adMare Institute

Canada's Evolving Life Sciences Industry: Exploring Ecosystems, Clusters, and the Need for Anchor Companies

Editorial Committee: Mounia Azzi, PhD; Gordon C. McCauley, BA, MBA, ICD; Anie Perrault, LL.L, ASC; Sarah Williams, PhD

The authors would like to acknowledge the time and insight of the review committee, consisting of Dr. Cedric Bisson, M.D., LL.B., Partner, Teralys Capital, Jodi L.H. Butts, Partner, M.A., LL.B, WATSON Advisors Inc., and Dr Elicia Maine VanDusen, PhD, Professor of Innovation & Entrepreneurship, Simon Fraser University.

Executive Summary

Canada's life sciences sector is a vital and essential contributor to the national economy. Twenty years ago, the sector was poised to emerge as a global player with the combined strengths of its research enterprise and burgeoning industry, but the acquisition or demise of several anchor companies, together with the 2008 financial crisis, disrupted the sector's progress. In recent years, significant national and provincial public policy initiatives, combined with both public and private investments, have been made towards reinvigorating the life sciences industry.

These efforts have generated much discussion about the role of innovation ecosystems, advantages of industrial clusters, and impact of anchor companies on the life sciences industry. This paper describes how innovation ecosystems differ from clusters, and explores the symbiosis that exists among the component parts. We also propose a definition of research-based anchor companies in the Canadian context and explore the critical roles they play in leading internationally prominent life science clusters – a role that is absent in Canada.

Innovation ecosystems are so-named to recognize the complex interactions of their participants, including large companies, startups, universities, research centres and industry advocacy organizations. They may be regional or geographically dispersed, and often arise from a combination of public policy, advocacy efforts, the cultural and business environment and competitive and market challenges. Ecosystems can accelerate innovation by providing leadership and industry engagement, attracting and developing talent, through development of research assets, and building market awareness and brand recognition.

Clusters are internationally prominent geographic concentrations of interconnected companies and institutions in a particular industry or field; they develop as a function of market economic activity as opposed to public policy initiatives. The co-location of these specialized groups leads to self-reinforcement, particularly through positive 'spillover' effects of knowledge and talent that accelerates innovation. While clusters and innovation ecosystems share many components, advantages such as world-leading business and innovation insights, heightened supply chain integration, quality of ancillary service and capital providers and integration with leading research institutions provide a sustained competitive edge to clusters.

An **anchor firm** is a dominant company with considerable market share, brand recognition, and a track record of sustained success. Anchor companies are a hallmark of successful clusters. They make heavy investments in R&D, and have the ability to develop, absorb and apply innovative knowledge; these attributes and capabilities are essential to sustaining the company's success. The global prominence of an anchor firm enables unique insights into market opportunities, helping to maintain its dominance. An anchor firm interacts systematically with other companies and organizations within a cluster and acts as a bridge, connecting its regional and global networks of partners, suppliers, customers, and stakeholders. In doing so, anchor companies strengthen innovation within clusters. Studies that have explored the biotechnology sector's emergence within the United States suggest that the presence of an anchor firm, with a dense web of local relationships, is a necessary condition for cluster formation.

The Canadian life sciences sector continues to evolve and grow, and strong life sciences innovation ecosystems are found in Montreal, the Greater Toronto Area and Vancouver, with emerging concentrated activity in other cities. But there remains a long-recognized disconnect between Canada's strong foundational research performance and ingenuity, and translation into commercialized innovations that capture resulting economic benefits for Canada. This document explores how developing Canadian anchor firms could help to bridge this gap.

Although there are currently several prominent Canadian life science firms with potential to evolve into anchor companies, today no Canadian firm meets all of the core established criteria. In the Canadian context, anchor companies appear to be the key element currently missing from life sciences innovation ecosystems, that could catalyze their transformation into globally prominent clusters. Given that the elements within a successful ecosystem are symbiotic, missing this keystone component is a critical deficiency that must be addressed if Canada's ecosystems are to evolve into clusters.

To realize the potential of Canada's life sciences innovation, there must be a focus on developing as many potential anchor companies as possible. Meeting this challenge comes with the promise of significant human health and economic benefits generated by an innovative and self-sustaining life sciences sector.

Introduction

Canadian life sciences have a proud history, including the development and advancement of science through the discovery of medicines, devices, and knowledge that have profoundly changed the lives of millions of patients around the world (1). From discovering insulin in the 1920s and leadership in stem cell research in the 1960s, to today's excellence in genomics research, lipid nanoparticle drug delivery and the early adoption of articial intelligence in drug discovery and health care delivery, life sciences in Canada have been at the forefront of innovation. This history is based on a significant research enterprise supported by public policy dollars and private enterprise. Although biomedical clusters arise around leading research universities and their associated star scientists (2–4), discoveries alone do not lead to thriving sectors; they also require industry involvement and commitment.

In the early part of the 21st century, the Canadian life sciences industry appeared poised to emerge as a global player with the combined strengths of its research enterprise and burgeoning industry (5). At that time Vancouver-based Quadra Logic Technologies (QLT) was one of the largest dedicated biotechnology firms worldwide, and one of the earliest to be profitable. However, unlike counterparts south of the border, the Canadian life sciences innovation ecosystems were not robust enough to survive a downturn (6). The acquisition or demise of several anchor companies, together with the 2008 financial crisis, disrupted the sector's emergence.

Since 2008, significant public policy, advocacy, and investment have gone into reestablishing a life sciences industry that matches the strength of Canada's basic research enterprise. Efforts to reinvigorate the life sciences have generated much discussion about the role of ecosystems, advantages of industrial clusters, and the impact of anchor companies in the sector. This paper seeks to contribute positively to the considerable academic literature and discussion in this field in the following ways:

1. Describe the generally agreed component parts of an innovation ecosystem and how it differs from a cluster.
2. Demonstrate the symbiosis that exists among those component parts.
3. Propose a definition of research-based anchor companies in the Canadian context.
4. Explain the importance of anchor companies and how they play a critical role in leading life science clusters that is absent in Canada.

What is an Ecosystem?

An innovation ecosystem refers to a systemic interaction of different actors, including large companies, startups, universities, research centres, and more. Ecosystems can be geographically independent and are generally created through a combination of public policy, the cultural environment, research strengths, market challenges and advocacy efforts (5,7–12).

Ecosystems generate a range of contributions to innovation and sector growth, such as strong leadership, industry engagement, talent acquisition and development, capital availability, research assets, market awareness, and brand recognition. It's worth noting that while clusters focus on geographic concentrations that favor innovation-advancing spillovers resulting from physical proximity, ecosystems encompass a broader range of interactions that emphasize the interconnectedness of various actors and resources within a specific industry or domain. Ecosystems can be considered "clusters-in-development", that, with time and the emergence of an anchor company, evolve into innovation clusters and generate a broader range of spillover benefits.

