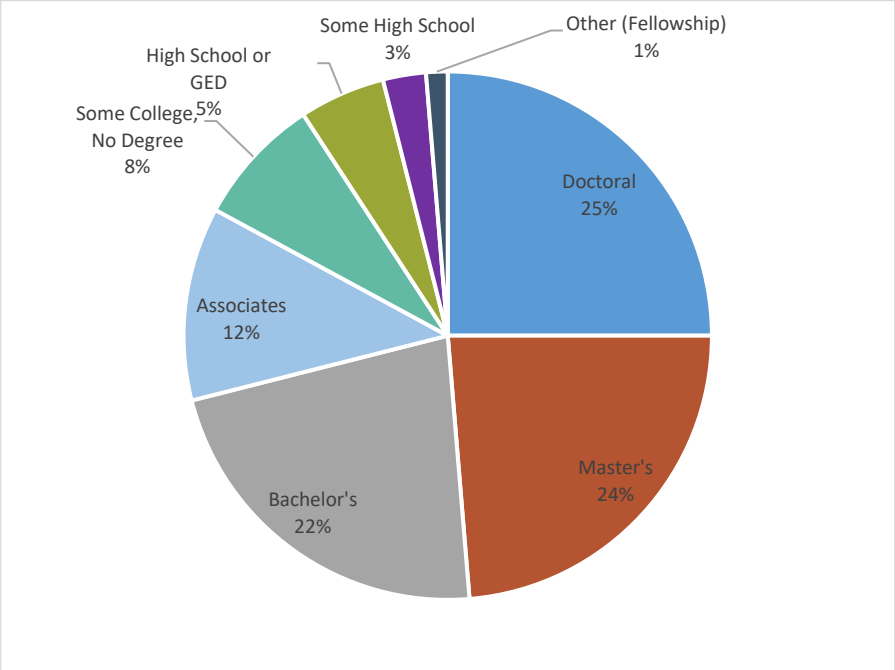


Figure 34. Education In-House

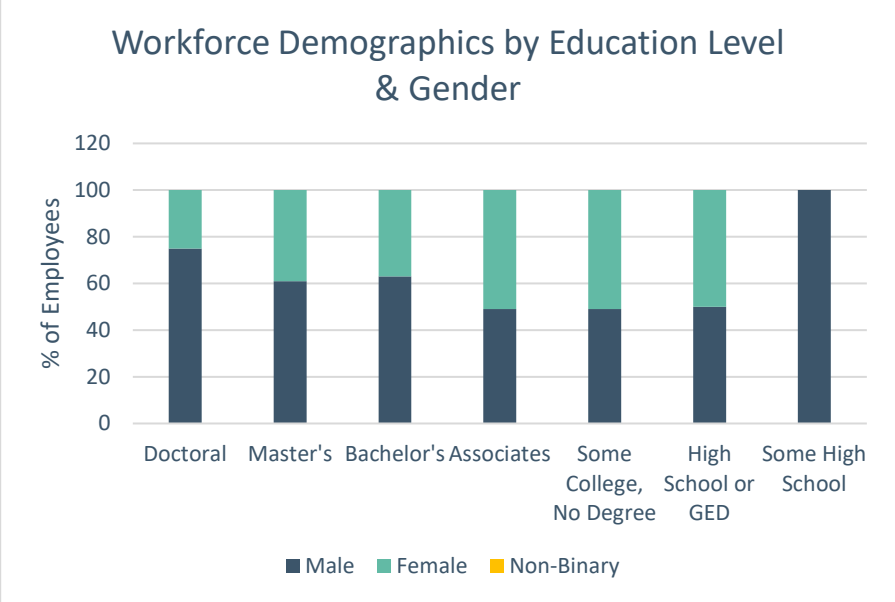


Figure 35. Workforce Demographics by Education Level & Gender

When asked what the key workforce challenges were, the top responses were related to finding qualified applicants, followed by adequate staffing, and employee retention **(Figure 36)**.

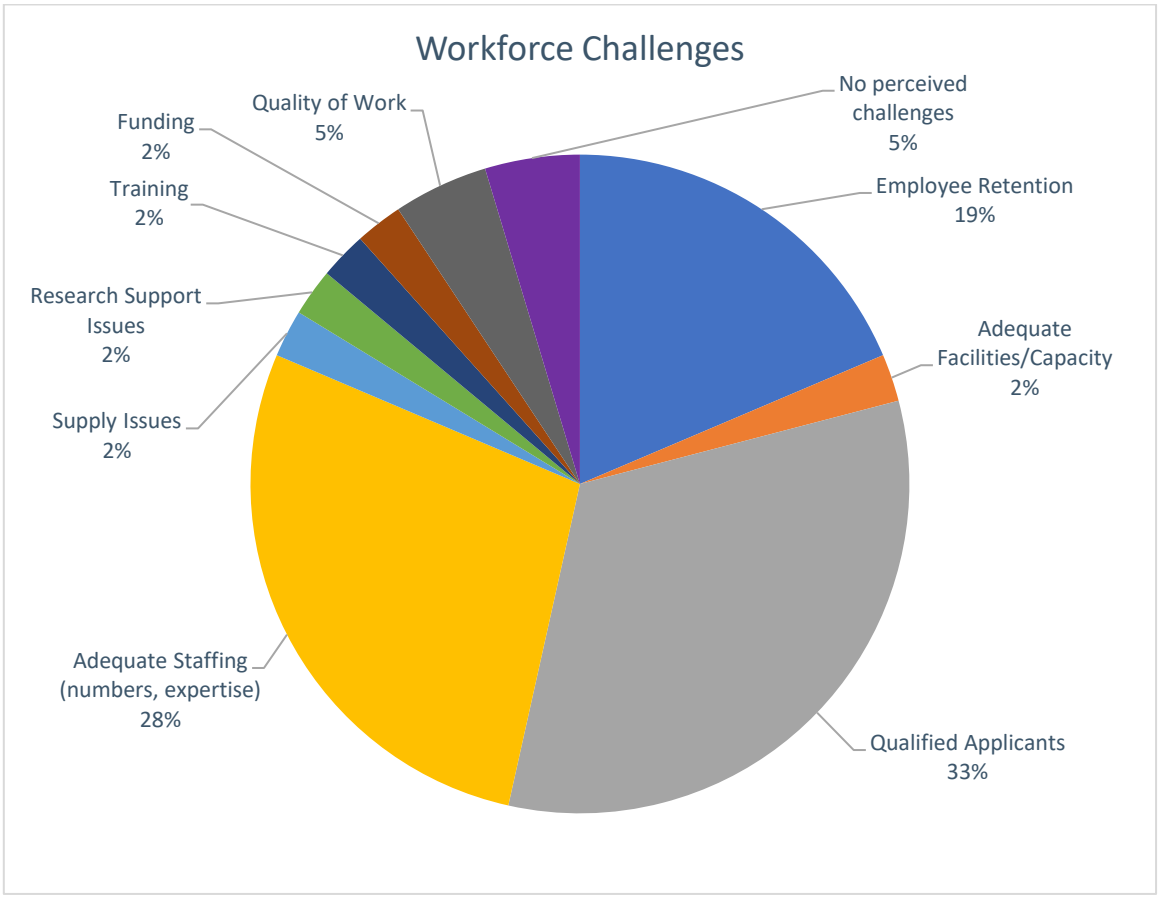


Figure 36. Workforce Challenges

Qualitative Workforce Demographics to Inform Diversity, Equity, and Inclusion Task Force Outcomes for Interviewed Organizations

Questions 12-17 of the Industry Interview Guide were focused on diversity, equity, and inclusion (DEI) within the companies of the KC regional biologics industry. Responses to these questions are summarized in figures **Figure 37 - Figure 40**. Note that while a few interviewees initially stated that they were willing to share DEI data, no information regarding employee demographics was ultimately shared by any of the interviewed companies. However, some clear positive trends were observed in their perspective of DEI. Regarding viewpoints on DEI importance to the workforce, 80% of responses indicated that DEI was of moderate importance or higher. Additionally, 80% of respondents stated that DEI initiatives were at least of moderate importance or higher in their

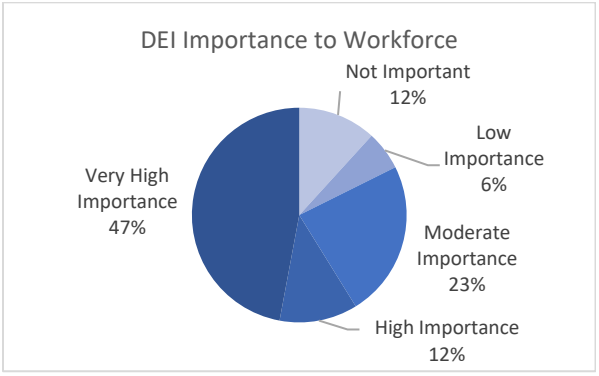


Figure 37. Interviewee Perception of DEI Importance to Workforce

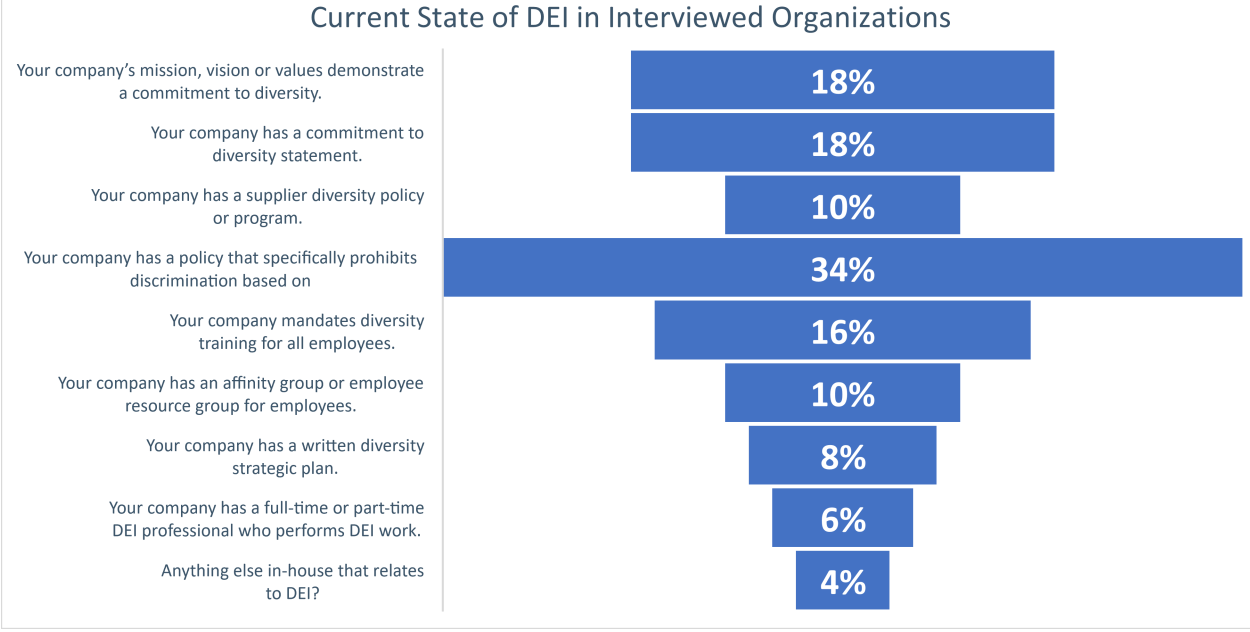


Figure 38. Current state of DEI in Interviewed Organizations

ability to attract new employees **(Figure 39)**. Further, 70% indicated that DEI had either greatly (20%) or very greatly (50%) impacted their companies' overall success **(Figure 40)**.

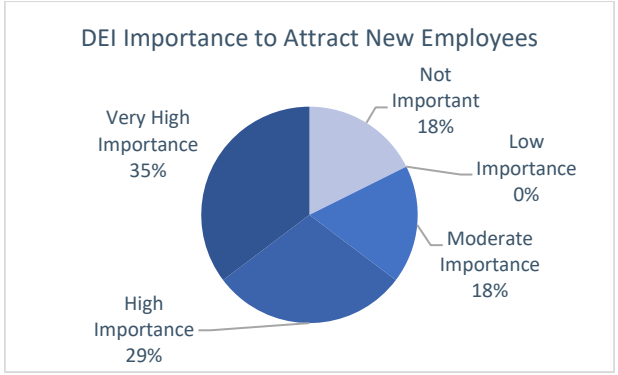


Figure 39. Interviewee Perception of DEI Importance to Attract New Employees (n=17)

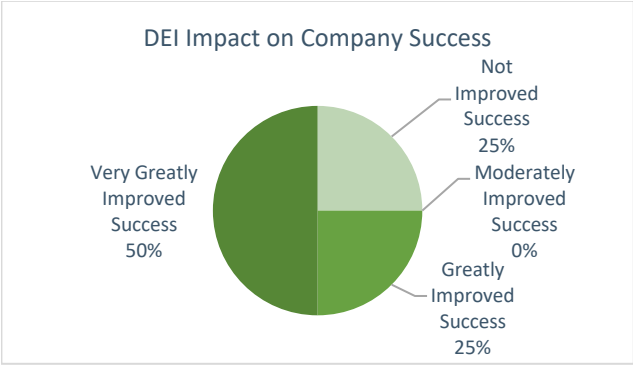


Figure 40. Interviewee Perception of DEI Impact on Company Success (n=12)

Source of Investment(s) for Interviewed Organizations

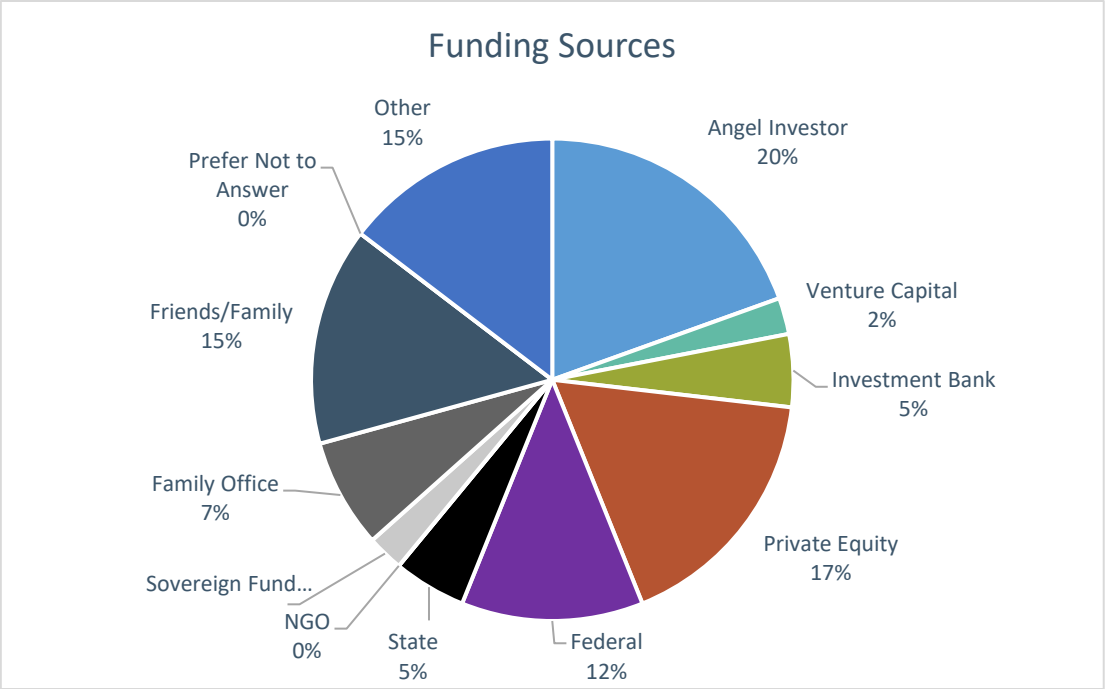


Figure 41. Interviewee Percentages of Funding Sources

Companies in the region are funded mostly by dilutive sources, including private equity (20%), angel investors (17%), and friends/family (15%) **(Figure 41)**. Given the high number of small businesses, funding via angel investors and friends/family is not surprising. This aligns with what was reported to be the most important type of funding (higher rank score equals larger source of funding) **(Figure 42)**.

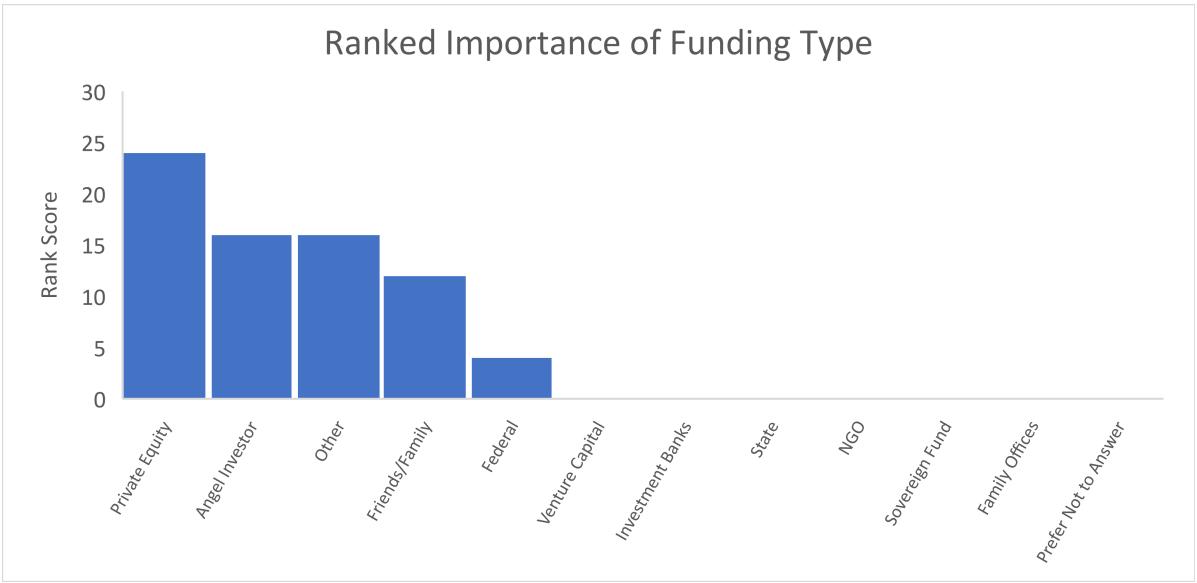


Figure 42. Interviewee Funding Sources Ranked by Importance

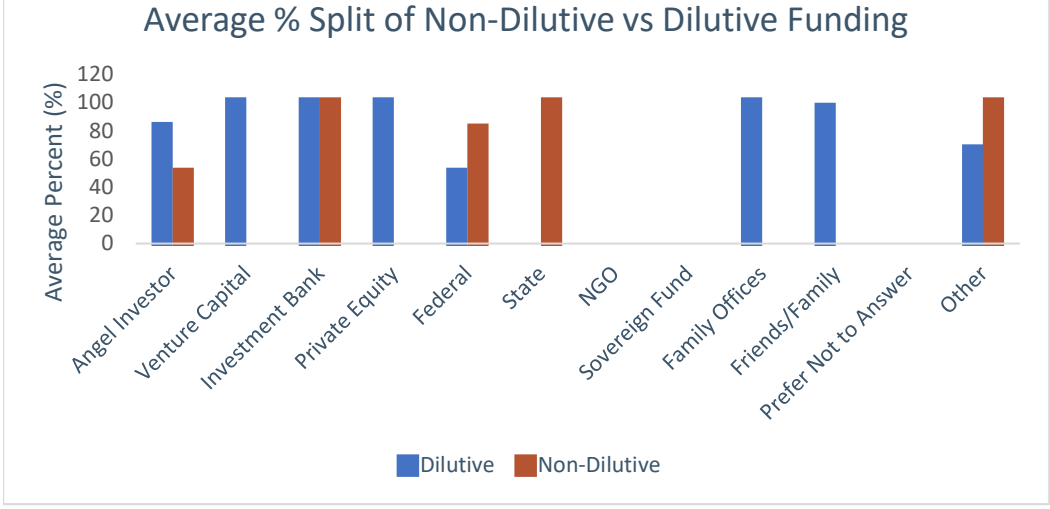


Figure 43. Interviewee Funding Ranked by Percentage of Funding

Commercial Accomplishments and Growth Plans

Amongst interviewees, there were varying accomplishments reported over the last 2 years **(Figure 44)**. Furthermore, of these varying accomplishments, the most prevalent accomplishment included the launch of a new product **(Figure 45)**. Most of the companies also are in active development of at least one new product with plans to launch many of these products within the next two years **(Figure 46)**. Other notable planned accomplishments include infrastructure or geographic expansion (approximately 66% of interviewees plan to expand), as well as forming additional strategic partnerships or participating in mergers or acquisitions **(Figure 45).**

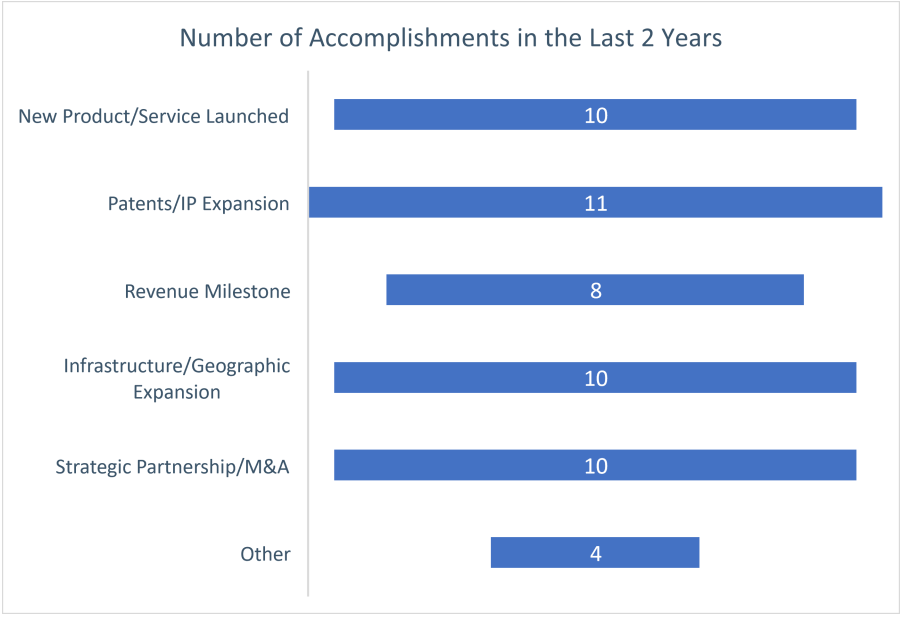


Figure 44. Number of Accomplishments in the Last 2 Years

Figure 45. Specific Commercial Accomplishments in the Last 2 Years

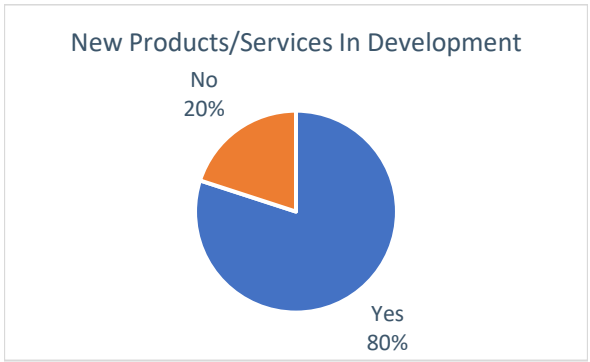


Figure 46. New Products and Services in Development

When asked if there were any challenges or barriers that companies encountered while working to achieve these milestones, several were reported. The top two challenges reported were regulatory and legal as well as funding **(Figure 48)**. Of least concern was capacity and brand awareness (6% each). The COVID-19 pandemic currently remains in the mix of challenges with 12% of interviewees noting it as a key challenge to their past and planned accomplishments. Adequate staffing, subcontracting, and site selection were also noted by multiple interviewees.

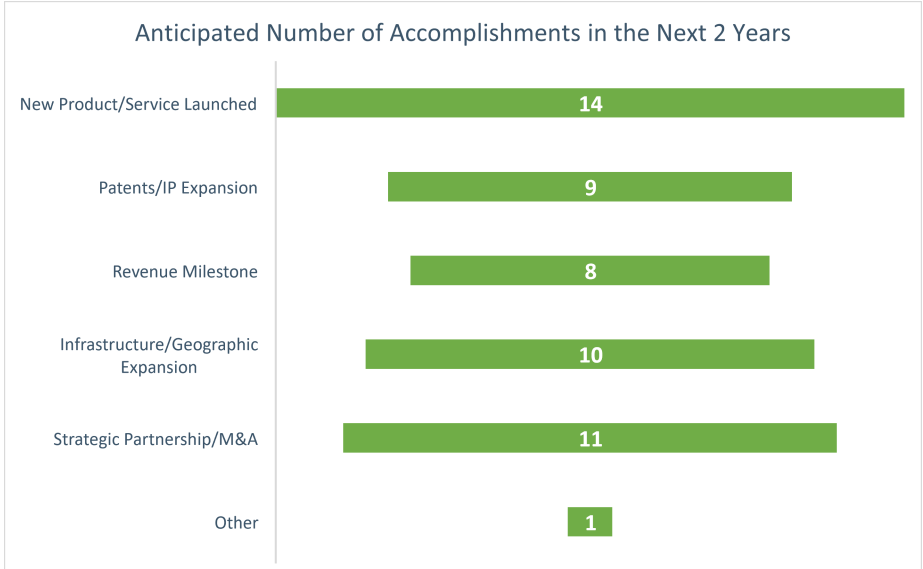


Figure 47. Anticipated Number of Accomplishments in the Next 2 Years

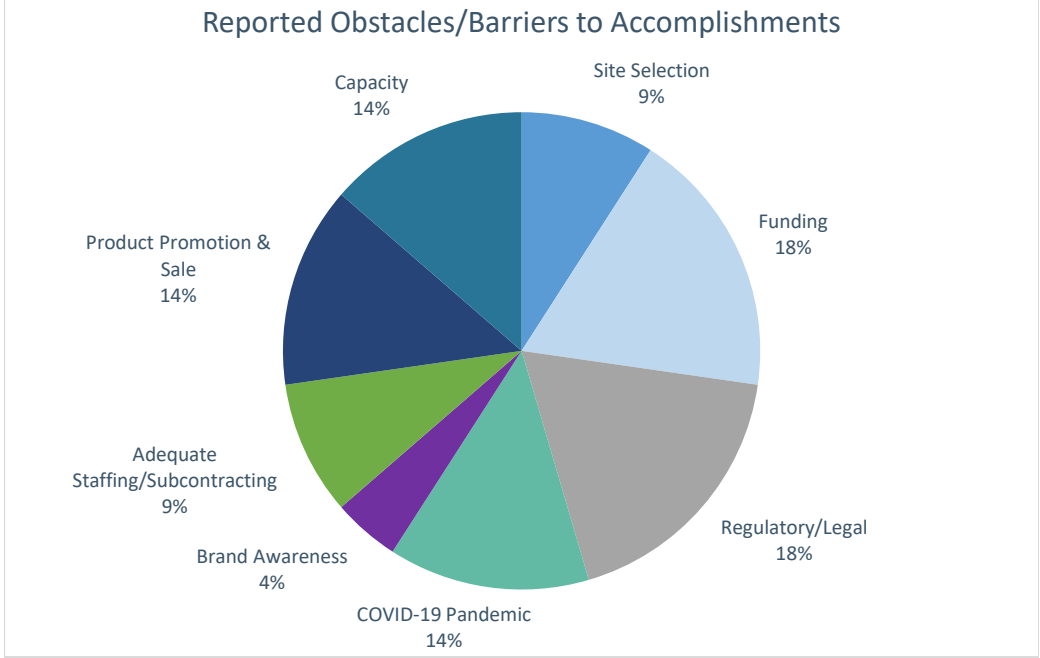


Figure 48. Reported Obstacles/Barriers to Accomplishments (n=18)

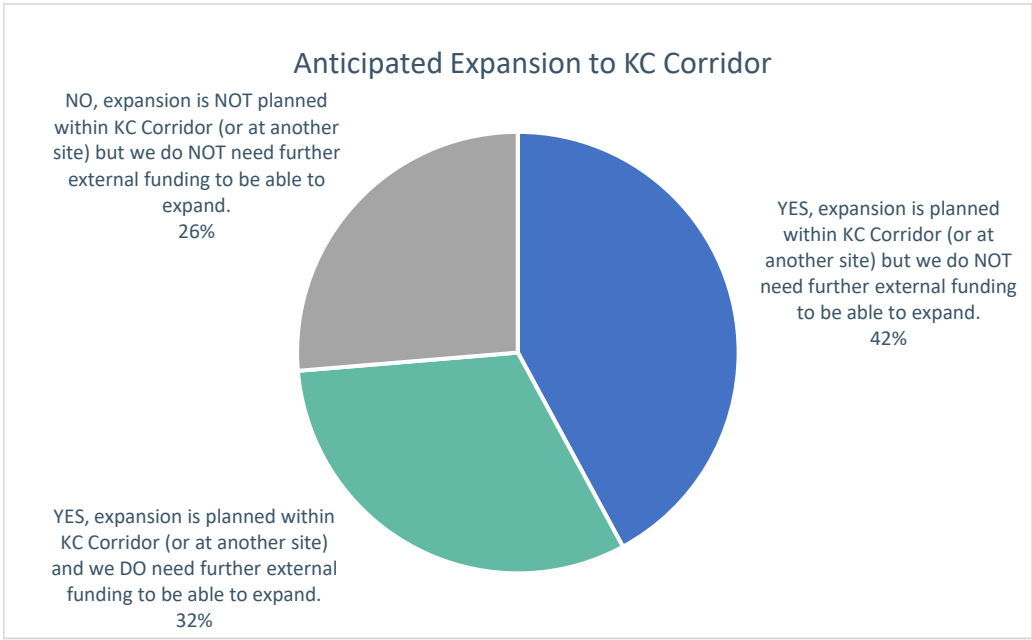


Figure 49. Anticipated Expansion to KC Corridor

Regional Market Perceptions

Among interviewees there is a strong perception that the regional biologics industry will grow and that there is adequate expertise within the region to support that growth, but there are mixed feelings on adequate support within the region for said growth. Many believe that there is some support available from both local government/infrastructure and other organizations, but they are wary on exactly how much support is practical – many that reported little or moderate support do not think the extra steps that one must take to receive such support is worth the growth that comes from it.

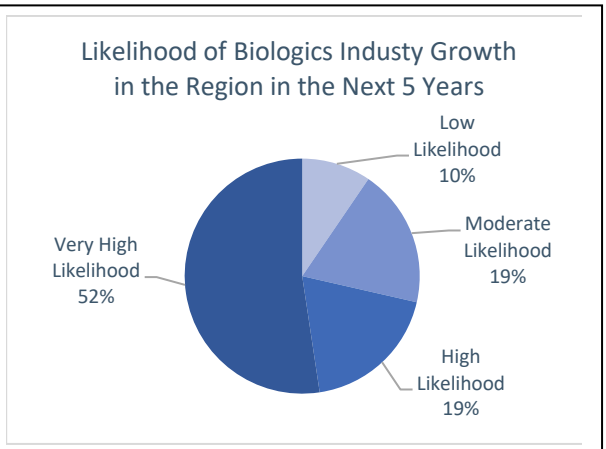


Figure 50. Likelihood of Biologics Industry Growth in the Region in the Next 5 Years

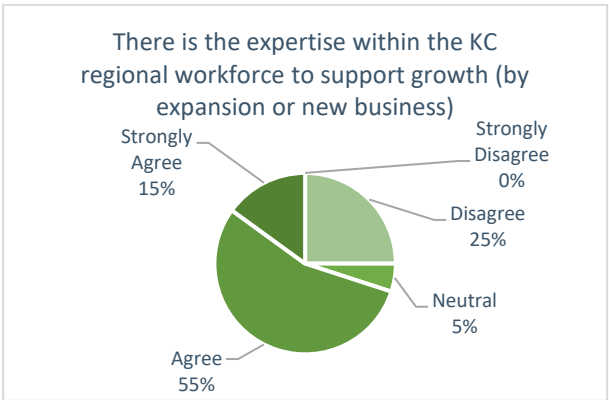


Figure 51. There is the Expertise Within the KC Regional Workforce to Support Growth (By Expansion or New Business)

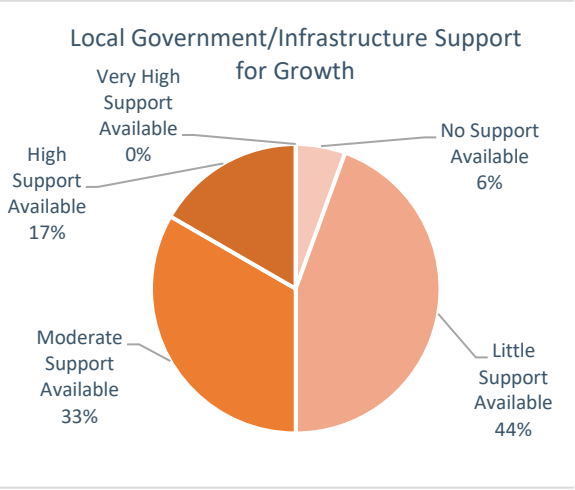


Figure 52. Likelihood of Biologics Industry Growth in the Region in the Next 5 Years

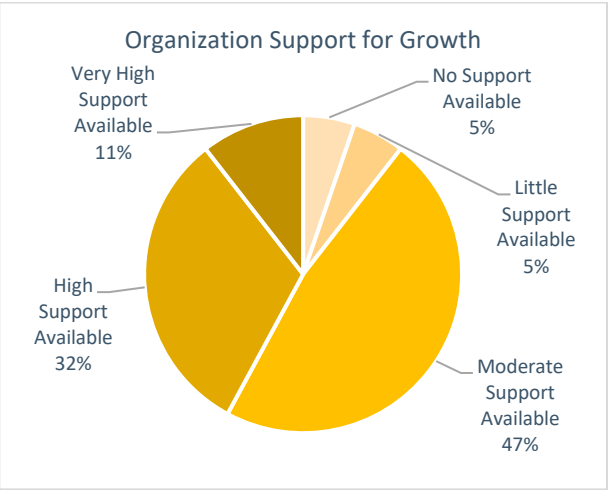


Figure 53. Likelihood of Biologics Industry Growth in the Region in the Next 5 Years

Interviewees were asked what the strengths, weaknesses, opportunities, and threats of the region were. **Figure 54 - Figure 57** show categorical responses.

