Working paper #3: developing a best-practice health care economy

Eastern Region Health Innovation and Care Economy Project

Victorian Government and Eastern Region Group of Councils, prepared by SGS Economics & Planning

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OFFICES IN CANBERRA, HOBART, MELBOURNE, AND SYDNEY ON THE COUNTRY OF THE NGAMBRI/NGUNNAWAL/NGARIGO, MUWININA, WURUNDJERI, AND GADIGAL PEOPLES.

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Executive summary

Introduction

The project is a region-wide research and engagement project to develop a strategy to advance regional priorities and inform advice to government on the development of a health innovation and care (HI&C) economy in the Eastern Region of Metropolitan Melbourne.

This working paper is the third in a series. This paper was written to understand how best practice health innovation and care industry development is being done elsewhere and the lessons relevant to the Eastern Region.

This included identifying the form and function of leading regional health innovation and care economies, including their economic impact. To do this, case studies of regions with successful health innovation and care economies were developed.

Further research has identified the following:

- Best-practice land-use planning for health precincts and clusters
- Best-practice infrastructure provision and urban design
- Best-practice government funding and policy support
- Best-practice workforce development

Working paper findings

The major findings from the paper are outlined below.

The emergence of health innovation and care clusters

Since the 1980s, HI&C economy clusters (also known as biotechnology and life sciences hubs) have formed around major cities and regional centres in Australia and the world. They tend to be located close to universities that provide the enabling intellectual property; close to established biotech or medical device companies that act as incubators for new talent; and where investors can impart knowledge to new start-ups.

HI&C economy clusters can be challenging to initiate and develop

The sole presence of a hospital does not mean that a health cluster is bound to form, expand, and thrive. Developing and solidifying clusters requires consistent efforts from public and private sector stakeholders to assess the market and strategic injections of funding and other resources in support.

Case studies and research reveal the best practice needs to develop a leading regional cluster of activity in the HI&C economy.

Best practice land use planning for a HI&C economy

A strategic location is critical for forming successful health precincts and creating a competitive advantage. A strategic location includes access to major health and education institutions and a large pool of knowledge workers. Co-location of health anchors and industry is critical for innovation and commercialisation.

For knowledge workers, accessibility is an essential aspect of best-practice land use planning for HI&C clusters. Accessibility includes efficient public transport, arterial road corridors, and proximity to airports for domestic and international connections. Suitably zoned land suitable for laboratory research, prototyping and small-batch manufacturing to accompany advanced manufacturing or biotechnology processes is also a need.

One concern from cluster formation is the pricing out of SMEs and other essential and supporting businesses in the area. Affordable industrial land should be protected to accommodate ancillary and complementary uses. This helps to protect second-order precincts that have critical roles to play in supporting the development of the HI&C economy.

Best practice infrastructure provision

It is essential to align land use with infrastructure planning to maximise the use of existing transport infrastructure and plan appropriately for the future.

Best practice infrastructure also includes shared facilities to support various activities, including R&D and early-stage businesses. There should be a focus on different types of facilities to suit the diverse needs of industry communities, such as wet labs, clean labs, access to specialised computing infrastructure, precision manufacturing spaces and machinery. It is likely that over time, research and development will become increasingly technologically complex and require ICT infrastructure such as data centres, high-capacity fibre connections and high-speed internet to enable high-tech industries and operations.

Best-practice government funding and policy support

Governments play a critical role in funding and leading the development of HI&C economy clusters and regions. The case studies of leading HI&C economy clusters all identify strong government leadership in providing roadmaps for future development, developing infrastructure, attracting international investment and collaborating with research institutions as critical to success.

Best-practice workforce development

A critical element of developing a leading HI&C economy is a skilled and deep workforce. Providing pathways from education to employment is also an important element of best-practice workforce development, as is ensuring that the HI&C economy is an industry that skilled workers are attracted to work in through good employment opportunities, high-quality workspaces and great liveability.

The right geographic scale

The geographic scale of a successful HI&C economy can vary significantly. Many world-leading precincts are larger geographically than the ERG area and cross whole cities or multi-city regions. This shows that

HI&C economies can operate across large geographical areas. There is, therefore, an opportunity for the ERG to work in conjunction with other health and medical precincts within Melbourne, such as Parkville and East Melbourne. For innovation, it is also essential that precincts are integrated into local, regional, national and international networks and supply chains, not isolated on their own.

Case studies

There are examples from around the world where governments, education institutions and industry have worked together to create leading HI&C economy regions, clusters or precincts. These examples include:

- Melbourne's own **Biomedical Precinct, Parkville**, which claims to be the country's leading biomedical centre with specialisations across infectious diseases and immunology, neurosciences, cancer, child health and healthy ageing. The Parkville case study provides an example of how the Victorian Government would be willing to assist the development of a HI&C economy in the Eastern Region. The development of the Metro Tunnel in Parkville can provide lessons for the development of Monash and Box Hill once the Suburban Rail Loop is developed.
- The Eastern Region's **Monash Health Translation Precinct**, in Clayton. The precinct demonstrates typical attributes of a thriving HI&C economy cluster, including facility co-location, research translation and access to patient cohorts. Monash's strengths lie in the state-of-the-art facilities that have helped attract renowned clinician-scientists and catalyse research, resulting in new jobs and industries for Victoria. The Monash Health Translation Precinct is an incredible local asset and will be fundamental to the success of growing the HI&C economy more broadly across the Eastern Region.
- **The Life Sciences Corridor** (Greater Boston-Cambridge, United States) is a region that developed world-leading innovations in biotechnology, diagnostics, and pharmaceutical drug research. This was achieved by building on its local assets, including MIT and Harvard University, through support from the government, and the entrepreneurial mindset of academics
- **The Durham Research Triangle** (North Carolina, United States) has made North Carolina a world leader in biotechnology. A skilled workforce, educational institutions and an innovative business environment have driven the Triangle's success. The North Carolina Government has played a prominent role through grants for university research, loans for emerging companies and significant investments in economic and workforce development.
- **BioRegion** (Catalonia, Spain) has grown to account for half of Spain's pharmaceutical laboratories and over 60 per cent of its production. Building relationships and partnerships between public and private institutions facilitated innovation in the BioRegion. The other elements that make BioRegion attractive are its competitive property, workforce and public service costs; widely available and high-quality facilities; efficient logistics systems; and talent in life sciences and health care.
- **The BioValley** (Switzerland, Germany & France) is a tri-national health and biotech cluster comprised of more than 40,000 workers across the Alsace in France, the South Baden region in Germany and north-western Switzerland. The main objective of BioValley is to facilitate greater research collaboration between companies and academia in the life sciences sector. The success of BioValley can be attributed to its central location in Europe, tertiary education institutions and its

provision of necessary facilities and infrastructure, and its ability to attract a high density of world-class life science companies and start-ups.

- The Biopolis (Singapore) health technology and biomedical cluster was purpose-built by the Singapore Government to attract innovation industries, who took on a proactive role in developing the biomedical manufacturing industry. Policies included attracting and sponsoring top scientists worldwide, publicly funding research institutes and a biomedical science park, creating scholarship programmes in global and local universities, investing government venture capital for private sector industrial projects and establishing tax incentives and IP frameworks.

The case studies reveal a similar list of best-practice needs for HI&C economy development, including building on existing regional strengths, a collection of large health and education assets in close proximity, government leadership and support, a deep and skilled workforce, and best-practice land use planning and infrastructure provision.

1. Introduction

1.1 Introduction to the project

The project is a region-wide research and engagement project to develop a strategy to advance regional priorities and inform advice to the government.

This project seeks to understand the regional strengths and opportunities relevant to health and the role of the health economy in regional recovery and growth.

The project aims to position the region as a leader and to support future growth in health care and innovation for regional economic benefit through:

- Leveraging existing regional strengths (world-class health precincts, R&D capacity)
- Capitalising on current government investment and projected future growth and innovation (e.g. MedTech; active and future medical / health precincts; clinical trials)
- Futureproofing against regional vulnerabilities and health challenges (e.g. fastest ageing metropolitan region; COVID-19 recovery; key worker housing)
- Addressing current and projected workforce and skills shortages (nursing, aged care, disability care; highly-skilled innovative professionals and entrepreneurs)

The project's first stage will produce a series of five working papers to act as a resource to inform a co-design phase in 2023. The co-design phase will identify how regional stakeholders will respond to the opportunities and challenges presented.

1.2 Introduction to the paper

This task and paper are to understand how best practice health innovation and care industry development is being done elsewhere and the lessons relevant to the Eastern Region.

This working paper is the third in a series. This paper was written to understand how best practice health innovation and care industry development is being done elsewhere and the lessons relevant to the Eastern Region.

This included identifying the form and function of leading regional health innovation and care economies, including their economic impact. Further research has identified the following:

- Best-practice land-use planning for health precincts and clusters
- Best-practice infrastructure provision and urban design
- Best-practice government funding and policy support
- Best-practice workforce development

1.3 Other papers in the series

This working paper is the third in a series. The other papers are:

- Working paper #1: the region's health innovation and care ecosystem: This first paper defines the health innovation and care economy and maps its current ecosystem in the Eastern Region across four sub-sectors (hospitals, health services, health product manufacturing and health research). The sector's economic value, in terms of gross regional product, export value, flow-on impact, innovation and employment, has also been estimated, as well as assets, strengths, and weaknesses.
- Working paper #2: health innovation and care trends assessment: This paper aims to understand the trends that will impact the development of a health innovation and care economy into the future locally, across Melbourne and nationally, and what the opportunities are for the Eastern Region.
- Working paper #4: best-practice innovation: This paper aims to understand the role of innovation in economic development. The focus is on understanding how innovation happens in places and creates new businesses, products or services and what government can do to support it.
- Working paper #5: community wealth building (CWB) diagnostic: This paper explores industry development outcomes. Though health care spending is booming, it's essential to consider where that money is going and whether it creates local wealth, local business opportunities and great jobs for residents.

2. HI&C economy clusters

Governments and economic development organisations, locally and globally, are putting in significant effort to cultivate successful industry clusters. This paper explores best practice health innovation and care industry development worldwide and draws lessons relevant to the Eastern Region.

2.1 The emergence of health care clusters in Australia

Since the 1980s, HI&C economy clusters (also known as biotechnology and life sciences hubs) have formed around major cities and regional centres in Australia. Key hubs are located in Sydney, Melbourne, Perth and Brisbane. They tend to be located close to universities which provide the 'enabling' intellectual property; close to established biotech or medical device companies that act as incubators for new talent; and where investors can impart knowledge to new start-ups.

Leading health innovation clusters drive the continuous creation of new life sciences and health-based companies through start-ups or spin-offs (primarily led by educational institutions). High-quality research facilities, world-class scientists, strong yet flexible regulatory schemes, and a stable business environment are among the factors that have led to Australia being considered a standard in the world of biotechnology and pharmaceutical innovation. Australia is considered one of the best places in the world to conduct clinical trials due to the high-quality research and health care infrastructure, stable socio-economic environment, ethnically diverse population and strong intellectual property regime.