What is a Cluster?

A cluster refers to a geographic concentration of interconnected companies and institutions in a particular industry or field. An important distinction is that a cluster is a function of market economic activity and not public policy efforts, although after clusters develop, public policy makers often try to enhance or protect them.

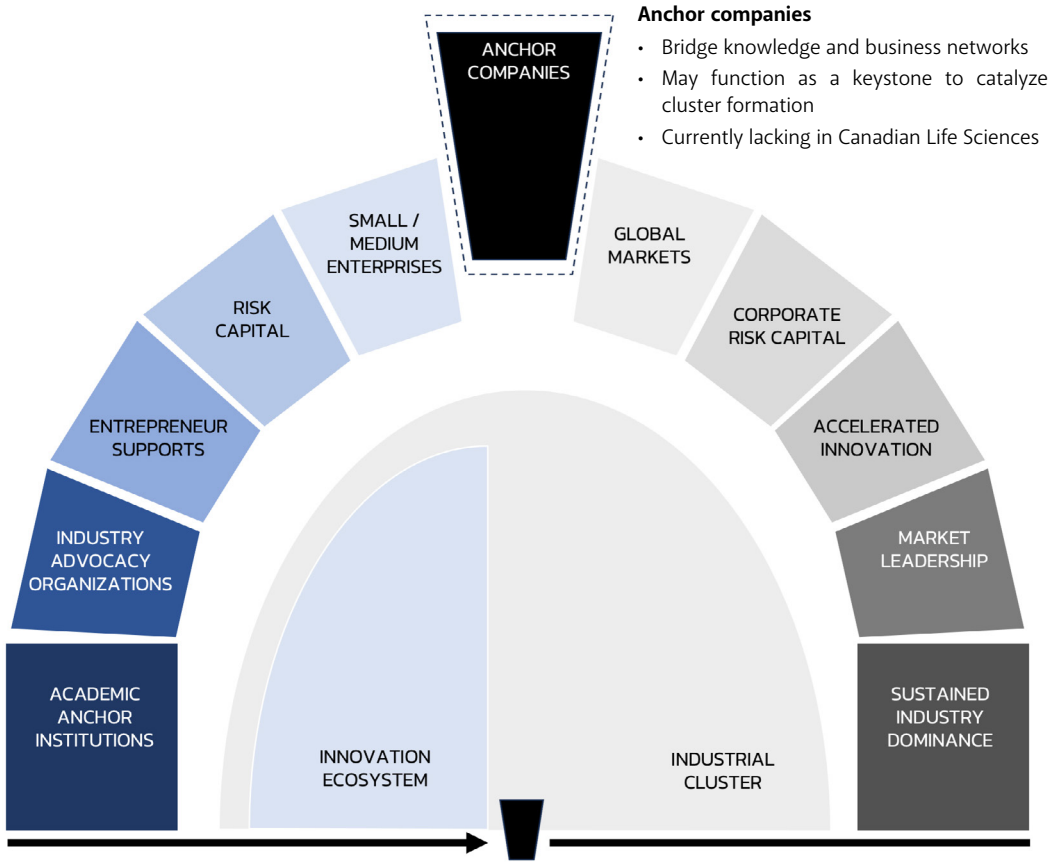
Clusters involve specialized groups co-locating, leading to accelerated innovation and spillover effects due to their physical proximity. The concept is over 100 years old, although modern iterations perhaps began with the late urbanist Jane Jacobs, who defined "spillovers", the innovation resulting from the collaboration of specialized groups collocating (13). More recently, Michael Porter developed the idea of clusters as organic concentrations of competitive businesses that enhance competition through better access to resources, expertise, and complementarities (14). The biotechnology industries in Boston and San Francisco provide examples of modern clusters, and are home to prominent anchor companies. Indeed, Genzyme which emerged as a key anchor company in Boston, was one of the examples originally used by Porter to demonstrate the self-reinforcing effects of clusters (14).

Most clusters, including virtually all life sciences clusters, include leading academic and government institutions alongside prominent companies (3,15). These universities and vocational training institutions often were a source of cluster emergence, and continuously strengthen the cluster by conducting innovative research and delivering specialized education, training, and technical support which can be tailored towards industrial needs (14). There is also a key role for the local entrepreneurial community, and the organizations that support and promote them (16), especially those which are well integrated with research universities (6,17). Cluster growth can be further reinforced by perceptions of a region's reputational prestige and the opportunities for professionals to build successful and stable careers within them. Collectively, such clusters of "independent and informally linked companies and institutions represent a robust organizational form that offer advantages in efficiency, effectiveness and flexibility" (14).

While there may be some 'chicken and egg' debate about which comes first, an ecosystem or a cluster, it is undeniable from the literature that a cluster is dominated by private sector activities around which many other private, quasi-private, and public entities are found. For the purposes of this paper, it is accepted that ecosystems are synthetically produced by public policy and advocacy, whereas clusters emerge as a function of market-driven activity, and thus for ecosystems to become self-sustaining they need to become clusters.

If Canadian life sciences ecosystems desire to become self-sustaining industrial entities, i.e., life sciences clusters — and it is hard to imagine any reason for them to not want these attributes – they must seek to develop its one elusive element: anchor companies.

Anchor companies bridge knowledge and business networks



Components and Characteristics of Innovation Ecosystems vs Clusters. While core components of innovation ecosystems are also foundational within industrial clusters, a cluster differs critically in terms of knowledge of, and access to global markets, which ultimately attracts talent and capital, creating forward momentum that sustains the region's dominant market position. Anchor companies within industrial clusters play a keystone role as a bridge between knowledge and business networks; through their deep regional connections and understanding of global market opportunities, they are ideally positioned to accelerate the quality and pace of innovation within a region.

What is an anchor company?

The concept of an anchor company is easily understood within a retail mall: a large, prestigious and successful store "anchors" the mall, attracting smaller tenants through the promise of increased consumer traffic. Just as in the mall example, anchor companies in the life sciences sector attract a range of other players such as service providers, expert resources, public institutions, ancillary services and investors (18). Significantly, anchor companies in the life sciences sector offer greater benefits than the store anchor in the mall because they also attract and develop talent that become a source of desirable forward momentum (15). As talent succeeds and is enriched within an anchor, they often consider their next venture to repeat the company creation process. The talent migration effect catalyzed by anchors is critical to clustering because anchors often either spin-off new ventures, or see their alumni leave to form newcos within the same cluster.

Arriving at a universal definition of anchor companies is challenging given industry-specific considerations for the typical characteristics of a leading company. Quantitative measures, such as the number of employees within an R&D site (19–21) or patent filings (22), revenue generated, the qualitative profile of the firm, and the nature of its regional interactions within an ecosystem (23–25), can be applied to define anchors.