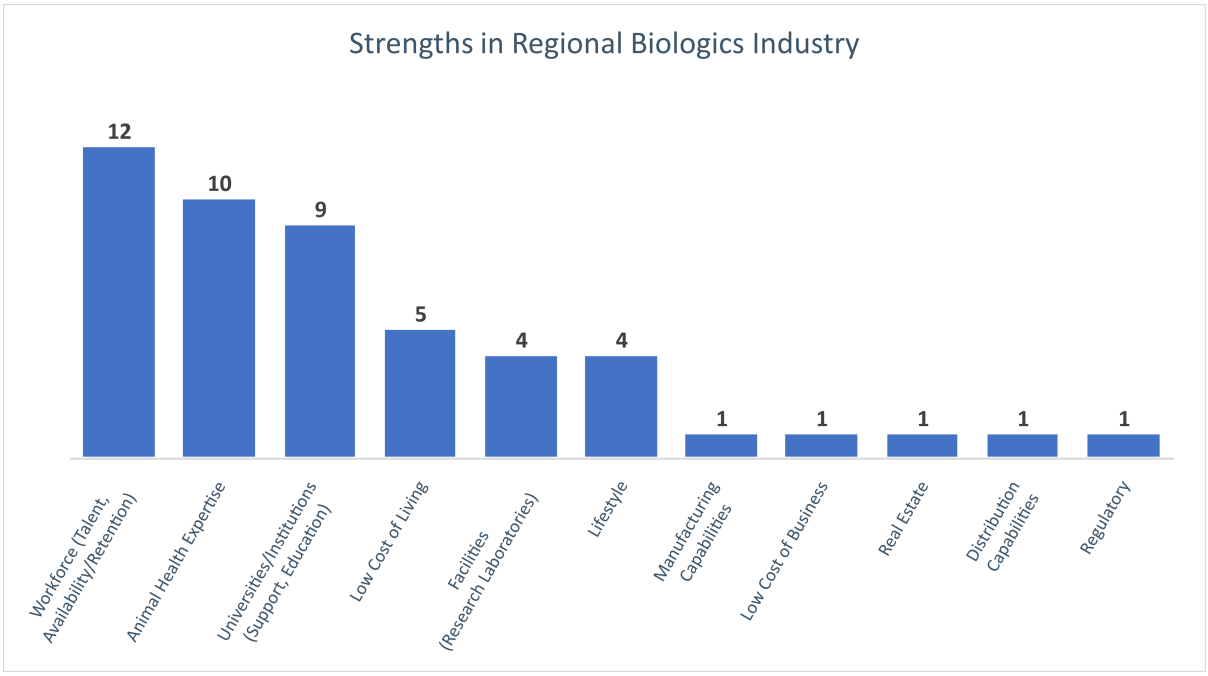


Figure 54. Strengths in Regional Biologics Industry

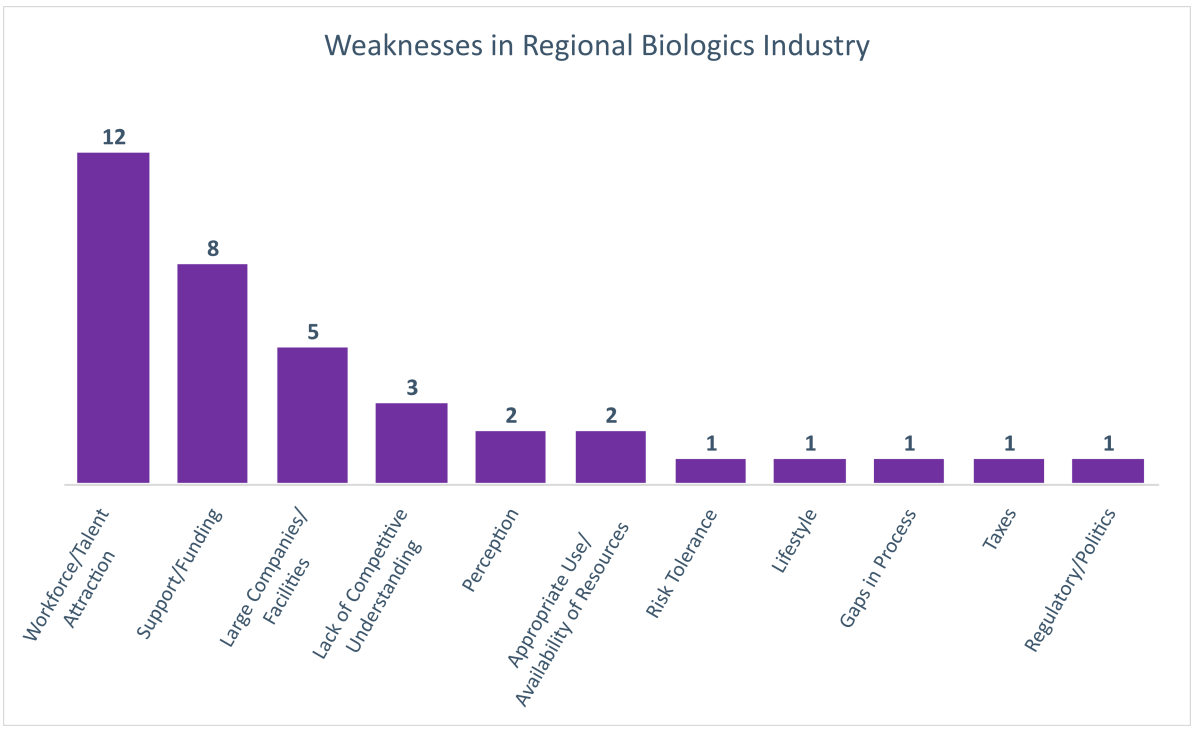


Figure 55. Weaknesses in Regional Biologics Industry

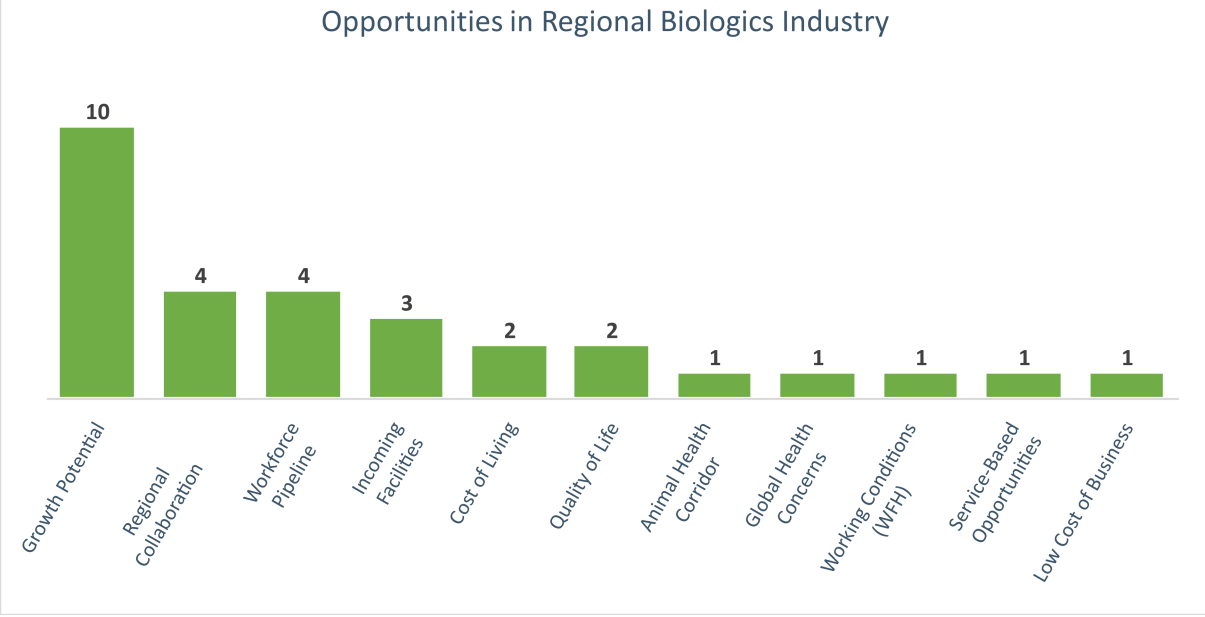


Figure 56. Opportunities in Regional Biologics Industry

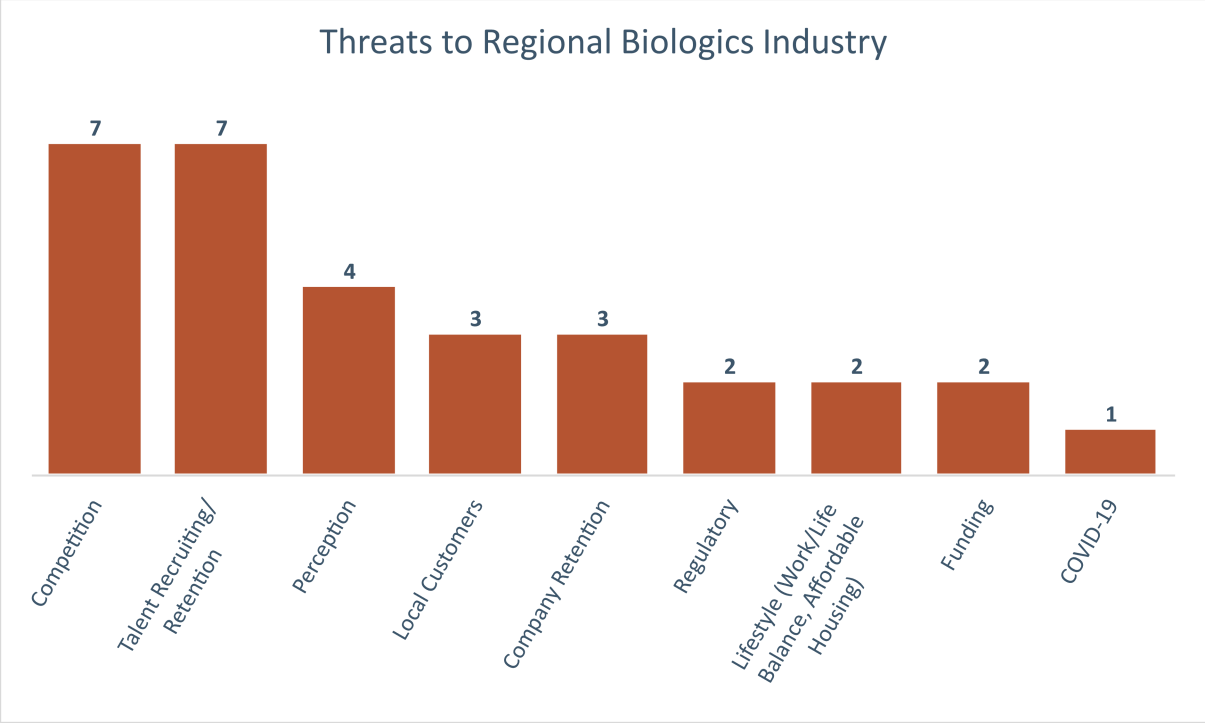


Figure 57. Opportunities in Regional Biologics Industry

Universities & Academia

Assessing the contribution of the higher education to the regional biologics R&D landscape is a complex, yet important research question. The functional unit of these organizations typically is comprised of faculty-led laboratory groups, centers of excellence or other focused conglomerations of people, equipment, and facilities which are focused on specific research and/or educational scopes. The structure of the stereotypical public university creates challenges when attempting to delineate capability and capacity for a specific purpose, due to the formation of independent silos of work/effort as well as the sheer size of major public universities. For example, the University of Kansas (KU), inclusive of the University of Kansas Medical Center (KUMC) touts a total of 6,401 faculty members (Source: University of Kansas website). Assessing the degree to which each faculty member and the facilities and equipment for which they are responsible for contributes to the research and development of biologics presents is nearly an implausible task within the reasonable constraints of resources. However, systematic engagement at the level of research administration, combined with secondary research methods yields a repeatable and feasible approach to inventorying these assets.

Universities & Academia Methods

Over 200 university and academic associated centers were originally identified as potential university interview targets. Of these 200+ university and research centers, 3 were removed for being outside the geographic scope of the Kansas City region, extending from Manhattan, KS to Columbia, MO, and inclusive of Wichita, and St. Joseph, MO. The major three university affiliations were: The University of Kansas and University of Kansas Medical Center populating 62 university centers, Kansas State University with 51 university centers, and the University of Missouri, providing 48 university centers. The remaining 41 university and research centers were located across the region, including affiliations with Avila University, Children's Mercy Kansas City, Johnson County and Kansas City Kansas Community College, Kansas City University, St. Luke's Health System, and the University of Missouri-Kansas City.

Although the main objective of this project was to identify and inventory any life science-related assets within the region that are performing research and development in biologics, university centers may or may not be a part of a larger program offering at a university or hospital that performs R&D. For this reason, no initial filter on biologics-focused work was applied and therefore no university and research centers were removed. Of the 202 remaining university centers identified as potential interviewees, 120 were Kansas-based, and 82 were Missouri-based. After performing secondary research (see methodology below), internal and external contact identification took place, and 25 potential respondents were contacted at these university and research centers. Email outreach started with the most appropriate point of contact followed by secondary outreach and alternative point of contacts being assessed.

Primary Research

Primary market research is the output of structured interviews with universities who support biologics in the KC region. For this benchmarking effort, this included universities and institutions that were provided by BioNexus KC, and additional groups identified by local KC SMEs and secondary research. LBG drafted an interview guide in a collaborative manner with BioNexus KC stakeholders. This interview guide was meant to be filled out offline by the university to the best of their ability. LBG would attend an initial interview reviewing the content and expectations of the

interview guide and confirming that the point of contact had the ability to gather the information. Interview responses were collected in an electronic format, and following receipt of the completed interview questionnaire, LBG would review and collate the data.

Secondary Research

In support of the benchmarking efforts, the LBG team conducted secondary research. Secondary market research is the review and aggregation of available information which in this effort included public university announcements and websites. This research deepened LBG's understanding of the biologics landscape in the KC Region as well as develop profiles for other geographies that were determined to be comparative by BioNexus KC.

University Full Analysis Set (FAS)

The FAS was created using a combination of primary and secondary research efforts and after application of selection criteria (geographically in-scope: (Y/N) and biologics related according to the establish definition (Y/N)), was comprised of total of 82 distinct targets. The outcomes for the FAS were limited to assessment of Core R&D Capability and Technology Sector. Core R&D Capability was fractionated according to the following categories: Discovery, In Vitro/Bench, Analytical, Biomanufacturing, Clinical Research, Commercialization, Regulatory, Supplier, and Consulting/ Service Provider. Technology Sector was fractionated according to the following categories: Vaccines, Cell/Gene Therapy, Diagnostics, Blood/Blood Components, Therapeutic Proteins, Allergenics, Tissues, and Diagnostics. For comprehensive definitions of Core R&D Capability and Technology Sectors, review them in Technology Sector and Core R&D Capabilities Definitions.

It should be noted that, as expected, many targets within the FAS possessed multiple Core R&D Capability x Technology Sector combinations, therefore the following results cannot be interpreted in the context of numbers of targets within with the Core R&D Capability, Technology Sector or combination thereof, but rather the frequency of the Core R&D Capability by Technology Sector within the FAS.

University FAS Results

Full Analysis Set (FAS): Biologics-Focused Organization Landscape in the Kansas City Region

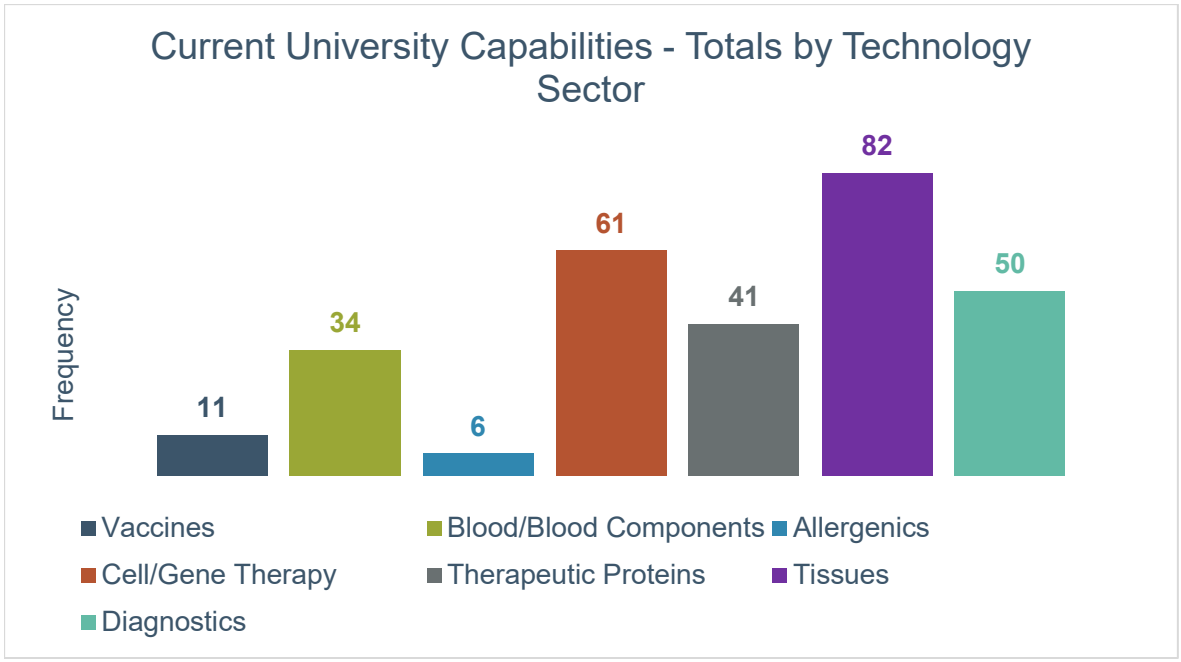


Figure 58. Current Total Capabilities by Technology Sector (n=82)

Of note, the most frequent Technology Sector capability observed within the 82 targets of the FAS was within Tissues, followed by Cell/Gene Therapy, and Diagnostics **(Figure 58)**. Within Core R&D Capability, the consistent focus on Tissue and Cell/Gene Therapy related technologies was also observed for Discovery (**Figure 59**), In Vitro/Bench (**Figure 60**), Biomanufacturing (**Figure 61),** and Analytical (**Figure 62**). Capabilities specific to R&D of vaccines (**Figure 69**), were surprisingly sparse given the large industry focus on the technology sector. Again, if the capabilities do exist at a higher frequency, they were poorly reported or communicated by the various targets.

In support of the paradigm that Universities typically occupy a much earlier role in product development, regardless of the technology, a consistent trend was observed showing relatively few capabilities exist within the region for Clinical Development, Commercialization and Regulatory interactions in comparison to the considerable capability that exists for Discovery level R&D, or if they do exist, information relaying these capabilities is not well communicated or published for public consumption. The FAS contained no targets which were identified as having any Regulatory R&D capability or expertise for any Technology Sector.

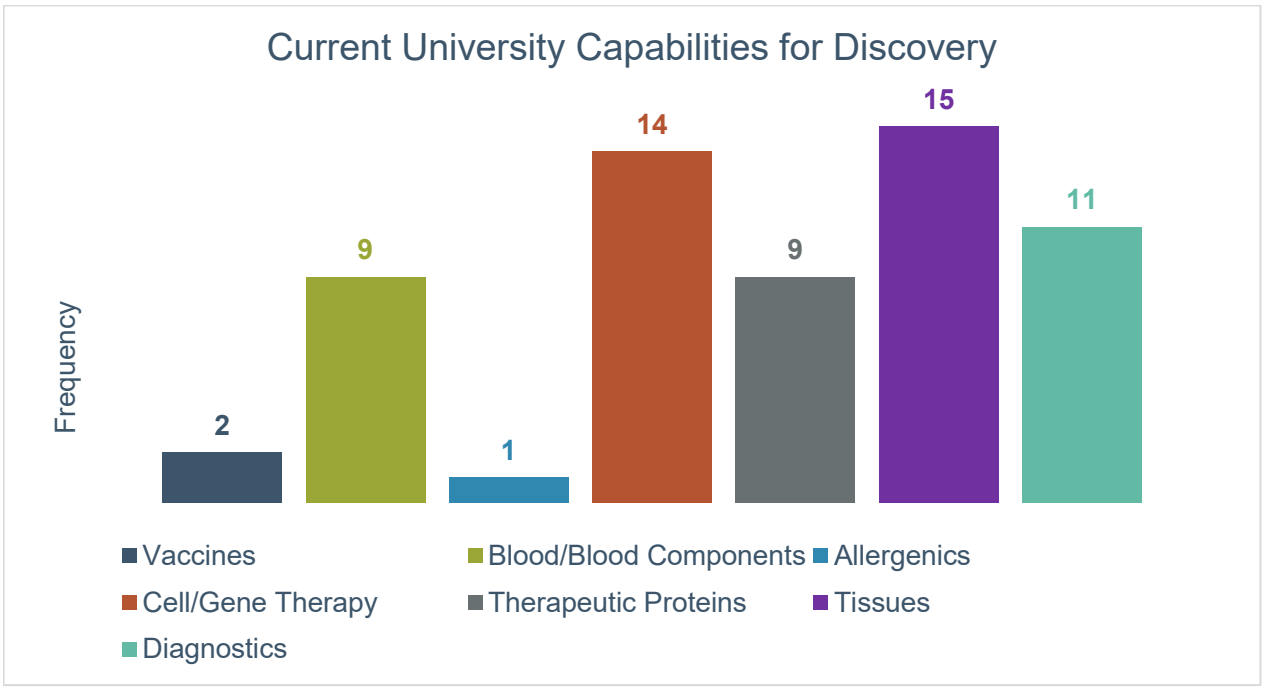


Figure 59. Current Total Discovery Capabilities (n=82)

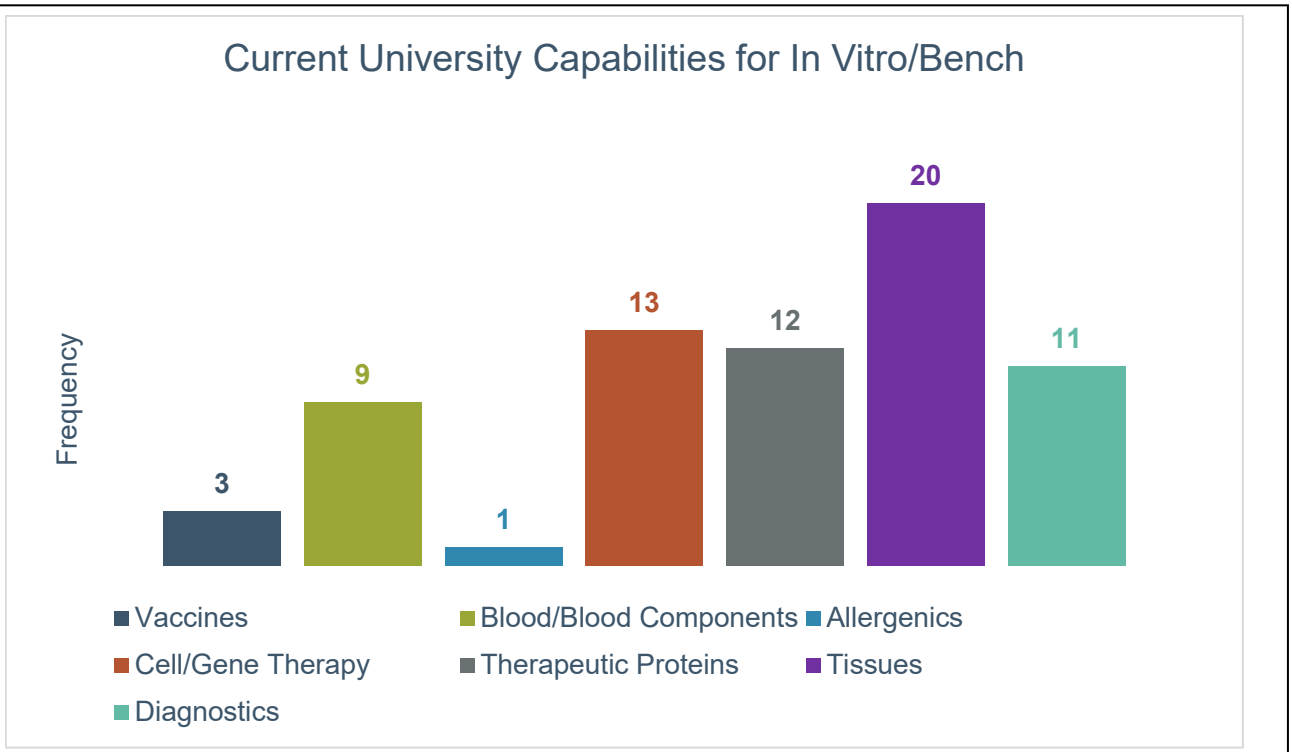


Figure 60. Current Total In Vitro/Bench Capabilities (n=82)

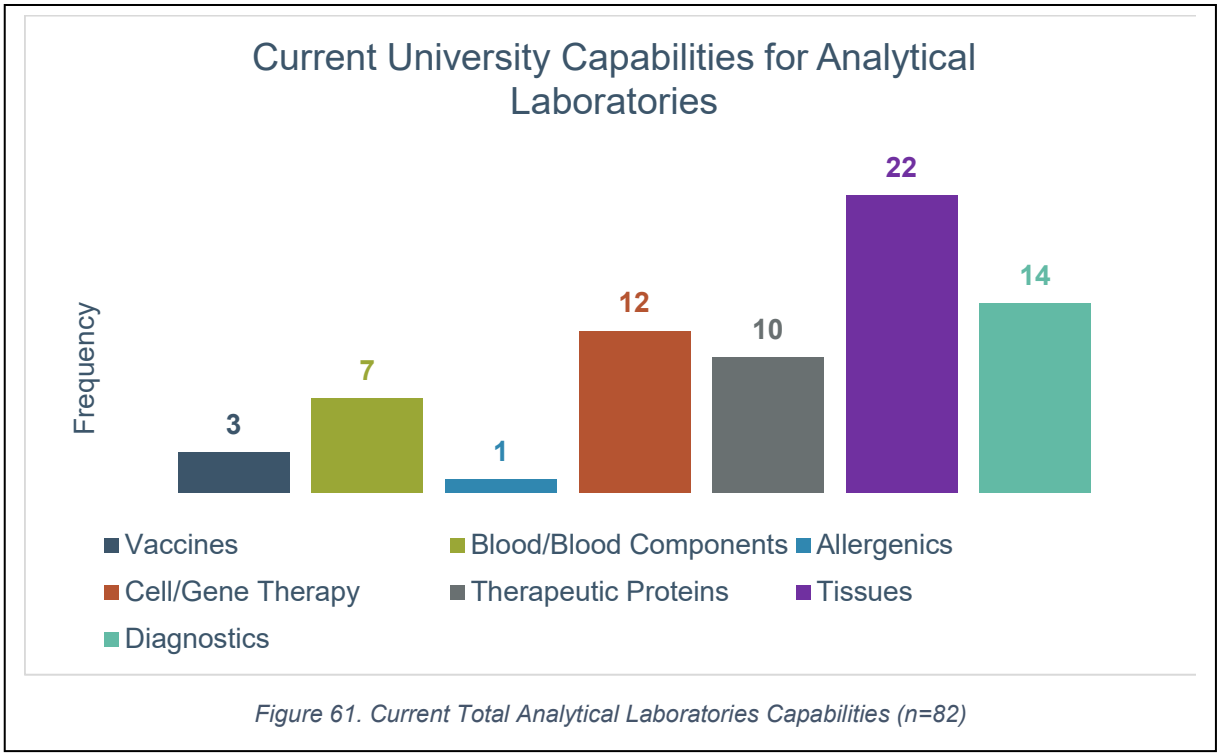


Figure 61. Current Total Analytical Laboratories Capabilities (n=82)

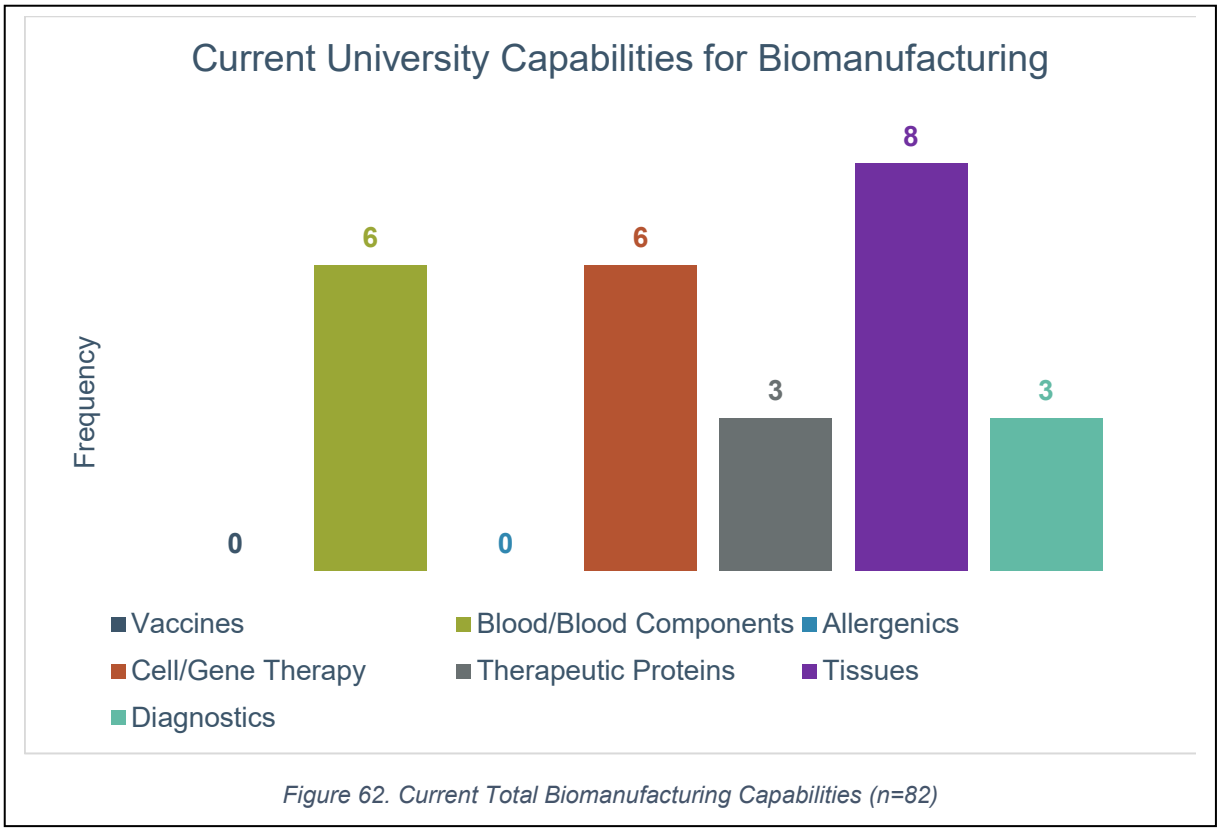


Figure 62. Current Total Biomanufacturing Capabilities (n=82)

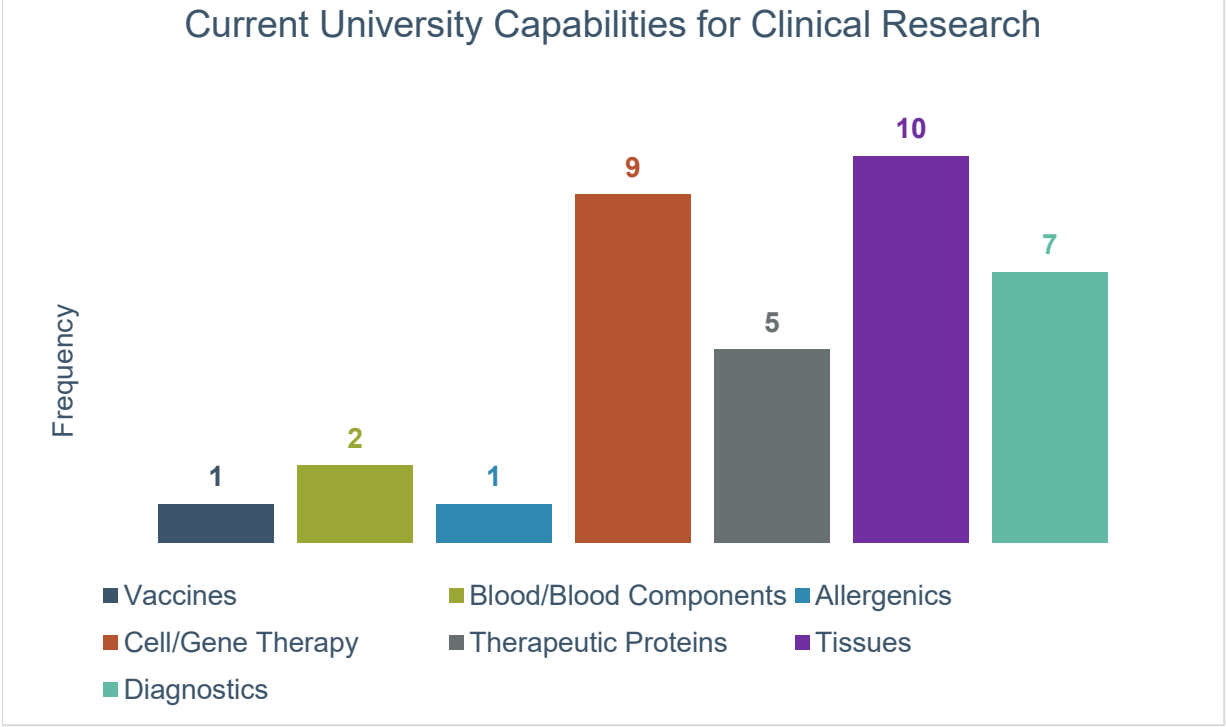


Figure 64. Current Total Clinical Research Capabilities (n=82)

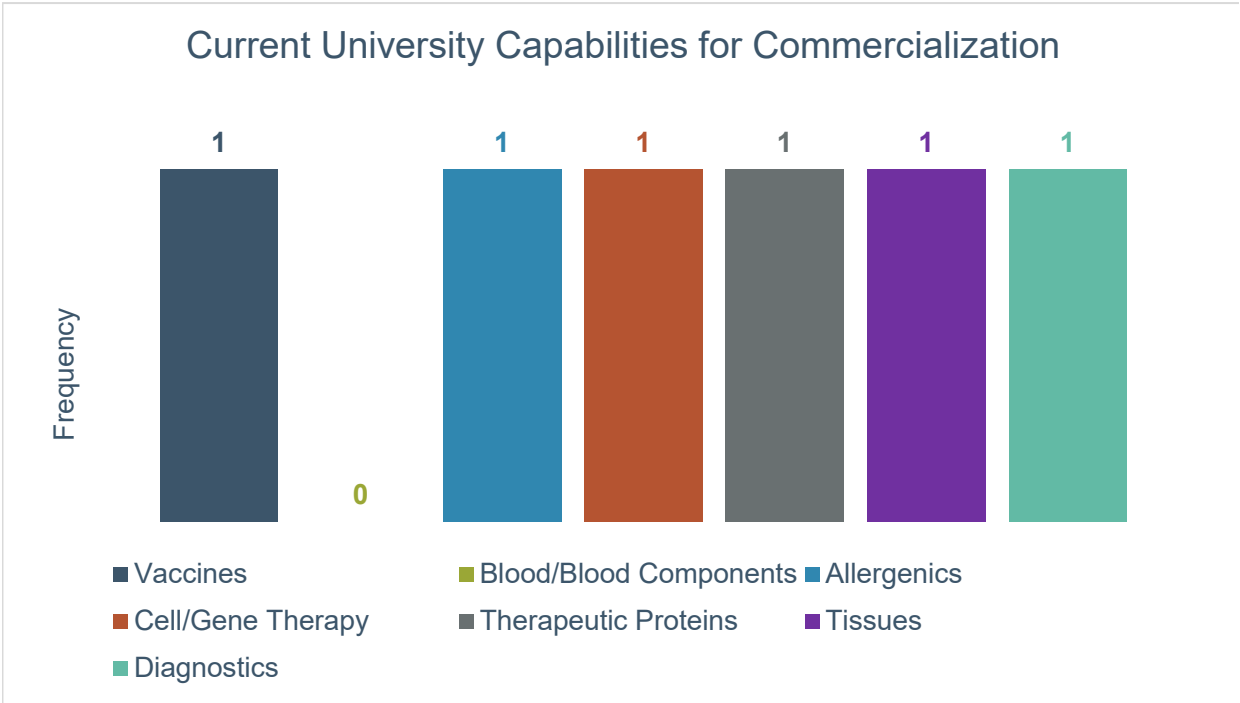


Figure 63. Current Total Commercialization Capabilities (n=82)

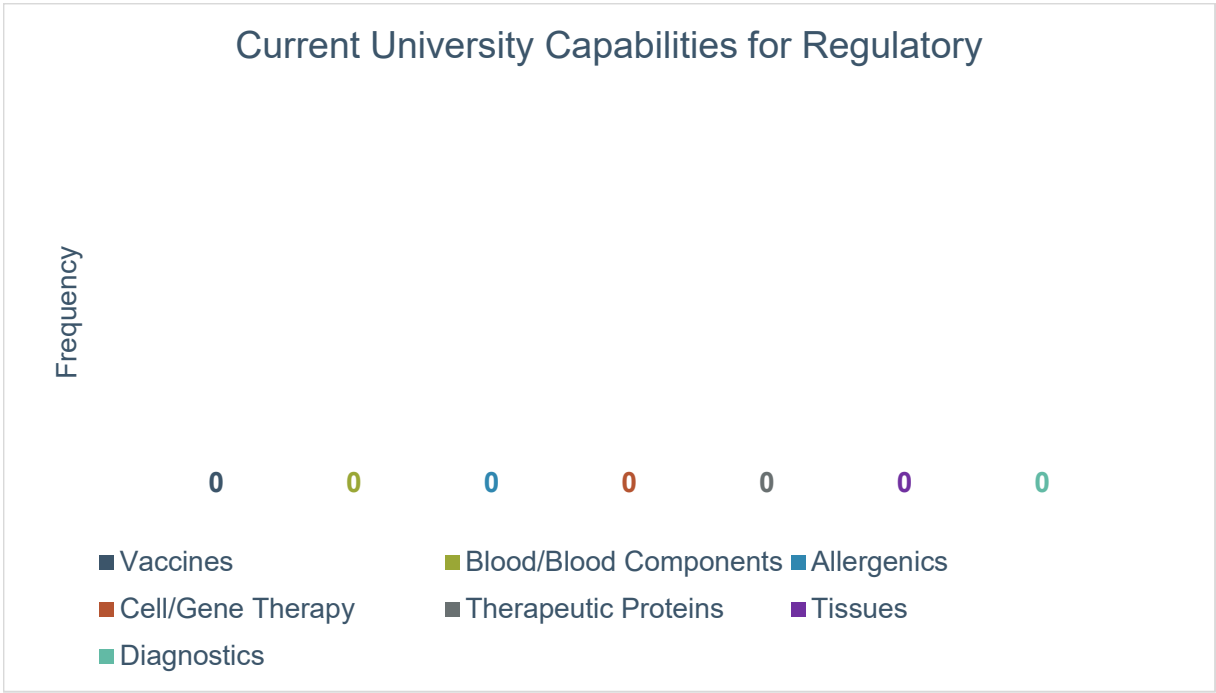


Figure 65. Current Total Regulatory Capabilities (n=82)

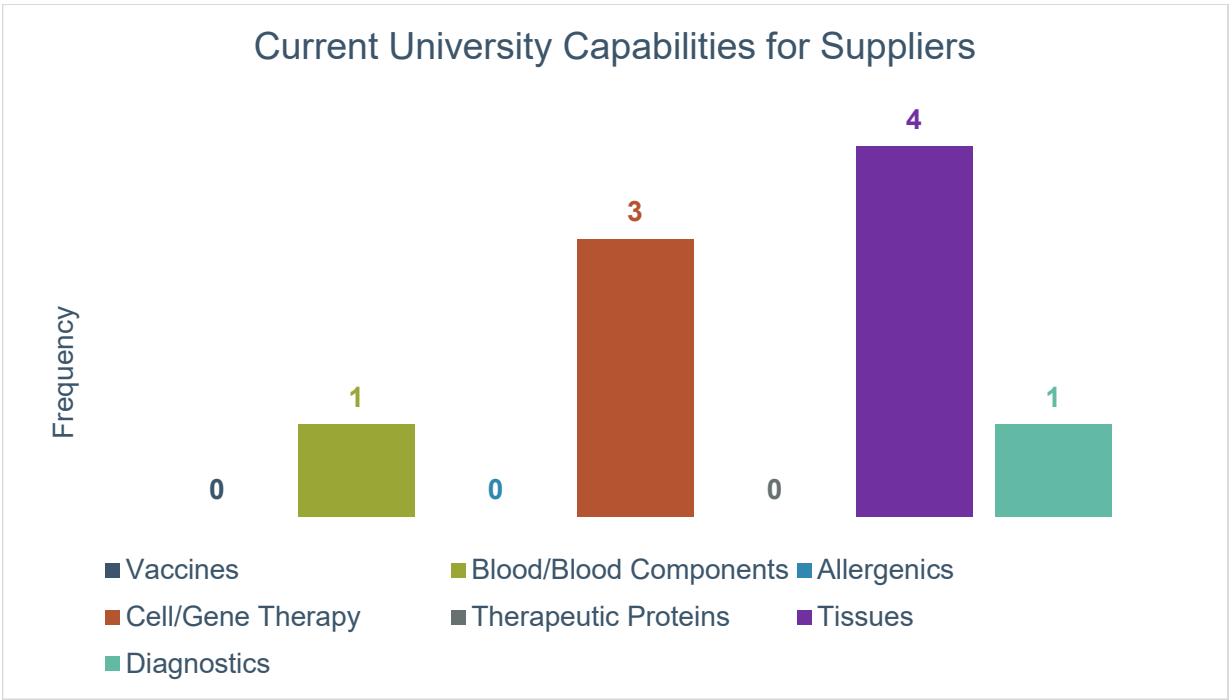


Figure 66. Current Total Suppliers Capabilities (n=82)