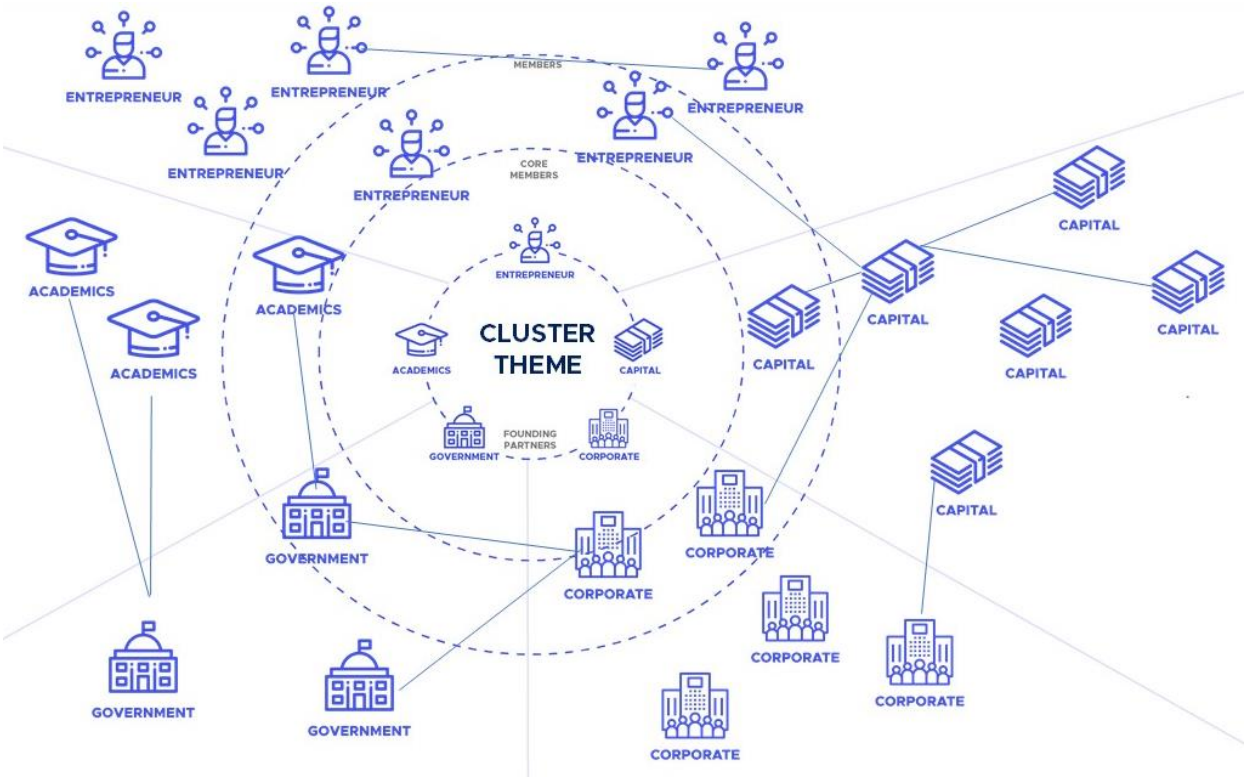
The sole presence of a hospital does not mean that a health cluster is bound to form, expand, and thrive. Developing and solidifying clusters requires consistent efforts from public and private sector stakeholders to assess the market and strategic injections of funding and other resource support.

Clusters must have a critical mass of firms that are close together and economically tied to each other. This economic linkage is what the Brookings Institution calls "interdependence." This critical mass means that firms located near each other in terms of geography gain a competitive advantage from proximity. Brookings outlines three traits of a thriving cluster; being industry-driven, university-fuelled, and government funded. In addition to these traits, successful clusters can also depend on good flows of capital, high start-up activity, enabling institutions and favourable government policies.[1]

Figure 1 visually represents the relationships between key stakeholders involved in innovation cluster formation, including academics, government, entrepreneurs, corporations and capital.

[1] Deloitte (2020). *New roads to the health innovation ecosystems of tomorrow.* https://www2.deloitte.com/us/en/pages/life-sciences-and-health-care/articles/innovation-ecosystems-in-health-care.html

FIGURE 1: INNOVATION CLUSTER KEY STAKEHOLDERS



Source: https://www.engage-innovate.com/insights/building-an-innovation-cluster/

Determining the right formula to develop mutually beneficial relationships and connect the right players to be coaxed into a successful, strong network of public-private partnerships has proven very challenging to replicate for governments.

2.2 How do health clusters create economic value for regions?

HI&C clusters can be essential to a region's economy, increasing competitiveness and driving job growth, wage growth, and new business creation. The aim is to generate innovation and strengthen a region's competitiveness and economic growth.[2] Innovative health clusters can help increase economic activity while providing attractive places to visit, live, and work. The co-location of institutions can lead to formal and informal knowledge transfers, encouraging an environment of collaboration. When fostered in HI&C clusters, these elements can provide a strong foundation for commercialising ideas and creating and expanding firms and jobs.[3]

The HI&C industry is a significant economic contributor in Australia. For example, AusBiotech estimates that the biotech sector:

[2] Wiggli (2020). *Outside of the two big regions in the USA of California and Boston, the European BioValley is considered the best cluster for biotechnology is the world*. https://www.wiggli.io/testing/the-european-biovalley
[3] State of Victoria (2018). *Melbourne Biomedical Precinct: From research engine to economic powerhouse*. https://www.melbournebiomed.com/wp-content/uploads/2018/04/DPC_MBP-Strategic-Plan_WEB.pdf