For example, the literature suggests that an anchor company must meet measures of scale, international profile and connectivity, as well as economic impact through R&D investment and/or revenues, and regional employment. These characteristics enable a firm to raise the profile of a region and attract a diversity of talent. However, beyond these metrics, the firms that truly provide an anchor function

Key characteristics of an anchor company

Characteristic	Definition
Size and Scale	— Large firm, typically having >500 employees based at the same site (19–21) — Benefits from economies of scale and scope, which broadly advantages the firm across all domains and enables diverse local interactions (18) — Headquartered in the region
Market Leadership	— Dominant firm with considerable market share, brand recognition, and sustained success (18) — Global prominence enables unique insights into market opportunities helping to maintain dominance (18,24)
Stability and Sustainability	— Track record despite market fluctuations and economic cycles — Act as a magnet for other major companies and high-quality suppliers of ancillary products and services (18)
Business Model	— Innovation is essential to sustaining the company's dominance, via the development of new products, technologies, and/or processes (23,25) — Heavy investment in R&D, with the ability to absorb and apply new innovation knowledge (14,18,23,24) — Managerial approach values engagement with local ecosystem and seeks to influence regional innovation efforts (23,24) — Directly or indirectly leads to an increase in regional spin out company formation (19,23)
Industry Influence	— Anchor firm can act as a bridge, connecting networks of partners, suppliers, customers, and stakeholders with global reach and acting as a broker within the regional network (26) — Global position of the anchor firm raises the bar for regional innovators, and enhances confidence in regional market insights and access (14,21,23) — Broad influence, with participation in industry associations, trade groups, lobbying initiatives, and collaborating with universities to establish specialized research and training facilities (14)
Economic Impact	— Establishes high-value R&D facilities (19) — Market Cap — Revenues from commercial activities — Generates significant tax revenues
Value chain integration	— Engages locally to strengthen upstream and downstream value chain (14)

engage within their regional innovation ecosystem in specific and constructive ways. This engagement can comprise collaborations with smaller, local firms, directly promoting start up activity via seed capital or spin-out company formation, and active participation with the wider community through mentorship, research collaboration, and networking initiatives. Anchor companies actively contribute to regional leadership and development (23,25): they are also frequently a focal point for science and technology innovation sector thought leadership and policy exploration (13,14).

Becoming an anchor company involves deliberate choices. The decision of a corporation to assume an anchor role within an innovation cluster is influenced by changing economic dynamics. As highlighted by Porter, enduring competitive advantages are rooted in local assets such as knowledge and relationships that are hard for remote competitors to replicate. This underscores the potential gains of active participation in a robust innovation cluster. However, not all large companies are suitable for or capable of fulfilling the anchor function.

First, as a general rule, anchor companies are headquartered in the region they anchor. Often the rationale for taking on this role is driven by commercial priorities. To take on the anchor role intentionally, management must align this function with corporate goals. Companies see assuming the role as enhancing the firm's competitive advantage, providing a rationale for sustained local presence and substantial investments.

Dhanaraj and Parkhe's research argues that anchor firms' competitive advantage stems not just from their position but also their strategic approach. How they interact within the cluster determines their benefit (24). Anchors shape networks to create and extract value, managing processes like knowledge flow and innovation absorption. Trust is key, enabling knowledge exchange and fostering innovation if interactions are perceived as fair and reciprocal. Stable networks build trust, benefiting both the firm and the wider network.

Companies that are heavily reliant on innovation and adept at engaging regional stakeholders can gain competitive edge through strategic regional investments (25). Anchor firms leverage local advantages aligned with their objectives to both enhance regional ecosystems and reap competitive benefits as a result. For example, Genzyme, founded in 1981 by researchers at Tufts University and MIT, continued to benefit greatly from the tacit knowledge of Tufts, MIT and Harvard researchers, through co-location, membership on their scientific advisory board, and talent acquisition. Strategic regional investments included Genzyme headquarters and investment into the Whitehead Institute and other research facilities. Even when Genzyme was acquired by French multinational Sanofi in 2011, the regional advantages were such that Sanofi Genzyme remained in place as an anchor company of the Boston lifesciences cluster.

To identify an anchor or potential anchor, the competitive advantages gained by strengthening a regional innovation ecosystem across all business domains must be considered (see appendix) (23). These advantages involve synergies with the innovation ecosystem, government policies, IP legislation, academic institutions, entrepreneurial support, and the region's appeal for talent recruitment.

Are anchors necessary for progress to a mature innovation cluster?

Given that successful clusters evolve around anchor companies, an ecosystem needs to encourage the creation of anchor companies if it seeks to become a cluster. The emergence of the biotechnology sector over the past ~40 years provides an interesting case study to explore the evolution of successful innovation ecosystems, and a prime opportunity to address the question of how anchor companies have influenced the progression of existing ecosystems to mature, becoming self-sustaining innovation clusters.

Powell, Packalen and Whittington explored the regional emergence of biotech clusters within the US from the late 1970's onwards across 11 regions that were identified to be rich in ideas, money and skills (16). They identified the presence of an anchor amongst a diversity of for profit, nonprofit and public organizations, with a dense web of local relationships as a necessary condition for cluster formation. Within the successful clusters, anchors were described as sustaining world class science that fuelled biomedical discovery towards unmet medical needs while pursuing financial opportunity, and by doing so these companies continually recombined and repurposed diverse activities within the region. This process transposed ideas across the network, which further allowed the experience, status, and legitimacy of a region within one field to convert into emerging areas and perpetuate the region's dominance.

In the Canadian context, anchor companies appear to be the key element currently missing from life sciences innovation ecosystems. Consequently, given that the elements of the ecosystem are symbiotic, missing one core component is a critical deficiency that must be addressed if ecosystems are to evolve into clusters. Even so, this absence cannot be addressed at the expense of other critical cluster components such as strong research institutes, global pharmaceutical companies, small and medium enterprises, treatment facilities, and service providers.

Canadian Life Sciences

Canada's strengths in life science innovation have led to numerous valuable discoveries, and were also reflected in the founding of notable Canadian companies such as Vancouver's QLT (1981), Montreal's BioChem Pharma Inc (1986) and Toronto's Allelix Bio Pharmaceuticals (1987) early in the global establishment of the biotechnology industry. Unlike prominent companies that have anchored US biotechnology clusters and sustained dominant market positions to the present day, these pioneering Canadian firms are no longer active, having merged with international companies (BioChem Pharma Inc merged with Shire in 2000), been acquired (Allelix acquired by NPS Pharma in 2003), or struggled and ultimately succumbed to bankruptcy (QLT merged with Aegerion Pharma to form Novelion Therapeutics in 2016, which commenced liquidation in 2020). However, the regional impacts of Canada's earliest life science companies were substantial.