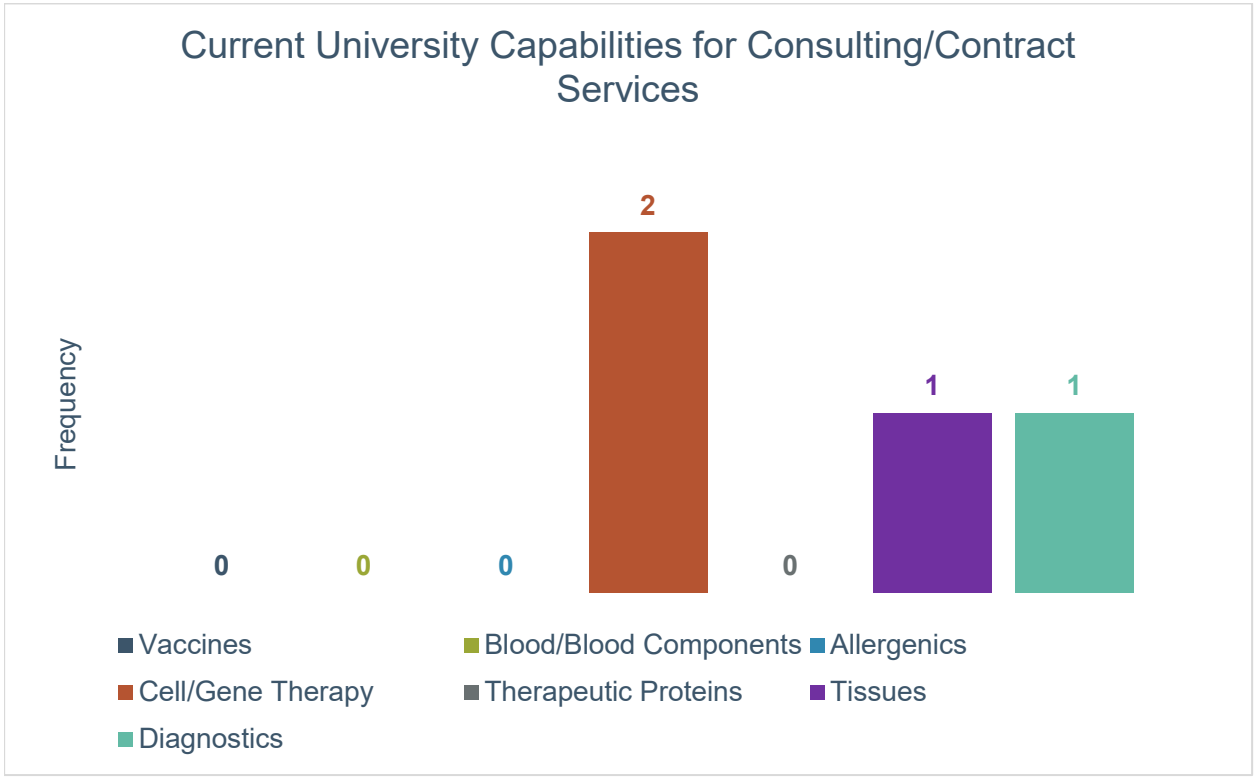


Figure 67. Current Total Consulting/Contract Services Capabilities (n=82)

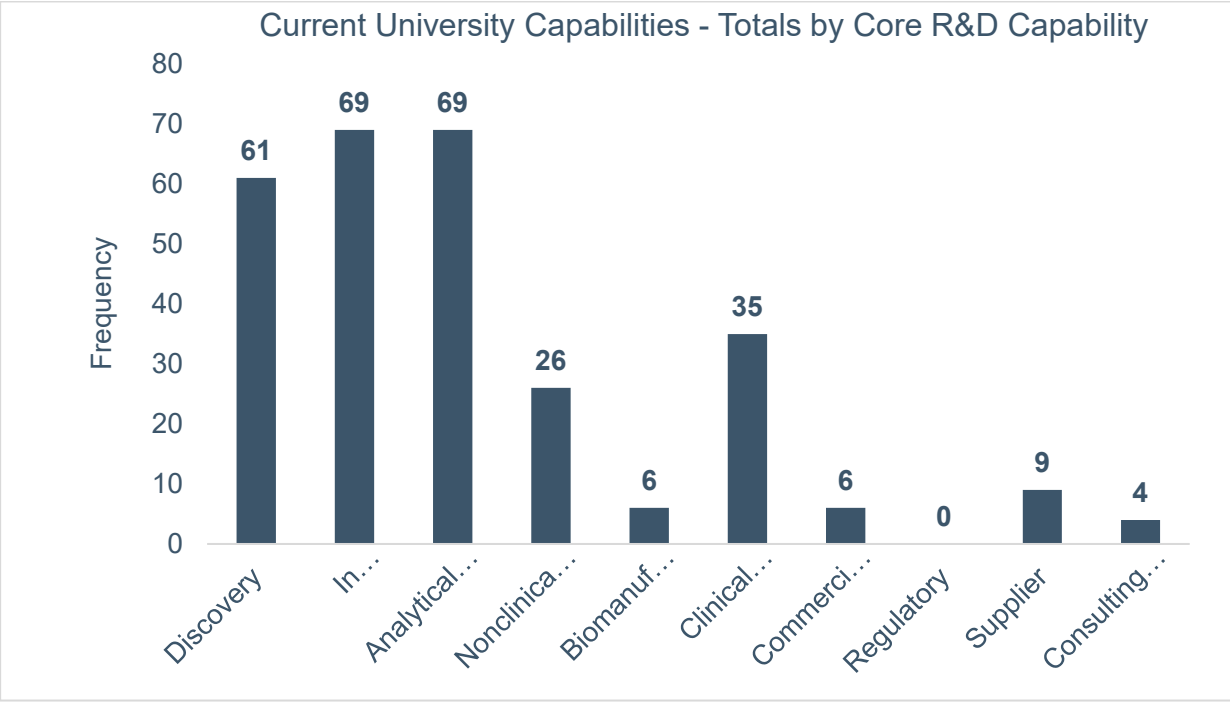


Figure 68. Current Total Capabilities by Service Type (n=82)

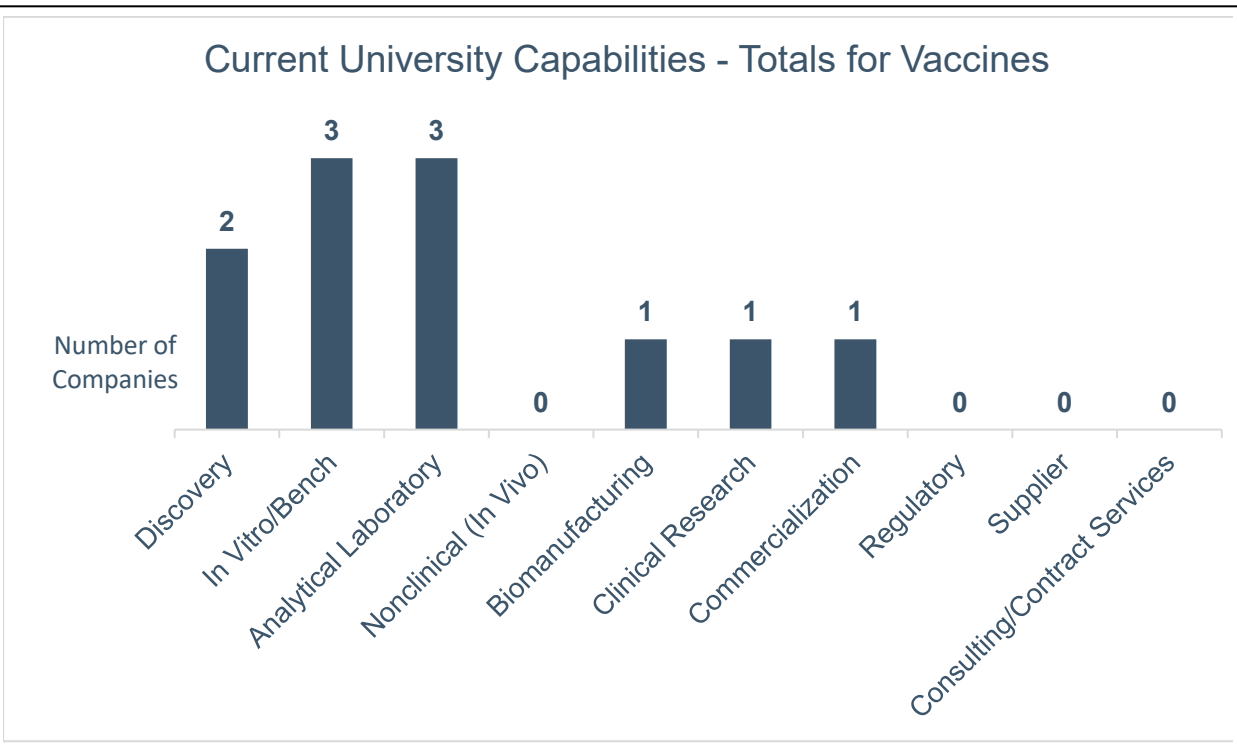


Figure 69. Current Total Vaccine Capabilities

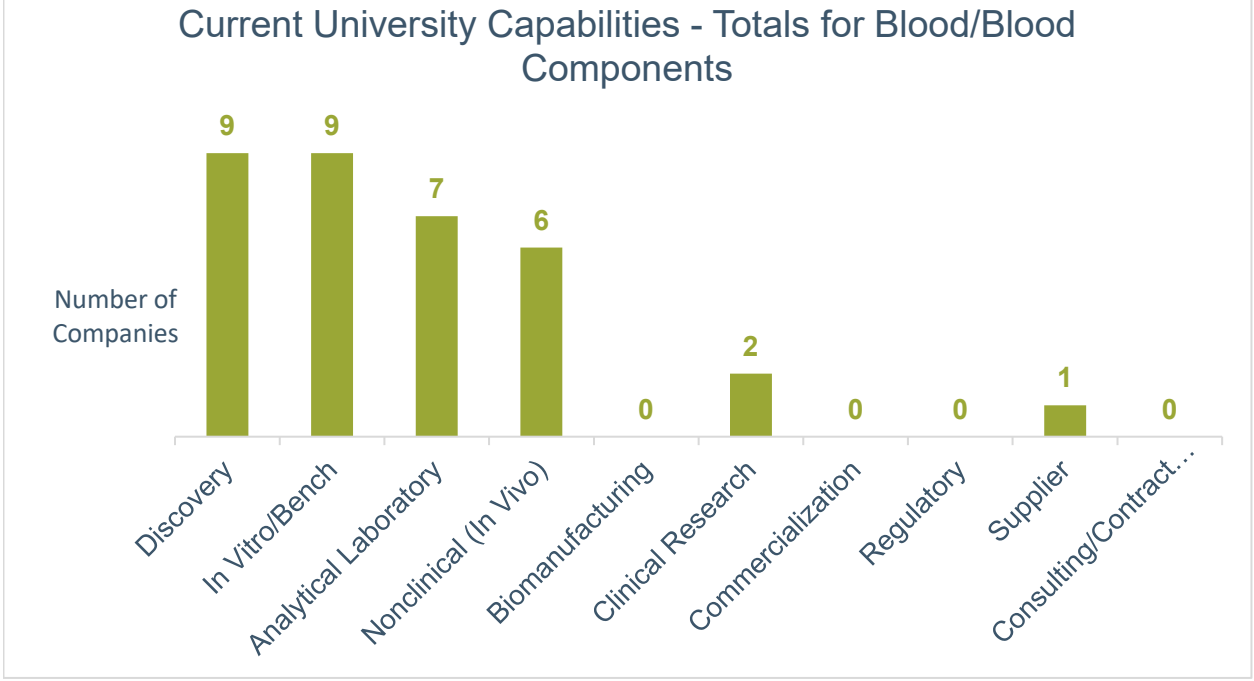


Figure 70. Current Total Blood/Blood Component Capabilities (n=82)

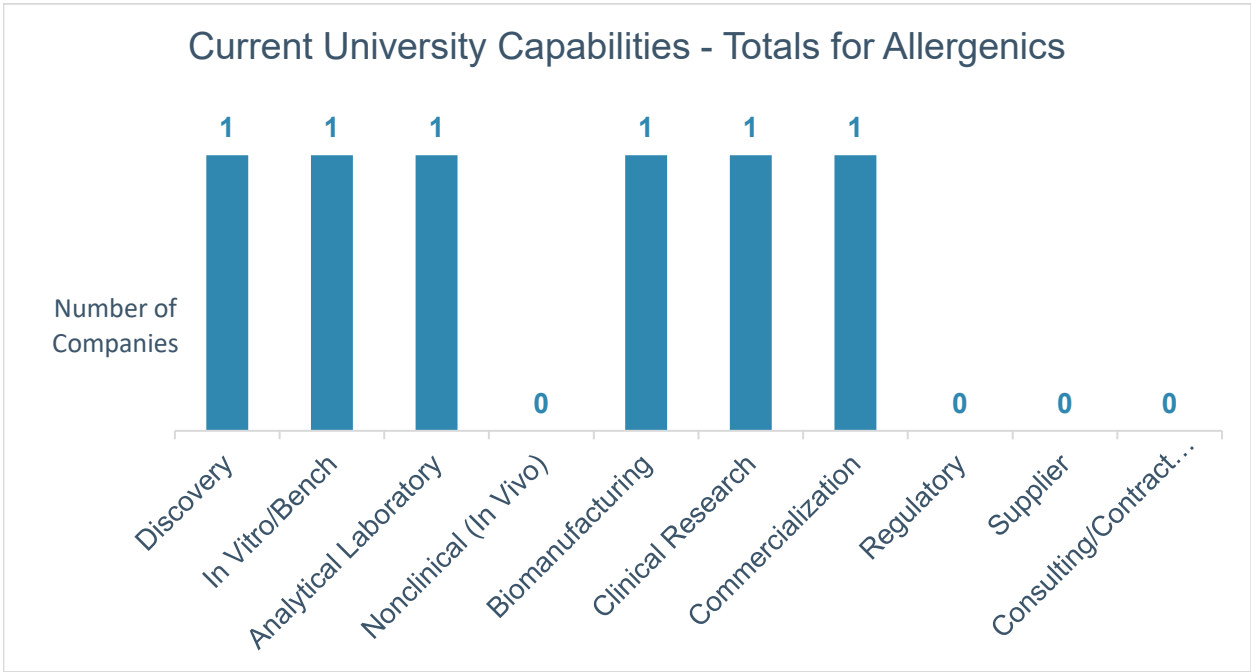


Figure 71. Current Total Allergenics Capabilities (n=82)

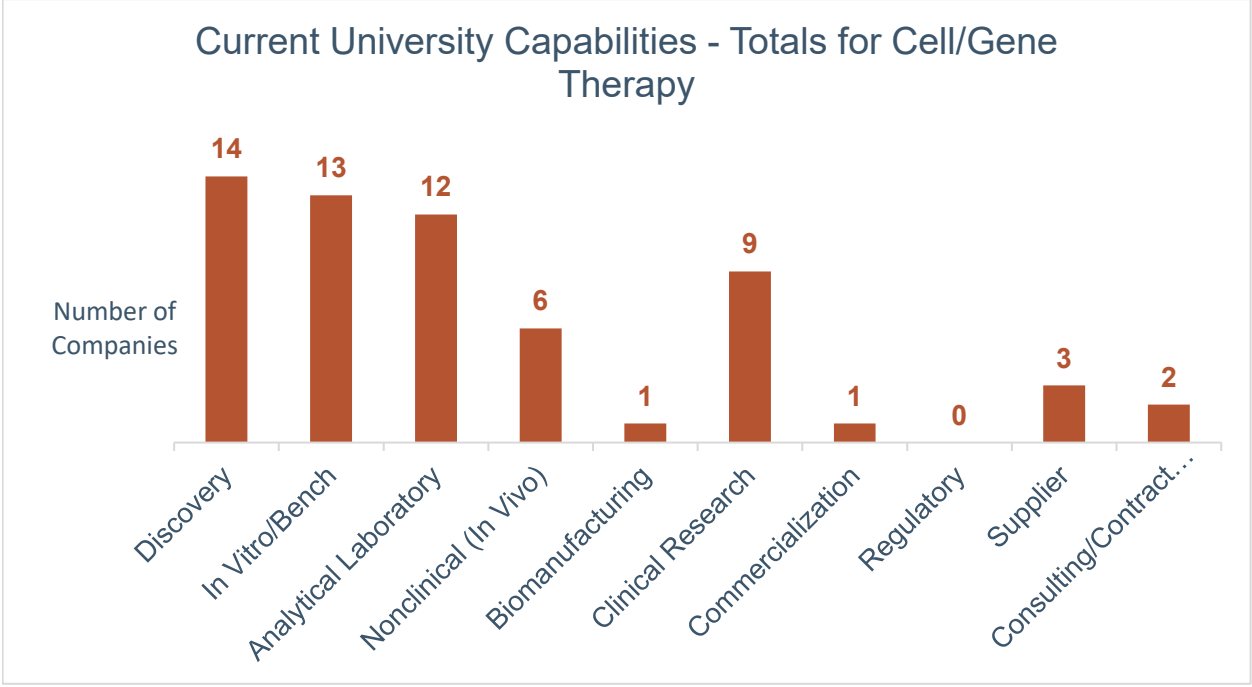


Figure 72. Current Total Cell/Gene Therapy Capabilities (n=82)

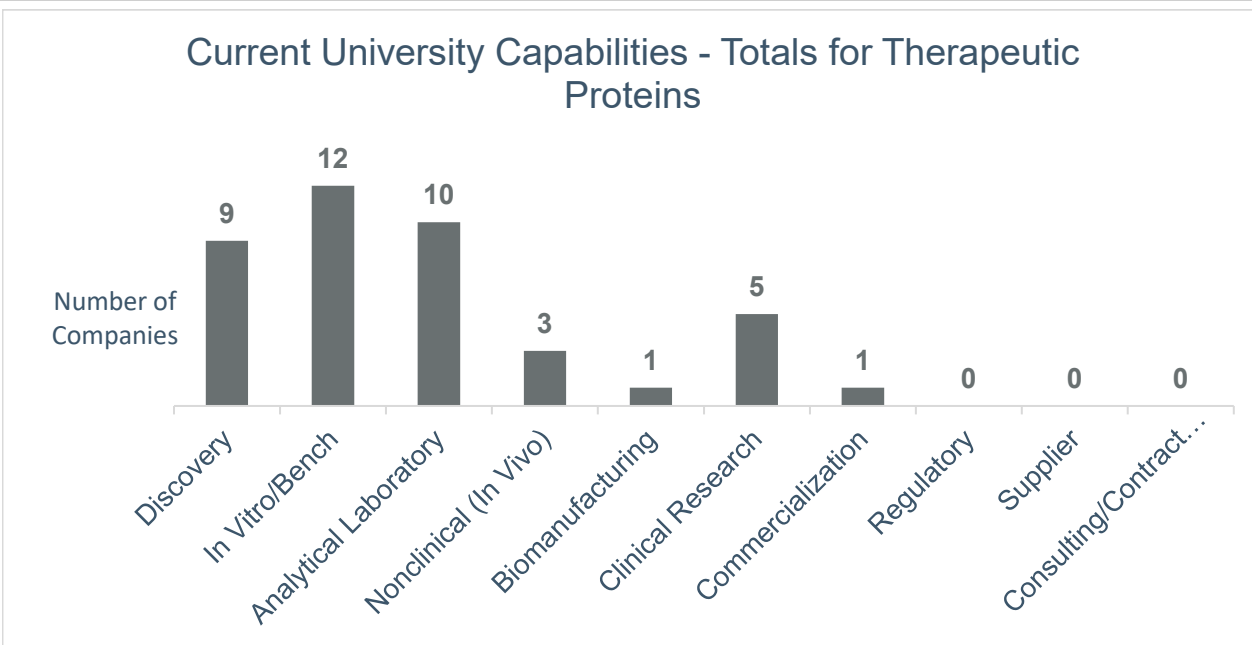


Figure 73. Current Total Therapeutic Protein Capabilities (n=82)

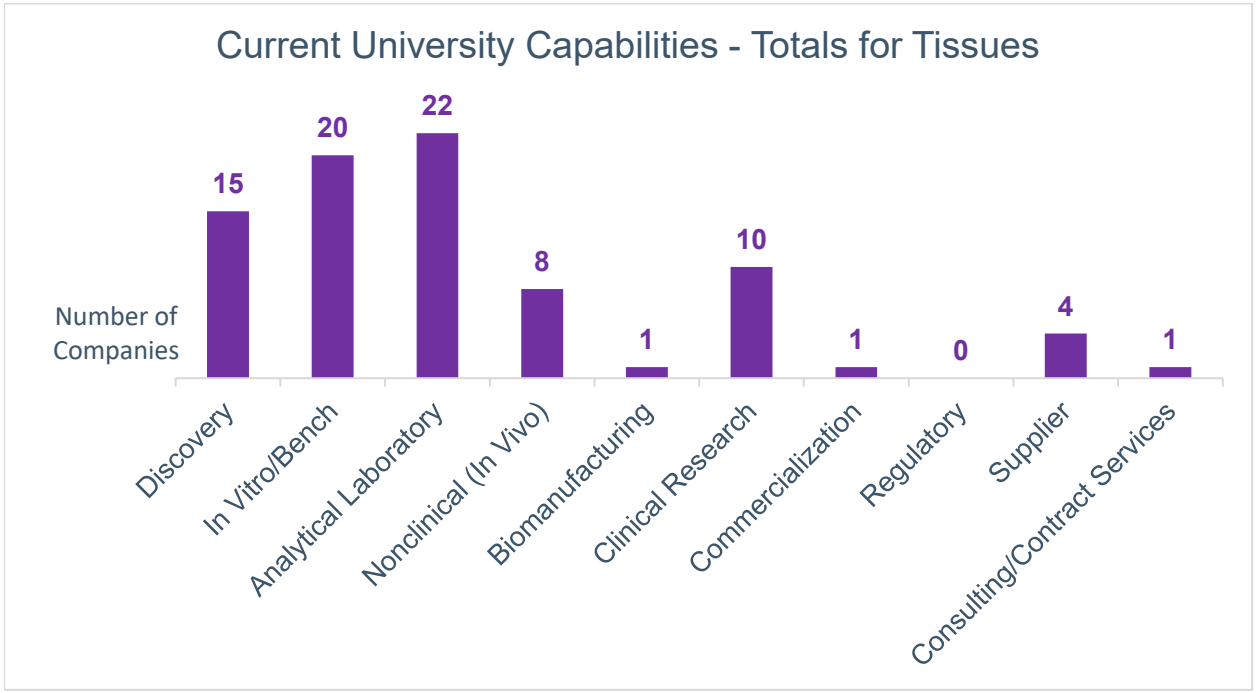


Figure 74. Current Total Tissue Capabilities (n=82)

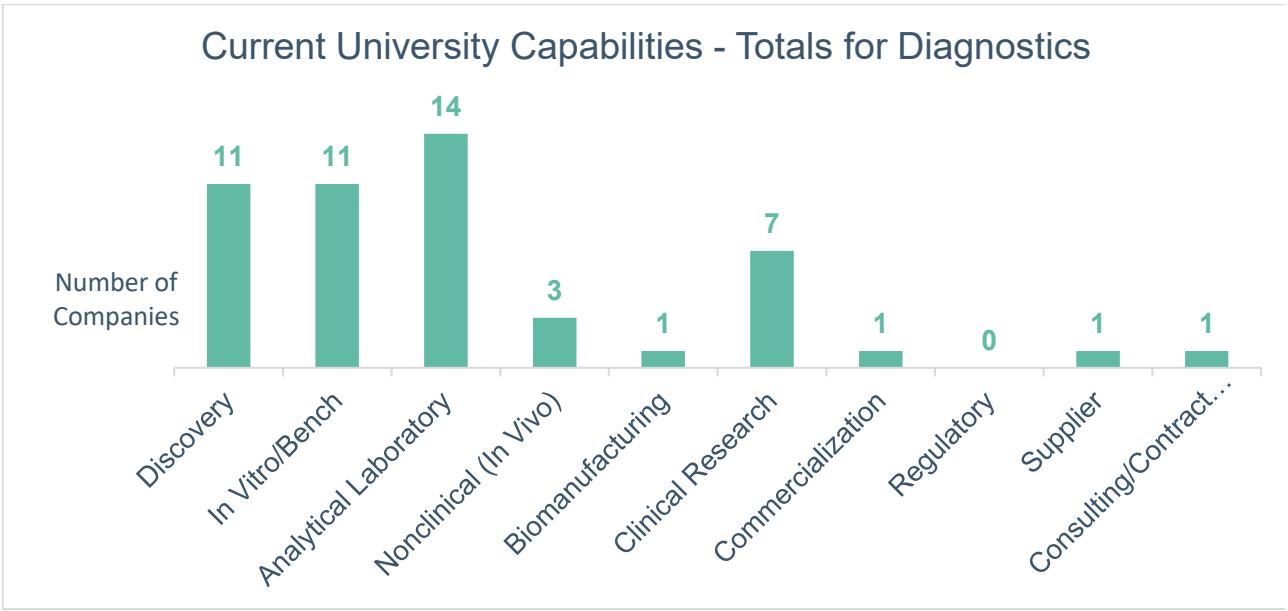


Figure 75. Current Total Diagnostic Capabilities (n=82)

Cohort II: External Perceptions

Cohort II Methods

485 individuals, identified as life science product development experts from the internal LBG contact database, were contacted via a direct email and asked to complete an online survey via a unique link, housed on the LBG Qualtrics platform. Given the subjective nature of much of the data and objectives of the Cohort II effort, the development of the questions for the survey was completed by LBG, with minimal input from BioNexus KC in an effort to mitigate contextual bias on the basis of intimate knowledge of the region and its stakeholders.

Inclusion Criteria

- Pre-screened as life science product development experts
- Respondents identified their primary location outside of the geographical area of interest
- >25% Completion of the questionnaire
- Was not considered a duplicate response (IP Screening).

Inclusion of Responses

- 47 of 56 Met Inclusion Criteria
- 7 exclusions for incomplete data
- 2 exclusions for responses from individuals inside the geographical region of interest.

Respondent Demographics & Independent Variables of Interest

The demographics of respondents to the Cohort II primary research efforts were considered diverse and balanced in terms of their affiliation with LBG **(Table 2)** and also their geographic location **(Table 3)**.

Organizations Classification of Respondents

Table 2. Organization classification of Cohort II Respondents that met inclusion criteria standards.

Organization Classification	Count
External	29
LBG Direct Affiliation	17
Not Provided	1
Grand Total	47

Location of Respondents

Table 3. Self-identified primary location of respondents

Location (Primary)	Count
California	6
Colorado	1
Connecticut	1
Delaware	2
Florida	1
Georgia	1
Maryland	6
Massachusetts	7
Missouri	1
Montana	1
Nebraska	2
New Hampshire	1
New Jersey	4
New York	2
North Carolina	4
Not Provided	1
OCONUS	1
Pennsylvania	2
Tennessee	2
Texas	1
Grand Total	47

Familiarity of Respondents with the KC Region

Respondents Previous Physical Interaction with KC Region

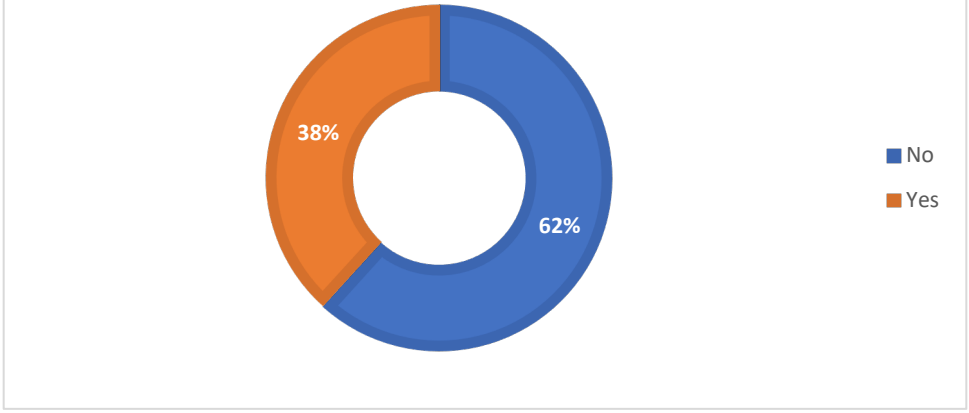


Figure 76. Response distribution to the question; "Have you ever lived in, worked in, or traveled to the greater KC region (extending from Manhattan, KS to Columbia, MO, inclusive of Wichita & St. Joseph, MO)?"

Of the 47 responses included in the dataset, 29 indicated that they had previously lived in, worked in, or traveled to the greater KC region (extending from Manhattan, KS to Columbia, MO, inclusive Wichita and St. Joseph, MO); **Figure 76.**

Biologics R&D Expertise of the Respondents

Though the targets of the survey were prescreened for varying levels of expertise and experience in Life Science product development, there was expected to be a significant variance in the degree of experience of the respondents in respect to the research and development of biologics. 89% of respondents indicated some degree of familiarity with the research and development of biologics and 73% of the respondents indicated that that they were Familiar or Extremely Familiar with the research and development of biologics, with Extremely Familiar being the most frequent selection at 45%. This indicates that the vast majority of respondents could be reasonably expected to be well informed on the landscape of the capability and capacity required for biologics R&D efforts.

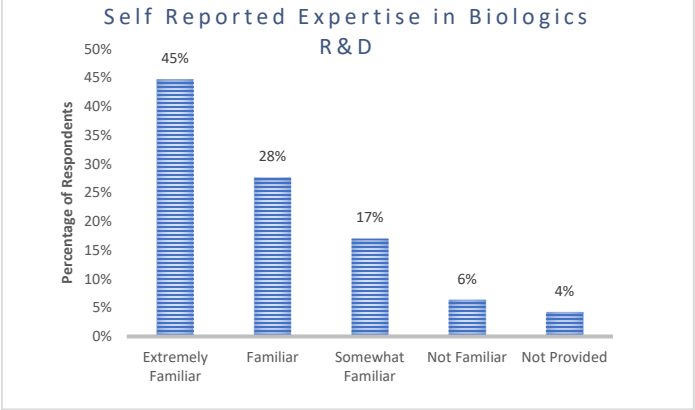


Figure 77. Distribution of self-reported expertise and experience with the research and development of biologics by respondents.

It should be noted that this question was strategically positioned at the end of the survey so that respondents were not able to consciously or subconsciously bias their responses throughout the

survey. It was hypothesized that if, for example, an expert in the field was truly unfamiliar with the KC Region's capability and capacity, they may tend to over report or compensate their responses if they had already indicated a high degree of familiarity with biologics R&D so as not to contradict themselves. No opposing negative effect of this strategy was anticipated.

Biologic Definitions Provided By Respondents

Biologic Definition Word Cloud

F

Listing of Definitions

45 Respondents provided a coherent, written definition of a Biologic which are listed below in **Table 4.**

Table 4 Written definition of the term 'Biologic' provided by Cohort II respondents.

Respondent Written Definition of a Biologic
Biological material or pharmaceutical drug product
Any product regulated by CBER or produced by a cell/organism.
Therapeutic protein, expressed from recombinant cells in a defined manufacturing process.
A biologic is a product derived from living organisms or components thereof.
Anything having to do with living organisms including things like vaccines and antibodies
A vaccine, therapeutic, treatment, additive, or technology derived from living sources, such as mammalian and non-mammalian cells, that is designed to nourish, protect, or improve human or animal health.
Biopharma material with medicinal capability for human or veterinary clinical use
Large molecule found naturally in organisms
A medication created from human derived or modified natural product

Respondent Written Definition of a Biologic
Usually protein therapeutics. More expansively, newer modalities such as cellular therapeutics, gene therapies, etc. Most expansively, same/similar modalities across industries (e.g., Agriculture).
Biologics (in terms of human health) include a wide range on naturally occurring or engineered natural products (proteins, nucleic acids, or complex mixtures) that have numerous applications (vaccines, monoclonal antibodies, cell and gene therapy, therapeutic proteins, etc.) in the treatment of medical conditions.
A recombinant protein or peptide, viral vector, cell or tissue therapy
Any research pertaining to biology such as small or large organic molecules.
A compound coming from nature (animal, plant, etc.).
A drug that is based on a biological process not chemical synthesis
A biologic is made from a living organism and can be used to impact the health of animals, plants, or humans. This encompasses vaccines, therapeutics, blood, and tissue products.
A product derived from a natural source used to treat or prevent diseases (antibodies, vaccines, gene therapy, etc.)
A large molecule, a biopharmaceutical
A drug or other product expressed by cells.
Related to biology; a drug that is produced from living organisms or components of living organisms are used.
Product originating from living material
A drug, Device, or therapeutic that originates from a biological process, such as cell culture and would exclude synthetically made materials
Therapeutic derived from live source
Biological products are a diverse category of products and are generally large, complex molecules. These products may be produced through biotechnology in a living system, such as a microorganism, plant cell, or animal cell, and are often more difficult to characterize than small molecule drugs.
A biologic is a vaccine or monoclonal antibody.
Therapeutics synthesized from living organisms such as hormones could be classified as a biologic
From a living organism, organic, (carbon based), synthetic replicate/copy of an organic compound
Something derived from a living organism and is used to treat disease
I think a biologic is a drug that interacts with your body rather than treating a symptom, like a vaccine.
A medication that can be biosynthesized.
Any product derived from a naturally occurring organism or whose action is directed toward altering or enhancing the function of a living system.
A molecule (enzyme, protein, antibody) that has been developed to interrupt a biological/physiological process to treat a disease.
Vaccines and therapies from living sources
Related to or derived from biology
Drug substance/ drug product used as therapeutics produced by biological means
Something is alive or part of alive system

Respondent Written Definition of a Biologic
FDA definition
Peptide, Polypeptide or Protein comprised of a linear length of amino acids, and often differentiated as a 'large molecule'.
A biologic is a protein or product derived from or containing living cells either by expression or as a product in its own right.
Protein or nucleic acid-based therapeutics, to include virus-mediated therapies, cell-based therapies, and proteins conjugated with small molecule payloads.
Any product sourced directly from a living entity.
A pharmaceutical drug based on a biological agent
Products produced in cell culture (microbial, fungal, mammalian) or obtained from biologic material such as blood.
Anything produced from biologic sources, particularly proteins, cell lines, genomic-based products, and antigens. Also, I follow the USDA and FDA guidelines for "biologic".
Vaccines, blood, and blood products, allergenics, somatic cells, gene therapy, tissues, and recombinant therapeutic proteins.

Accuracy of the Provided Definition of Biologics

Respondents were provided with the below definition of the term 'Biologic" and asked to indicate their opinion on the accuracy of the provided definition where "0" was a "Completely Inaccurate Definition and 100 was a "Perfect Definition":

"A biologic is a vaccine, therapeutic, treatment, additive, or technology derived from living sources, such as mammalian and non-mammalian cells, that is designed to nourish, protect, or improve human, animal, and plant health."

Figure 79 displays the distribution of responses to the accuracy of the provided biologics definition by the level of familiarity of respondents with research and development of biologics. Overall, strong agreement with the provided definition is shown across all levels of familiarity/ expertise with biologics research and development. The provided definition was identical to the definition prepared and utilized for the Cohort I Primary Research efforts. This data serves to validate that this definition is well received across levels of expertise and regions.

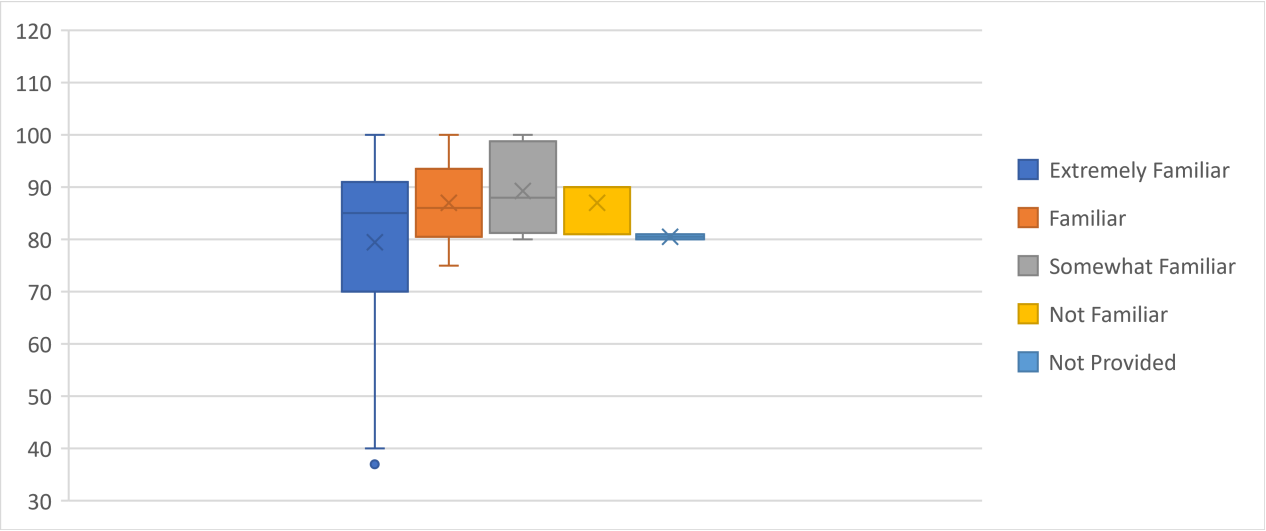


Figure 79. Box and Whisker plot displaying the distribution of responses to the accuracy of the provided biologics definition where "0" was a "Completely Inaccurate Definition and 100 was a "Perfect Definition" by self-reported familiarity with the Research & Development of biologics.