- Employs more than 240,000 Australians.
- Involves approximately 1,850 organisations, where 1,000 are life sciences companies developing new health technologies.
- Contributes an additional $5 billion gross value every year to Australia's economy.
- Attracts $1.5 billion in venture capital each year.[4]

A report by KMPG for the Department of Jobs, Skills, Industry and Regions (DJSIR)[5] evaluated the economic impact of government investments in the health technology sector, finding that it led to enhanced economic value. For every dollar of government funding, there was an additional GSP of $3.66 and an additional income of $4.54 across the state. These findings relate to investments made across discovery research, research platform technologies, product development and commercialisation capabilities, and industry and academic networks through three different funding programs:

- Science, Technology and Innovation Initiative in 1999 and 2004 ($620 million)
- Healthy Futures: Victoria's Life Sciences Statement in 2006 ($230 million)
- Operational Infrastructure Support Program from 2001 to present.

Overall, these government-funded programs have created 73,717 employee job years (FTE) over 18 years.

The State Government continues to support the sector, with the 2020 state budget including a $2 billion Breakthrough Fund and a $350 million Victorian Higher Education Strategic Investment Fund.

2.3 Best-practice land-use planning for HI&C precincts and clusters

A strategic location is critical for forming successful health precincts and creating a competitive advantage. A strategic location includes access to major health and education institutions, a large pool of knowledge workers and co-location with similar sites or large-scale manufacturing. Universities, hospitals, medical research institutes and large businesses can act as anchor institutions that create specialisation and attract new industries to the area.

Accessibility is an essential aspect of best-practice land use planning. Accessibility includes efficient public transport, arterial road corridors, and proximity to airports for domestic and international connections. Further, proximity to where research and prototyping occur is essential to a successful HI&C precinct. The intersection between advanced manufacturing processes and knowledge-rich and highly skilled labour forces typically supports inner-city locations close to concentrations of research and development capability.

Another critical consideration is supplying zoned land suitable for laboratory research, prototyping and small-batch manufacturing to accompany advanced manufacturing or biotechnology processes. The growth of emerging sectors within biotech, particularly those with strong links to R&D and fabrication,

[4] AusBiotech, 2020, 'AusBiotech's Pre-Budget Submission Federal Budget 2020-2021', https://treasury.gov.au/sites/default/files/2020-09/115786_AUSBIOTECH.pdf, p. 2
[5] KPMG (2021). *Creating a Healthy Future: The impact of Victorian Government investment in health and medical research*. https://djsir.vic.gov.au/__data/assets/pdf_file/0009/1988532/Creating-a-Healthy-Future-Report.pdf

will require flexible floor space. A final key aspect of leading HI&C clusters is a long-term vision, where land use planning is geared towards supporting future industries.

According to the Greater Sydney Commission,[6] best practice land-use planning includes a need to:

- Plan for the diversification and expansion of precincts.
- Protect surrounding employment areas for health, education, research, innovation, and creative industry land uses.
- Explore flexible zoning in suitable locations to accommodate ancillary and complementary uses such as health and medical research activities, private hospitals, allied health, start-ups, innovation and creative industries, ancillary retail, visitor, carer and aged accommodation.
- Plan for infrastructure, improved access and urban amenity within and around precincts.

Figure 2, overleaf, maps out some key target industries in developing HI&C clusters and identifies the required functional and locational land use planning attributes. The fourth column lists occupations required in the surrounding labour market.

[6] Greater Sydney Commission (2018). *Our Greater Sydney 2056: Eastern City District Plans.* https://greatercities.au/eastern-city-district-plan/productivity/jobs-and-skills-city/growing-and-investing-health-and

FIGURE 2: HI&C CLUSTER COMPONENTS

TARGET INDUSTRIES	FUNCTIONAL ATTRIBUTES	LOCATIONAL ATTRIBUTES	JOB TYPE
Bio-medical advanced manufacturing			
• 3D printing for prosthetics • Small and nano medical devices for remote and virtual care • Compounding chemist for personalised medicine • Specialised SME engineering firms	• Specialised clean laboratory space (TGA regulated, dust sensitive etc) • Flexible production space, often with good ground floor access and dock access for loading/unloading materials or products direct to trucks • Ancillary commercial space for research, administration	• Suitably zoned land (industrial zoning) • Close to clinicians and researchers for trials • Arterial road access for truck access	• Engineers • Medical researchers • Sales reps • Fabricators
Digital health			
• Computer engineering and IT • Nano-technology • Virtual health data systems	• Data storage systems • Clean lab space • High capacity, high speed internet		• Data scientists • Engineers
Bio-medical research			
• Early phase prototyping and trials	• Specialised clean laboratory space (TGA regulated, dust sensitive etc) • Access to incubator / accelerator space • Access to patients, clinical trial space	• Proximity to hospitals and MRIs • Proximity to universities for research partnership	• Medical practitioner and clinicians • Researchers • Medical educators • Government – health policy, regulation etc
Pharmaceuticals			
• Medical sales • Small-to mid-sized pharmaceuticals	• Commercial premises	• Proximity to places of clinical trials	• Medical sales • corporate
Financial, legal and business services			
• Bio & med-tech focused venture capital firms • Associated legal and other professional support systems • Business development actors	• Commercial premises	• Proximity to core industry partners is advantageous but not essential	• Venture capital • Lawyers • Finance and professional services

Source: SGS Economics and Planning and EY, 2022

2.4 Best-practice infrastructure provision and urban design

It is essential to align land use with infrastructure planning to maximise the use of existing infrastructure and plan appropriately for the future. Best practice infrastructure includes shared facilities to support various activities, including R&D and early-stage businesses. There should be a focus on different types of facilities to suit the diverse needs of industry communities, such as wet labs, clean labs, access to specialised computing infrastructure, precision manufacturing spaces and machinery. It is likely that over time, these precincts will become increasingly technologically complex and require ICT infrastructure such as data centres, high-capacity fibre connections and high-speed internet to enable high-tech industries and operations. Increasingly, high-quality medical research relies on biological and health-related infrastructures that store large and diverse data sources and samples.[7]

Table 1 below outlines the infrastructure needs of innovative industries related to the HI&C economy.