Based on interviews with key stakeholders across several Canadian regions, Gertler noted that in most cases there was a single lead firm that was critical in initiating the successful evolution of the regional life sciences ecosystem (5). These firms were especially impactful in attracting highly skilled workers, producing spin off firms, and encouraging the local community's entrepreneurial activity. The talent concentrated and developed by Canada's earliest biotechnology companies, along with their sustained, multidimensional influence, laid an important foundation that is evident to the present day (27).

The Canadian life sciences industry continues to evolve. In 2016, the health and biosciences industry contributed C$7.8 billion to Canada's GDP, representing 0.45% of the total (28). More recent reports suggest an upward trend; in 2018-2019, the R&D pharmaceutical sector contributed just over 0.7% of Canada's GDP, with a gross value of $15 billion (29). By comparison, the US pharmaceutical and medical-instrument subsector output in 2015 was US$675 billion, almost 4% of total GDP. Clearly, there appears to be considerable opportunity for Canada to take a bigger slice of this global market, and for the domestic life sciences industry to increase both its contribution to the Canadian economy and its capacity to address unmet medical needs. Moreover, much of the market of Canadian life sciences firms is global: for example, 95% of Stemcell Technologies revenues are from exports (30).

Within the key research and innovation hubs of Montreal, Toronto and Vancouver, and other nodes of high-quality research elsewhere in Canada, components of the life science ecosystem are strong, with world class research institutions, venture capital firms, strong industry associations, entrepreneurial support systems, and a growing number of companies. Today, several putative anchor companies are in development, these include CellCarta, StemCell Technologies, BIOVECTRA, AbCellera, among others (17,31). Even as this maturation is underway, Canada's relative size as a biotechnology industry player continues to significantly lag its research enterprise strengths (32).

Canadian Life Sciences Ecosystem Strengths

Component	Canadian Life Science Ecosystem Strengths
Physical proximity	— Canada's key life sciences hubs including Montreal, the Greater Toronto Area and Vancouver have established regions where stakeholders interact in close proximity, with emerging concentrated areas in other cities (33,34)
Interconnectedness	— Across Canada's life sciences hubs, formal and informal connections are fostered through many programs and initiatives. An example is Mitacs, which deploys federal funding to advance Canadian innovation by enabling academic: industry partnerships (35)
Strong leadership	— Provided by strong regional (ie. OBIO, LSO, BIOQuebec, LSBC) and national industry (BIOTECanada) organizations working alongside prominent Canadian companies and VC firms, government agencies, non-profit and academic organizations (36)
Talent availability	— Each of Canada's leading universities has strong life sciences programs, generating well-prepared graduates to sustain a highly skilled workforce. Within Canada there are additional efforts to train and retain talent (BIO Talent, CASTL) (37)
Capital availability	— Currently there are >10 Venture Capital firms with Canadian offices that have funds dedicated to investing in life science companies
Research assets	— Canada is home to world-leading academic research institutions, with Canada's three leading universities all ranked within the top 50 institutions worldwide for life sciences (37) — Leading Canadian life sciences hubs also perform well when comparing US patents issued to inventors per 100,000 population (27) — Canada is home to >300 biopharmaceutical firms, collectively developing >800 new products (38)
Market awareness	— Pharmaceutical sales in Canada have a 2.1% share of the global market, making Canada the 9th largest world market (39) — Proximity to the US market, and availability of talent having experience with US drug development and commercialization can provide further strategic advantages for life sciences companies

Academic Research Anchors, Innovation Research Output and Government Investments in Life Sciences

Canadian academic research is of a high quality and has an outsized impact as measured by research publications. Ranked in the top 10 countries for overall research output worldwide, Canada produces 3.8% of global research publications (40). In this analysis, Canada was over-represented in the top-cited 1% of publications across all specialties, with particularly high impact in fields including clinical medicine and biology, as well as general science and technology (40).

There remains a long-recognized disconnect between Canada's strong foundational research performance and ingenuity, and its translation into commercialized innovations that capture resulting economic benefits within Canada (40,41). This gap – recognized for more than a decade – is exemplified by Canada's 2020 ranking from the World Intellectual Property Organization. Based on data across 80 innovation indicators such as research and development, venture capital, and high-tech production, Canada ranks 9th among input leaders (32). Canada does less well on indicators such as infrastructure and business sophistication, and falls far down the field in knowledge and technology outputs to rank 17th overall in the global innovation index rankings.

Strong inputs with weak outputs characterize an innovation ecosystem needing to become a cluster. At a minimum, the "output deficit" represents unrealized commercialization opportunity. Addressing this gap has led to a multitude of policies, initiatives, and organizations to enhance commercialization of Canadian research by successive federal governments. In July 2021, the government of Canada launched a new Biomanufacturing and Life Sciences Strategy aimed at strengthening Canada's ability to respond to pandemics and other emerging health threats, while also ensuring that associated health and economic benefits are realized within Canada. However, the capture of ensuing economic benefits has not yet been fully realized.

Within this strategy, the Canadian government allocated $2.2 billion over seven years for life sciences, spanning the innovation continuum, from basic research to translation/commercialization, capital generation, clinical trials, biomanufacturing, and training. Significant provincial efforts are also underway to broaden and deepen life sciences public policy supporta. Quebec's Research and Innovation Strategy and Life Sciences Strategy, Ontario's strategy for "taking life sciences to the next level" and the new BC Innovation Framework. This heightened focus and new investment has created an unprecedented opportunity to finally build a truly sustainable, high diversity, globally competitive Canadian life sciences cluster.

Industry Organizations and Entrepreneurial Supports

Gertler and Vinodrai highlighted the influence of local industrial associations and entrepreneurial support initiatives in the early emergence of Canadian life science ecosystems (5). With the long timeframes from discovery research through to impactful biomedical innovation, more emphasis is needed on translational supports for scientists seeking to commercialize breakthrough research (17,42).

The supports provided to scientist-entrepreneurs' pre-company formation are critical for success, in particular providing a lens through which to assess technology-market matching, patenting strategy, building and developing a founding team and strategic timing (17,43). Increasing emphasis on the importance of developing researchers' entrepreneurial skills and supporting nascent ventures has led to the establishment of a diversity of academic and independent programs to develop scientist-entrepreneurial skills, and to incubate and accelerate spin out company formation. STEM researchers gaining innovation skills and entrepreneurial capabilities will also benefit Canada's lifesciences ecosystem through strengthening receptor capacity in industry. The success of these efforts should be measured against innovation outputs, with intangible assets as intermediate proxies (31). Equally, the emergence of anchor companies, the single largest missing output in the Canadian ecosystem, should be the primary output measure.

Canadian Risk Capital

Canada's key research hubs are also home to several life science focused venture capital (VC) firms that are instrumental in supporting emerging companies. In recent years, the pandemic triggered high volatility in the life sciences investment sector. Initially, there was record investment in life sciences companies worldwide. This positive investment climate contributed to a 36% increase in the number of Canadian public life sciences companies to 85, with a collective market capitalization of almost C$32 billion, more than double the 2019 total (44). Across 89 deals in 2020, Canadian life sciences companies secured C$1.1 billion in venture capital (45). This strong performance continued into 2021, when VC investment in Canadian life science companies, particularly from US, UK and China, reached a record level of just over $2 billion, a 70% year-over-year increase (46).