Dissenting Opinions of the Provided Definition

If a respondent indicated an opinion of the accuracy of the provided biologics definition less than or equal to 50, they were asked what part of the definition they found inaccurate. **Table 5** lists the 3 written responses provided by the 3 respondents who provided an agreement score ≤ 50.

Table 5. Written Dissenting Opinion of the Provided Definition of Biologics and corresponding Accuracy Score to the provided definition

Written Response	Provided Definition Accuracy Score
Do not agree with vaccines being included as industry definition of biologics mostly centers on it being used as a therapeutic	40
By trying to name too many specific examples of what the molecule is used for it's limiting and at the same time, when you say a biologic can just be a "technology" it's so broad that the definition isn't even accurate. Then when you say it has to be derived from "living" sources you also run into caveats by being overly opinionated about the bioengineering/manufacturing process.	37
There are many small molecules that are derived from cells and used in medical applications that are not biologics such as atropine, norepinephrine, etc.	50

Familiarity of Respondents with Core Aspects of the KC Region

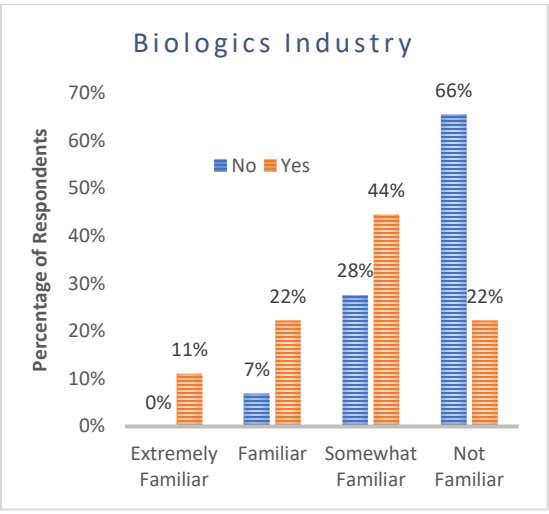


Figure 80. Familiarity of Respondents with KC Life Science Industry by Previous Physical Exposure to KC Region (Y/N)

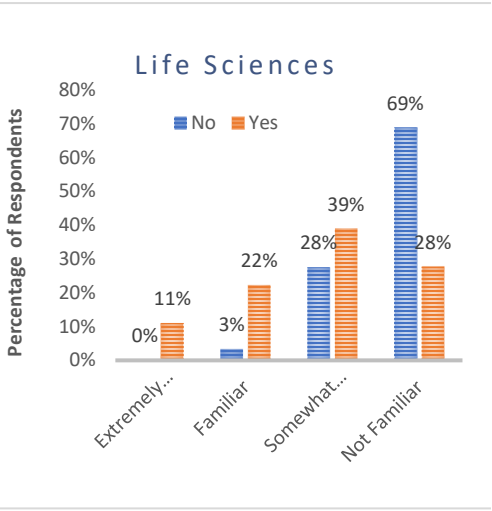


Figure 81. Familiarity of Respondents with KC Life Science Industry by Previous Physical Exposure to KC Region (Y/N)

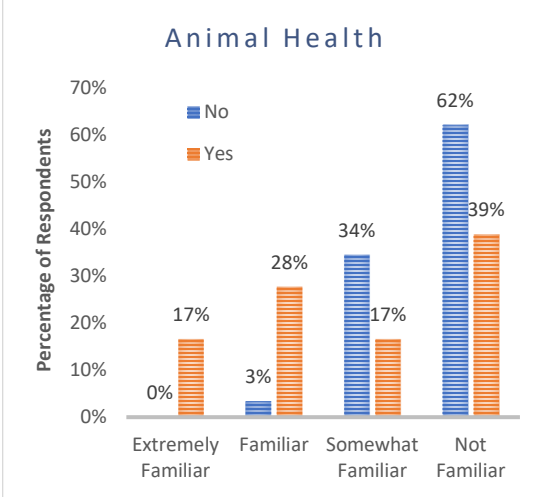


Figure 83. Familiarity of Respondents with KC Animal Health Industry by Previous Physical Exposure to KC Region (Y/N)

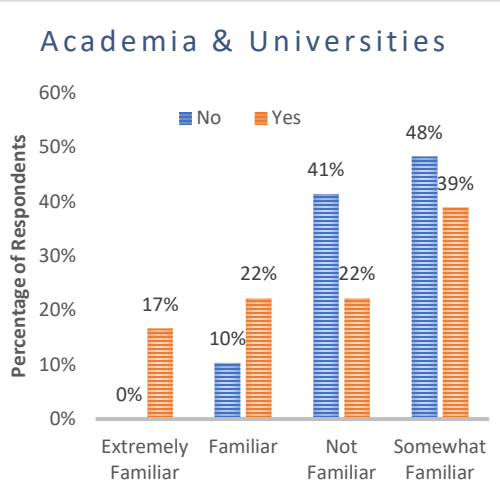


Figure 82. Familiarity of Respondents with Academia & Universities by Previous Physical Exposure to KC Region (Y/N)

As expected, familiarity of respondents with various aspects of the KC Region was heavily dependent upon their previous physical exposure to the area (lived, worked, or traveled to). *Of particular interest, respondents generally indicated that that they were the least familiar with the Life Science, Biologics Industry and Nonprofits and Industry Groups in the region compared to the other items queried and well over 50% of the respondents who had previous physical experience in the region were either not familiar or were only somewhat familiar with the Biologics and Life Sciences industry in the region.* As a control, respondents were also asked their familiarity with 2 items which were not related to the scope of this work but could be generally expected to be of interest to a wide array of the population. The selected items (Sports Teams and Food & Entertainment) confirmed the disparity in familiarity of the various core aspects between those with physical exposure to the region was not solely due to the subject matter (Biologics), as a comparable disparity was still present in the data. However, it also confirmed that, even among a population prescreened for expertise in life science product development, respondents nonetheless indicated a greater familiarity with these off-topic regional features than was indicated for the core features of interest (Biologics, Life Science Industry, etc.).

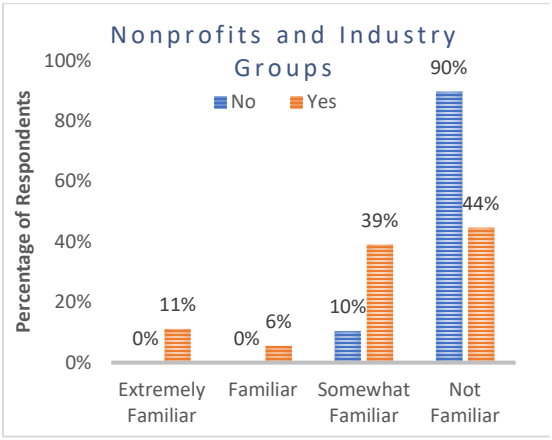


Figure 84. Familiarity of Respondents with KC Nonprofits & Industry Groups by Previous Physical Exposure to KC Region (Y/N)

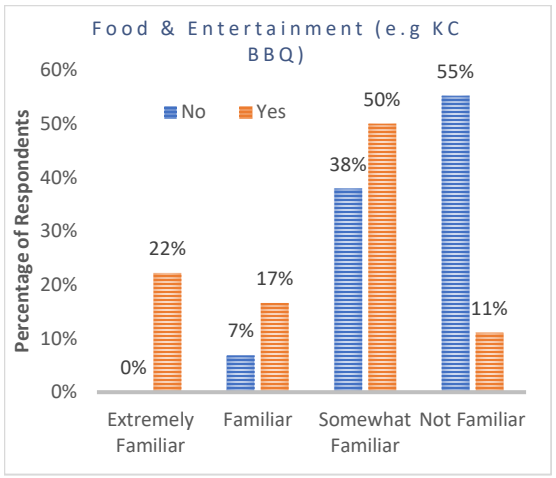


Figure 85. Familiarity of Respondents with KC Food & Entertainment (e.g., BBQ) by Previous Physical Exposure to KC Region (Y/N)

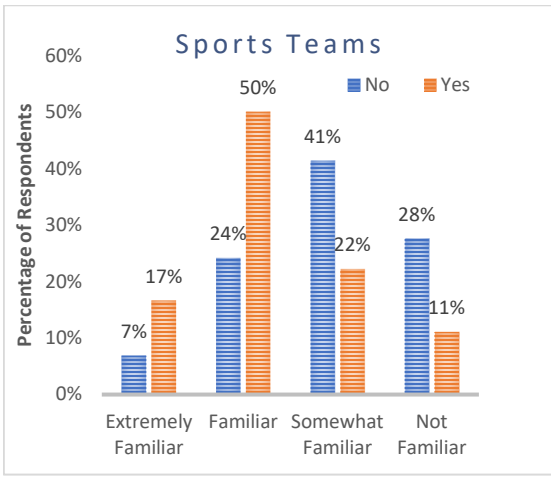


Figure 86. Familiarity of Respondents with KC Sports Teams by Previous Physical Exposure to KC Region (Y/N)

Perception of KC Regional Biologics Core Capabilities

For reporting, the perception of KC Regional Biologics Core Capabilities, data were filtered to include only those respondents who indicated some level of familiarity with Biologics R&D. Respondents were asked to rate the relative strength of each area by selecting a categorical value of either “Strength”, Neither Strength nor Weakness”, “Weakness” or “Don’t Know” to each Core Capability.

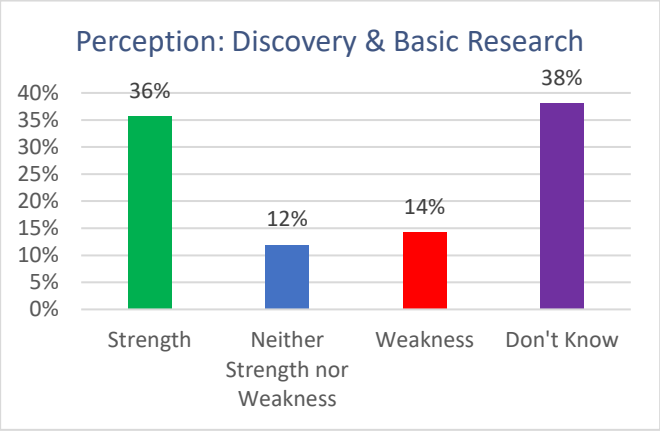


Figure 87. Strength / Weakness Perceptions of Cohort II Respondents for the KC Region concerning Discovery & Basic Research of Biologics R&D

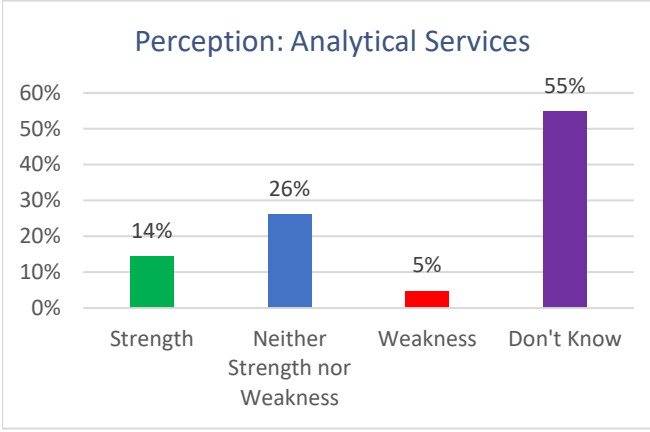


Figure 88. Strength / Weakness Perceptions of Cohort II Respondents for the KC Region concerning Analytical Services for Biologics R&D

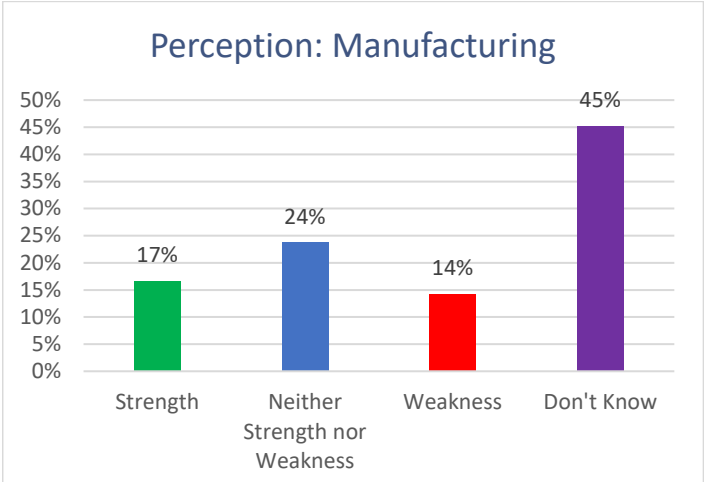


Figure 89. Strength / Weakness Perceptions of Cohort II Respondents for the KC Region concerning Manufacturing capabilities for Biologics R&D

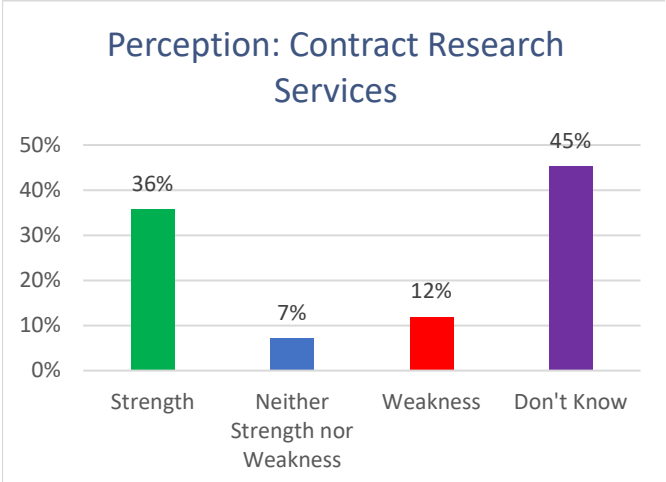


Figure 90. Strength / Weakness Perceptions of Cohort II Respondents for the KC Region for Contract Research Services for Biologics R&D

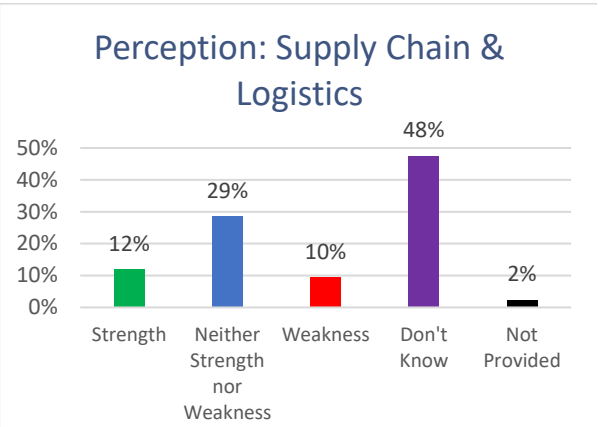


Figure 91. Strength / Weakness Perceptions of Cohort II Respondents for the KC Region concerning Supply Chain & Logistics capabilities for Biologics R&D

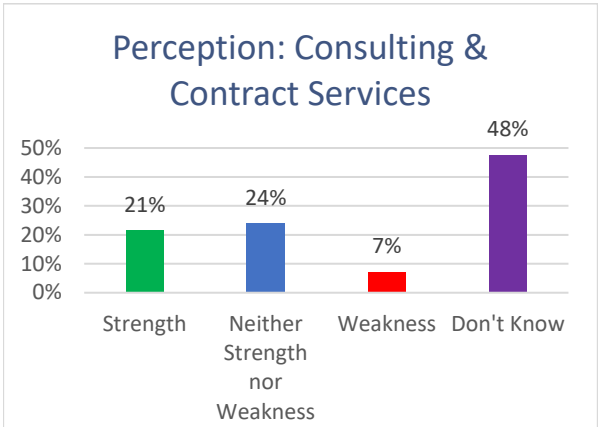


Figure 92. Strength / Weakness Perceptions of Cohort II Respondents for the KC Region concerning Consulting and Contract services for Biologics R&D

Perception of KC Regional Biologics Core Characteristics

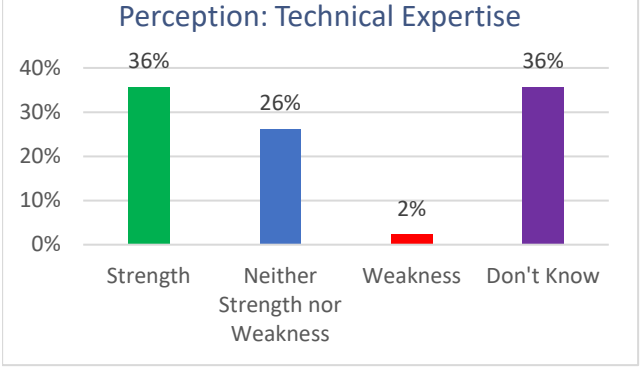


Figure 93. Strength / Weakness Perceptions of Cohort II Respondents for the KC Region concerning Technical Expertise

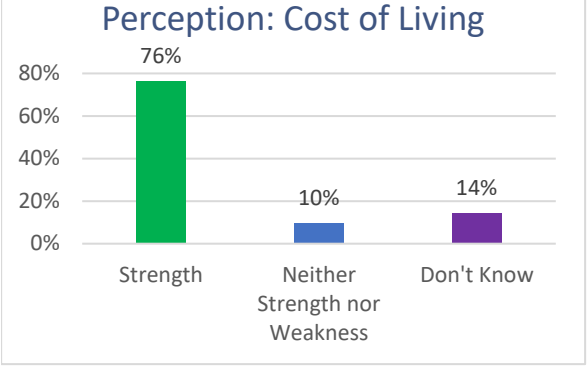


Figure 94. Strength / Weakness Perceptions of Cohort II Respondents for the KC Region concerning Cost of Living

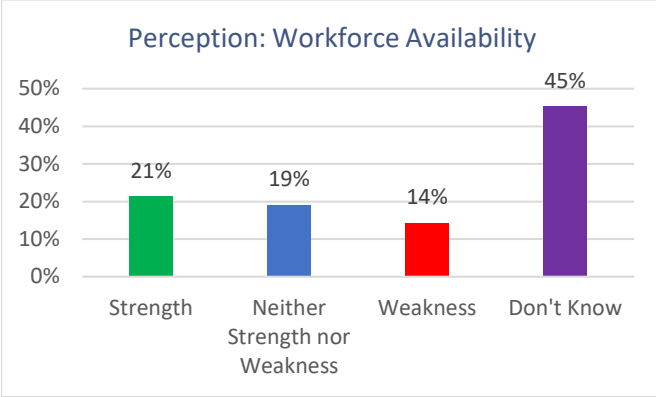


Figure 95. Strength / Weakness Perceptions of Cohort II Respondents for the KC Region concerning Workforce Availability

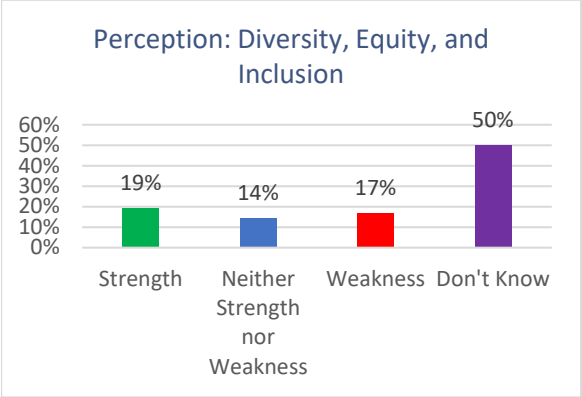


Figure 96. Strength / Weakness Perceptions of Cohort II Respondents for the KC Region concerning Diversity, Equity, and Inclusion

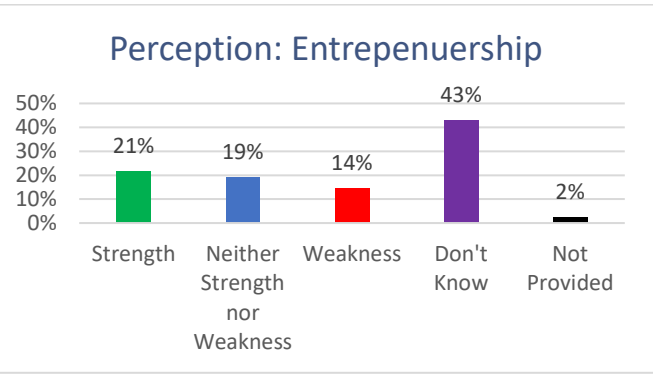


Figure 97. Strength / Weakness Perceptions of Cohort II Respondents for the KC Region concerning Entrepreneurship

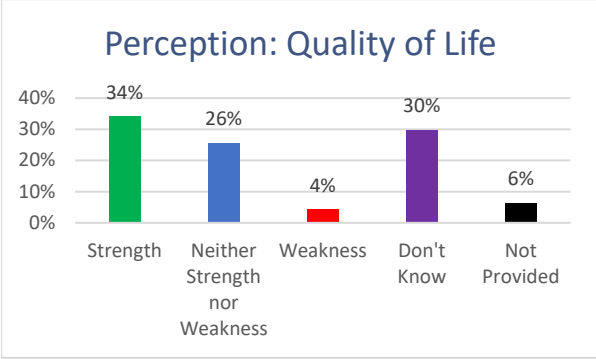


Figure 98. Strength / Weakness Perceptions of Cohort II Respondents for the KC Region concerning Quality of Life.

Perceptions of Growth

To assess the perception of future growth, respondents were asked to assign a likelihood to significant growth in the Biologics industry (>10%) in the next five years in the US. As shown below in **Figure 99** , the vast majority (87%) of respondents indicated that significant growth was highly or very highly likely in the biologics industry.

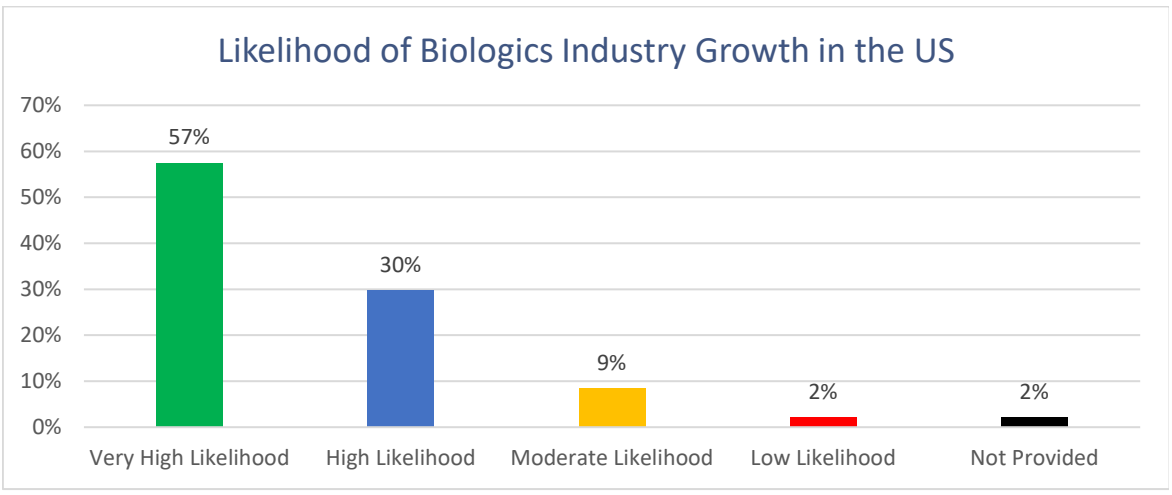


Figure 99. Likelihood of significant growth (>10%) in the biologics industry in the next five years. 87% of respondents indicated that significant growth was highly or very highly likely in the next 5 years.

To assess the respondent's perception on the capability and capacity of the KC Region to support the future expansion and growth of the Biologics industry, they were provided with the below statement and asked to indicate their opinion on the accuracy of the provided statement where "0" was a "Completely Inaccurate" and 100 was a "Perfect Definition":

"The Kansas City Region has the capability and capacity to support the growth of the Biologics industry."

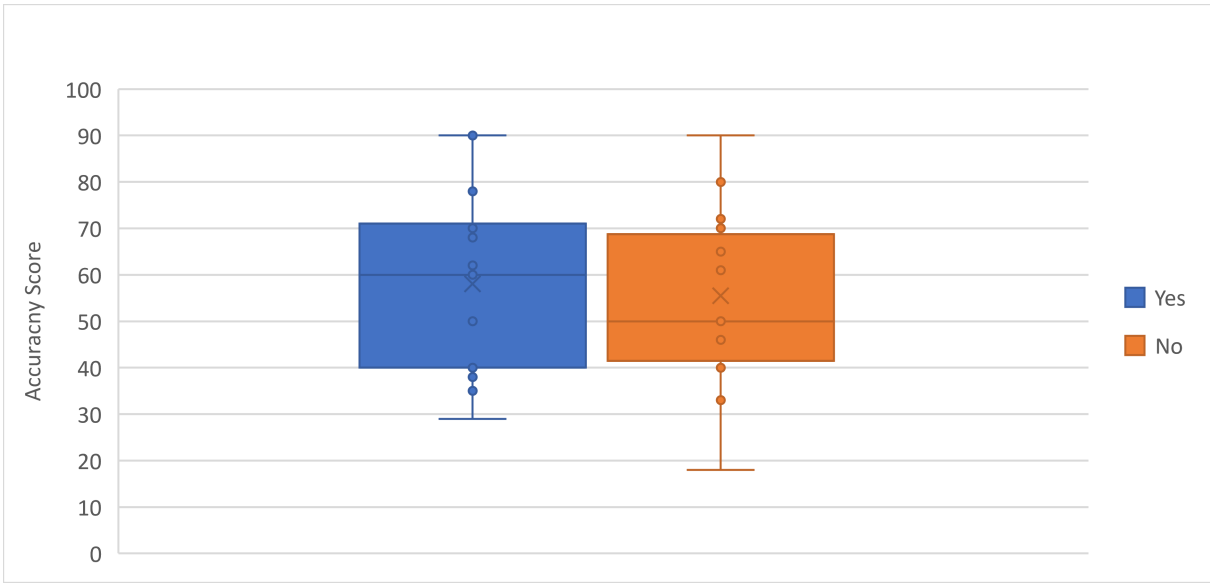


Figure 100. Box and Whisker plot displaying the distribution of responses to the accuracy of the provided statement ***"The Kansas City Region has the capability and capacity to support the growth of the Biologics industry"*** *where "0" was a "Completely Inaccurate" and 100 was "Extremely Accurate" by previous physical exposure to the KC Region (Y/N). Overall, regardless of previous physical exposure to the KC Region, respondents indicated a moderate agreement with the provided statement. The mean accuracy score was equal to 58 and 55 for those with and without previous physical exposure to the KC Region.*

Figure 100 displays the distribution of responses to the accuracy of the provided statement by the previous physical exposure to the KC Region of the respondents (previously lived in, worked in, or traveled to). Overall, moderate agreement with the provided statement is shown regardless of the respondents' previous physical exposure to the region, which was defined as previously living in, working in, or traveling to the KC Region. Though the exact nature of the hesitancy to agree strongly that the region is not able to support the growth, data gathered previously in the survey relating to the perceptions of the capabilities and capacities of the region, and most specifically, the perceived shortcomings may be used to gain insight into this research question.

Biologics Industry Landscape Assessment

General Industry Profile

Within the Kansas City region's biologics industry, 64% of companies are considered a small business, 36% of them are considered a large business (based on employee number) and a significant majority of the companies are private (87%). The interviews that were conducted are reflective of this, as 83% of the interviews were with small businesses and only two of the companies interviewed were public. Most companies, approximately 69%, are a service provider while 31% are a supplier/sponsor. There are very few companies that identify with other socio-economic classifications (e.g., women-owned, minority owned, LGBTQ+ owned, veteran owned).

Based on interview responses, companies in the region are primarily funded mostly by private equity (20%), angel investors (17%), and friends/family (15%). Given the high number of small businesses, funding via angel investors and friends/family was not a surprising finding.

Definition of Biologics

Overall, strong Cohort II respondents' agreement with the provided definition is shown across all levels of familiarity/expertise with biologics research and development. The provided definition for Cohort II was identical to the definition prepared and utilized for the Cohort I Primary Research efforts. The provided definition was developed as a result of multiple iterations with various subject matter experts internal to LBG and with input and consensus from BioNexus KC. This data serves to validate that this definition is well received across levels of expertise and regions.

Nevertheless, in review of biologics definitions submitted by Cohort I and II respondents (n=62), no two definitions were the same. This variability in defining the word "Biologic" presents a unique challenge for efforts which seek to influence the future of this sector in the region. While the umbrella term "Biologics" opens a wide array of opportunities or targets for which strategic initiatives can be planned and executed, a lack of focus and consensus may present challenges. Within the working definition of this effort and those gleaned from Cohort I & II respondents, there exists many discrete, key terms which correspond to specific capabilities and product types e.g., Vaccines, Antibodies, Recombinant Therapeutic Proteins, Cell & Gene Therapies, etc. Only 3 Cohort II respondents indicated a dissenting agreement with the provided definition, which are listed in **Table 5**. Perhaps the most inciteful response of the 3 was the following *"By trying to name too many specific examples of what the molecule is used for, it's limiting and at the same time, when you say a biologic can just be a "technology", it's so broad that the definition isn't even accurate. Then when you say it has to be derived from "living" sources you also run into caveats by being overly opinionated about the bioengineering/manufacturing process."*

Another striking anecdote was that during Cohort I primary research efforts, many individuals interviewed were surprised to learn that they were in fact involved in the research and development of biologics, as they themselves did not consider their scope of business within that realm.

It is apparent that the broad definition which was organically developed for the purposes of this effort was well received by a majority of subject matter experts and stakeholders which were engaged in Cohort I and II. Moreover, it was generally useful for encompassing the capabilities and capacities for which baseline/benchmarking data was sought (lab space, product types, etc.).

However, as stated above, a more surgical approach, which targets specific product types and the core technical services or capabilities to support them is warranted as strategic efforts are planned and executed.

Specific Capabilities

Therapeutic proteins capabilities were the most prevalent, with 162 instances of companies having capabilities in this area, followed by vaccines (143 instances), diagnostics (127), and cell/gene therapy (114). Allergenics capabilities were the least prevalent across all stages of development.

Most companies fell under the clinical research business type (~160 instances), followed closely by the discovery business type (~140), with the regulatory (~125) and nonclinical (*in vitro*) company types having the third and fourth most prevalence, respectively. This is in alignment with Cohort II responses that identified discovery/basic research, and contract research services as a strength of the region.

The companies that identify as a supplier are the only ones that do not have any focus on vaccine or therapeutic protein capabilities in-house (2 and 9 instances, respectively). Instead, these companies have a strong diagnostics focus.

It was found in the primary research that the highest reported amount of dedicated facility space was for cell/gene therapy products, with vaccine products ranked second and therapeutic proteins ranked third. This was expected and is in alignment with the region's capabilities profile which based on secondary research. There is some dedicated facility space, however, for diagnostics, but this is an outlier and seems to only be related to companies that identify as suppliers.

Primary research demonstrated that most of the companies in the biologics industry (68%) outsource work in some capacity. Most of them outsource both inside and outside of the region, but it was expressed that there is preference to outsource within the region, although this is often driven by specific company needs.

Workforce Profiles

It was found that a majority of the region's biologics workforce are C-suite level, including chief executive officers, vice presidents, chief scientific officers, and executive directors. It was expected to find a larger number of employees in the middle and lower management/scientists tier, but these results are reflective of the large presence of smaller companies in the region.

Educational profiles of the workforce were evenly split amongst doctorate, master's, and bachelor's degrees. This is to be expected as work within the biologics industry is highly technical and is in line with Cohort II response in that there is a perception that the technical expertise is a strength of the KC region.

While it was shown that there is an even distribution of males and females in these organizations across education levels, there is not an even distribution of males and females across levels within the organizations. Men occupy more of the workforce at all levels (based on average reported percentages), although the gap between males and females in business support roles is less than other levels/titles.

While primary research showed that there is a belief that there is adequate expertise within the region (47% agree,18% strongly agree), the key challenges reported were related to finding qualified applicants, followed by adequate staffing, and employee retention. The educational institutions in the region provide and attract ample technical expertise, but the perception is that many entering the workforce leave the region upon graduation from these institutions before returning several years later. This was further validated by Cohort II responses that there is not a clear perception of workforce availability in the region. This may contribute to the higher concentration of C-suite employees in the area.

Diversity, Equity, and Inclusion

While 46% of interviewees stated that Diversity, Equity, and Inclusion is of high importance to the workforce and 50% stated that DEI has a very strong impact on company success, most companies in the region have minimal DEI programs/policies with only 30% of the interviewed companies stating that they have a policy that specifically prohibits discrimination based on ability, veteran status, sexual orientation, gender identity or gender expression. The high number of small businesses in the regional biologics industry likely impacts the demonstrated lack in DEI initiatives. Many interviewees stated that they do value DEI, but do not have anything formal in place.

Of the 6 core characteristics of the region which Cohort II respondents rated as strengths or weaknesses, DEI was most frequently indicated as a weakness for the region, which further demonstrates that the KC Region is not known for putting a high level of focus on DEI initiatives.

Regional Biologics Industry Growth

Potential growth of the regional biologics industry is indeed a high likelihood as most of the interviewed companies are also in active development of at least one new product, have plans to launch many of these products and are looking into infrastructure or geographic expansion (approximately 66% of interviewees plan to expand), as well as forming additional strategic partnerships or participating in mergers or acquisitions. This aligns with the strong perception, inside and outside of the region, that there is a high likelihood that the regional biologics industry will grow, but there are mixed feelings on adequate support within the region for said growth. The understanding is that those who reported the perception of little or moderate regional support do not think the extra steps (“red tape”) that one must take to receive such support is worth the growth that comes from it.

Additionally, it is perceived both inside and outside the region that the cost of living is a clear strength of the area, while the quality of life has mixed reviews. There were concerns noted of being a landlocked region and lack of entertainment in the area as this is perceived to be a reason why many young professionals look for work outside of the area.

Cohort II demonstrates an opportunity for the regional biologics industry. When asked questions regarding perceptions of the industry, the most common response (for all questions except the cost of living) was “Don’t Know”. The KC Region would benefit from additional marketing and networking efforts that educate others on the local biologics industry and promote collaboration with other organizations outside of the region (thus raising awareness).

Peer Metros

LBG performed secondary research to assess how the identified peer metro areas of Omaha, NE, Des Moines, IA, Pittsburgh, PA, and Indianapolis, IN qualitatively compared to the KC region.

Omaha, Nebraska

Omaha is home to the University of Nebraska Medical Center which contains the Nebraska Biocontainment Unit, commissioned in 2005 by the CDC as one of only a few biocontainment units in the US. Additionally, within the College of Medicine is the Biologics Production Facility, providing an environment compliant with Good Manufacturing Practices (GMP) regulations, intended for the manufacture, processing, cryopreservation, and/or storage of cells, tissues, and cellular and tissue derived products for administration to humans, such as bone marrow, peripheral blood stem cells, cord blood cells, and vaccines. To leverage these and other regional capabilities in the Omaha region, the University of Nebraska Medical Center and University of Nebraska Omaha teamed up to create UNeTech, an entrepreneurial support organization established to foster public-private partnerships between regional startups and research centers. Connections provide startup assistance, laboratory use, technology development, research support, and more.

In research conducted by Bio Nebraska, the bioscience industry (in the state of NE) in general, grew by 4.5 percent between 2016 and 2018. Within the bioscience industry, the state is specialized in its concentrations of three industry subsectors—agricultural feedstock and industrial biosciences; bioscience related distribution; and medical device manufacturing. The state's research universities conducted nearly $374 million in bioscience-related R&D in 2018. From 2016 to 2019, there was an increase in NIH funding (~15% increase) as well as venture capital investments ($29.8M in 2019) in the state. Additionally, between 2016 and 2019, a large number of patents were created for the plant health sector, including novel plant variants (241) and agricultural chemicals (11).

The greater Omaha region possesses several large companies and startups within the biologics space such as American Laboratories, ADM, Bayer Crop Science, Becton Dickinson (BD), Huvepharma, and Zoetis. Their key strengths are in the areas of plant health, agriculture, and animal health.

Des Moines, Iowa

Iowa is a leading force in Plant Health (development of bioproducts, crop genetics), Human Health, and Animal Health. Des Moines is an R&D location for several global companies, including Eurofins Scientific and Bayer Crop Science. Including other cities near Des Moines such as, Ames, Cedar Falls, Cedar Rapids, and Iowa City (similar in geographic distribution to the KC Region used in this report) captures the research capabilities of the Iowa State University and it's College of Veterinary Medicine, the University of Iowa, its academic medical school, the University of Iowa Hospitals and Clinics, and the University of Northern Iowa. Relevant capabilities associated with the University of Iowa alone, include: the FDA-Approved GMP Drug & Biologic Production Facility, the Center for Advanced Drug Development, the Center for Biocatalysis and Bioprocessing, the Center for Bioinformatics & Computational Biology, the Holden Comprehensive Cancer Center, the Center for Gene Therapy of Cystic Fibrosis & Other Genetic Diseases, and the Transgenic Animal Core & Vector Core Facilities.

Ames is a hub for animal vaccine development with the presence of USDA research facilities conducting animal health research, the ISU College of Veterinary Medicine, the USDA National Animal Disease Center, and associated USDA Animal & Plant Health Inspection Service (APHIS) National Veterinary Services Laboratory (NVSL), as well as the USDA Center for Veterinary Biologics be located in Ames.

In addition to the area's robust academic institutions, according to IowaBio: "Iowa's bio-based economy encompasses the development of industrial enzymes, livestock genetics, seed genetics, human gene research, nutraceuticals, pharmaceuticals, advanced bio-composites, biomass technologies and healthy foods/beverages. Iowa is home to global companies known for developing new plant hybrids for grains, leading genetics for beef and dairy production and many contributions to the rapid expansion of enzymes used for ethanol bio-processing."

The biologics industry in this area appears to be growing at a rapid pace and is suited to continue competitive growth in the area of biologics R&D. Many strengths of the Des Moines region are congruent to many emerging capabilities in the KC Region and therefore the greater Des Moines area can be viewed as a direct competitor to the KC Region in this regard.