TABLE 1: INFRASTRUCTURE NEEDS OF HI&C-RELATED INDUSTRIES

HI&C industries	Infrastructure needs
Biomedical advanced manufacturing *(3D printing for prosthetics; small and nanomedical devices for remote and virtual care; compounding chemist for personalised medicine; specialised SME engineering firms)*	Specialised clean laboratory space (TGA regulated, dust sensitive). Flexible production space, often with good ground floor access and dock access for loading/unloading materials. Ancillary commercial space for research and administration.
Digital health *(Computer engineering and IT; nanotechnology; virtual health data systems)*	Data storage systems Clean lab space High-capacity, high-speed internet
Biomedical research *(early phase prototyping and trials)*	Specialised clean laboratory space (TGA regulated, dust sensitive). Access to incubator/accelerator space. Access to patients, clinical trial space.
Pharmaceuticals *(medical sales; small- to mid-sized pharmaceuticals)*	Commercial premises
Financial, legal and business services *(bio- and med-tech-focused venture capital firms; associated legal and other professional support systems; business development actors)*	Commercial premises

Source: SGS Economics and Planning and EY, 2022

[7] OECD (2010). *Biomedicine and Health Innovation Synthesis Report.* https://www.oecd.org/health/biotech/46925602.pdf

2.5 Best-practice government funding and policy support

Government support can help deliver a roadmap to define the future development of the HI&C economy, create incentives for research and development, provide sustainable financing for shared research infrastructures, attract international investment through tax concessions and promote standards development.[8] Governments can also focus on industry attraction, business concierge services, administration of incentives, funding mechanisms and precinct-wide infrastructure coordination (including data and cyber systems).

The OECD[9] have collated several lessons and policy recommendations for government to help facilitate best practice in health innovation. These include:

- Encouraging exchange and cooperative research for improved access to biomedical technologies through legislation, regulation, policies, guideline development, conditions for funding or for providing grants and training and norms of practices.
- Collaborating with different groups to discuss new mechanisms for knowledge exchange and formations, such as public-private partnerships, consortia, innovation networks, brokerage facilities, prize mechanisms and data sharing/exchange platforms.
- Encouraging the reporting of intellectual assets (IA) as associated business plans, developing and harmonising IA reporting guidelines, developing tools that allow patents and other IA to be valued, and making patenting and licensing information readily available and searchable.
- Work with industry to reduce the cost of health products by streamlining clinical trials to make them smaller and faster while maintaining the established standards for both efficacy and safety. This involves simplifying and coordinating the permissions needed for clinical trials, making advice consistent and standardised, creating model contracts and developing early warning systems for problems.

The McKell Institute notes that Australian businesses could be better at collaborating with research institutions and that the Australian Government needs to provide more support to the industry by 'catching up' with the rest of the world in reviewing its legislative and funding mechanisms.[10]

2.6 Best-practice workforce development

A critical element of developing a leading HI&C economy is a skilled and deep workforce. The Greater Sydney Commission suggests that developing a leading economy to attract the best talent is the best way to do this. This can include growing international gateways, investment, business opportunities and jobs in strategic centres and supporting the growth of targeted industry sectors and developing competitive advantages like:

- Internationally desirable premium-grade office space, supported by lower-cost office spaces.
- Being connected to the agglomeration of businesses in economic corridors.

[8] OECD (2010). *Biomedicine and Health Innovation Synthesis Report.* https://www.oecd.org/health/biotech/46925602.pdf
[9] OECD (2010). *Biomedicine and Health Innovation Synthesis Report.* https://www.oecd.org/health/biotech/46925602.pdf
[10] McKell Institute, 2016, Bio-Savvy: How Australia can build a stronger biotechnology industry, pp. 34 and 52

- Developing a robust creative sector providing entrepreneurial opportunities.
- Entertainment, cultural, tourist and conference assets.
- High accessibility, supported by established transport networks.
- Safe and high-amenity residential areas[11].

Providing pathways from education to employment is also an important element of best-practice workforce development. An example is the BioNetwork in North Carolina which supports training programs in the health innovation and biotech fields. This includes the Biomanufacturing Training and Education Centre (BTEC) at North Carolina State University, the Biomanufacturing Research Institute and Technology Enterprise (BRITE) at North Carolina Central University and the specialised education and training resources of BioNetwork at the state's community colleges. The investment in future talent has substantially grown North Carolina's education and training capabilities in biomanufacturing and catalysing the region's life sciences manufacturing growth for the next two decades.[12]

[11] Greater Sydney Commission (2018). *Our Greater Sydney 2056: Eastern City District Plans.* https://greatercities.au/eastern-city-district-plan/productivity/jobs-and-skills-city

[12] Bullock (2022). *North Carolina is taking the next big step as a global life sciences leader.* https://wraltechwire.com/2022/06/19/north-carolina-is-taking-the-next-big-step-as-a-global-life-sciences-leader/