The beginning of a cyclical public market correction was apparent by Q4, 2021, with a prolonged negative trend in biotechnology stocks – driven by complex factors including a generally negative economic outlook, rising interest rates, and retreat of generalist VC firms from the sector. Investors who remain in the sector must now plan to support companies over a longer runway to exit, which requires investors with sufficient capital at early stages of their cycle of investment.

Developing Canadian anchors

Within Canadian life science ecosystems, there are currently several prominent firms that, based on the quantitative and qualitative metrics outlined in this paper, exhibit the potential to evolve into anchor companies. Notable among these are StemCell Technologies, AbCellera, BIOVECTRA, Xenon, and CellCarta, among others. However, when assessed against most definitions of anchor companies found

in the academic literature, no Canadian firm currently meets all the criteria.

The competitive edge that these large, regionally embedded companies can provide to accelerate innovation across wider Canadian life science ecosystems, and enable the development towards true clusters, is exciting. The historical reflections provided by Gertler and Vinodrai (5) prompt some questions. For example, given the turbulence inherent within life sciences due to mergers and acquisitions, how many anchors would be required to achieve sustainability of Canadian clusters? And further, what lessons can be learned from anchor company departures or collapse within other Canadian technology sectors, (44) to ensure the continued resiliency of a life sciences cluster that loses its anchor?

Although the literature does not provide definitive answers to these questions, a comparative analysis of factors influencing the career trajectories of two star scientists based in Massachusetts and Vancouver respectively (6), identified 18 anchor companies in the Massachusetts life sciences regional innovation ecosystem, as compared to 1 in British Columbia . Such breadth and depth is mutually reinforcing, and provides resilience against cyclical economic downturns.

Towards a Canadian Life Sciences Cluster

One consideration not currently addressed in the academic literature concerning the Canadian life sciences ecosystem is the need for scale, which plays a pivotal role in the development of life sciences ecosystems and innovation clusters. There is a significant gap between the scale of the leading life sciences economies and the Canadian ecosystems, exemplified clearly by the 'outputs deficit' noted above. Closing this deficit to at least a proportionate level suggests the need for a comprehensive effort, one that takes into account both national and regional dimensions.

The clusters defined by Porter are generally geographically proximal. They prioritize regional strengths but there are broader pan-Canadian market, regulatory, and public policy impacts that may be brought to bear on many sectors of the economy. Both national and provincial priorities, supports, and regulatory policies are particularly relevant for Canadian life sciences (49). As in other countries, Canada's federal and provincial governments are responsible for significant economic investments in innovation, science and technology, research, and economic development. These nuances, combined with other strategic and serendipitous factors (5), have led to the evolution of distinct regional strengths and priorities within Canada's strongest life sciences hubs. Harnessing these strengths in a collaborative Canadian manner, with emerging anchor companies benefiting the entire cluster, will contribute to addressing the "outputs deficit". One notable example that sheds light on this challenge can be drawn from Canadian telecom industry, where national anchor companies have emerged to support a national cluster, while capitalizing on regional strengths.

All of this leads to a fundamental question: what defines a Canadian anchor company? Rather than attempting to devise a uniquely Canadian definition, it may be more sensible to rely on the literature-supported definition mentioned above and ask a different question. Are there examples of successful life sciences clusters in other countries where anchor companies have contributed both regional and national strengths? One need only look at the impact of Genzyme in the Boston cluster, as cited by Porter, to find a positive answer. Twenty-five years later, the extensive influence of Genzyme (now Sanofi Genzyme)

The Role of Mergers & Acquisitions (M&A) in Life Sciences

It is important to note that mergers and acquisitions are as natural an element of the life sciences industry as they are in any emerging sector. By definition, the most desirable M&A targets are successful firms. This factor may be discouraging to some, especially when that firm is an anchor or potential anchor. However, the literature suggests that the effects of M&A are actually desirable in a cluster.

Successful exits lead to the creation of other newcos by successful management, particularly when that management cadre has enjoyed economic success from the first exit (16,47,48). For instance, following Eli Lilly's 1985 acquisition of Hybritech, former Hybritech employees who stayed in, or returned to San Diego collectively founded more than 40 biotech firms and are credited with triggering cluster formation (16). Studying the impact of acquisition on subsequent employee entrepreneurship, Kim also observed increased entrepreneurial activity from high value former employees of acquired firms (47). Similarly, one can easily track the career paths of a large number of Canadian biotech leaders back to their earlier experiences with QLT and BioChem Pharma. And, with a strong cluster developed, acquired firms are more likely to keep their R&D center intact, to reap the talent and tacit knowledge advantages of the region. San Francisco's Genentech is a good example of this, after acquisition by Roche.

This fact also suggests that anchor company creation is as much a mindset as it is a management process. Clearly, not all companies will ultimately become anchors, if for no other reason than successful firms will be purchased before they have a chance to anchor a cluster. However, if an emerging company does not think like an anchor, consider all of the challenges involved in getting a product through regulatory approval and to the market, it is likely making significant mistakes that will diminish its value.

extends far beyond Boston, evident in the leadership talent alone it has cultivated throughout the United States. A similar pattern can be observed in virtually every life sciences cluster worldwide.

Conclusion

The Canadian life sciences industry has a rich history of scientific discoveries and developments that have impacted human health and the Canadian economy profoundly. However, challenges developed that slowed Canada's emergence as a global player.

In response, significant efforts have been made to rebuild the Canadian life sciences industry, with a focus on creating innovation ecosystems. The literature clearly shows the component parts of an ecosystem all of which are present in Canada. The literature also shows clearly that clusters are market driven economic phenomena surrounding one or more anchor companies. The only element of a cluster not present in the Canadian ecosystem today is anchor companies.

Anchors are incredibly important because they:

- Attract, network, and support a range of other essential players such as service providers, expert resources, and investors;
- Attract and develop critically important talent that becomes a source of desirable forward momentum;
- Generate a talent migration effect, often facilitating either spin-off ventures from an anchor, or result in alumni forming newcos;
- Enhance the transfer of knowledge from leading research centres into commercial activity;
- Spin-off 21% more businesses with higher paying jobs and a resultant multiplier outside the specific industry;
- More effectively integrate and network nonprofit and public organizations, such as universities and research institutes, into a dense web where proximity is crucial for hands-on guidance, reducing information gaps, and facilitating knowledge transfer;
- Concentrate collective technical and business acumen, and build globally relevant connections within local professional networks (23); and
- Catalyze direct investments in emerging firms, generating higher valuations and faster exits.