Pittsburgh, Pennsylvania

Pittsburgh is a global life sciences hub and hotspot for innovation. The Pittsburgh region's life sciences industry is poised for further growth, featuring a vast network of research universities, a growing pool of startup companies with massive research capabilities and funding from USG agencies and VC, as well as established Fortune 500 companies. In 2019, alone, 139 tech startups in the region had received $3B in funding. The University of Pittsburgh and Carnegie Mellon University are two major medical and technical research centers in the area. As of 2019, the University of Pittsburgh had received $546.4M in NIH grants from 1,116 awards; they were ranked 6th nationally in NIH funding. Since 2015, Carnegie Mellon University has been awarded multiple contracts for federal funding from the Department of Defense totaling over $2.7 billion.

The 2021 Global Startup Ecosystem Report (GSER) by Startup Genome and the Global Entrepreneurship Network, ranked Pittsburgh #23 in the report's list of Emerging Startup Ecosystems. Pittsburgh attributes this success to a strong partnership between InnovatePGH, Innovation Works, and the Pittsburgh Regional Alliance as well as a culture of collaboration and partnership unseen in other cities. InnovatePGH is a next generation public-private partnership built to accelerate Pittsburgh's status as a global innovation city through collective leadership of civic leaders, the University of Pittsburgh, Carnegie Mellon University, and other regional philanthropic institutions. Innovation Works is the Pittsburgh region's most active early-stage investor and one of the nation's top investors in early-stage technology startups. Along with investing more than $100 million into the tech startups of the region, they provide emerging companies with assistance and the network to customers and other investors that startups depend on to launch, scale up, and reach their next stage of development and growth. The Pittsburgh Regional Alliance attracts strategic investment opportunities and diverse talent to the Pittsburgh region, supports the growth of existing regional businesses, and assists companies that have an interest in investment in the Pittsburgh region by providing services such as real estate identification, data and information support, and connections to local employers, schools, and government at no cost to the company.

Additionally, the ecosystem in Pittsburgh is touted as being conducive to life science growth due to a growing amount of lab-office space, research capabilities with a funding framework in place to foster innovation and development, strong public-private partnerships, and universities (namely University of Pittsburgh and Carnegie Mellon) with high enrollment numbers in the life-sciences fields have put Pittsburgh on a major growth trajectory in the field of life sciences over the last 20 years. During this period, a total of 923 startups have launched in Pittsburgh with the University of Pittsburgh Innovation Institute cultivating 183 startups alone. Pittsburgh's position as a life science hub is positioned for further growth.

Indianapolis, Indiana

Indiana is a premier contract drug development and manufacturing center in the United States, home to pharmaceutical contract service providers supporting the growing outsourcing needs of both large pharmaceutical and smaller biotechnology companies. Indiana as a whole has seen a double digit increase in Biotech jobs over the last 5 years. Nearly 40 contract research and manufacturing organizations employ more than 7,000 workers throughout the state. Companies like Covance Central Labs (Indianapolis), Catalent Biologics (Bloomington) and B2S Life Sciences (Franklin) provide pre-clinical testing, toxicology, product manufacturing and other support to pharmaceutical companies worldwide.

In 2021, Indiana's life sciences industry experienced strong growth in the attraction and expansion of life science companies across the state. Twenty-three companies committed to invest over $500 million and hire 2,100 employees. Of those 23 companies, nine committed to invest over $10 million each and two others will invest over $100 million in new Indiana facilities. Many of the major announcements in 2021 included companies focused within the biologics sector and within or very near to Indianapolis (e.g., Stevanato Group, List Biotherapeutics, Exelead, Genezen Labs). Further, Indianapolis is the home to Elanco Animal Health, Corteva Agriscience, Cargill, Archer Daniels Midland (ADM), and Pioneer Hi-Bred International.

Indianapolis's proximity to Purdue University (West Lafayette, IN) and its College of Veterinary Medicine as well as Indiana University (Bloomington) and its School of Medicine are advantageous for furthering research capabilities but also in providing an educated workforce. Additionally, with the unveiling of the Indiana Biosciences Research Institute in 2013, there has been a state-government led commitment to strengthening the biotechnology and health sectors within the state of Indiana.

The Indiana Biosciences Research Institute is a statewide public-private partnership advanced by BioCrossroads and led by Indiana's life sciences industry, with support from the State of Indiana and partnerships with Indiana's research universities to discover, develop and deliver biosciences innovations in Indiana. The Institute serves as the centerpiece project of the BioCrossroads public-private collaboration through its attraction of world-class scientific leaders and life sciences research dollars to Indiana, while focusing on human health solutions. The Institute also draws on a life sciences industry cluster that is one of the largest and most diverse in the nation, with global companies that are developing next-generation drugs and pharmaceuticals, diagnostics tests, medical devices, cell-based therapies, agricultural biotechnology and animal health and production solutions.

Kansas City, Missouri

The KC Region is an established global leader in animal health, drug development, diagnostics, contract research, clinical and nutrition research, as well as innovation and production in the life science and biotech industries. The KC area is situated near large productive universities engaged in animal and human health research; The University of Kansas Medical Center, the University of Missouri School of Medicine and College of Veterinary Medicine, and the Kansas State University College of Veterinary Medicine all provide the region with a large pool of talented life science professionals. Additionally, there are numerous smaller academic institutions, such as UMKC School of Medicine and Kansas City University of Medicine and Biosciences, adding expertise to the workforce.

Beginning in 2003, BioNexus KC has commissioned an industry census of life-science companies in the KC Region every three years. In 2021, the census identified 286 companies in the KC Region, employing an estimated 35,000 people in the area. Human health-focused companies accounted for two-thirds (68%) and animal health-focused companies represented roughly one quarter (23%) of the companies in the KC Region. In comparison, plant and crop science-focused companies, comprised a relatively small portion (9%) of the total regional life sciences company portfolio.

The KC Region has a healthy mix from large to small start-up companies. In 2021, 13 companies in the region had in excess of 500 employees, and 88 companies reported having five or fewer employees. This is not surprising considering the KC Region has a large number of academic research assets serving as incubator hubs, as well as a robust angel investor, and growing venture capital network.

Although the 2021 census reported, for the first time since the report's inception, a decline in the number of companies in the region over the long term, the region has seen a net increase of 87 companies since 2006, a 44% increase. Given the abundance of expertise from the educational institutions in the area, the attractive cost of living, and support in the area, the KC region is poised for further growth in the life science space.

Conclusions

The main objective of Cohort I was to identify and inventory any life science-related companies within the region that are performing research and development in biologics, while the main objective of Cohort II was to gain a better understanding of the outside perception of various attributes of the KC region bioscience hub from those who do not live or work in the region. Key strengths of the region include:

- The KC region is well-known as an innovation hub for human and animal health work, as well as for research and development capabilities, specifically in the contract research services.
- The KC region's strongest capabilities in the field of biologics by business type (stage of development support) are in analytical laboratory, biomanufacturing, *in vitro* / bench, and nonclinical *in vivo*.
- The KC region's strongest capabilities in the field of biologics by technology sector are in therapeutic proteins, vaccines, and diagnostics.
- The KC region is known for its attractive cost of living.

- Due to the educational organizations in the region, there is an abundance of expertise and talent available in the region.
- There is an understood value placed on diversity, equity, and inclusion within the region.
- The KC region is expected to see continued growth.

The key identified areas of improvement include:

- There is an opportunity to assess and bring in additional key services needed for companies looking to outsource within the region.
- The KC region's capabilities could be bolstered by expansion of companies offering biologic lifecycle development support in the regulatory space and supply of raw materials / equipment.
- The KC region's Industry capabilities in Allergenics, Blood and Blood Components, and tissues are notably lacking as compared to other technology sector capabilities, however, Tissues was a prevalent capability for University led R&D. While Allergenics and Blood and Blood Components may be affected by the underlying market, does this delta indicate a lack of efficiency in the regional technology transfer ecosystem between universities and industry?
- There is a lack of larger company presence to attract new or entry-level employees to the region.
- Disparities between internal and external perceptions on quality of life that the region affords and its effect on Workforce (Talent, Availability and/or Retention) should be addressed. Significant growth will likely necessitate the need to retain existing talent as well attract new talent to the region.
    - Amongst Internal Industry stakeholders Workforce Talent, Availability and/ or Retention was the most prevalently identified Strength **and** Weakness.
    - Amongst External stakeholders (Cohort II), Quality of Life and Workforce Availability was an identified Strength.
- General perceptions outside of the region are uninformed, as most respondents outside of the KC region were unable to give a true opinion of various attributes of the region. The region may benefit from additional marketing and networking efforts that educate ex-KC professionals on the local biologics industry and promote collaboration with other organizations outside of the region (thus raising awareness).
- While diversity, equity, and inclusion are understood to be important to those within the region, the region lacks clear/more formal initiatives. A higher prevalence of this may come with larger companies expanding to the area, but there is opportunity to bring more awareness to these types of initiatives.

In summation, the biologics industry in the KC Region is currently in a healthy phase of continued growth. However, these data show that there are several areas in which efforts can be focused to increase the trajectory of that growth. The KC region possess clear strengths in discovery, *in vitro* / bench, analytical laboratory, nonclinical (*in vivo*), and biomanufacturing, specifically for therapeutic proteins and vaccines. The overall capabilities of the region would be strengthened by a concerted effort to **attract companies devoted to supporting biologics at any stage of product development in allergenics, blood and blood components, and tissues**.

KC's position relative to prestigious academic institutions provide startups and larger companies in this space ready access to a talented and experienced workforce which offers the area a clear advantage for towards further sustained growth. However, in stark contrast to this fact, **workforce availability perceptions provided the largest disparity** of all categories that were in question for Cohort II; 21% viewed workforce availability as a strength, 19% as neither a strength nor a weakness, 14% as a weakness, and an alarming 45% did not know if it was a strength or a weakness.

Additional areas that could provide opportunity in support of further growth in the biologics industry within the KC Region are **promoting the Region's availability of technical expertise and the perception of the entrepreneurship culture in the KC Region**. Thirty-six percent (36%) of Cohort II respondents perceived the Region's access to technical expertise as a strength, equal to the number of respondents (36%) that stated that they did not know if it was a strength or weakness. In regard to entrepreneurship, 43% didn't know if it was a strength or a weakness of the area, in contrast to the 21%, 19%, and 14% that viewed it as a strength, neither a strength nor a weakness, or a weakness, respectively.

In regard to Cohort II's perception of the KC Regions' current biologics core capabilities, these data are a clear indicator that many outside of KC are unaware of many of capabilities the KC Region is currently offering in this space. An overwhelming number of respondents indicated that they did not know if the KC Region offered the following capabilities in the biologics space: discovery and basic research (38%), manufacturing (45%), manufacturing (45%), contract research services (45%), supply chain and logistics (48%), consulting and contract services (48%), and analytical services (55%). Ironically, LBG's secondary research indicates that the KC Region self-identifies as a global leader in both diagnostics (inclusive of analytical services) and contract research services, amongst other areas. However only 14% (analytical services) and 36% (contract research services) of Cohort II respondents identified these two core capabilities as Strengths to the KC Region. These data demonstrate that KC needs to make a concerted effort to more actively promote these core capabilities in biologics outside of the KC Region.

Given KC's geographical location in the Midwest, it comes as no surprise that an attractive cost of living was confirmed by external perceptions by Cohort II (76% deemed this to be a strength of the region). However, **the KC Region would benefit from efforts to highlight the high quality of life** afforded by the living in KC Region as 30% of respondents didn't know if the quality of life in the KC Region was a strength or a weakness, compared to 34% that perceived the quality of life is a strength and 26% that perceived the quality of life was neither a strength nor a weakness.

Appendix I - Kansas City Regional Biologics Research & Development Inventory Request Interview – Industry

Project: Kansas City Regional Biologics Research & Development Inventory Request Interview Outline

Interviewee Profile

Name: _____
Title: _____
Organization Name: _____

Background about Interviewee:

Introduction

Thank you (insert name here) for agreeing to speak with us today. If you are not familiar with LBG, we are a mid-sized life science consulting firm that provides strategic consulting, product development and government contracting support.

BioNexus KC has selected LBG to provide an assessment of biologics R&D assets, capabilities, and capacity in the Kansas City region, extending from Manhattan, KS to Columbia, MO, and inclusive of St. Joseph, MO. The goal of this project is to identify and inventory any life science-related assets within the region that are performing research and development in biologics and create a baseline against which future growth can be measured. This intentional focus on biologics is part of a broader strategic collaborative being led by BioKansas and KC Rising and represents one possible strategy to fuel post-COVID recovery for the region and ensure that the region's economy is growing at a pace faster than that of peer metros across the country.

We anticipate the interview will take approximately 45 minutes to an hour. As a thank you for participating in this discussion, we are offering a donation to either Doctors Without Borders or Veterinarians without Borders on your behalf.

Interview Questions

General

1. **How do you define the term 'biologic' within your organization?**

Initially, we would like to understand your perspective on the definition of a 'biologic'. We have provided the below definition:

A biologic is a vaccine, therapeutic, treatment, additive, or technology derived from living sources, such as mammalian and non-mammalian cells, that is designed to nourish, protect, or improve human, animal, and plant health.

Current Capabilities

We are interested in understanding what biologics you currently work with and what describes your company the best:

2. In which of the following categories would you place your business (select all that apply)?

Category	Selection	Comments
Service Provider		
Sponsor / Supplier		
Private or Public		
Animal Health		
Human Health		
Small or Large Business		
Veteran, Minority, or Women-Owned		
Other (please specify)		

R&D Capabilities and Capacities By Biologics Product Type

3. Which of the following are *current* R & D capabilities of your organization? Note: Only record capabilities that exist locally / regionally.

	Vaccines[1]	Blood and Blood Components	Allergenics	Cell or Gene Therapies	Therapeutic Proteins	Tissues	Diagnostics
Discovery							
***In Vitro* / Bench**							
Analytical Laboratory							
Nonclinical (*In Vivo*)							
Manufacturing							
Clinical Research							
Commercialization							
Regulatory							
Supplier (Raw Materials/Equipment)							

Consulting/Contract Services							

[1]Specify Type (e.g. Subunit, Killed, Vector, Nucleic Acid, etc.)

Specify Other (please specify):

4. Facilities

What is the total approximate square footage in your local facilities devoted to biologics R&D activities? What is the relative percentage by product type and activity? (Note: it is acceptable to report the same facility in multiple fields, but please indicate when you do so)

	Vaccines	Blood and Blood Components	Allergenics	Cell or Gene Therapies	Therapeutic Proteins	Tissues	Diagnostics
Discovery							
In Vitro / Bench							
Analytical Laboratory							
Nonclinical (*In Vivo*)							
Biomanufacturing							
Clinical Research							
Commercialization							
Regulatory							
Supplier (Raw Materials/Equipment)							
Consulting/Contract Services							

5. Value of durable R&D Assets

What is the total approximate value of the durable assets and real estate devoted to biologics R&D activities? What is the relative percentage by product type and activity? (Note: is it acceptable to report the same facility in multiple fields, but please indicate when you do so)

	Vaccines	Blood and Blood Components	Allergenics	Cell or Gene Therapies	Therapeutic Proteins	Tissues	Diagnostics
Discovery							
In Vitro / Bench							
Analytical Laboratory							
Nonclinical (*In Vivo*)							
Biomanufacturing							
Clinical Research							
Commercialization							
Regulatory							
Supplier (Raw Materials/Equipment)							
Consulting/Contract Services							

6. **Do you outsource any of your company's capabilities?** **Yes** **No**

   If so, which ones? _____

   Inside or outside the region?_____

Expertise & Workforce

7. **What is the company's current number of employees within the Kansas City region (extending from Manhattan, KS to Columbia, MO, and inclusive of St. Joseph, MO)?**

8. **What percentage of your organizational workforce is in the KC region?**

9. **a. What types/levels of education do you have in-house (select all that apply)?**
   b. What percent of your local workforce does each expertise type represent?
   c. What percent of your local workforce does each expertise type represent by % Male/ Female / Non-binary?

Degree Breakdown	Selection (check all that apply)	% Of Workforce	%Male/Female/Non-Binary
Doctoral			
Master's			
Bachelor's			
Associates			
Some College, No Degree			
High School or GED			
< High School			
Other			

10. **a. What types/levels of expertise do you have in-house (select all that apply)?**
    b. What percent of your local workforce does each expertise type represent?
    c. What is the average tenure of each expertise type?
    d. What percent of your local workforce does each expertise type represent by % Male/ Female / Non-binary?

Expertise Type	Selection (check all that apply)	% Of Workforce	Average Tenure	%Male/Female/Non-Binary
C-Level				
Scientist/Engineers				
Technicians				

Business Support (Administrative, Marketing/ Sales, IT)				
Other (please specify)				

11. What are your greatest workforce challenges (i.e., quality of work, workforce retention, gaps in expertise)?

Qualitative Workforce Demographics to Inform Diversity, Equity, and Inclusion Task Force Outcomes

12. We would like to understand the current state of Diversity, Equity, and Inclusion (DEI) in your company? Please let us know all that apply.

- ❑ Your company's mission, vision or values demonstrate a commitment to diversity.
- ❑ Your company has a commitment to diversity statement.
- ❑ Your company has a written diversity strategic plan.
- ❑ Your company has a full-time or part-time DEI professional who performs DEI work.
- ❑ Your company has a supplier diversity policy or program.
- ❑ Your company has an affinity group or employee resource group for employees.
- ❑ Your company has a policy that specifically prohibits discrimination based on ability, veteran status, sexual orientation, gender identity or gender expression.
- ❑ Your company mandates diversity training for all employees.
- ❑ Anything else in-house that relates to DEI?

13. Does your organization collect the following type of demographic information from its employees on a self-identification/voluntary basis?

Demographics	Technician/ Entry Level Workforce	Management	Executive Leadership
Average Age			
Ethnicity			
% White/Caucasian			
% Hispanic/Latino			
% Black/African American			
% Native American			
% Asian/Pacific Islander			

% Other			
%US Citizen/Legal Permanent Resident			
% Veteran			
% LGBTQIA			
% Disability (as defined under ADA)			
Other (please specify)			
Prefer Not to Answer			

14. Would you be comfortable sharing this type of demographic information with us? As a reminder, LBG will not disclose any identifying or private information shared during this interview process to anyone other than those intimately involved with the interview process and BioNexus KC. Results of this information will be reported as aggregate data.

15. How do you rate the importance of DEI to your current workforce?

1	2	3	4	5	N/A
Not Important	Low Importance	Moderate Importance	High Importance	Very High Importance	Not Applicable

16. How do you rate the importance of DEI in attracting new employees?

1	2	3	4	5	N/A
Not Important	Low Importance	Moderate Importance	High Importance	Very High Importance	Not Applicable

17. Do you perceive that your organization's DEI program has improved/increased the success of the company (choose one)?

1	2	3	4	5	N/A
Not Improved Success	Slightly Improved Success	Moderately Improved Success	Greatly Improved Success	Very Greatly Improved Success	Not Applicable

Source of Investment(s)

18. a. Where/what sources has your organization received investment funds from (select all that apply)?

b. Please rank the amount of investment from each source (1=highest investment amount).

c. Please indicate the percentage of dilutive vs non-dilutive funding your organization has received. (i.e. 60/40; 70/30)

Investment Source	Selection (check all the apply)	Ranking (1=highest dollar amount/most important)	Percentage of dilutive vs non-dilutive funding
Angel Investor(s)			
Venture Capital			
Investment Banks			
Private Equity (if so, partnership or sole proprietor?)			
Federal			
State			
NGO			
Sovereign Fund			
Family Offices			
Friends/Family			
Prefer Not to Answer			
Other			

Commercial Accomplishments and Growth Plans

19. Please list major commercial accomplishments of the organization within the last 2 years.

Accomplishment	
New Products Launched	
Patents/IP Expansion	
Revenue Milestones	
Infrastructure or Geographic Expansion	
Strategic Partnerships/M&A	
Other	

a. Please list any obstacles or barriers overcame to achieve these milestones/ accomplishments.

20. Do you have new products in development? **Yes** **No**

a. What stage of development is your lead product at today? Where will it be in 1, 3, and 5 years?

21. Is expansion planned within KC Corridor (or at another site)? Do you need further external funding to be able to expand?

a. **Do you have concerns about attracting new talent to fill new roles brought about by expansion (are you concerned about being able to attract them locally or drawn them in from other geographic areas)?**

22. Please list major commercial accomplishments of the organization anticipated within the next 2 years:

Accomplishment	
New Product Launch	
Patents/IP Expansion	
Revenue Milestone	
Infrastructure or Geographic Expansion	
Strategic Partnerships/M&A	
Other	

Regional Market Perceptions

23. How likely is the biologics industry to grow in this region in the next five years?

1	2	3	4	5	N/A
No Likelihood	Low Likelihood	Moderate Likelihood	High Likelihood	Very High Likelihood	Not Applicable

24. There is the expertise within the KC regional workforce to support growth (by expansion or new business)?

1	2	3	4	5	N/A
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Not Applicable

25. What do you think the Strengths, Weaknesses, Opportunities, and Threats of the regional biologics industry are?

Strengths	Weaknesses
Opportunities	**Threats**

26. Does the local government / infrastructure support growth and expansion of organizations in the region? Explain.

1	2	3	4	5	N/A
No Support Available	Little Support Available	Moderate Support Available	High Support Available	Very High Support Available	Not Applicable

27. Do organizations within the regional biologics ecosystem (outside of the local government) provide support for growth and expansion of other organizations? (e.g. BioNexus KC)

1	2	3	4	5	N/A
No Support Available	Little Support Available	Moderate Support Available	High Support Available	Very High Support Available	Not Applicable

28. What is the quality of life/job satisfaction of the regional workforce?

1	2	3	4	5	N/A
Very Low Satisfaction	Low Satisfaction	Moderate Satisfaction	High Satisfaction	Very High Satisfaction	Not Applicable

29. Is there opportunity within the area to draw in additional talented professionals within biologics? If so, what opportunities exist?

Final Question Close Out

30. Do you have any contacts or know of any other organizations that may be interested in speaking with us about this topic?

31. If we have topics or projects that are pertinent and valuable to you, would you be interested in speaking with us again?

For participating in this discussion, we are offering a donation to either Doctors Without Borders or Veterinarians without Borders on your behalf.

Doctors without Borders	Veterinarians without Borders

Thank you for participating. Your opinion is very much appreciated.

Appendix II- Kansas City Regional Biologics Research & Development Inventory Requestion Interview Guide – University

Kansas City Regional Biologics Research & Development Inventory Request Interview

Interviewee Profile

Name:
Title:
Organization/University:

Introduction

Thank you for agreeing to speak with us today. If you are not familiar with LBG, we are a mid-sized life science consulting firm that provides strategic consulting, product development and government contracting support.

BioNexus KC has selected LBG to provide an assessment of biologics R&D assets, capabilities, and capacity in the Kansas City region, extending from Manhattan, KS to Columbia, MO, and inclusive of St. Joseph, MO. The goal of this project is to identify and inventory any life science-related assets within the region that are performing research and development in biologics and create a baseline against which future growth can be measured. This intentional focus on biologics is part of a broader strategic collaborative being led by BioKansas and KC Rising and represents one possible strategy to fuel post-COVID recovery for the region and ensure that the region's economy is growing at a pace faster than that of peer metros across the country.

Interview Questions

1. **How do you define the term 'biologic' within your organization?**

Initially, we would like to understand your perspective on the definition of a 'biologic'. We have provided the below definition:

A biologic is a vaccine, therapeutic, treatment, additive, or technology derived from living sources, such as mammalian and non-mammalian cells, that is designed to nourish, protect, or improve human, animal, and plant health.

Current Capabilities

We are interested in understanding what biologics you currently work with and what describes your institution the best:

2. **In which of the following categories would you place your institution's work in relation to biologics R&D (select all that apply)?**

R&D Capabilities and Capacities By Biologics Product Type

3. Which of the following are *current* R & D capabilities of your organization?

Note: Only record capabilities that exist locally / regionally.

Category	Selection	Comments
Fee for Service Provider	☐	
Animal Health	☐	
Human Health	☐	
Private Institution	☐	
Public Institution	☐	
Degree Track Educational Institution	☐	

	Vaccines[1]	Blood and Blood Components	Allergenics	Cell or Gene Therapies	Therapeutic Proteins	Tissues	Diagnostics
Discovery							
In Vitro / Bench							
Analytical Laboratory							
Nonclinical (*In Vivo*)							
Biomanufacturing							
Clinical Research							
Commercialization							
Regulatory							
Supplier (Raw Materials/ Equipment)							
Consulting/Contract Services							

[1]Specify Type (e.g. Subunit, Killed, Vector, Nucleic Acid, etc.)

Specify Other (please specify):

4. Facilities: What is the total approximate square footage in your local facilities devoted to biologics R&D activities? What is the relative percentage by product type and activity? (Note: it is acceptable to report the same facility in multiple fields)

	Vaccines	Blood and Blood Components	Allergenics	Cell or Gene Therapies	Therapeutic Proteins	Tissues	Diagnostics
Discovery							
In Vitro / Bench							
Analytical Laboratory							
Nonclinical (*In Vivo*)							
Biomanufacturing							
Clinical Research							
Commercialization							
Regulatory							
Supplier (Raw Materials / Equipment)							
Consulting/Contract Services							

5. **Value of durable R&D Assets**

   What is the total approximate value ($) of the durable assets and real estate devoted to biologics R&D activities? What is the relative percentage by product type and activity? (Note: is it acceptable to report the same facility in multiple fields, but please indicate when you do so)

	Vaccines	Blood and Blood Components	Allergenics	Cell or Gene Therapies	Therapeutic Proteins	Tissues	Diagnostics
Discovery							
In Vitro / Bench							
Analytical Laboratory							
Nonclinical (*In Vivo*)							
Manufacturing							
Clinical Research							
Commercialization							
Regulatory							
Supplier (Raw Materials/ Equipment)							
Consulting/Contract Services							

6. **Partnering on Biologics R&D Efforts (Rank Importance and % data for both tables)**

Partnering Type	Rank Importance (1 to 4)	%
Industry (Small Business)		
Intramural		
Extramural (Other Universities)		
Industry (Large Business)		

Locations of Partners	Rank Importance (1 to 3)	%
State & Regional		
Out of State (US)		
International		

Expertise & Workforce

7. **What is the university's current number of employees within the Kansas City region, (extending from Manhattan, KS to Columbia, MO, and inclusive of St. Joseph, MO) dedicated to biologics R&D?**
8. **What percentage of your organizational workforce is in the KC region?**
9. **What types/levels of expertise do you have in-house (select all that apply)?**

Note: If possible, please include only staff related to activities regarding biologics. If this is not possible, please simply what your response includes (i.e., university-wide numbers, department-specific numbers, etc.).

b. What percent of your local biologics workforce does each expertise type represent?

c. What is the average tenure of each expertise type?

d. What percent of your local biologics workforce does each expertise type present by % Male/ Female / Non-binary?

Expert Type	Selection (check all that apply)	% Of Workforce	Average Tenure	% Male/ Female/ Non-Binary
Faculty	☐			
Research Staff	☐			
University Administrator	☐			
Grad Students with research appointments	☐			
Post-Docs	☐			
Assistant Professor	☐			
Associate Professor	☐			
Research Associate Professor	☐			
Research Assistant Professor	☐			
Professor	☐			
Other (please specify)	☐			

10. **If possible, could you provide a list of Faculty at your University who are doing work in biologics?**
11. **What are your greatest biologics workforce challenges (i.e., quality of work, workforce retention, gaps in expertise)?**

Qualitative Workforce Demographics to Inform Diversity, Equity, and Inclusion Task Force Outcomes

11. We would like to understand the current state of Diversity, Equity, and Inclusion (DEI) at your university? Please let us know all that apply.

- ❑ Your university's mission, vision or values demonstrate a commitment to diversity.
- ❑ Your university has a commitment to diversity statement.
- ❑ Your university has a written diversity strategic plan.
- ❑ Your university has a full-time or part-time DEI professional who performs DEI work.
- ❑ Your university has a supplier diversity policy or program.
- ❑ Your university has an affinity group or employee resource group for employees.
- ❑ Your university has a policy that specifically prohibits discrimination based on ability, veteran status, sexual orientation, gender identity or gender expression.

- ❑ Your university mandates diversity training for all employees.
- ❑ Anything else in-house that relates to DEI?

13. What types of STEM DEI initiatives do you currently have in place?

14. Please help us understand the demographics of your university's R&D centers, including the most detailed level of demographic breakout you are able to provide (i.e. university-wide, department-wide, class-wide, etc.)

Demographics	Students	Research Staff & Post-Docs	Non-Tenure Track Faculty	Tenure Track Faculty
Average Age				
Ethnicity				
% White/Caucasian				
% Hispanic/Latino				
% Black/African American				
% Native American				
% Asian/Pacific Islander				
% Other				
%US Citizen/Legal Permanent Resident				
% Veteran				
% LGBTQIA				
% Disability				
Other (please specify)				
Prefer Not to Answer				

15. How do you rate the importance of DEI to your students, staff, and faculty members?

1	2	3	4	5	N/A
Not Important	Low Importance	Moderate Importance	High Importance	Very High Importance	Not Applicable

16. Do you perceive that your organization's DEI programs have improved/increased the success of your STEM or biologics university research initiatives? (choose one)?

1	2	3	4	5	N/A
Not Improved Success	Slightly Improved Success	Moderately Improved Success	Greatly Improved Success	Very Greatly Improved Success	Not Applicable

Source of Funding(s)

17. a. Please identify the funding sources your organization has received for biologics R&D (select all that apply)?
b. Please rank the amount of funds from each source (1=highest investment amount).

Investment Source	Selection (check all the apply)	Ranking (1=highest dollar amount/most important)	Additional Comments
Federal	☐		
State	☐		
NGO	☐		
Joint Ventures (Public Private Partnerships)	☐		
Endowment	☐		
Foundation	☐		
Fee For Service	☐		
Industry-Sponsored Research	☐		

Tech Transfer and Growth Plans

18. Please list major technical accomplishments and tech-transfer accomplishments of the organization within the last 2 years.

Accomplishment	
Patents	
Patent Licensing	
Publications	
# of Grant Applications	
# of Grants Received	
Royalty Streams	
Infrastructure or Geographic Expansion	
Public Private Partnerships & Joint Ventures	
Companies Created/Started	
Other	

a. Please list any obstacles or barriers overcome to achieve these milestones/ accomplishments.

19. Is expansion planned within KC Corridor (or at another site)? Do you need further external funding to be able to expand?

b. **Do you have concerns about attracting new talent to fill new roles brought about by expansion (are you concerned about being able to attract them locally or drawn them in from other geographic areas)?**

Regional Market Perceptions

20. **How likely is the biologics industry to grow in this region in the next five years?**

1	2	3	4	5	N/A
No Likelihood	Low Likelihood	Moderate Likelihood	High Likelihood	Very High Likelihood	Not Applicable

21. **Is there the expertise in the workforce within the KC area to attract growth (by expansion or new business) in the area?**
22. **What do you think the Strengths, Weaknesses, Opportunities, and Threats of the regional biologics industry are?**

Strengths	Weaknesses
Opportunities	**Threats**

23. **Does the local government / infrastructure support growth and expansion of organizations in the region? Explain.**

1	2	3	4	5	N/A
No Support Available	Little Support Available	Moderate Support Available	High Support Available	Very High Support Available	Not Applicable

24. **Do organizations within the regional biologics ecosystem provide support for growth and expansion of other organizations? (e.g. BioNexus KC)**

1	2	3	4	5	N/A
No Support Available	Little Support Available	Moderate Support Available	High Support Available	Very High Support Available	Not Applicable

25. **Is there opportunity within the area to draw in additional talented professionals within biologics?**

Final Question Close Out

26. **Do you have any contacts or know of any other organizations that may be interested in speaking with us about this topic?**
27. **If we have topics or projects that are pertinent and valuable to you, would you be interested in speaking with us again?**

Thank you for participating. Your opinion is very much appreciated.

Appendix III. Cohort II Questionnaire

Start of Block: Interviewee Profile and Introduction

Q1 Thank you for agreeing to take this short survey!

We are conducting an assessment to gauge the perception of the Biologics Research & Development capability and capacity within the greater Kansas City region (extending from Manhattan, KS to Columbia, MO, and inclusive of St. Joseph, MO) from life science industry members who are outside of this region.

This very important information is being used by regional non-profit and economic development groups to design efforts to enhance and grow the Biologics industry in an inclusive and equitable manner. Your responses will be anonymized for reporting purposes.

We anticipate this survey will take less than 5 minutes to complete.

Q2 Tell us a little about yourself.....

- Name (1) _____
- Title (2) _____
- Organization / Company Name: (3)

_____

- Primary Location (State) (7)

_____

End of Block: Interviewee Profile and Introduction

Start of Block: Biologics Definition

Q3 How do you define the term 'Biologic'?

_____

_____

_____

_____

_____

Q4 What is your perception of the below definition of the term 'Biologic'?

"A biologic is a vaccine, therapeutic, treatment, additive, or technology derived from living sources, such as mammalian and non-mammalian cells, that is designed to nourish, protect, or improve human, animal, and plant health."
Please use the slider to indicate your opinion of the accuracy of the provided definition.

Completely Inaccurate Definition — Perfect Definition

0 10 20 30 40 50 60 70 80 90 100

Accuracy Score ()	

Page Break

Display This Question:

If What is your perception of the below definition of the term 'Biologic'? "A biologic is a vaccine... [Accuracy Score] <= 50

Q5 What part of the definition did you find inaccurate?

"A biologic is a vaccine, therapeutic, treatment, additive, or technology derived from living sources, such as mammalian and non-mammalian cells, that is designed to nourish, protect, or improve human, animal, and plant health."

_____

End of Block: Biologics Definition

Start of Block: Familiarity with KC

Q6 Have you ever lived in, worked in, or traveled to the greater Kansas City region (extending from Manhattan, KS to Columbia, MO, and inclusive of St. Joseph, MO)?

- Yes (1)
- No (2)

Q7 How familiar are you with the below aspects of the Kansas City region (extending from Manhattan, KS to Columbia, MO, and inclusive of St. Joseph, MO)?

	Not Familiar (1)	Somewhat Familiar (2)	Familiar (3)	Extremely Familiar (4)
Life Science Industry (1)	○	○	○	○
Biologics Industry (2)	○	○	○	○
Animal Health Industry (5)	○	○	○	○
Academia & Universities (3)	○	○	○	○
Nonprofits and Industry Groups (4)	○	○	○	○
Sports Teams (6)	○	○	○	○
Food & Entertainment (e.g. BBQ) (7)	○	○	○	○

End of Block: Familiarity with KC

Start of Block: Market Perceptions

Q8 In your opinion, how likely is the Biologics industry to grow significantly (>10%) in the next five years in the US?

- ○ No Likelihood (1)
- ○ Low Likelihood (2)
- ○ Moderate Likelihood (3)
- ○ High Likelihood (4)
- ○ Very High Likelihood (5)
- ○ Not Applicable/Unknown (6)

Page Break

Q9 As it pertains to **Biologics Research & Development within the Kansas City Region**, please indicate whether you perceive the various core capabilities as a strength or weakness of the region.

	Strength (1)	Neither Strength nor Weakness (3)	Weakness (2)	Don't Know (4)
Discovery & Basic Research (6)	○	○	○	○
Analytical Services (3)	○	○	○	○
Manufacturing (5)	○	○	○	○
Contract Research Services (CROs, etc.) (8)	○	○	○	○
Supply Chain & Logistics (4)	○	○	○	○
Consulting & Contract Services (2)	○	○	○	○

Q10 As it pertains to **Biologics Research & Development within the Kansas City Region**, please indicate whether you perceive the various core characteristics as a strength or weakness of the region.

	Strength (1)	Neither Strength nor Weakness (3)	Weakness (2)	Don't Know (4)
Technical Expertise (1)	○	○	○	○
Workforce Availability (2)	○	○	○	○
Diversity, Equity & Inclusion (8)	○	○	○	○
Cost of Living (3)	○	○	○	○
Entrepreneurship (7)	○	○	○	○
Quality of Life (9)	○	○	○	○

Q11 What is your perception of the below statement?

"The Kansas City Region has the capability and capacity to support the growth of the Biologics industry"

Please use the slider to indicate your opinion of the accuracy of the provided definition.

	Extremely Inaccurate									Extremely Accurate
	0	10	20	30	40	50	60	70	80	90	100
Accuracy Score ()											

Page Break

Q12 Please indicate your familiarity with Research & Development of Biologics.

- Not Familiar (1)
- Somewhat Familiar (2)
- Familiar (3)
- Extremely Familiar (4)

End of Block: Market Perceptions

Appendix IV. Industry Outreach Message

BioNexus KC has selected Latham BioPharm Group to provide an assessment of biologics R&D assets, capabilities, and capacity in the Kansas City region, extending from Manhattan, KS to Columbia, MO, and inclusive of St. Joseph, MO. The goal of this project is to identify and inventory any life science-related assets within the region that are performing research and development in biologics and create a baseline against which future growth can be measured. This intentional focus on biologics is part of a broader strategic collaborative being led by BioKansas and KC Rising and represents one possible strategy to fuel post-COVID recovery for the region and ensure that the region's economy is growing at a pace faster than that of peer metros across the country. (For additional information on this effort please visit the BioNexus KC website.)

As a key stakeholder within the biologics industry, we hope you can speak with us for approximately one hour to provide your organizational insights and key information relating to Biologics R&D assets, capability & capacity. In recognition of your time investment, we are offering a charitable donation to Doctors without Borders or Veterinarians without Borders in your name in the amount of $200.00.

LBG prides itself on maintaining the highest level of integrity and we value your privacy. We intend to use the output of the interview to solely inform a report on the region's current capabilities and capacities.To ensure confidence in confidentiality of current and former interviewees, LBG will not disclose any identifying information or release any private information shared during the interview to anyone other than those intimately involved with the interview process and the client, BioNexus KC.

We currently have the following dates and times available:

Dates	Times (in Eastern Time)

Please let us know which date and time work best for you and we will send out a meeting invite, which you can join via telephone or computer.

If you feel you are not a fit to provide feedback for this particular area, please feel free to refer us to anyone you think may fit within your company.