3. Case studies

3.1 Melbourne Biomedical Precinct (Parkville, Australia)

TABLE 2: MELBOURNE BIOMEDICAL PRECINCT KEY INSTITUTIONS

Universities	University of Melbourne, RMIT, Monash Institute of Pharmaceutical Science (Monash University)
Hospitals	The Royal Melbourne Hospital, The Royal Children's Hospital, The Royal Women's Hospital, Frances Perry House
Health Research Centres	Walter and Eliza Hall Institute, Victorian Comprehensive Cancer Centre, Florey Institute of Neuroscience and Mental Health, Murdoch Children's Research Institute, Peter Doherty Institute for Infection and Immunity, Peter MacCallum Cancer Centre, CSIRO.
Biopharma Research Centres	CSL Limited, BioGrid Australia, Melbourne Bioinformatics, Melbourne Brain Centre, Australia Genome Research Facility, Bio21 Molecular Science and Biotechnology Institute and the National Ageing Research Institute

The Melbourne Biomedical Precinct claims to be the country's leading biomedical centre with specialisations across infectious diseases and immunology, neurosciences, cancer, child health and healthy ageing.[13] There are around 49,000 people employed within this precinct, with an additional 7,000 students being educated in the biotechnology and health sectors. Over the past decade, it is estimated that the precinct funded around $2.7 billion of investment capital into research and health care facilities.[14]

The Victorian Government has recognised that medical technologies and pharmaceuticals make up one of six priority sectors that have the potential to drive economic growth and more secure high-skill jobs.[15] This has driven government support to grow and develop innovation precincts, identified in *Plan Melbourne 2017-2050* as National Employment and Innovation Clusters (NEICs). These NEICs, of which Parkville is one, are a focus for jobs growth and strategic infrastructure investment and are anchored by specialised facilities.[16] The government has upgraded the Royal Melbourne Hospital, Royal Women's Hospital and aided the construction of a new Arden medical precinct. The government has also supported the precinct by investing a significant amount of money into the Australian Institute for Infectious Disease ($400 million) and the Cumming Global Centre for Pandemic Therapeutics ($75 million).[17]

[13] Invest Victoria (2022). *Melbourne Biomedical Precinct (Parkville)*. https://www.invest.vic.gov.au/opportunities/precincts/parkville-precinct
[14] Invest Victoria (2022). Ibid.
[15] State of Victoria (2018). *Melbourne Biomedical Precinct: From research engine to economic powerhouse*. https://www.melbournebiomed.com/wp-content/uploads/2018/04/DPC_MBP-Strategic-Plan_WEB.pdf
[16] State of Victoria (2018). Ibid.
[17] Department of Jobs, Skills, Industry and Regions (2022). *Parkville*. https://djsir.vic.gov.au/priorities-and-initiatives/business-precincts/parkville

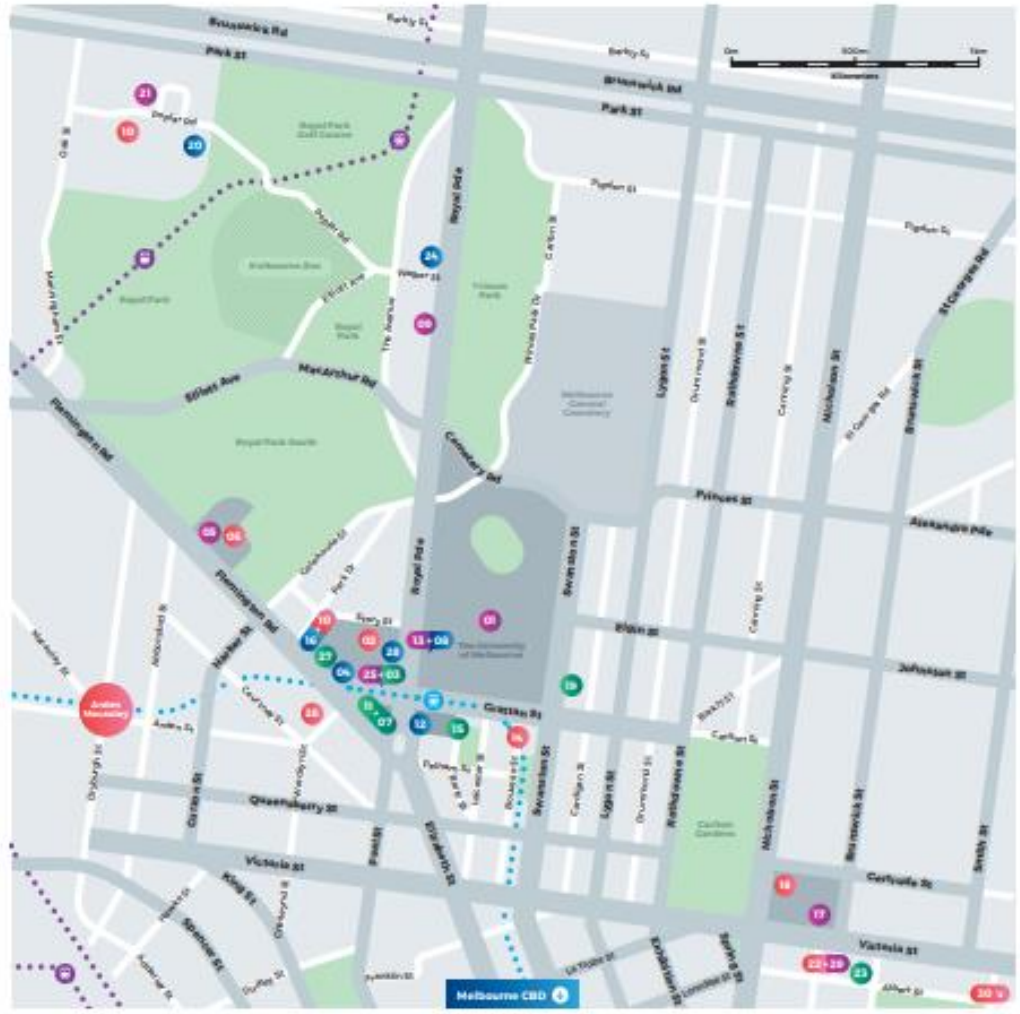
As well as providing funding to the various institutions that anchor the Melbourne Biomedical Precinct, the Victorian Government has also overseen and funded the construction of the Metro Tunnel. It is anticipated that the new train station in Parkville will improve access and that by 2036 the precinct (with its enhanced accessibility) will have created around 10,000 more jobs and $14 billion in private funding.[18]