There is a generally accepted definition of an anchor company that is as relevant in the Canadian context as it is elsewhere. There are no Canadian anchor companies consistent with this definition today. Encouragingly, several potential anchor companies have emerged in Canada. A focus on developing as many potential anchor companies as possible is needed.

Meeting this challenge comes with the promise of significant human health and economic benefits generated by an innovative and self-sustaining life sciences industry.

References

1. Innovative Medicines Canada, Health Research Foundation. History of biomanufacturing and life sciences in Canada [Internet]. Government of Canada; Available from: https://ised-isde.canada.ca/site/biomanufacturing/en/history-biomanufacturing-and-life-sciences-canada

2. Zucker LG, Darby MR, Brewer MB. Intellectual Human Capital and the Birth of U.S. Biotechnology Enterprises. Am Econ Rev. 1998;88(1):290–306.

3. Zucker LG, Darby MR, Armstrong JS. Commercializing Knowledge: University Science, Knowledge Capture, and Firm Performance in Biotechnology. Manag Sci. 2002;48(1):138–53.

4. Maine E, Thomas VJ, Murira A, Utterback J. The emergence of the nanobiotechnology industry. Nat Nanotechnol. 2014;9(1):2–5.

5. Gertler MS, Vinodrai T. Life Sciences and Regional Innovation: One Path or Many? Eur Plan Stud. 2008;17(2):235–61.

6. Thomas VJ, Maine E. Impact of regional systems of innovation on the formation of university spin-offs by biomedical star scientists. Int J Entrep Small Bus. 2019 Jan 1;37(2):271–87.

7. Calza F, Ferretti M, Panetti E, Parmentola A. Moving drug discoveries beyond the valley of death: the role of innovation ecosystems. Eur J Innov Manag. 2021;24(4):1184–209.

8. Cantner U, Cunningham JA, Lehmann EE, Menter M. Entrepreneurial ecosystems: a dynamic lifecycle model. Small Bus Econ. 2021 Jun 1;57(1):407–23.

9. Hubner S, Most F, Wirtz J, Auer C. Narratives in entrepreneurial ecosystems: drivers of effectuation versus causation. Small Bus Econ. 2022 Jun 1;59(1):211–42.

10. Boni AA, Gunn M. Building and leveraging the innovation ecosystem and clusters: Universities, startups, accelerators, alliances, and partnerships A "From the Boardroom" Perspective by the Special Edition Co-Editors. J Commer Biotechnol. 2021;26(1):13–8.

11. Yaghmaie P, Vanhaverbeke W. Identifying and describing constituents of innovation ecosystems: A systematic review of the literature. EuroMed J Bus. 2020;15(3):283–314.

12. Oh DS, Phillips F, Park S, Lee E. Innovation ecosystems: A critical examination. Technovation. 2016 Aug 1;54:1–6.

13. Jacobs, Jane. The Economy of Cities. New York: Random House; 1969. 268 p.

14. Porter ME. Clusters and the New Economics of Competition. Harvard Business Review. 1998;76:77–90.

15. Feldman M. The Locational Dynamics of the U.S. Biotech Industry: Knowledge Externalities and the Anchor Hypothesis. In: Industry and Innovation [Internet]. Springer Books; 2003. p. 201–24. Available from: https://ideas.repec.org/h/spr/sprchp/978-3-7908-1658-7_9.html

16. Powell W (Woody) W, Packalen KA, Whittington KB. Organizational and Institutional Genesis: The emergence of High-Tech Clusters in the Life Sciences. In: Padgett J, Powell WW, editors. The Emergence of Organization and Markets [Internet]. Queens School of Business Research Paper; 2010. Available from: https://ssrn.com/abstract=1416306

17. Park A, Goudarzi A, Yaghmaie P, Thomas VJ, Maine E. Rapid response through the entrepreneurial capabilities of academic scientists. Nat Nanotechnol. 2022 Aug 1;17(8):802–7.

18. Agrawal A, Cockburn I. The anchor tenant hypothesis: exploring the role of large, local, R&D-intensive firms in regional innovation systems. Econ Intellect Prop Univ. 2003 Nov 1;21(9):1227–53.

19. Gupta RR. Does Goliath Help David?: Anchor Firms and Startup Clusters [Internet]. U.S. Census Bureau, Center for Economic Studies; 2020. Available from: https://books.google.ca/books?id=BPXszQEACAAJ

20. Spencer, Gregory M. The economic impact of anchor firms and industrial clusters: an analysis of Canadian and American manufacturing firms and clusters [Internet]. Munk School of Global Affairs, University of Toronto; 2013 Mar. Available from: https://localideas.files.wordpress.com/2014/05/anchor-firms-and-clusters.pdf

21. Chen K, Marchioni M. Spatial clustering of venture capital-financed biotechnology firms in the US. Ind Geogr. 2008;5(2).

22. Lecocq C, Van Looy B. What differentiates top regions in the field of biotechnology? An empirical study of the texture characteristics of biotech regions in North America, Europe, and Asia-Pacific. Ind Corp Change. 2016;25(4):671–88.

23. NSW Innovation Council. The Role of Anchors: lessons from international innovation precincts. 2022.

24. Dhanaraj C, Parkhe A. Orchestrating Innovation Networks. Acad Manage Rev. 2006;31(3):659–69.

25. Robaczewska J, Vanhaverbeke W, Lorenz A. Applying open innovation strategies in the context of a regional innovation ecosystem: The case of Janssen Pharmaceuticals. Glob Transit. 2019 Jan 1;1:120–31.

26. Panetti E, Parmentola A, Ferretti M, Reynolds EB. Exploring the relational dimension in a smart innovation ecosystem: A comprehensive framework to define the network structure

and the network portfolio. J Technol Transf. 2020;45:1775–96.

27. Invest Vancouver. Life Sciences in Metro Vancouver: Shaping a Globally Prominent R&D Hub [Internet]. 2023 Apr. Available from: https://investvancouver.ca/Documents/IV_LifeSciencesReport_April2023.pdf

28. Ontario Bioscience Innovation Organization (OBIO). Leading the Pack: Accelerating the Success of the Canadian Health Science Industry. 2020 Oct.