Caty Metcalf, MMB, MBA
Associate Consultant
Latham BIOPHARM GROUP
Uniting Teams & Technologies in the Life Sciences

Appendix V. University Outreach Message

BioNexus KC has selected Latham BioPharm Group to provide an assessment of biologics R&D assets, capabilities, and capacity in the Kansas City region, extending from Manhattan, KS to Columbia, MO, and inclusive of St. Joseph, MO. The goal of this project is to identify and inventory any life science-related assets within the region that are performing research and development in biologics and create a baseline against which future growth can be measured. This intentional focus on biologics is part of a broader strategic collaborative being led by BioKansas and KC Rising and represents one possible strategy to fuel post-COVID recovery for the region and ensure that the region's economy is growing at a pace faster than that of peer metros across the country. (For additional information on this effort please visit the BioNexus KC website.)

As a valued institution providing direct influence into the KC Region's biologics industry, we hope you can support this effort. We would like to meet with you for 15-30 minutes to discuss the effort, review the questionnaire that we are using to collect information, and address any questions you may have. The goal of this is to capture your organizational insights and key information relating to biologics R&D assets, capability & capacity.

LBG prides itself on maintaining the highest level of integrity, and we value your privacy. We intend to use the output of these questionnaires to solely inform a report on the region's current capabilities and capacities.To ensure confidence in confidentiality of current and former interviewees, LBG will not disclose any identifying information or release any private information shared during the initial discussion or within the questionnaires to anyone other than those intimately involved with the interview process and the client, BioNexus KC.

We currently have the following dates and times available:

Dates	Times (in Eastern Time)

Please let us know which date and time work best for you and we will send out a meeting invite, which you can join via telephone or computer.

If you feel you are not a fit to provide feedback for this particular area, please feel free to refer us to anyone you think may fit within your institution.

Caty Metcalf, MMB, MBA
Associate Consultant

Uniting Teams & Technologies in the Life Sciences
www.lathambiopharm.com

Kansas City Regional Biologics R&D Landscape August 2022

Market Research performed by:

University Interview Analysis Report Addendum

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Executive Summary

The goal of this effort was to provide primary research from Universities and Academic institutions to determine the capability and capacity that exists for biologics research and development. Over 200 university and academic associated centers were originally identified as potential university interview targets. Of these 200+ university and research centers, 3 were removed for being outside the geographic scope of the Kansas City region, extending from Manhattan, KS to Columbia, MO, and inclusive of Wichita, and St. Joseph, MO. The major three university affiliations were: The University of Kansas and University of Kansas Medical Center populating 62 university centers, Kansas State University with 51 university centers, and the University of Missouri, providing 48 university centers. The remaining 41 university and research centers were located across the region, including affiliations with Avila University, Children's Mercy Kansas City, Johnson County and Kansas City Kansas Community College, Kansas City University, St. Luke's Health System, and the University of Missouri-Kansas City.

Although the main objective of this project was to identify and inventory any life science-related assets within the region that are performing research and development in biologics, university centers may or may not be a part of a larger program offering at a university or hospital that performs R&D. For this reason, no initial filter on biologics-focused work was applied and therefore no university research centers were removed. Of the 202 remaining university centers identified as potential interviewees, 120 were Kansas-based, and 82 were Missouri-based. After performing secondary research (see methodology below), internal and external contact identification took place, and 25 potential respondents were contacted at these university and research centers. Email outreach started with the most appropriate point of contact followed by secondary outreach and alternative point of contacts being assessed.

Primary market research is the output of structured interviews with universities who support biologics in the KC region. For this benchmarking effort, this included universities and institutions that were provided by BioNexus KC, and additional groups identified by local KC SMEs and secondary research. LBG drafted an interview guide in a collaborative manner with BioNexus KC stakeholders. This interview guide was meant to be filled out offline by the university to the best of their ability. LBG would attend an initial interview reviewing the content and expectations of the interview guide and confirming that the point of contact had the ability to gather the information. Interview responses were collected in an electronic format, and following receipt of the completed interview questionnaire, LBG would review and collate the data.

It should be noted that the level of effort which was required for universities to participate in these primary research efforts was perceived to be high relative to the quantity of information sought. This was presumably due to the fact that there was a lack of centralized and organized data available to research administrators regarding capability and capacity of their faculty and facilities. This stood in contrast to observations from primary research efforts for private sector companies, focused on biologics or life science product development where *specific* information was readily available and easily distilled.

Assessing the contribution of higher education to the regional biologics R&D landscape is a complex, yet important research question. The functional unit of these organizations typically is comprised of faculty-led laboratory groups, centers of excellence or other focused conglomerations of people, equipment, and facilities which are focused on specific research

and/or educational scopes. The structure of the stereotypical public university creates challenges when attempting to delineate capability and capacity for a specific purpose, due to the formation of independent silos of work/effort as well as the sheer size of major public universities. For example, the University of Kansas (KU), inclusive of the University of Kansas Medical Center (KUMC) touts a total of 6,401 faculty members (Source: University of Kansas website). Through these primary research efforts it was apparent that an objective assessment that determined how each faculty member and the facilities and equipment for which they are responsible for contributes to the research and development of biologics presents a nearly implausible task within the reasonable constraints of resources and the status quo of university data collection. However, systematic engagement at the level of research administration, combined with secondary research methods yields a repeatable and feasible approach to inventorying these assets. It was determined that, ultimately, the most relevant targets in this primary research effort in the region generally do not have the systems in place to efficiently determine qualitatively and/or quantitatively, the capability and capacity for research and development activities. It may behoove the region as a whole, to develop a common and efficient standardized reporting mechanism, which is completed at the faculty/principal investigator level to fill this void in information.

Introduction

The KC region serves as a prominent hub for innovation and growth in bioscience. BioNexus KC's mission is to highlight life sciences resources and their value to the community through collaboration and commercialization. BioNexus KC believes in the value of empowering thinkers from a variety of disciplines to unite their efforts and collectively enhance the future of the region's bioscience ecosystem. To ensure the region's biologics research and development industry is equipped for success, BioNexus KC selected Latham BioPharm Group (LBG) to provide an assessment of biologics R&D assets, capabilities, and capacity in the KC region, extending from Manhattan, KS to Columbia, MO, inclusive of Wichita, and St. Joseph, MO. The goal of this project is to identify and inventory any life science-related assets within the region that are performing research and development in biologics and create a baseline against which future growth can be measured. This intentional focus on biologics is part of a broader strategic collaborative being led by BioKansas and KC Rising and represents one possible strategy to fuel post-COVID recovery for the region and ensure that the region's economy is growing at a pace faster than that of peer metros across the country. BioNexus KC recognizes the region's potential and aims to not only capture the current achievements of the regional's biologics R&D but also to strategize how to capitalize on these successes.

Over the course of several months, LBG developed a comprehensive report that details the current and future projections of the KC region's R&D capabilities and capacities, including primary and secondary research, to better understand and validate physical capacity, depth of expertise, financial investment (private, government, philanthropic), and past commercialization accomplishments in private sector companies, non-profit research institutes, and academic institutions. Furthermore, LBG investigated the potential to grow capacity, expertise, funding support, tech transfer, and commercialization within the region to allow BioNexus KC, and ultimately the KC region, to further expand their foothold as the premier bioscience hub in the Midwest. This report ensures a focused economic development engine that can leverage existing strengths while providing a platform for growth and buildout of key areas of opportunities. LBG

collectively supports BioNexus KC and their dedication to promoting, developing, and accelerating the growth of the biologics industry for the benefit of the greater KC region and beyond.

Results

Biologics Definition Word Cloud

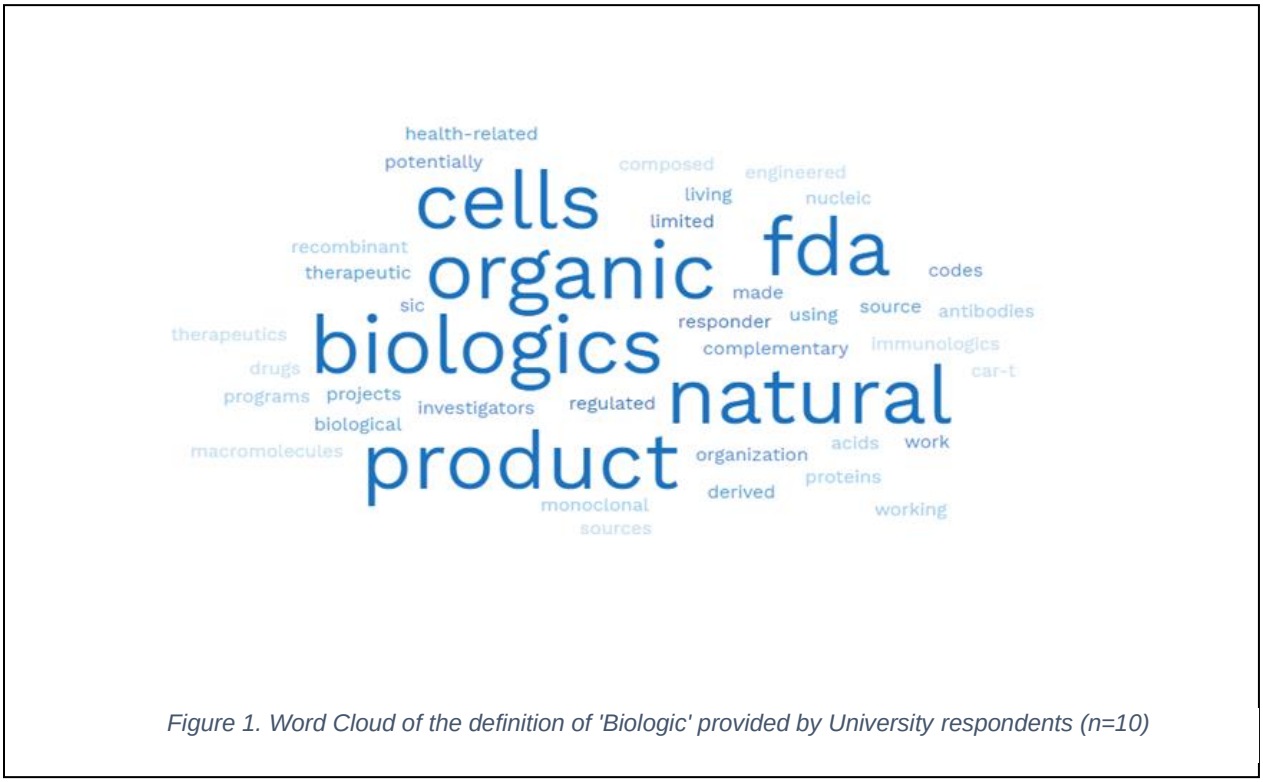

Figure 1. Word Cloud of the definition of 'Biologic' provided by University respondents (n=10)

Listing of Definitions

Table 1. Written definition of the term 'Biologic' provided by University respondents

Interviewee Definition of a Biologic
Used our definition.
Drugs and other therapeutics from natural sources composed of natural or engineered organic macromolecules.
Used our definition: "Broad enough definition to include all conceivable biologics"
Projects or programs working on monoclonal antibodies, recombinant proteins, nucleic acids and immunologics like CAR-T cells.
A therapeutic or health-related product derived from a biological source.
A product made using living cells that is organic. I agree with the definition below.
Agree with your definition.
We do not have a different definition from what is scientifically acceptable

We would not now be limited to the FDA definition for FDA regulated biologics or SIC codes. Individual investigators in our organization would potentially define their work as either addressing or complementary to biologics as defined above.
That is how we would describe it.

Current Capabilities:

Amongst the institutions interviewed, 55% have capabilities with a focus primarily on human health and 45% on animal health (**Figure 2**). A majority of the institutions interviewed as part of this landscape assessment are funded through public sources (89%) versus private funding (11%) (**Figure 3**). Specific sources of funding are further delineated in **Figure 4**.

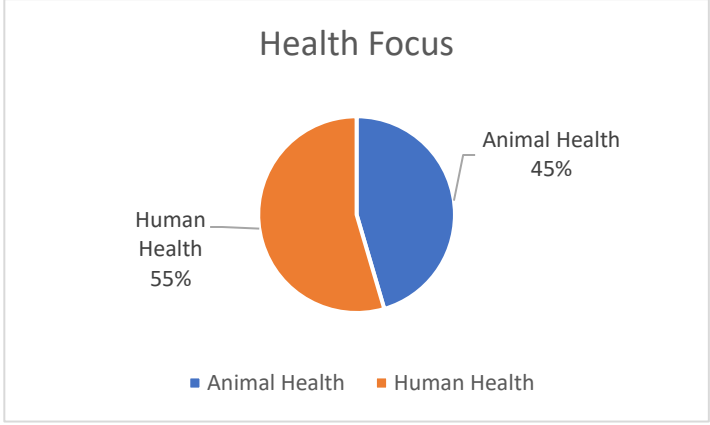

Figure 2. Health Focus

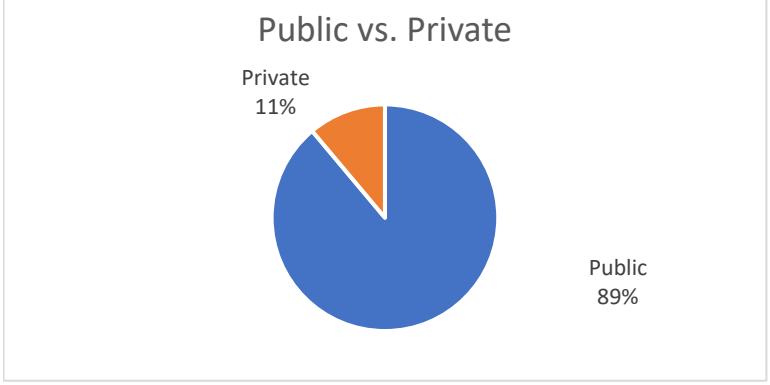

Figure 3. Private vs Public Companies

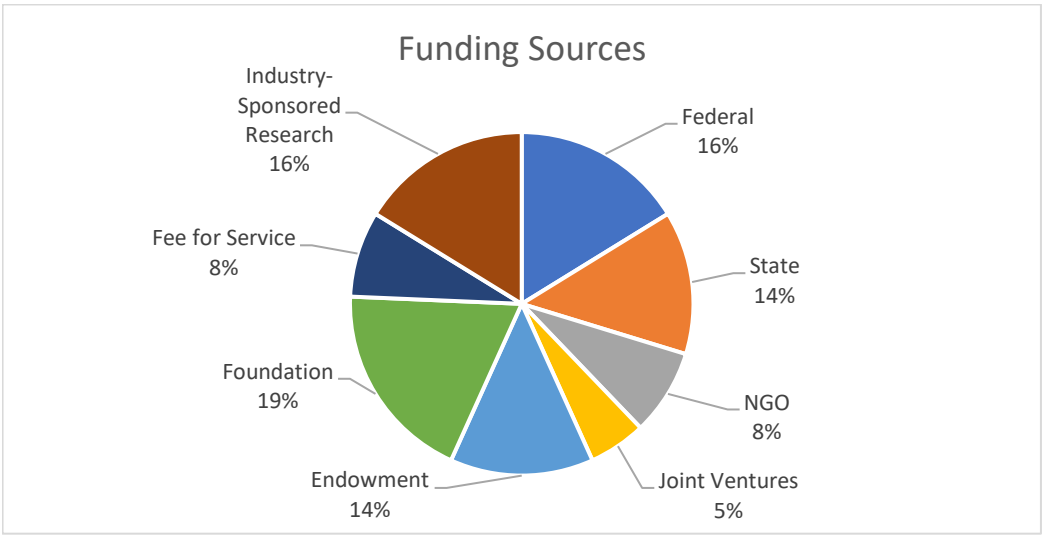

Figure 4. University Percentages of Funding Sources

R&D Capabilities and Capacities By Biologics Product Type

University contacts were asked to identify which R&D Capabilities and Capacities exist within their university currently, by service type **(Figure 5)**. **Figure 6 – Figure 15** demarcate the self-reported R&D capabilities and capacities of the universities interviewed regarding each technology sector capabilities by each individual service type.

Of the nine respondents, the leading capabilities are within the area of discovery and *in vitro*/bench, with 39 and 38 universities reporting that capability, respectively. The next most common biologics R&D capabilities lie within the areas of analytical laboratory (29), nonclinical/*in vivo* (21), and clinical research (21). Less common R&D capabilities are present in

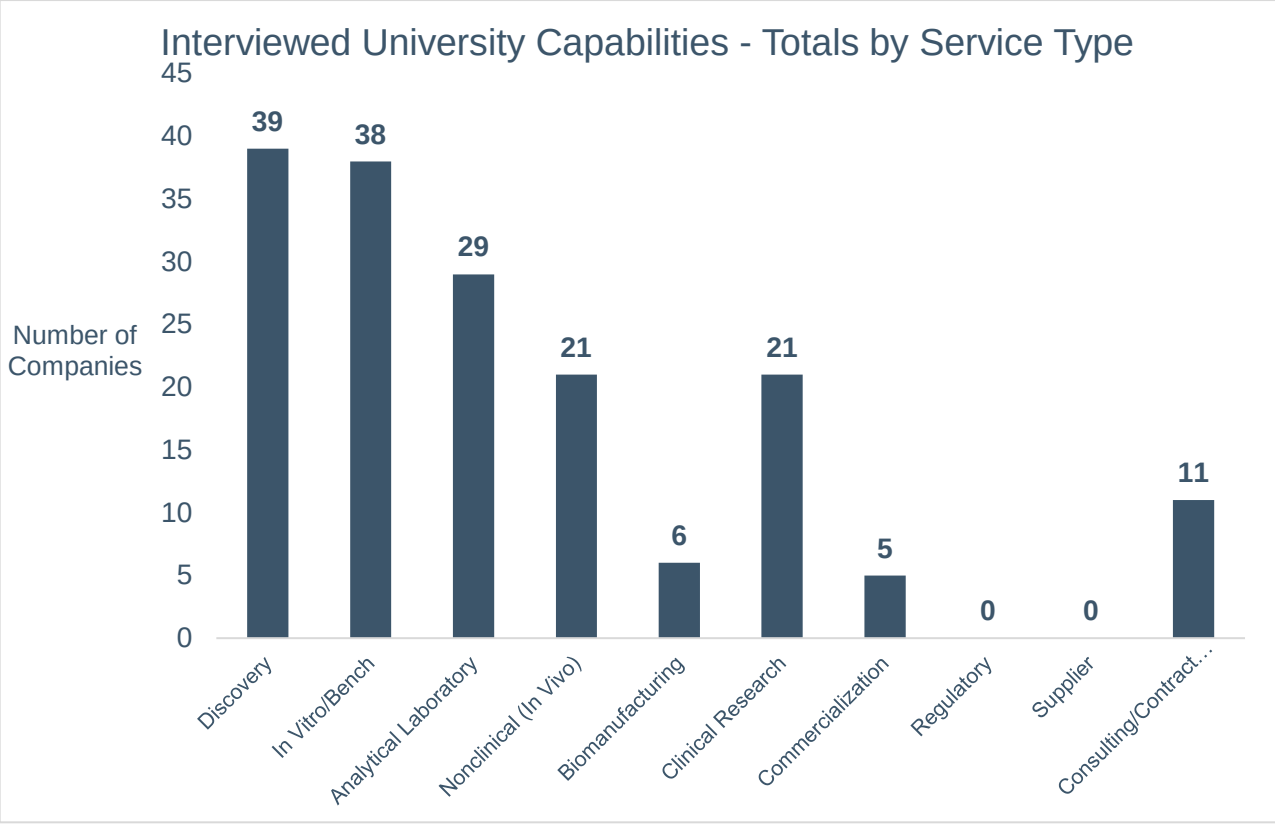

Figure 5. Current Total Capabilities by Service Type

consulting/contract services (11), biomanufacturing (6), and commercialization (5). Given the focus of university R&D, it is not surprising to see that there are currently no university R&D capabilities within the area of regulatory (0) and as a supplier of raw materials/equipment (0).