The Melbourne Biomedical Precinct in Parkville is an extremely compact precinct with all key institutions and organisation located within just a few kilometres of each other as shown in Figure 3.

The Parkville case study provides an example of how the Victorian Government would be willing to assist the development of a HI&C economy in the Eastern Region. The development of the Metro Tunnel in Parkville can provide lessons for the development of Monash and Box Hill once the Suburban Rail Loop is developed.

[18] Department of Jobs, Skills, Industry and Regions (2022). Ibid.

FIGURE 3: MELBOURNE BIOMEDICAL PRECINCT (PARKVILLE)



Source: The Melbourne Biomedical Precinct Office, 2018

3.2 Monash Health Translation Precinct (Clayton, Australia)

TABLE 3: MONASH TRANSLATIONAL RESEARCH FACILITY KEY INSTITUTIONS

Universities	Monash University
Hospitals	Monash Health
Research Centres	Monash University Translational Research Facility, Hudson Institute of Medical Research
Companies	Merck Sharpe & Dohme (Australia) Pty Ltd, IQVIA, Novotech, Amgen

Source: AAS Architecture (2017)

Since its establishment in 2015, the Monash Health Translation Precinct has attracted state and industry talent and investment. This investment includes $564 million for Australia's first heart hospital and $17.5 million for a health innovation accelerator, the Victorian Health Centre. The precinct also attracted support from RUCDR Infinite Biologics in New Jersey to create the first industry-focused biobank in Australia (Biobanking Victoria). This facility operates at international standards and contains over 4.5 billion specimens. It enables collaboration with industry that was not possible before its establishment. The precinct hosts global experts in childhood cancer, genomics, women's health and inflammatory diseases.

The cluster co-locates biomedical and clinical research to nearby clinical care. This co-location provides access to large patient cohorts for health translation in state-of-the-art facilities, helping translate it into a research powerhouse. The precinct is in high demand by major pharmaceutical companies for clinical trials, as it is increasingly recognised to accelerate the translation of scientific breakthroughs.

The role of the government has been to strategically plan for innovation within the Monash National Employment and Innovation Cluster and to provide funding. Since its establishment, the precinct has significantly accelerated funding for clinical trials and is now conducting at least 200 trials. It has attracted over $260 million in awarded funding since 2015 and receives over $70 million in research income annually. It has diversified its funding sources and grown funding by over 900 per cent from $3.2 million in 2014 to $20.8 million in 2021. The precinct has also positively affected the local community by translating breakthroughs directly to patients and efficiently driving better health outcomes, jobs and new industries.

The precinct demonstrates typical attributes of a thriving HI&C economy cluster, including facility co-location, research translation and access to patient cohorts. Monash's strengths lie in the state-of-the-art facilities that have helped attract renowned clinician-scientists and catalyse research, resulting in new jobs and industries for Victoria. The Monash Health Translation Precinct is an incredible local asset and will be fundamental to the success of growing the HI&C economy more broadly across the Eastern Region.

3.3 Life Sciences Corridor (Greater Boston-Cambridge, United States)

TABLE 4: LIFE SCIENCES CORRIDOR KEY INSTITUTIONS

Universities	MIT, Harvard, Boston University
Hospitals	Brigham and Women's Hospital, Massachusetts General Hospital, Boston Children's Hospital
Research Centres	Beth Israel Deaconess Medical Centre, Dana Farber Cancer Institute
Companies	Merck, Sanofi, Biogen-Idec, Johnson & Johnson, Vertex Pharmaceuticals, Glaxo Smith Klein, Boston Scientific, Haemonetics, Novartis

Source: The Boston Globe (2016)

The Life Sciences Corridor is located in the Greater Boston-Cambridge region and is anchored by a high density of renowned hospitals and research universities, including MIT and Harvard. The Corridor specialises in core biotechnology, diagnostics, pharmaceutical drug research and development. The Corridor caters to the region's academic community known for its entrepreneurial mindset. As scientists are enabled to pursue their careers in a bi-directional way, many postdoctoral fellows go on to create new companies within the industry.[19]

A bi-directional career is a career path that allows individuals to move back and forth between different industries, fields, or roles. In other words, a bi-directional career allows professionals to pivot and transition between different areas of expertise rather than being limited to a linear career path. Bi-directional careers are becoming increasingly common as the job market evolves and employers prioritise adaptability and transferable skills in their hiring processes.