29. Statistics Canada. Analysis in Brief: The Canadian Research and Development Pharmaceutical Sector, 2019 [Internet]. 2022. Available from: https://www150.statcan.gc.ca/n1/en/pub/11-621-m/11-621-m2022002-eng.pdf?st=U2yjAZjg

30. Export Development Canada. Vancouver's STEMCELL Technologies: An export story that spans 20 years [Internet]. 2016. Available from: https://www.edc.ca/en/article/stemcell-technologies-export-story.html

31. Park A, Goudarzi A, Yaghmaie P, Thomas VJ, Maine E. The role of pre-formation intangible assets in the endowment of science-based university spin-offs. 2023;

32. Cornell University INSEAD and WIPO. The Global Innovation Index 2020: Who Will Finance Innovation? [Internet]. 13th Edition. 2020. Available from: https://www.wipo.int/edocs/pubdocs/en/wipo_pub_gii_2020.pdf

33. Destination Canada. Industry Leadership: Life Sciences [Internet]. 2023 [cited 2023 Oct 5]. Available from: https://businessevents.destinationcanada.com/economic-sectors/life-sciences

34. Jones Lang LaSalle IP Inc. Canadian life sciences outlook [Internet]. 2023. Available from: https://www.jll.ca/en/trends-and-insights/research/life-science-outlook

35. Mitacs: Life sciences [Internet]. Mitacs; [cited 2023 Oct 5]. Available from: https://www.mitacs.ca/en/sector/life-sciences

36. Innovation Science and Economic Development Canada. Life Sciences: Canadian industry associations [Internet]. Government of Canada; [cited 2023 Oct 5]. Available from: https://ised-isde.canada.ca/site/canadian-life-science-industries/en/biopharmaceuticals-and-pharmaceuticals/associations

37. Times Higher Education. World University Rankings 2023 by subject: life sciences [Internet]. 2023 [cited 2023 Oct 5]. Available from: https://www.timeshighereducation.com/world-university-rankings/2023/subject-ranking/life-sciences

38. Innovation Science and Economic Development Canada. Canadian life science industries: Biopharmaceutical pipeline and partnering opportunities [Internet]. Government of Canada; Available from: https://ised-isde.canada.ca/site/canadian-life-science-industries/en/biopharmaceuticals-and-pharmaceuticals/biopharmaceutical-pipeline-and-partnering-opportunities

39. Innovation Science and Economic Development Canada. Canadian life science industries: Pharmaceutical industry profile [Internet]. Government of Canada; [cited 2023 Oct 5]. Available from: https://ised-isde.canada.ca/site/canadian-life-science-industries/en/biopharmaceuticals-and-pharmaceuticals/pharmaceutical-industry-profile

40. Council of Canadian Academies. Competing in a Global Innovation Economy: The Current State of R&D in Canada. Expert Panel on the State of Science and Technology and Industrial Research and Development in Canada. Ottawa, ON, Canada; 2018.

41. Council of Canadian Academies. Paradox lost: explaining Canada's research strength and innovation weakness [Internet]. Ottawa, (ON), Canada; 2013. Available from: https://cca-reports.ca/wp-content/uploads/2018/10/paradoxlost_en.pdf

42. Innovation Science and Economic Development Canada. Report of the Advisory Panel on the Federal Research Support System [Internet]. Ottawa, (ON), Canada: Government of Canada; 2023. Available from: https://ised-isde.canada.ca/site/panel-federal-research-support/en/report-advisory-panel-federal-research-support-system

43. Thomas VJ, Bliemel M, Shippam C, Maine E. Endowing university spin-offs pre-formation: Entrepreneurial capabilities for scientist-entrepreneurs. Technovation. 2020 Aug 1;96–97:102153.

44. Norton M. Canadian Commercialization Trends for Emerging Biopharma. BIOTECanada Insights. Fall 2021. 2021;72–9.

45. Wherry C, Kornacki D, Jackson J, Romana ISta. 2020 YEAR IN REVIEW CANADIAN VENTURE CAPITAL MARKET OVERVIEW [Internet]. Canadian Venture Capital Private Equity Association; 2020. Available from: https://www.cvca.ca/files/reports/year-end-2020-canadian-vc-pe-market-overview/CVCA_VC_Q4_2020.pdf

46. Reicin CV, Wright J. Canadian life sciences: a look back at 2021 [Internet]. Torys; 2022. Available from: https://www.torys.com/our-latest-thinking/publications/2022/02/canadian-life-sciences-a-look-back-at-2021

47. Kim JD. Startup acquisitions, relocation, and employee entrepreneurship. Strateg Manag J. 2022 Nov 1;43(11):2189–216.

48. Booth B. Why biotech's talent, capital and returns are consolidating into two key clusters. Forbes [Internet]. 2017;March. Available from: https://www.forbes.com/sites/brucebooth/2017/03/21/inescapable-gravity-of-biotechs-key-clusters-the-great-consolidation-of-talent-capital-returns/?sh=bd88f6752e92

49. Holbrook, J. Adam, Eng, P, Salazar, M, Crowden, S, Reibling, S, Warfield, K, et al. The biotechnology cluster in Vancouver [Internet]. Vancouver, BC, Canada: Centre for Policy Research on Science and Technology, Simon Fraser University; 2003. Available from: https://summit.sfu.ca/item/13433

50. Dimos C, Fai FM, Tomlinson PR. The attractiveness of university and corporate anchor tenants in the conception of a new cluster. Reg Stud. 2021 Aug 3;55(8):1473–86.

51. Clarysse B, Wright M, Bruneel J, Mahajan A. Creating value in ecosystems: Crossing the chasm between knowledge and business ecosystems. Res Policy. 2014 Sep 1;43(7):1164–76.

52. Park J, Wood IB, Jing E, Nematzadeh A, Ghosh S, Conover MD, et al. Global labor flow network reveals the hierarchical organization and dynamics of geo-industrial clusters. Nat Commun. 2019 Aug;10(1):3449.

53. Bloom N, Brynjolfsson E, Foster L, Jarmin R, Patnaik M, Saporta-Eksten I, et al. What Drives Differences in Management Practices? Am Econ Rev. 2019;109(5):1648–83.

54. Frølund L, Murray F, Riedel M. Developing successful strategic partnerships with universities. MIT Sloan Manag Rev. 2018;59(2):71–9.

Appendix

How do anchor companies impact regional innovation ecosystems?

Anchor companies have a significant impact by providing resources and expertise, attracting, and training talent, making possible and investments to foster innovation. Among other things, they can provide access to capital, mentoring, and other resources to help startups and entrepreneurs get their ideas off the ground. They can also provide a platform for collaboration and networking, enabling innovators to connect with each other and share ideas. Anchor companies help create a culture of innovation in the region where they are based by setting an example and encouraging others to do the same. Finally, they can help attract and train talent, which further strengthens the cluster. A closer look at each of the elements in which clusters have a real and concrete impact illustrates this effect.