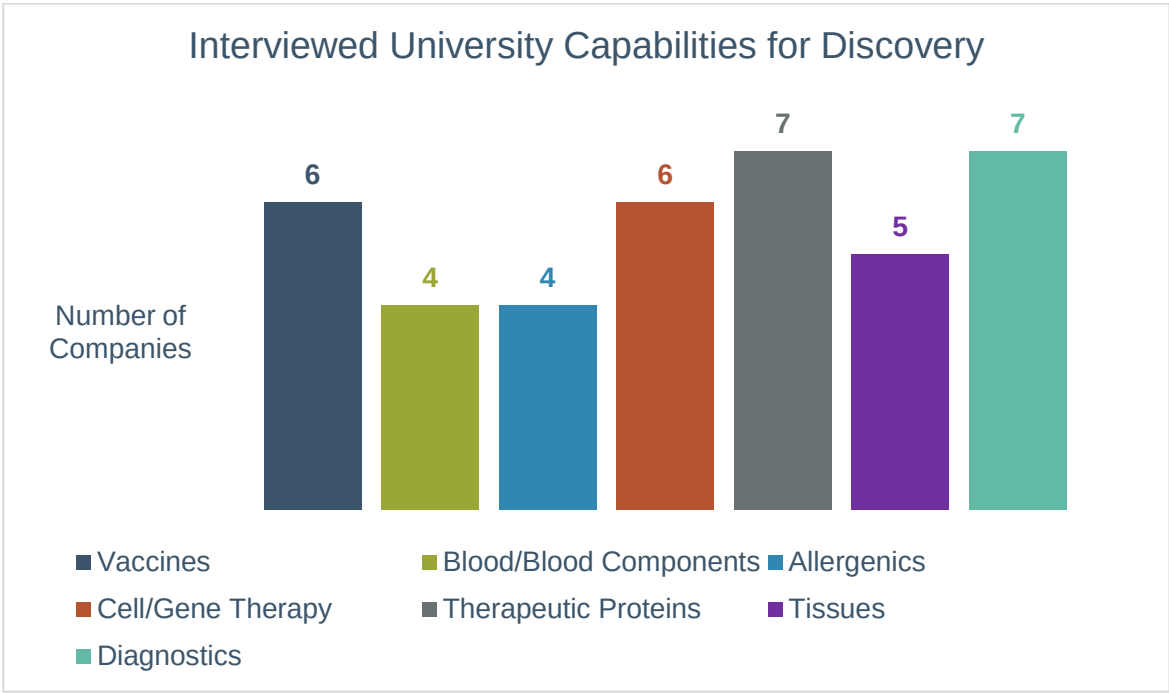

Figure 6. Current Total Discovery Capabilities

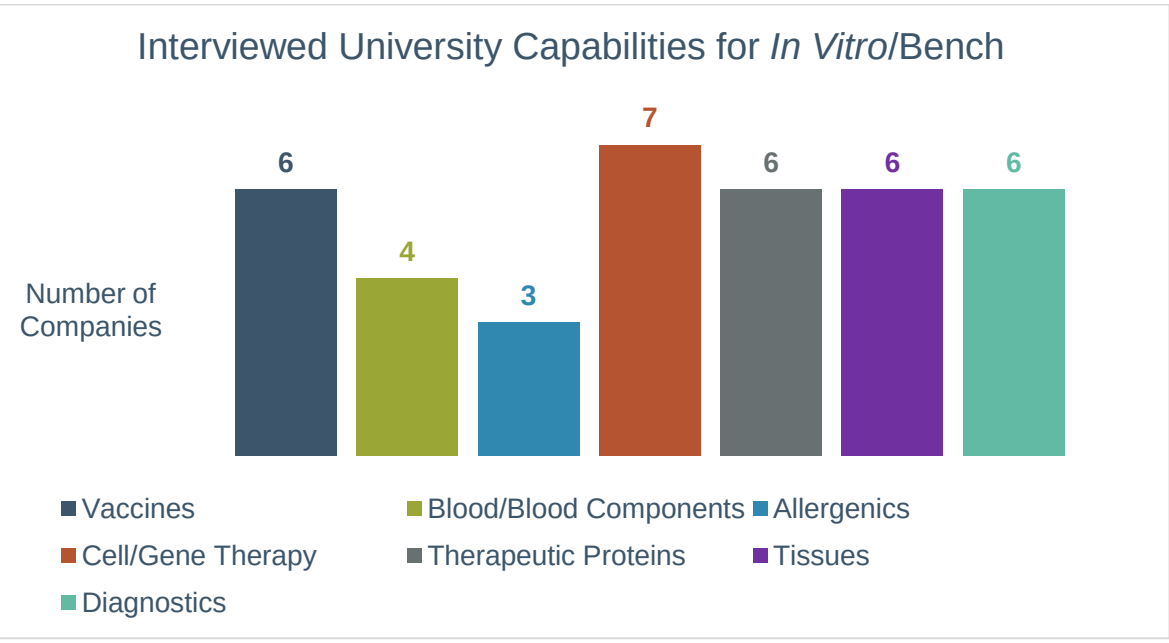

Figure 7. Current Total In Vitro/Bench Capabilities

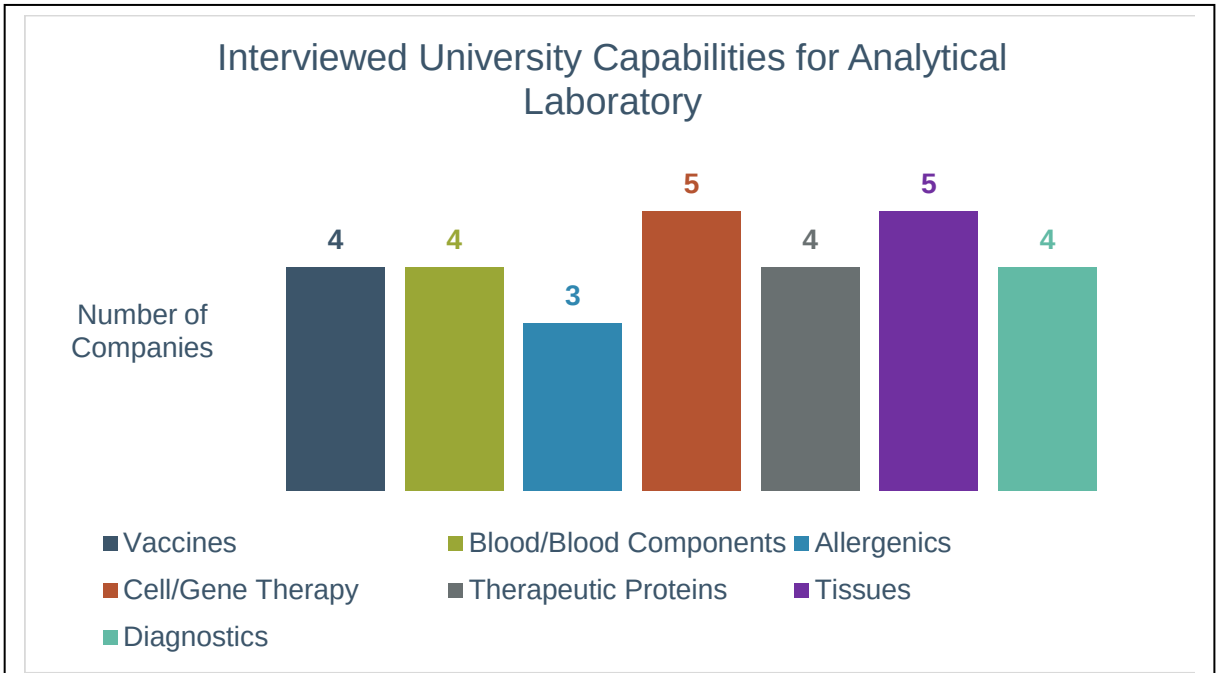

Figure 8. Current Total Analytical Laboratory Capabilities

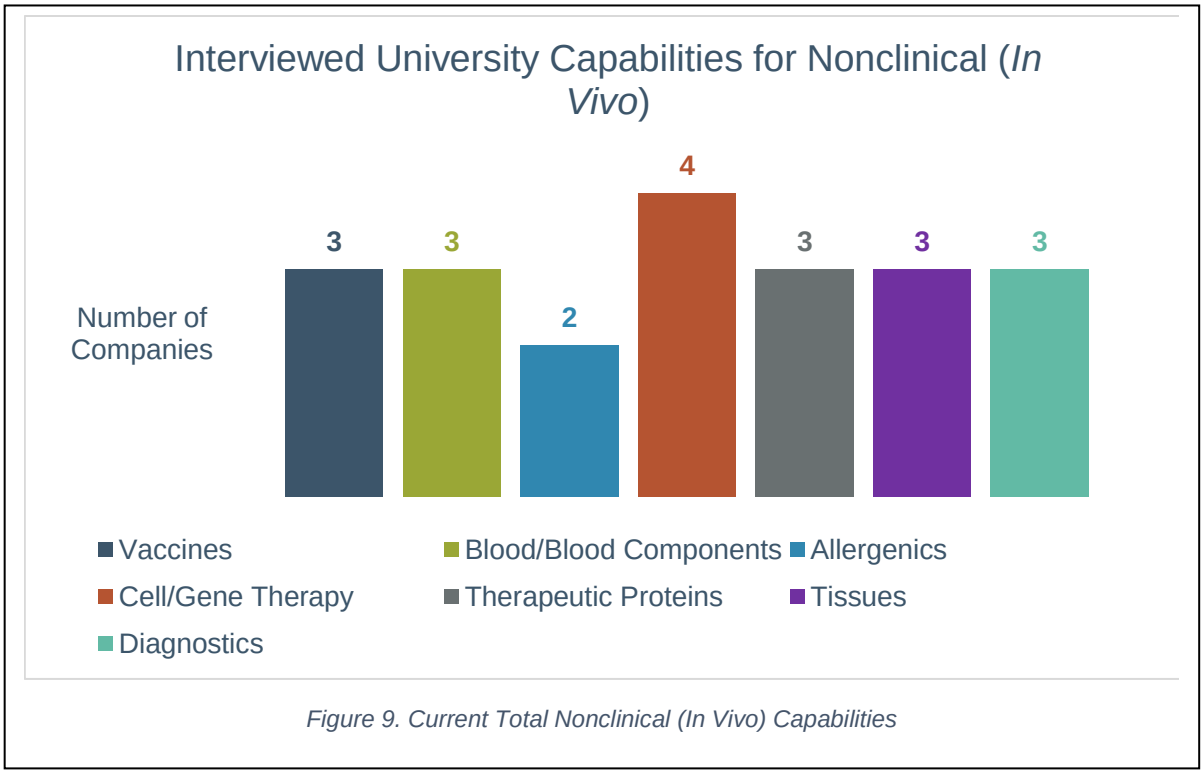

Figure 9. Current Total Nonclinical (In Vivo) Capabilities

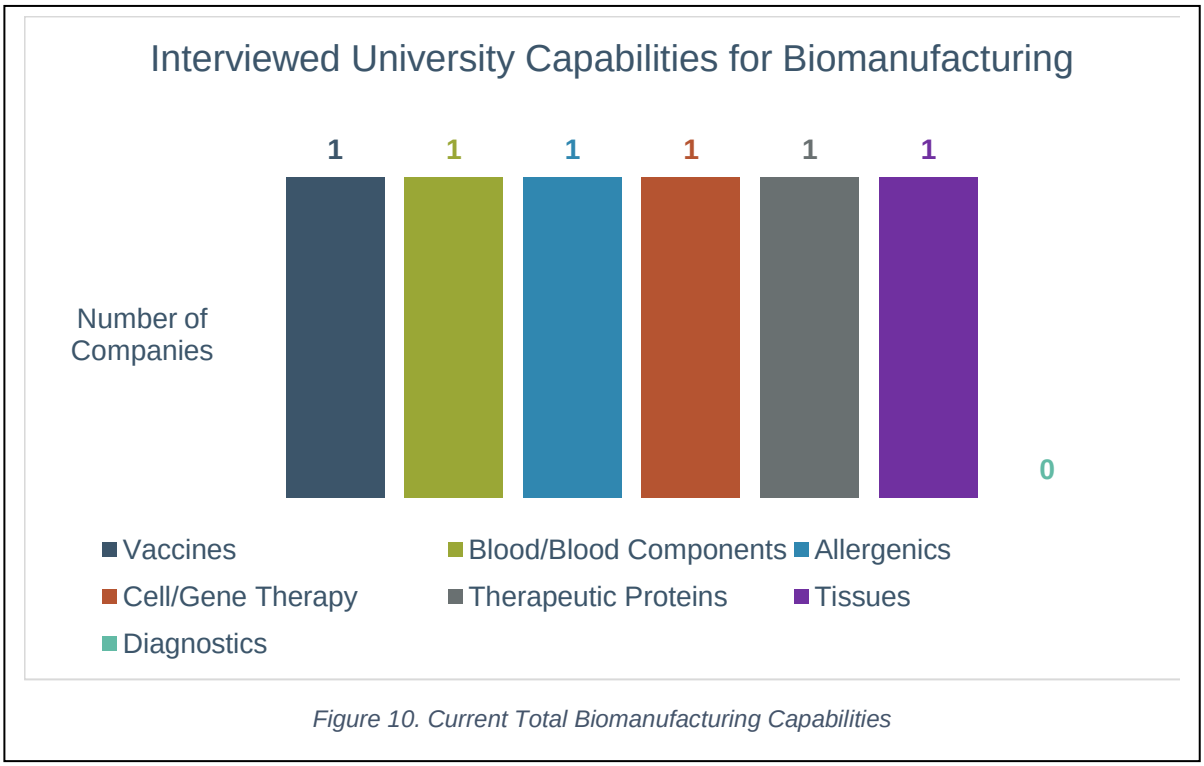

Figure 10. Current Total Biomanufacturing Capabilities

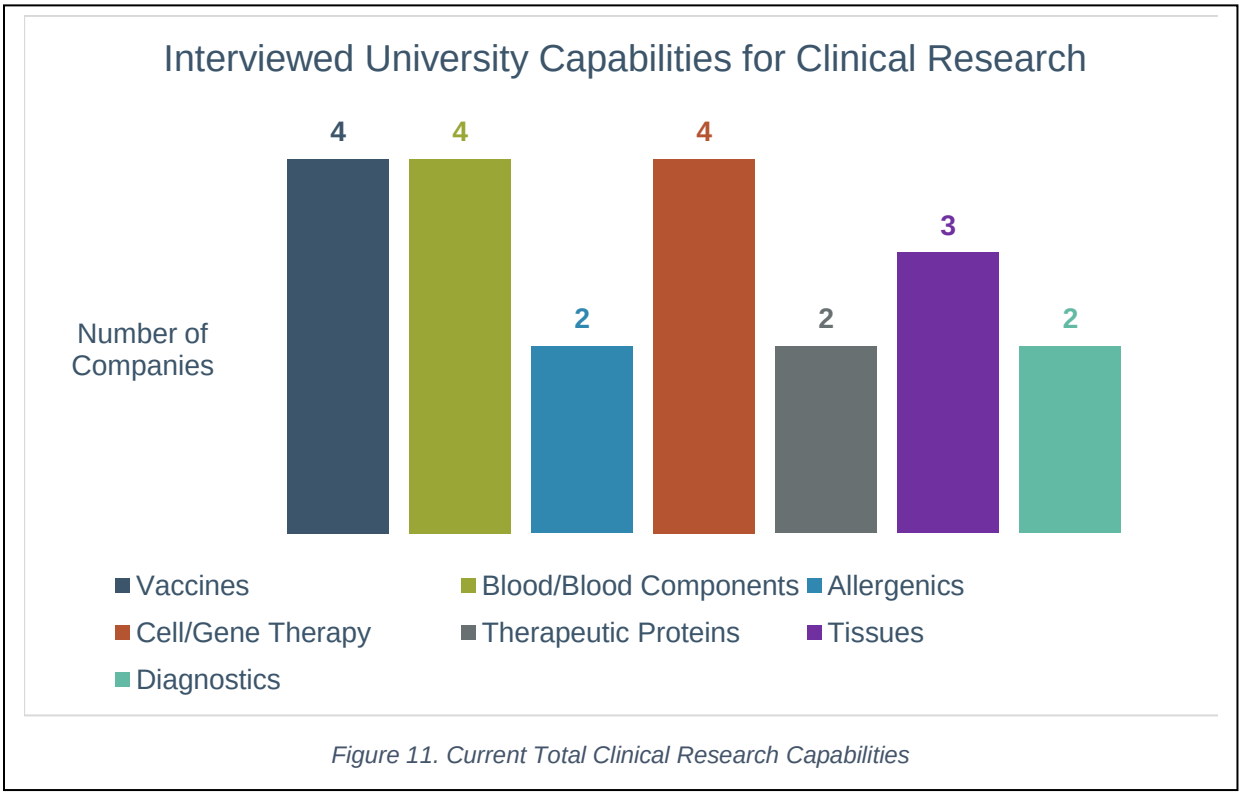

Figure 11. Current Total Clinical Research Capabilities

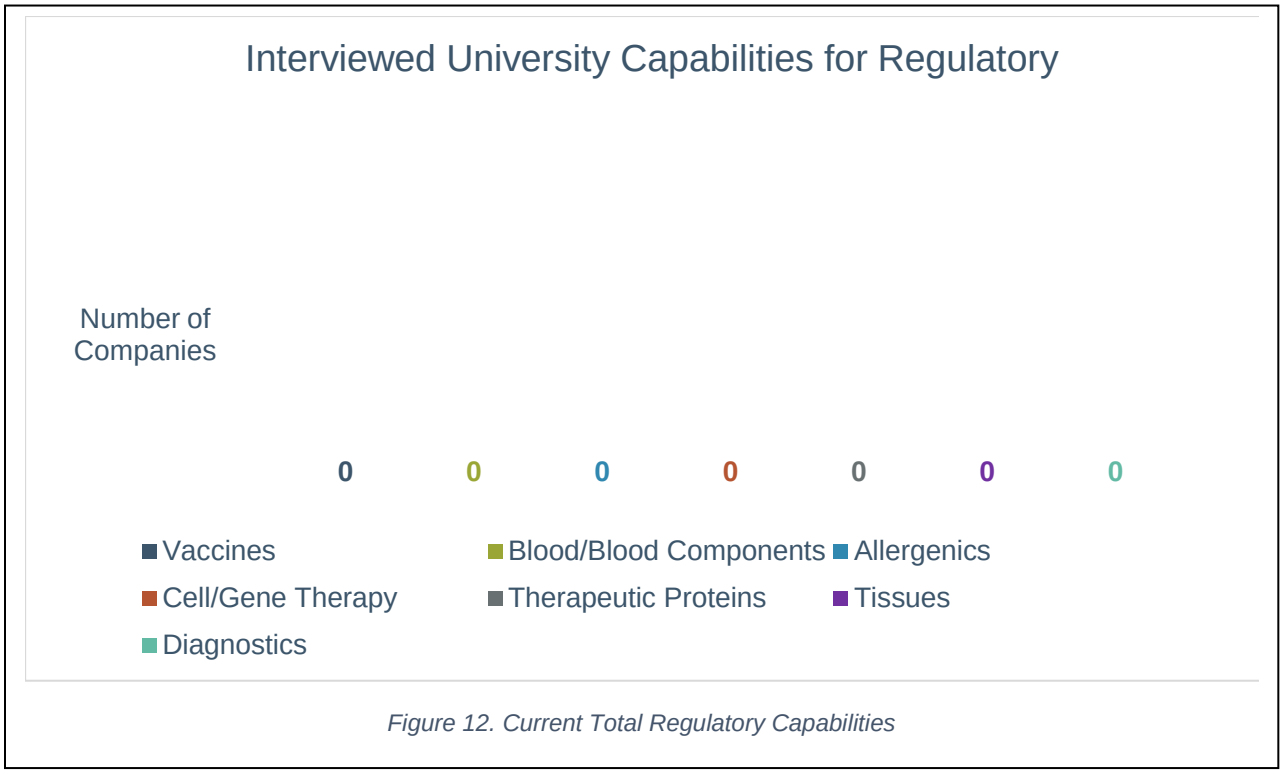

Figure 12. Current Total Regulatory Capabilities

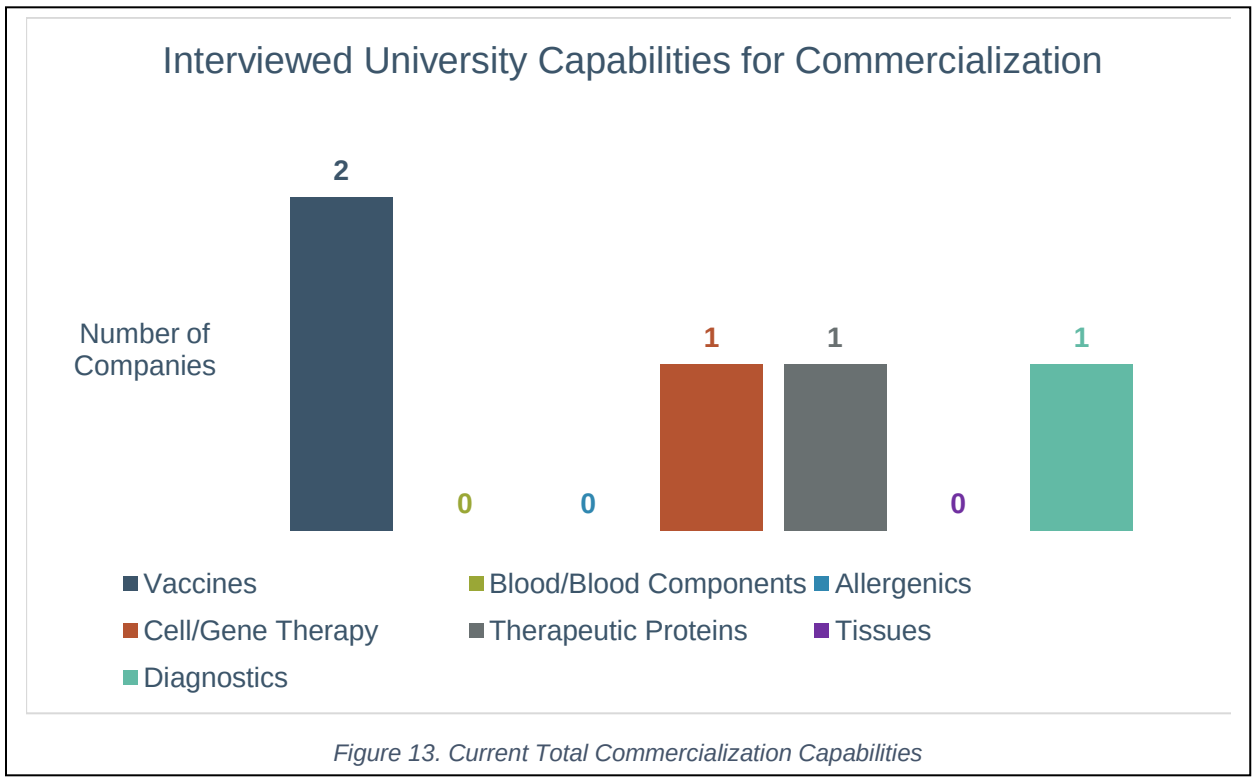

Figure 13. Current Total Commercialization Capabilities

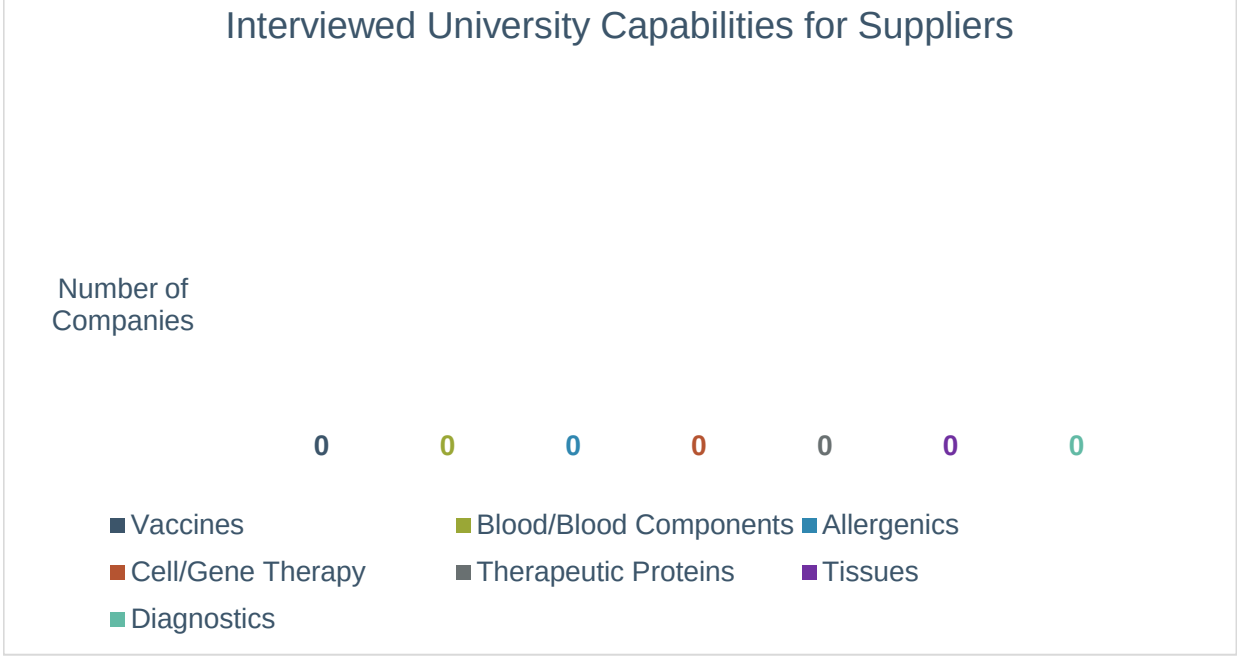

Figure 14. Current Total Supplier Capabilities

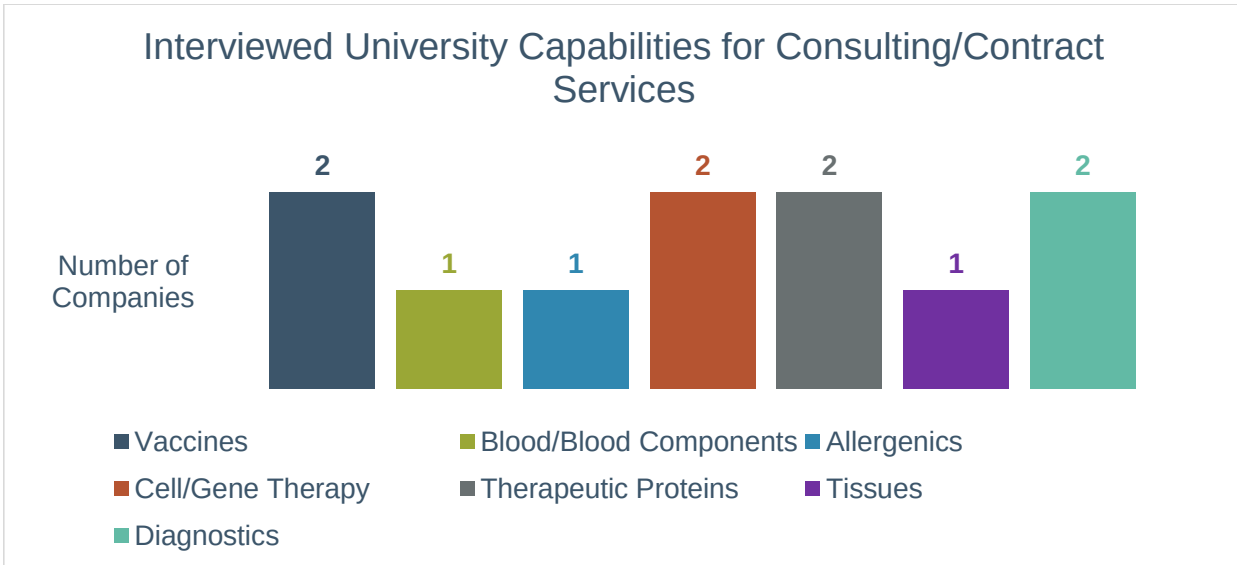

Figure 15. Current Total Consulting/Contract Services Capabilities

R&D capabilities and capacities are further broken down into university offering by technology sector, irrespective of service type **(Figure 16)**. The university contacts that were interviewed identified a fairly even spread across all technology sectors with the highest representation in cell and gene therapy (30) and vaccines (28) and the lowest technology sectors identified being allergenics (16) and blood/blood components (21).

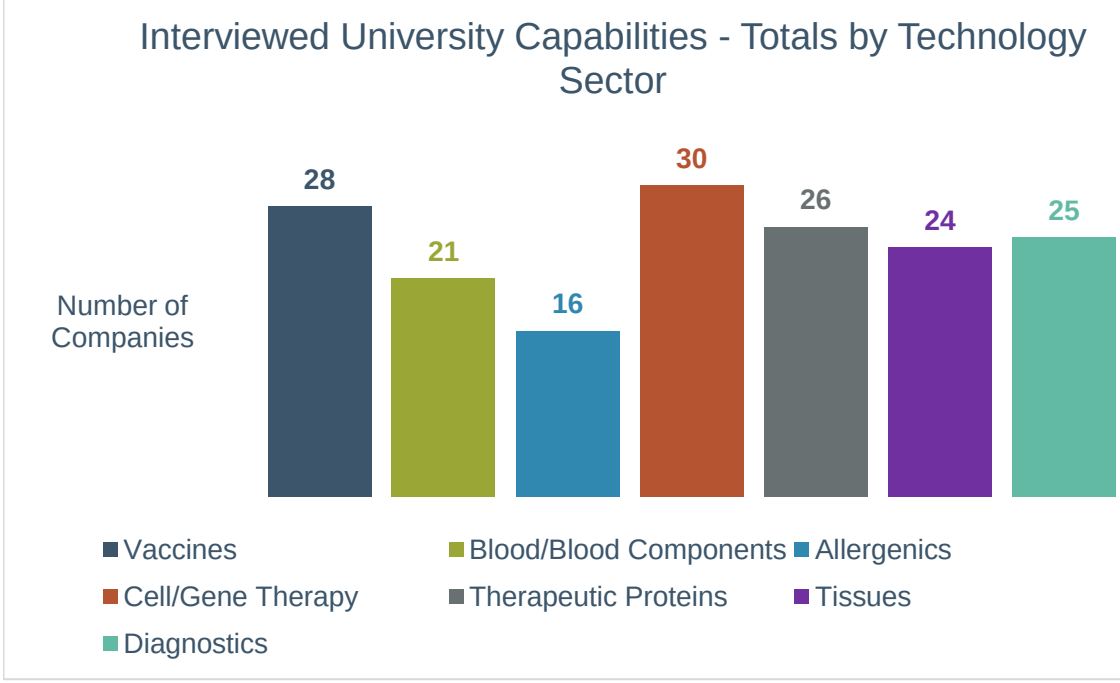

Figure 16. Current Total Capabilities by Technology Sector

Each technology sector was further delineated by university R&D capabilities regarding service type within each individual sector (**Figure 17 – Figure 23**). University capabilities and capacities were quite evenly represented across technology sectors. Notable exceptions were in the sector of commercialization where it seems a focus is primarily on the commercialization of vaccines (2), cell and gene therapy (1), therapeutic proteins (1), and diagnostics (1). There is a lack of university commercialization activity in blood/blood components, allergenics, and tissues. Further, there is currently no reported university activities with a focus on biomanufacturing nor in the diagnostics technology sectors.

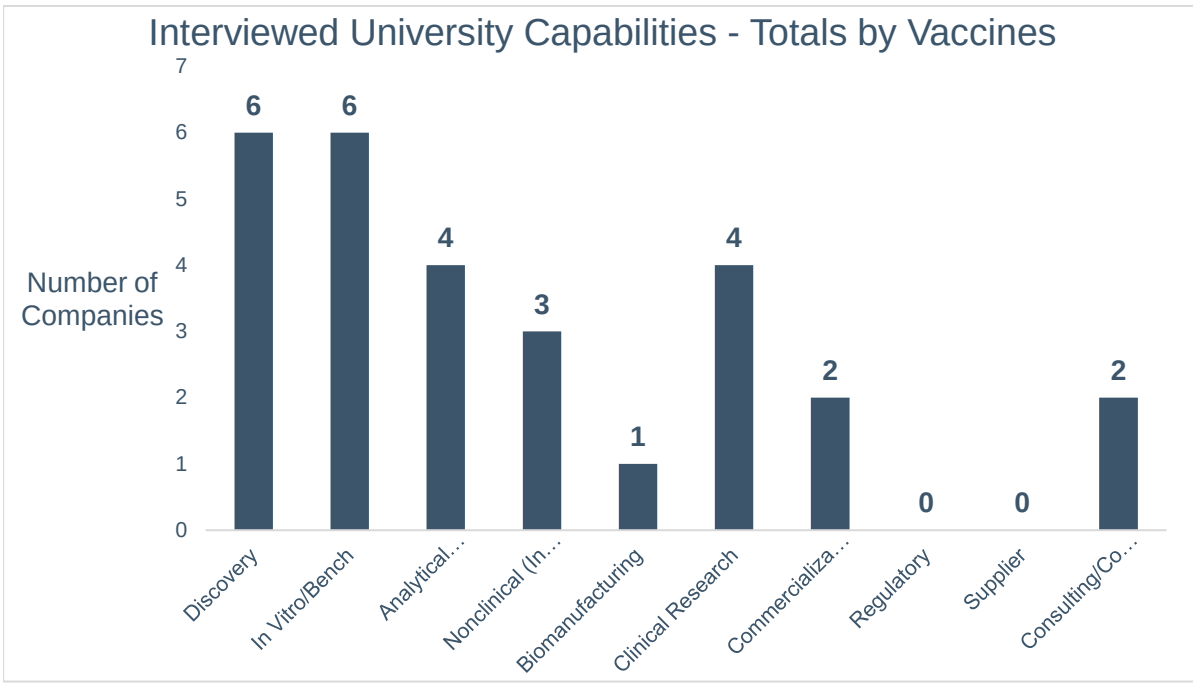

Figure 17. Current Total Vaccine Capabilities

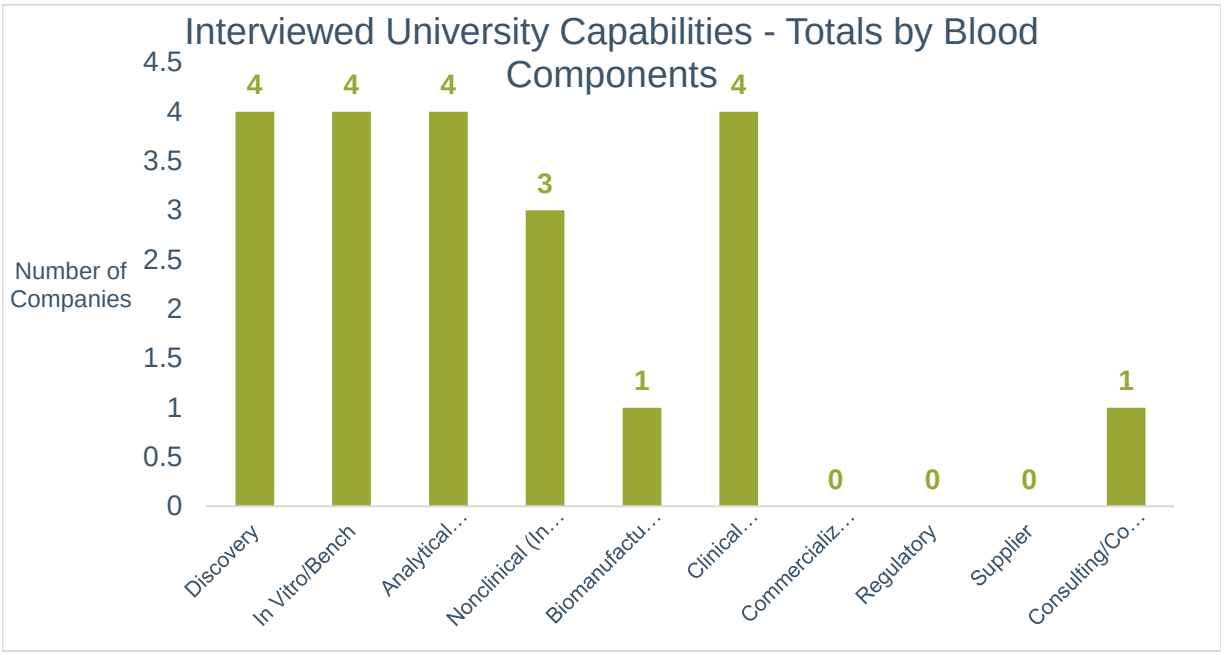

Figure 18. Current Total Blood Components Capabilities

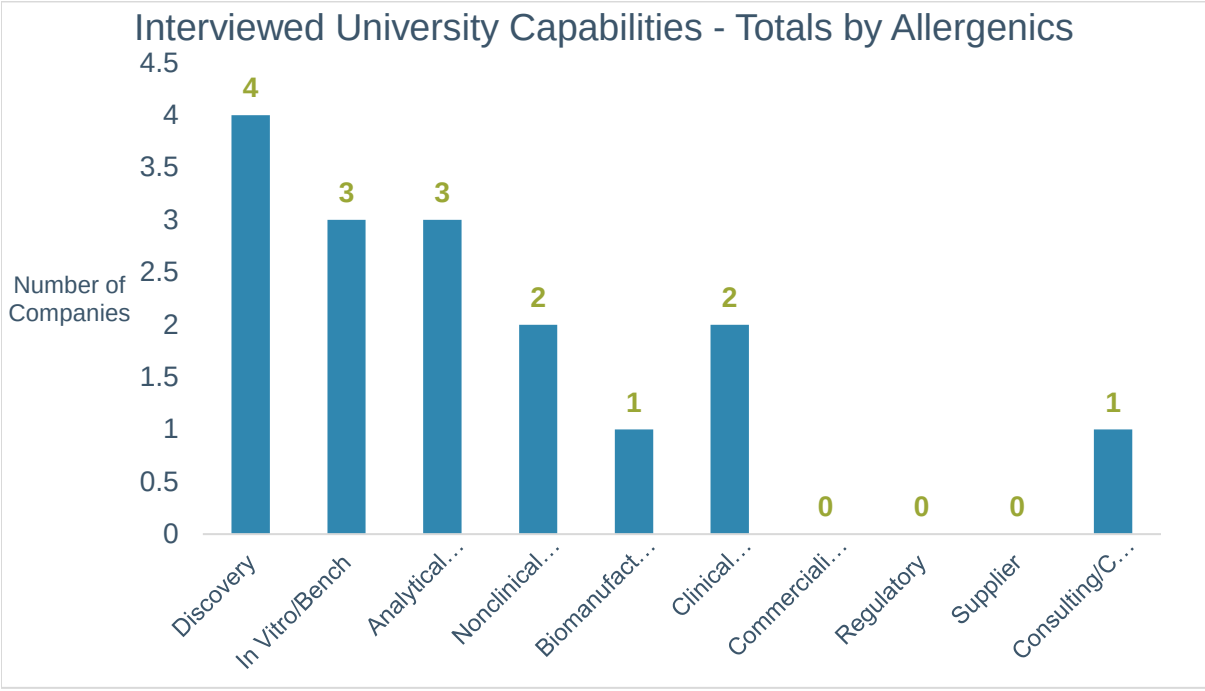

Figure 19. Current Total Allergenics Capabilities

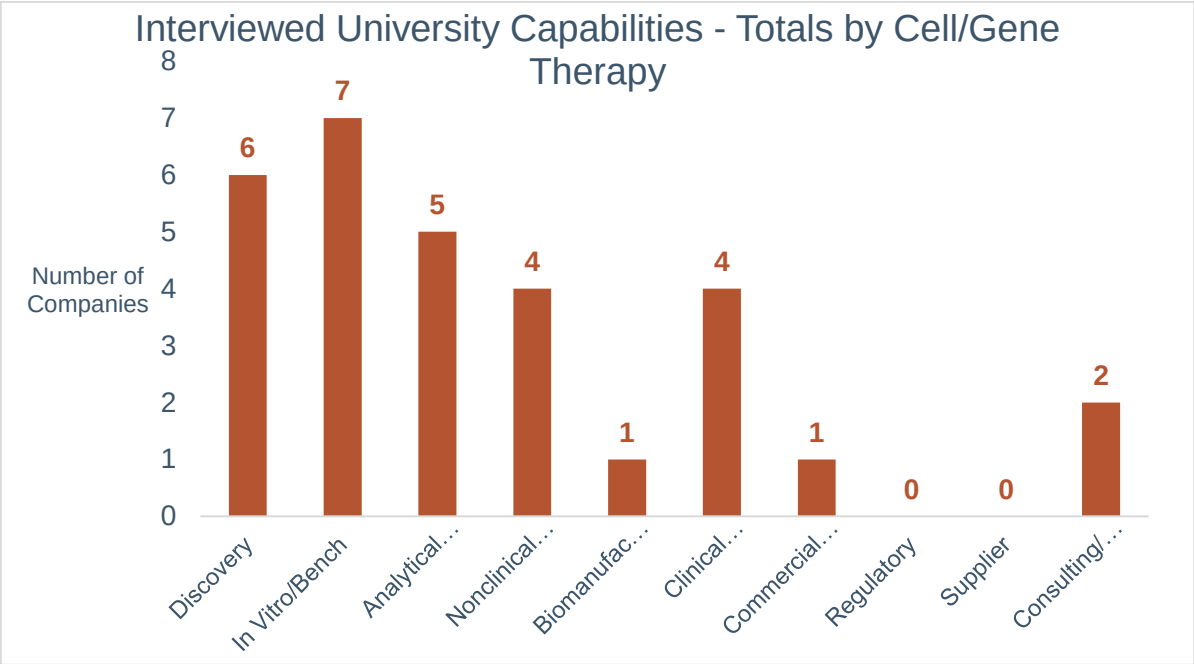

Figure 20. Current Total Cell and Gene Therapy Capabilities

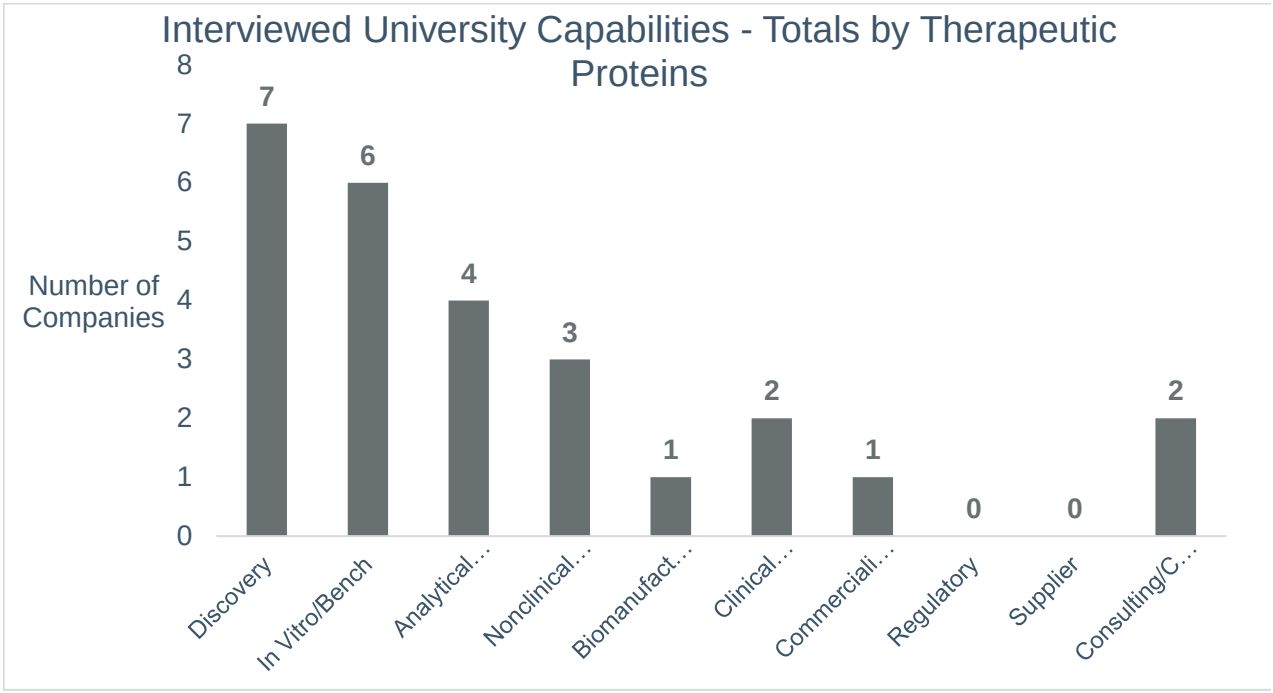

Figure 21. Current Total Therapeutic Protein Capabilities

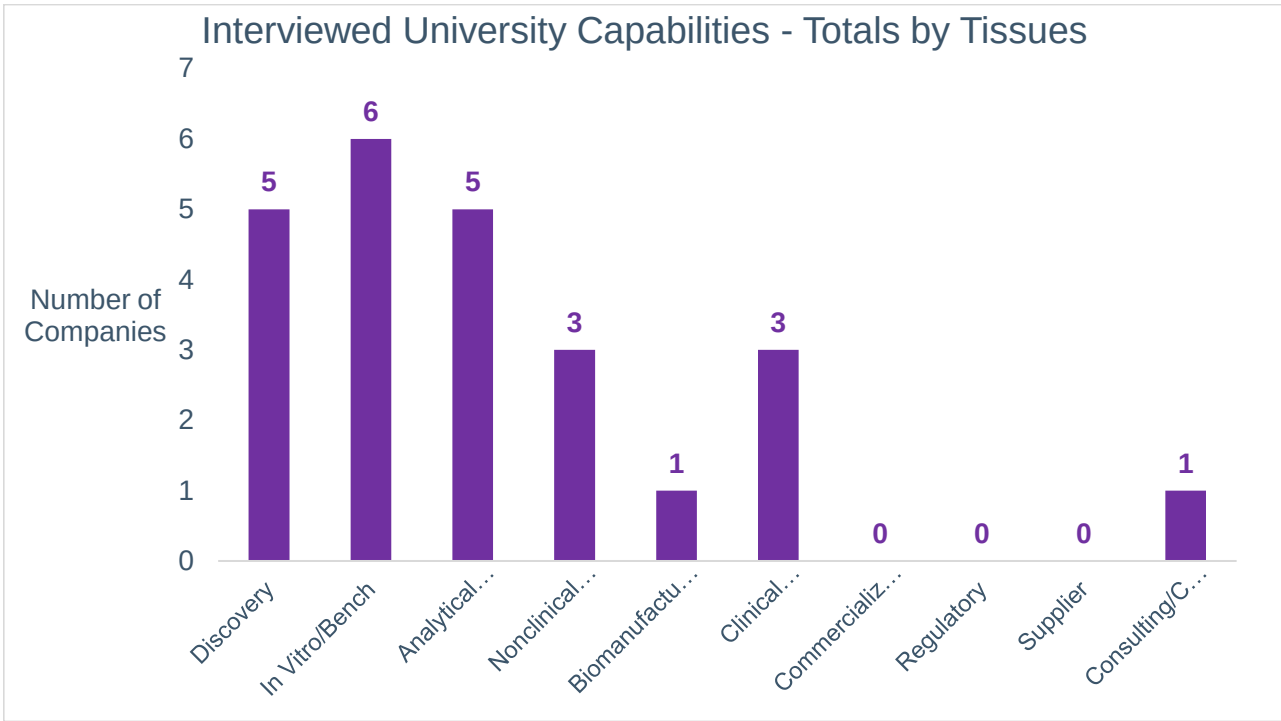

Figure 22. Current Total Tissue Capabilities

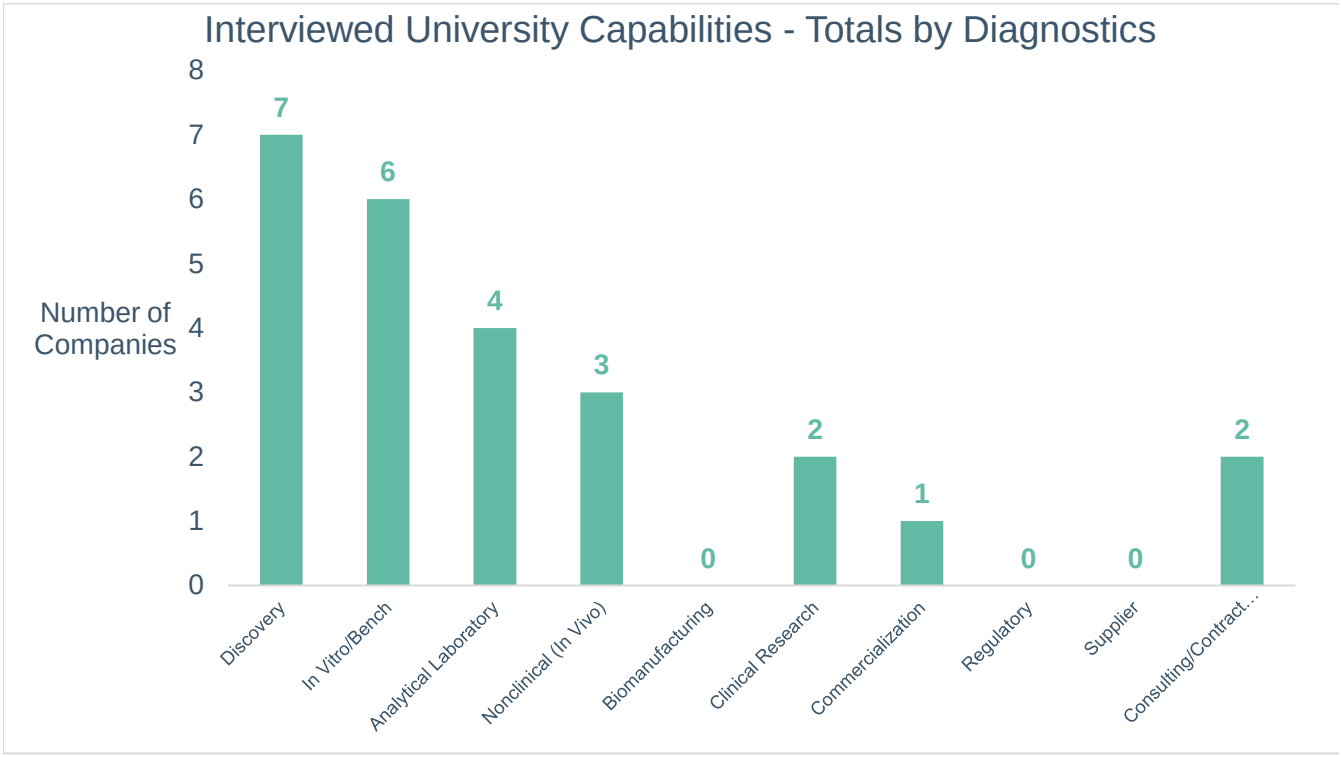

Figure 23. Current Total Diagnostic Capabilities

When asked to identify partnering engagements on biologics R&D efforts within their universities, the most common partner location was within the same state/region, followed by out of state, and international, respectively **(Figure 24)**. In terms of partnering type, the most common type of patterning engagements are reported as intramural followed by extramural, industry (large business), and industry, respectively.

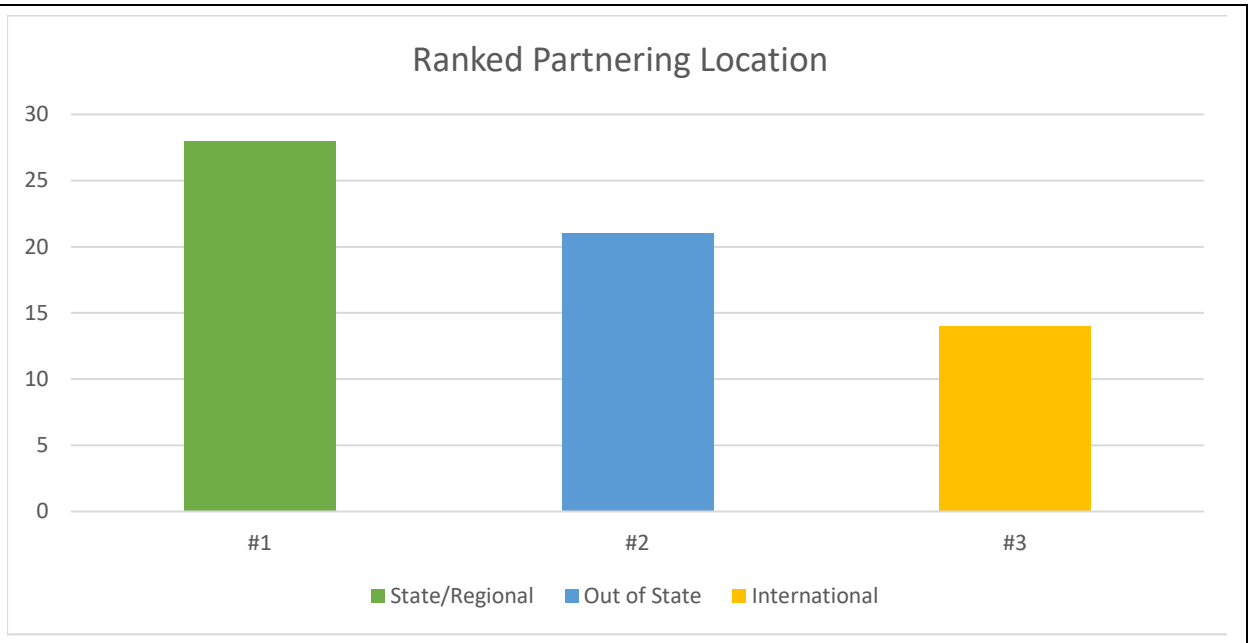

Figure 24. Ranked Partnering Location

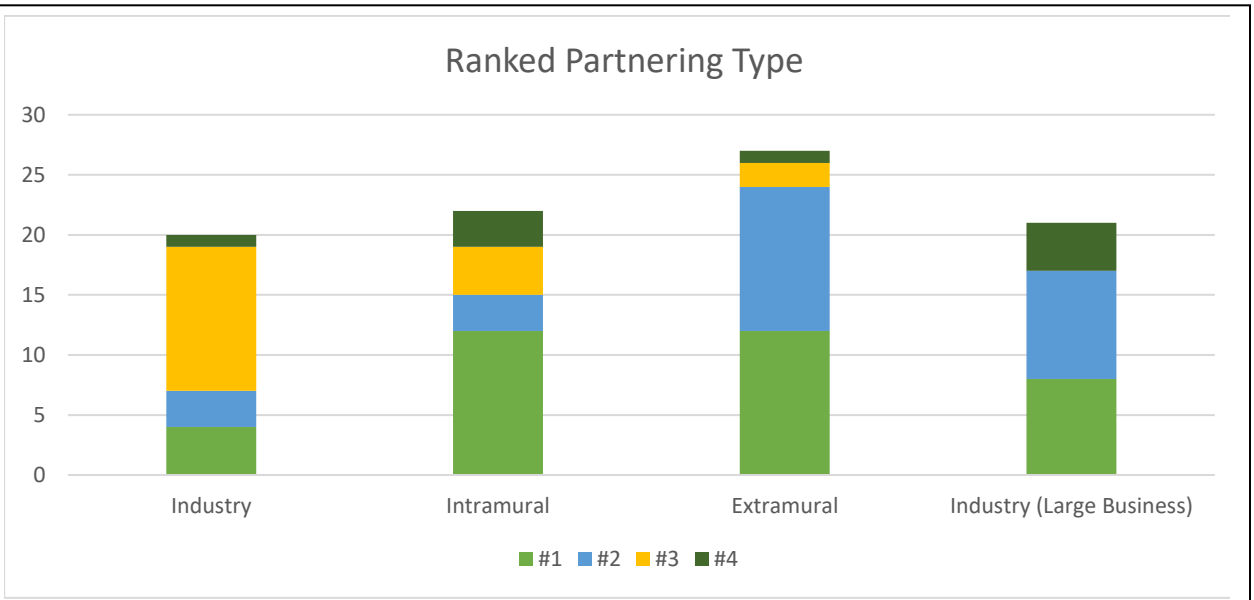

Figure 25. Ranked Partnering Type

Expertise & Workforce

Of the universities that responded (n=9), the breakdown of the number of respondents that have in-house positions by type/level of position/expertise level is reported in **Figure 26**.