Category of Impact	Impact Explained
Knowledge Flow and Expertise	— Knowledge flow entails the sharing of insights, technical advancements, intellectual property, and strategic information within an innovation ecosystem. Studies have extensively explored how anchor companies accelerate innovation, in part through the mobilization of knowledge within a cluster (19,50,51). These studies emphasize the pivotal role of reciprocal technical and business knowledge flow through anchor companies to accelerate innovation and strengthen the cluster. — Knowledge flow also involves the flow of technical and business insights among organizations through workforce mobility. Gupta examined the impact of the establishment of an anchor company on local worker transitions to emerging enterprises. The emergence of an anchor company prompted worker reallocation towards young firms in related industries, and increased formation of spin-offs which tended to relate to the anchor's upstream or downstream supply chain. This path of knowledge flow converts expertise into new business prospects, growing the regional ecosystem and strengthening the anchor company's competitive position (19). — Beyond enhancing the probability of start-up formation (19), anchor companies amplify business knowledge flow. Clarysse et al. explored the roles of public research institutions in knowledge transfer, and of anchor firms in connecting such knowledge ecosystems to business networks. Tight knowledge ecosystems alone did not guarantee the emergence of business ecosystems, rather anchor companies were required to foster connections. Beyond the business connections, there was an essential role for anchor companies to transfer commercial knowledge and logic to start-ups, which critically increased the likelihood of attracting investment (51).
Talent	— Knowledge mobilization and talent development are intertwined within an innovation ecosystem. Anchor companies play a crucial role in maturing such ecosystems into competitive innovation clusters, concentrating diverse talent and fostering globally relevant connections (23). — An anchor company's influence on talent flow in an innovation cluster is multifaceted. Gupta (2020) highlights that beyond talent attraction, an anchor firm's presence can induce talent competition and accelerate wage growth (19). This wage growth motivates the clustering of highly skilled workers (52) while compelling incumbent firms to restructure for cost efficiency (19). Shedding layers, particularly in middle management, enhances efficiency and cultivates an experienced talent pool with strong network ties, poised to establish and expand new enterprises. Gupta (2020) reports a 21% increase in spin-off formation with a one standard deviation rise in average firm pay for anchor industry firms, primarily aligned with the anchor company's supply chain. These spin-offs leverage existing knowledge and connections to address unmet needs, contributing to a local job multiplier of approximately 1.3 regional jobs per anchor firm job (19). — Examining an anchor firm's impact on regional management practices, Bloom et al. (2019) compares regions successfully attracting anchor companies with those narrowly missing out (53). Interestingly, management practice scores increase broadly after an anchor company's emergence. This improvement is attributed both to managers learning from anchor firms, and organizational pressures to streamline and discard less productive layers, enhancing structured management practice scores. Spillover of positive management practices is observed mainly when anchors are in industries with frequent managerial labour flows, such as biotechnology. This underscores the pivotal role of job transitions and knowledge exchange in fostering enhanced management practices (53).

— Knowledge mobilization and talent development are mutually enhanced by the flow of talent within an innovation ecosystem. The prestige and prominence of anchor companies are integral for an ecosystem to mature to a competitive innovation cluster, by attracting and concentrating a breadth and depth of talent within the region that raises the collective technical and business acumen, and builds globally relevant connections within local professional networks (23).

Risk Capital

— Securing venture capital investment is pivotal for developing and commercializing new innovations, particularly in biotechnology, where development is resource-intensive and failure risks are high. Investors like institutional investors, venture capitalists, angel investors, and corporate venture arms play a vital role in the innovation ecosystem, alongside initiatives such as incubators, accelerators, and government/NGO funding (21). These investors provide not just funds, but also expertise, guidance, and network connections to steer companies towards success (21).

— Analyzing ~300 VC-funded biotech firms in the US in 2006, Chen and Marchioni found a concentrated pattern with 36% located in the Bay Area, Boston, and San Diego clusters. More recently, Booth found that the proportion of VC funding invested in leading biotech clusters grew to 48% in 2016 (48). Clusters with robust life science research, a talent pool, large pharma firms, many venture capitalists, and entrepreneurial spirit dominate the largest biopharma market in the world. Furthermore, the presence of anchor companies significantly influenced VC investments, as their insights into industry direction, training of skilled labour-turned-entrepreneurs, subcontracting opportunities, and direct risk capital provision were all favourable for new venture success (21).

— Investors' active involvement stems from their vested interest in a company's success. Proximity is crucial for hands-on guidance, reducing information gaps, and facilitating knowledge transfer between investors and companies (21). Anchor companies often catalyze direct investments in emerging firms. In Boston's biotech cluster, anchor companies with venture arms foster knowledge exchange and connectivity (26). Comparing biotech clusters' performance, Booth underscores advantages of investing in leading clusters as companies in clusters exit faster and achieve higher valuations (48).

Partnerships

— Interactions among individuals, companies, and institutions are pivotal for driving knowledge flow, talent development, and innovation acceleration within innovation clusters. These interactions encompass formal R&D collaborations, partnerships, technology licensing agreements, and various types of relationships that span across diverse partners. Informal connections among professionals further catalyze formal collaborations (54), significantly contributing to innovation cluster success (26). Thus, innovation ecosystems employ structural strategies to foster informal interactions within the entrepreneurial community (26).

— A comprehensive examination of Boston's biopharma innovation cluster (26) explored the relational dynamics underpinning knowledge transfer within the system. The analysis looked at network connectivity among actors and their varied relationships, assessing their impact on innovation. The pivotal role of anchor companies within the Boston biopharma cluster was evident, as large companies with venture arms and major venture capital firms were central within the network, indicating profound engagement and influence (26). Impactful knowledge transfer relationships ranged from formal interactions between innovators and investors to informal connections through thematic associations and shared infrastructure agreements. Complementary skill exchange, grounded in trust, personal interactions, and reputation, fueled information transfer and future partnership formation, eclipsing long-term contracts in impact (26).

Leadership

— Globally, anchor companies such as Boston's Genzyme and San Francisco's Genentech have demonstrated pivotal leadership in cultivating their innovation ecosystems (16). Their international prominence uniquely positions them to comprehend and steer market trends, establish innovation benchmarks, drive technology adoption, and crucially, share this knowledge with local innovators. Some multinational corporations now exhibit a growing interest in strategically leading regional innovation ecosystems (25). These efforts represent an important contribution to emerging anchors, for all the characteristics noted above however, they do not replace the role of anchor companies.

[i] This point is incredibly important in the Canadian context. As an ecosystem trying to re-emerge as a leading global player, the capacity of Canada to generate and regenerate de novo and spin-off companies is critical. This is the most promising mechanism by which high quality research can be translated into commercial activity for the benefit of the ecosystem, even if a spin-off is ultimately acquired by a more mature enterprise.

CANADA'S GLOBAL LIFE SCIENCES VENTURE

adMare BIOINNOVATIONS

Vancouver Innovation Centre

2405 Wesbrook Mall,
Vancouver
(British Columbia)
V6T 1Z3

T. 604-827-1147

Montreal Innovation Centre

7171 Frederick-Banting
Montreal (Quebec)
H4S 1Z9

T. 514-385-3334

Toronto Office

MaRS Centre, West Tower
661 University Ave., Suite 405
Toronto (Ontario)
M5G 1M1

T. 416-673-8100

@adMare_Bio

@adMareBioInnovations

admarebio.com