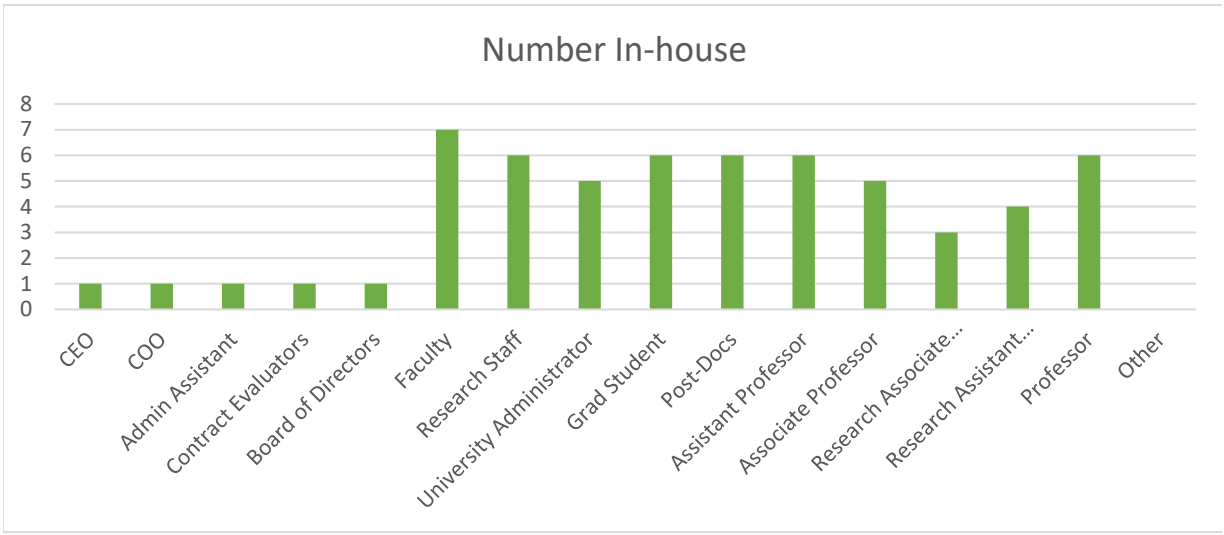

Figure 26. Expertise and Workforce In-House

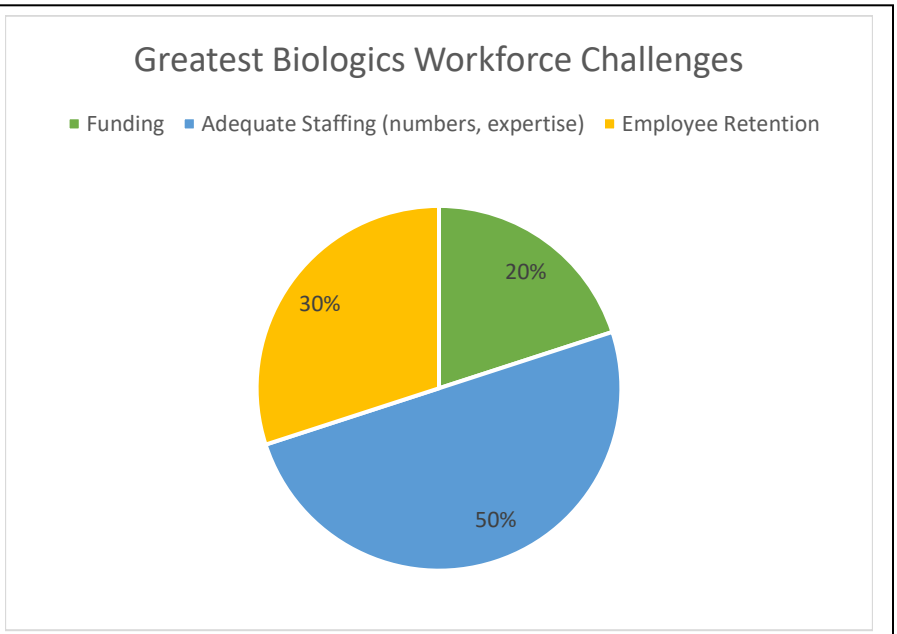

Figure 27. Greatest Workforce Challenges

Interviewees were asked to identify their perceived greatest workforce challenges in biologics, half (50%) of the universities reported struggling to find adequate staffing in terms of numbers of employees to fill open positions and/or a lack of expertise of the available pool of candidates. Thirty percent (30%) reported struggling to retain employees in positions and 20% reported a lack of funding to be their greatest workforce challenge **(Figure 27).**

Qualitative Workforce Demographics to Inform Diversity, Equity, and Inclusion Task Force

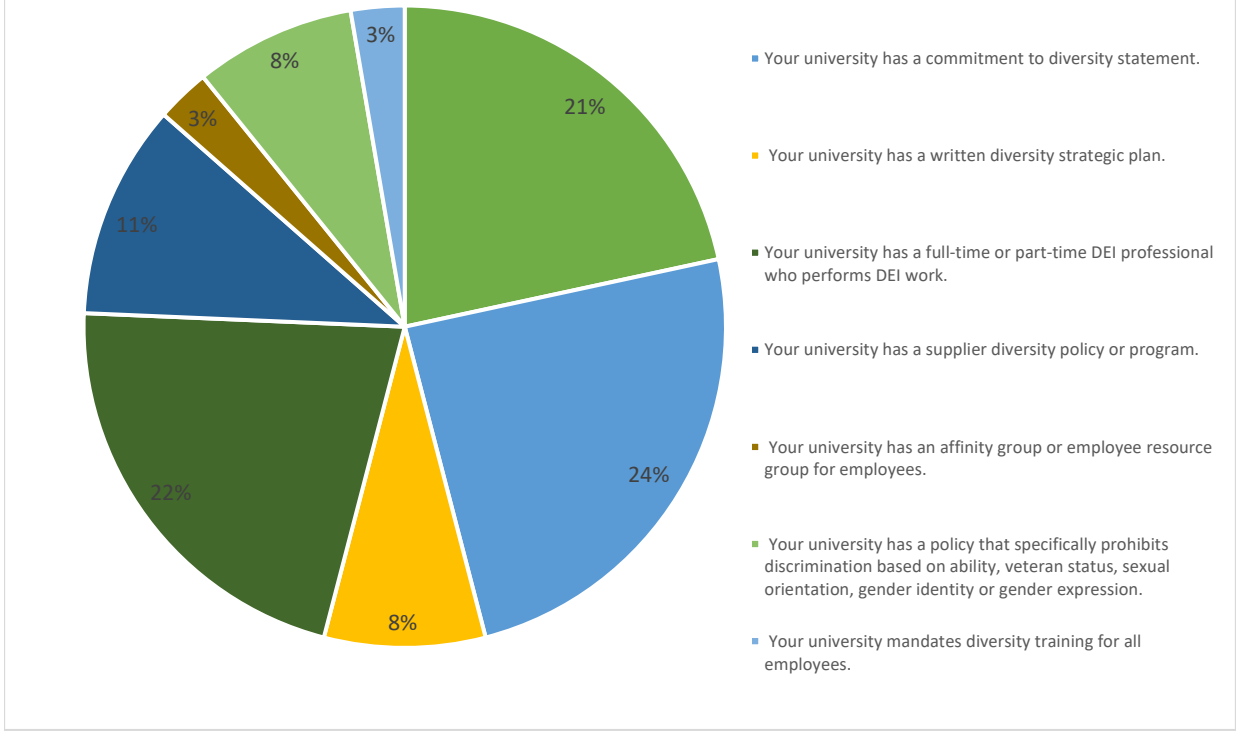

Figure 28. Current State of DEI in Interviewed Universities

Outcomes

The next questions were focused on diversity, equity, and inclusion (DEI) within universities in the KC regional biologics industry. The responses illustrate that all universities maintain at least some level of commitment to DEI initiatives in the KC region **(Figure 28)**. Interestingly, 22% of respondents stated that their university has a full-time or part-time DEI professional performing

DEI work, 24% stated that they have a commitment to diversity statement, yet only 8% stated that there was a written diversity strategic plan in place at their university.

Interviewees were asked to report the Science, Technology, Engineering, and Math (STEM) DEI initiatives in place at their university. Notably, there was a fairly uniform split amongst STEM DEI initiatives were observed across the recruitment of staff and students (22%), student transfers (11%), staff education programs (11%), primary/secondary education programs (17%), culture/committees (22%), and grants (17%) **(Figure 29)**.

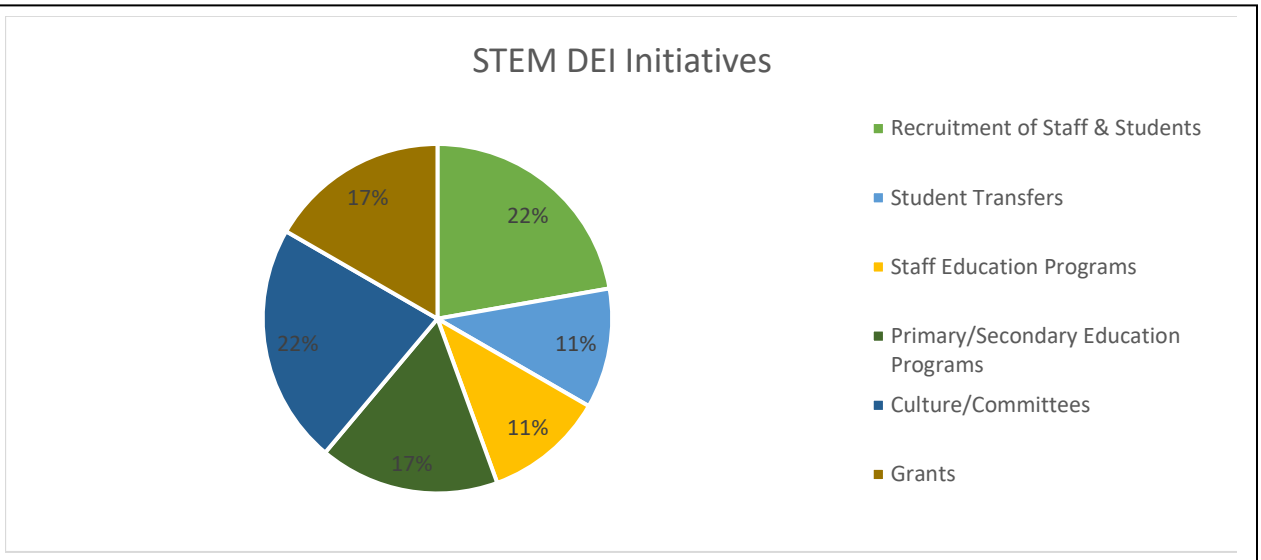

Figure 29. Current STEM DEI Initiatives in Place

Interviewees that responded (n=9) with their viewpoint of DEI importance to students, staff, and faculty self-reported that these initiatives are of high importance (n=3) or very high importance (n=6), see **Figure 30**. Respondents (n=11) noted that DEI initiatives in place at their university had either moderately (n=3), greatly (n=4), or very greatly (n=1) improved success providing an indicator that the initiatives appear to be having a positive impact on STEM and/or biologics university research initiatives **(Figure 31)**.

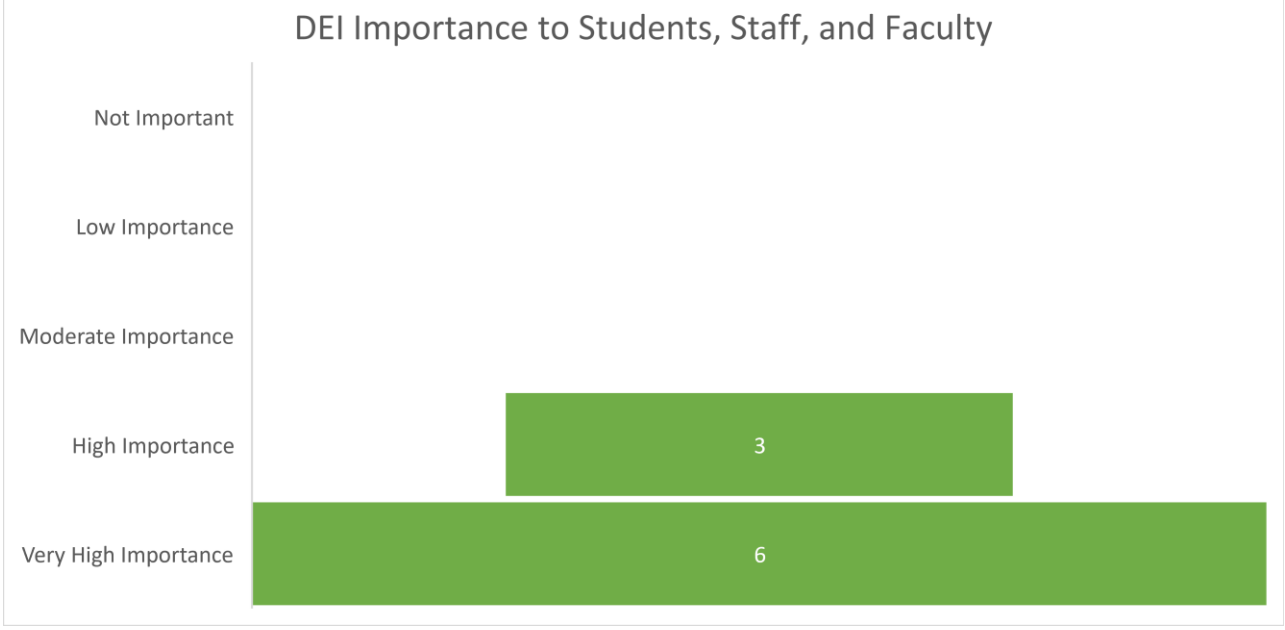

Figure 30. DEI Importance to Students, Staff, and Faculty

It should be noted that no university responded to the question regarding employee DEI demographics within their university.

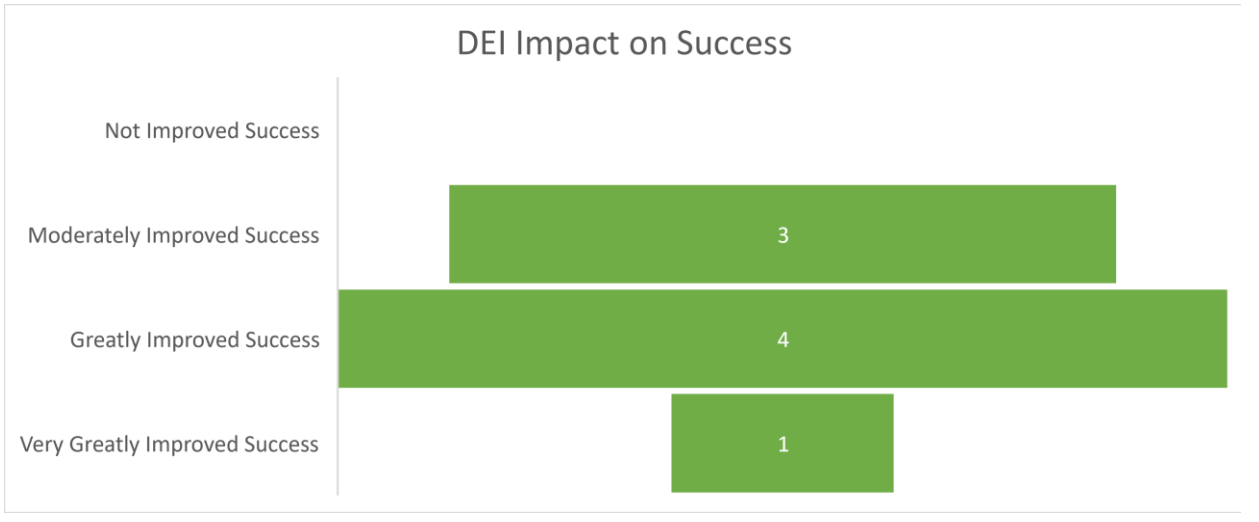

Figure 31. DEI Impact on Success

Source of Funding(s)

Federal and state sourced funds were most commonly ranked as the number one source of funding received for biologics R&D. Foundation sourced and industry sponsored funding were reported as a common source of funding but their importance, overall, in varied by university **(Figure 32)**.

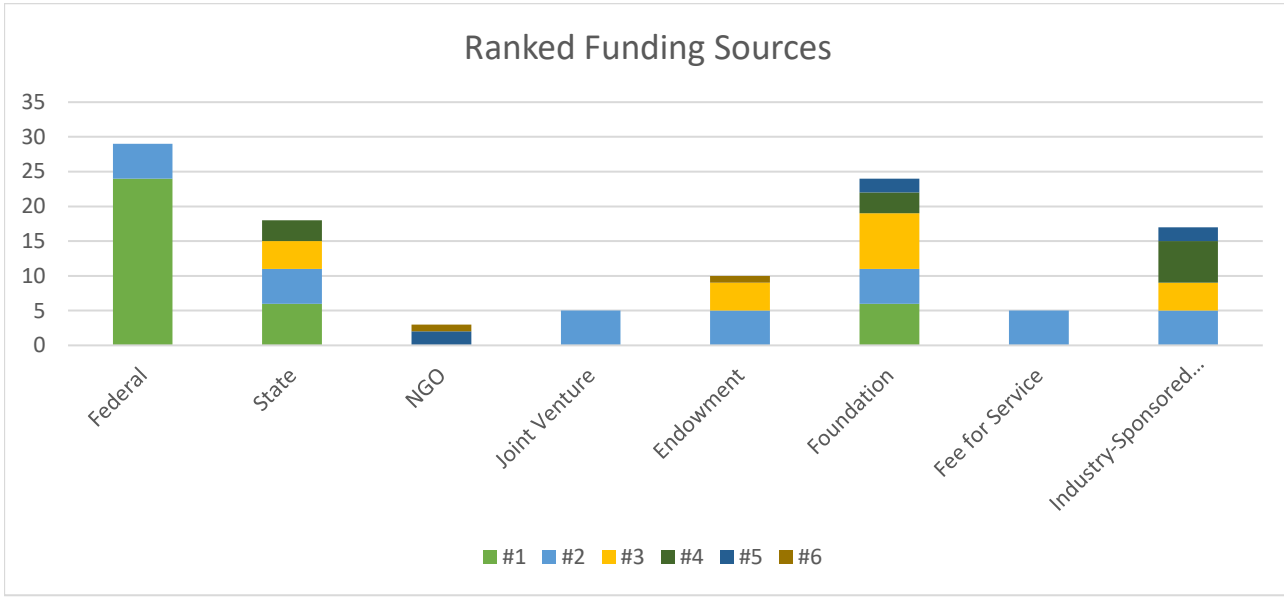

Figure 32. Ranked Funding Sources

Regional Market Perceptions

When questioned on their opinions of the likelihood that the biologics industry will grow in the KC Region in the next 5 years, the overall opinion of universities in the region is optimistic with all respondents reporting a moderate, high, or very high likelihood of growth **(Figure 33)**.

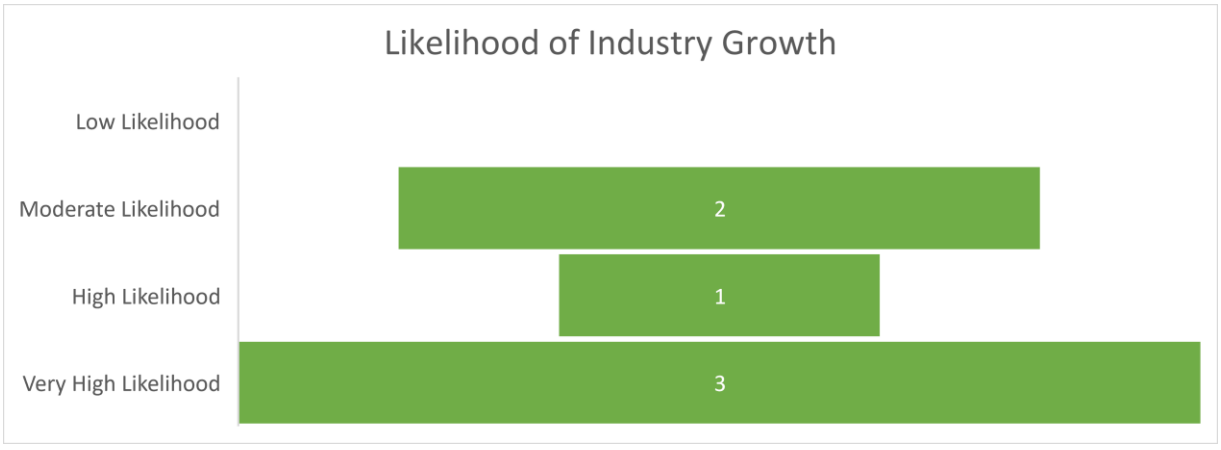

Figure 33. Likelihood of Industry Growth

University interviewees were asked to provide their opinions on Strengths, Weaknesses, Opportunities, and Threats (SWOT) of the regional biologics industry. The most cited strengths included both strong regional existing assets as well as regional expertise **(Figure 34)**. Low institutional enthusiasm / lack of career support was the most common weakness reported **(Figure 35)**. Collaboration opportunities and events are viewed as the largest current opportunity in the KC Region **(Figure 36)**. In general, threats were the least reported on in this question, however, the largest threat to the KC Regional biologics R&D is believed to be the fact that better efforts are being made in other regions across the US as compared to those taking place in KC **(Figure 37)**.

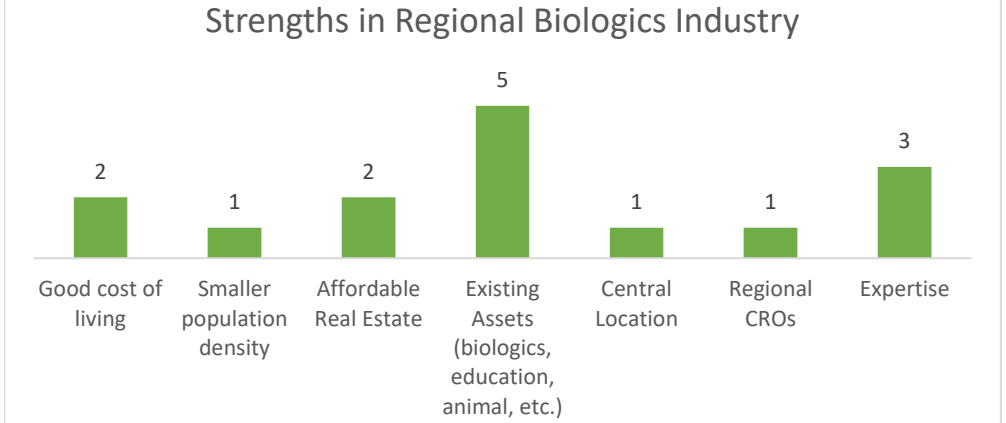

Figure 34. Strengths in the Regional Biologics Industry

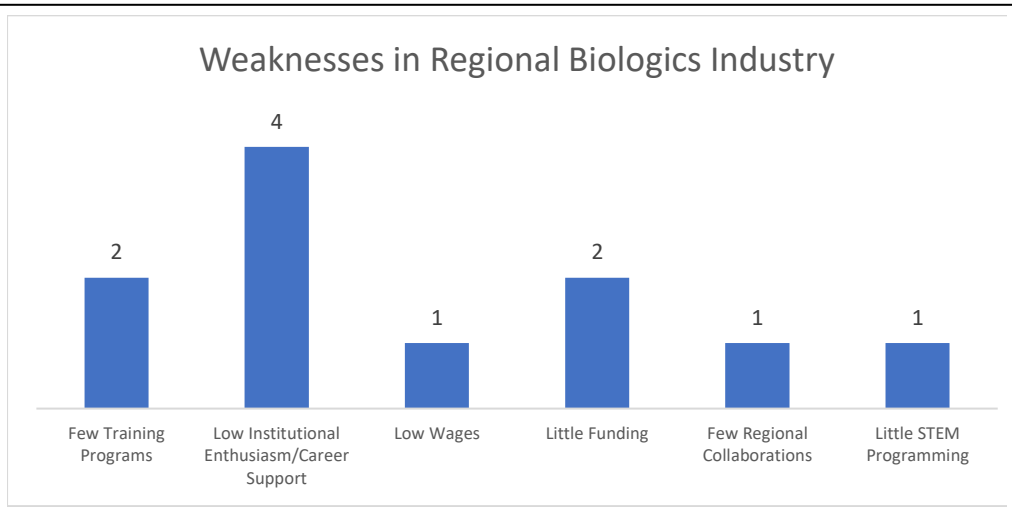

Figure 35. Weaknesses in Regional Biologics Industry

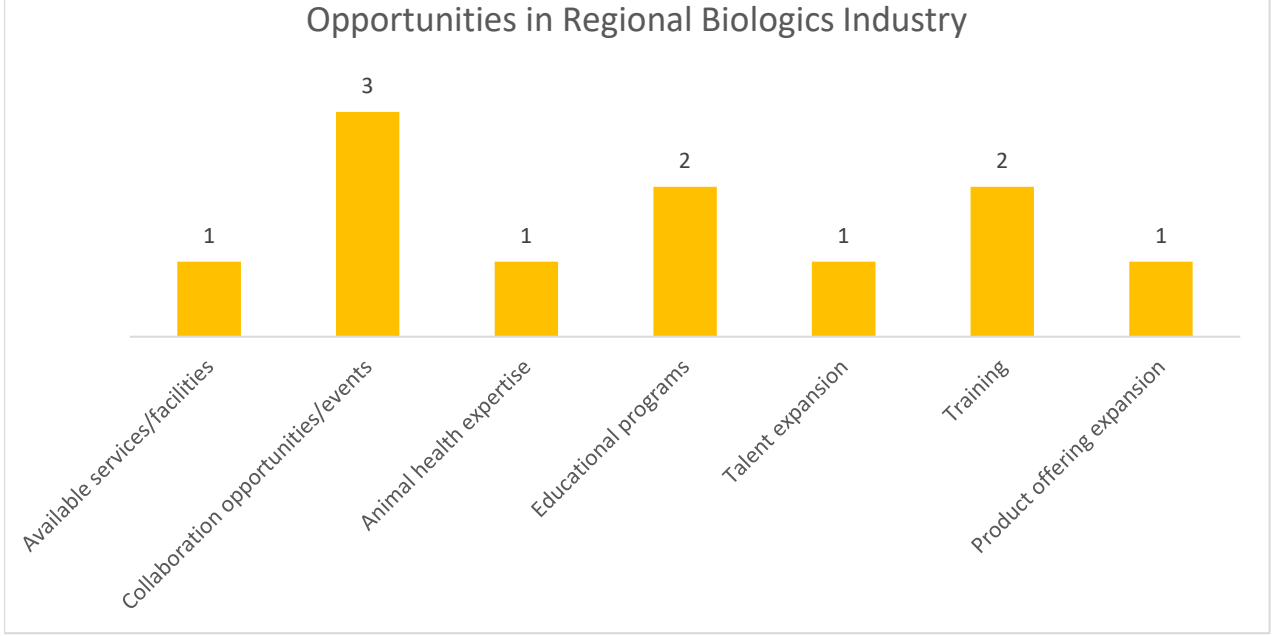

Figure 36. Opportunities in Regional Biologics Industry

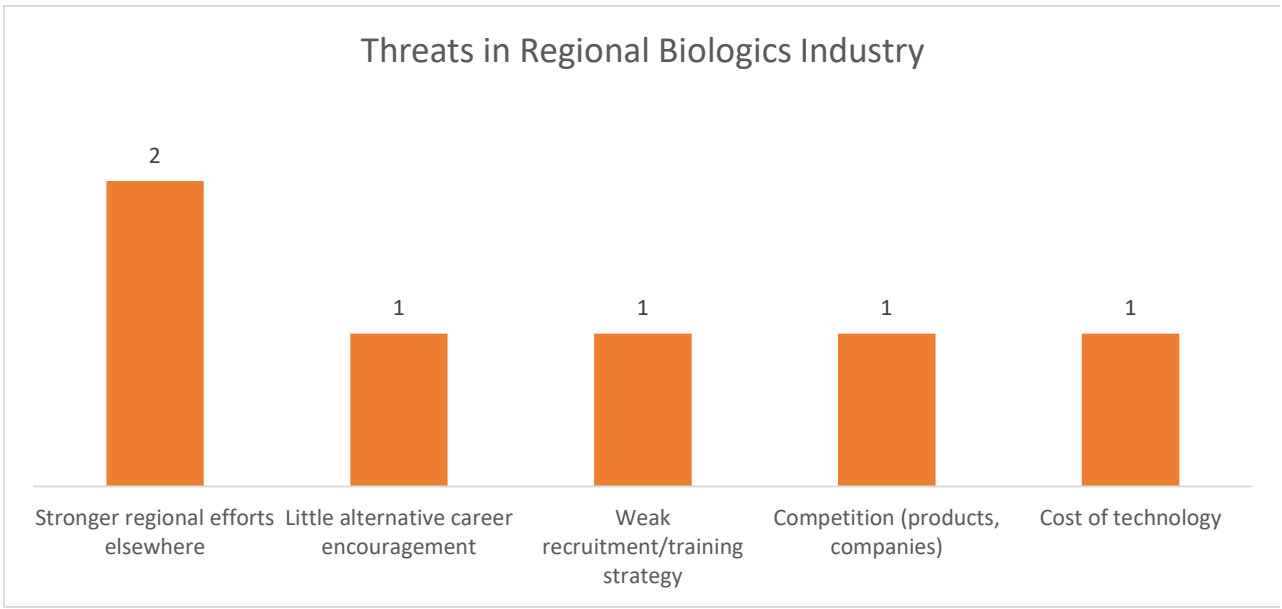

Figure 37. Threats in Regional Biologics Industry

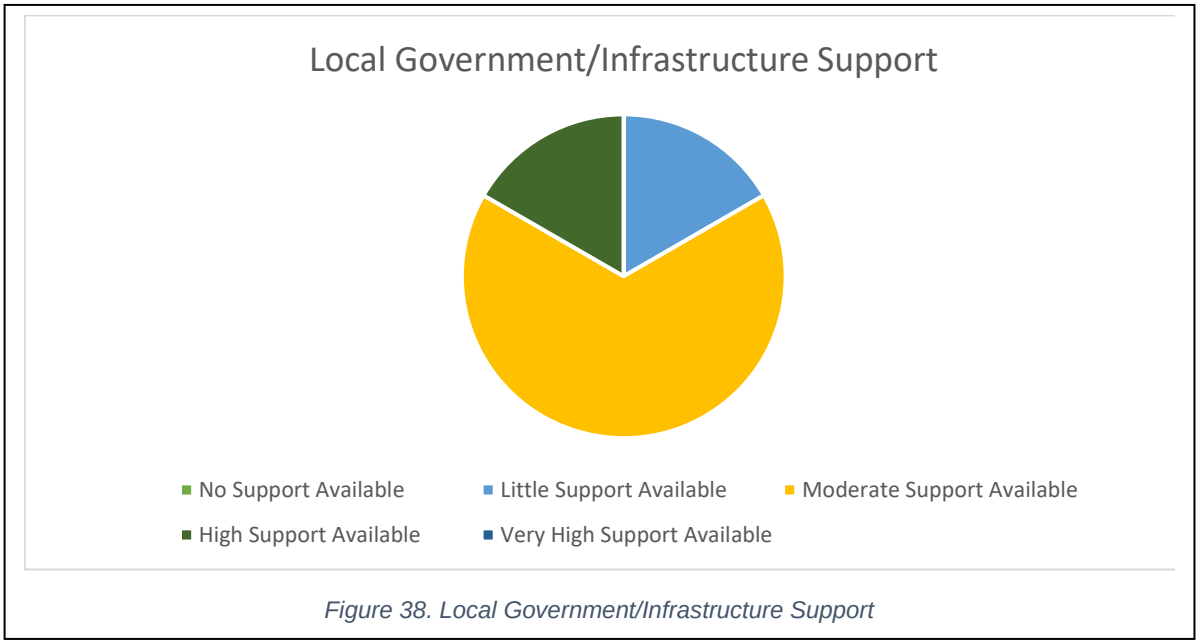

Figure 38. Local Government/Infrastructure Support

University respondents were generally in agreement that local government/infrastructure support is currently providing little (17%) to moderate (67%) support for growth and expansion of biologics organizations in the KC region **(Figure 38)**. Only 17% of respondents rated the local government/ infrastructure support as being perceived as high.

A majority (71%) of universities interviewed perceive only a moderate amount of support for growth and expansion is provided from one organization to another organization within the KC Regional biologics ecosystem **(Figure 39)**. However, the remaining 29% felt that this type of support from one organization to another was high in the KC Region.

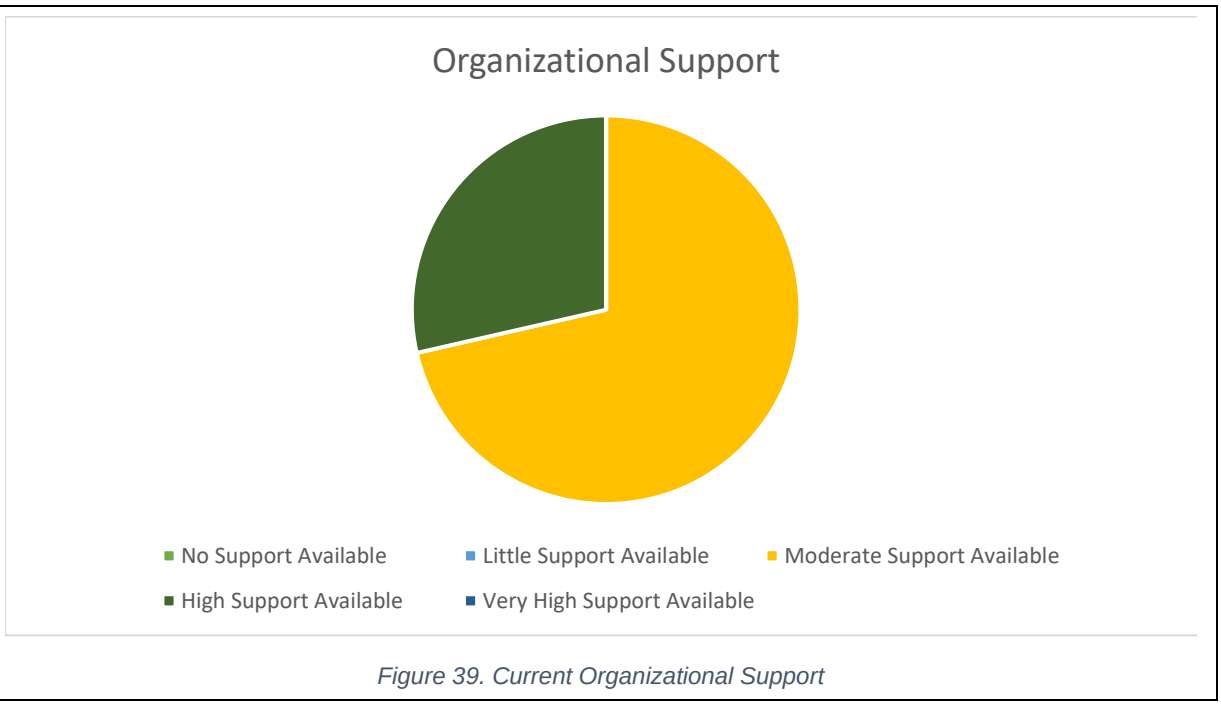

Figure 39. Current Organizational Support

Conclusion

The main objective of the University Interviews was to identify and inventory any life science-related university R&D activity within the region that is focused in biologics. The responses indicate that there is good representation of both human and animal health biologics university-based R&D in the KC Region that is diverse across different stages of development and various types of biologics R&D. Several areas stand out as clear strengths in capabilities and capacities of the region's universities:

- KC Regional universities are very active in discovery work in the fields of diagnostics, therapeutic proteins, cell/gene therapy, and vaccines.
- KC Regional universities are very active in *In vitro* / bench work in the fields of cell/gene therapy, therapeutic proteins, tissues, diagnostics, and vaccines.
- KC Regional universities are very active in analytical laboratory work in all technology sectors.
- KC Regional universities are very active in nonclinical / *in vivo* work in all technology sectors.
- KC Regional universities are active in clinical research work in all technology sectors.

Further, the KC Regional universities possess a vast diversity across all technology sectors as well. Of the universities interviewed the leading technology sector in terms of number of responses indicating activity within that particular space was cell/gene therapy (n=30), the lowest sector represented was allergenics (n=16). **The diversity and the relative uniformity across all biologics technology sectors in the regional universities is a key strength to the KC Region.**

University responses indicated a clear effort at DEI initiatives and these active efforts have positively impacted success overall in regard to university biologics focused R&D in general. Additionally, a wide variety of STEM DEI initiatives are active in regional universities, as well, though how those efforts were aimed at biologics, specifically, remain dubious.

The regional universities reported a diverse source of funding and partnering, indicative of sustainable momentum within the KC regional biologics R&D industry.

The key identified areas for improvement include:

- Commercialization activity in biologics, across all technology sectors is sparse.
- The KC regional universities report the largest current biologics workforce challenge to be inadequate staffing due to lack of numbers of candidates and lack of expertise in biologics.
- There is little activity in fee for service work in the university biologics R&D.
- NGO and joint venture funding were reported as low compared to other sources.
- Low institutional enthusiasm/career support was reported as a weakness, efforts to highlight successes in biologics of the KC Regional university may increase enthusiasm in this space.
- A lack of collaboration opportunities/events were noted in the SWOT analysis.
- A perception of moderate growth and expansion opportunities provided from one organization to another organization was identified.

- University responses indicate a perception of only moderate support from local government and infrastructure as well as other organizational support.

Collectively, **the KC Region has a strong presence in biologics in both animal and human health**. Indicators are present that the region is poised for further growth but efforts to sustain and support this growth have been presented in this report. Efforts to increase the commercialization activities across all technology sectors in biologics R&D in universities could help to foster collaboration between universities and in university-industry partnerships, which may in-turn increase institutional enthusiasm and spur future growth in the KC region. Universities perceive that the support they receive from both local government and infrastructure as well as other organizational support was deemed a moderate level of support by those interviewed for this report. An increase in support from both local government and infrastructure as well as other organizations may provide the necessary stimulus to maintain the clear momentum that is present in biologics in the regional universities.