Government support for the Life Sciences Corridor began in the 1970s when the local Cambridge City Council and the business and research community identified DNA experimentation as an opportunity.[20] The City decided to regulate the industry and implement municipal zoning to provide companies with research and technology development opportunities. The state of Massachusetts has since continuously provided support through funding, including a $1 billion commitment to the biotech industry over ten years. The economic impact of the Corridor on the broader region is demonstrated through the raising of nearly $11 billion in venture capital in Massachusetts in 2019, most of which came through Boston's biotechnology hub. Further, it has been estimated that 58 start-up companies were founded in 2019 in Greater Boston, raising around $498 million.[21]

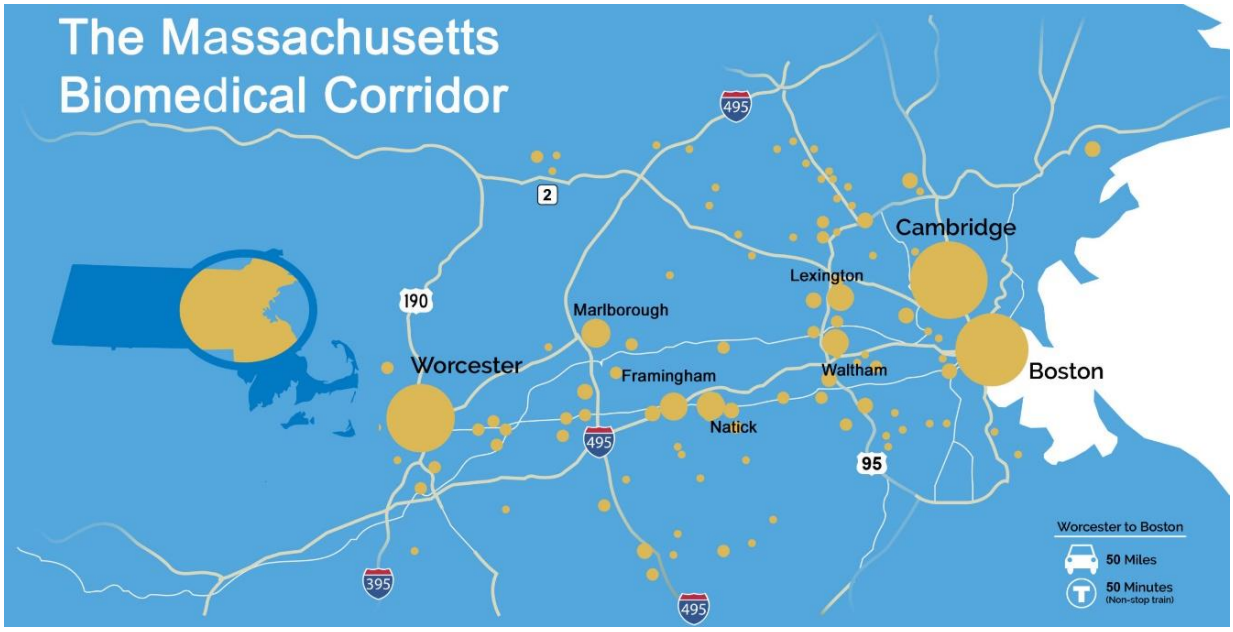
The future of the Life Sciences Corridor lies in its ambitions to upskill academics and industry professionals to specialise in gene editing, personalised medicine, digital health and telemedicine – as well as to capitalise on new capabilities in biomanufacturing. Several research institutions and industrial

[19] Swissnex in Boston and New York (2021). *Making Biotech Supercluster a Reality.* https://swissnexboston.medium.com/making-a-biotech-supercluster-a-reality-75e26ac0722a
[20] MIT Video Productions (2019). *"From Controversy to Cure" documentary chronicles the biotech boom in Cambridge, Massachusetts*. https://news.mit.edu/2019/controversy-cure-inside-cambridge-biotech-boom-1120
[21] Deloitte (2020). *New roads to the health innovation ecosystems of tomorrow*. https://www2.deloitte.com/us/en/pages/life-sciences-and-health-care/articles/innovation-ecosystems-in-health-care.html

partners in Boston recently came together to implement a $50 million centre for gene and cell therapy manufacturing, which will also direct new biotech capabilities in the Life Sciences Corridor.[22]

The life sciences corridor has grown exponentially in size over the years and while much of the clustering and activity lies within Boston and Cabridge, the corridor extends across Massachusetts to Worcester, a distance of around 80 kilometres. The extent of the corridor is shown in Figure 4.

FIGURE 4: LIFESCIENCE CORRIDOR MAP



Source: Massachusetts Biomed, 2015.

A lesson that the Eastern Region can take from this case study is to focus primarily on existing strengths to concentrate efforts and funding into developing innovation across these areas, in the same way, that the Life Sciences Corridor pushed its industry forward. Proximity is also a significant factor to consider in the success of biotech and health clusters, including access to capital, education, workforce, cost and quality of life.[23] In addition, the Life Sciences Corridor highlights that a combination of infrastructure, regulatory certainty and fostering a culture of innovation can develop an advanced health technology hub.

[22] Swissnex in Boston and New York (2021). Ibid.
[23] Swissnex in Boston and New York (2021). Ibid.

3.4 Durham Research Triangle (North Carolina, United States)

TABLE 5: DURHAM RESEARCH TRIANGLE KEY INSTITUTIONS

Universities	North Carolina State University, Duke University, University of North Carolina at Chapel Hill
Research Centres	Research Triangle Park, North Carolina Biotechnology Centre (NCBiotech)
Companies	Merck, Pfizer, GSK, GlaxoSmithKline, KBI Biopharma, Biogen, Advarra, Novo Nordish


Source: NCBioTech (2015)

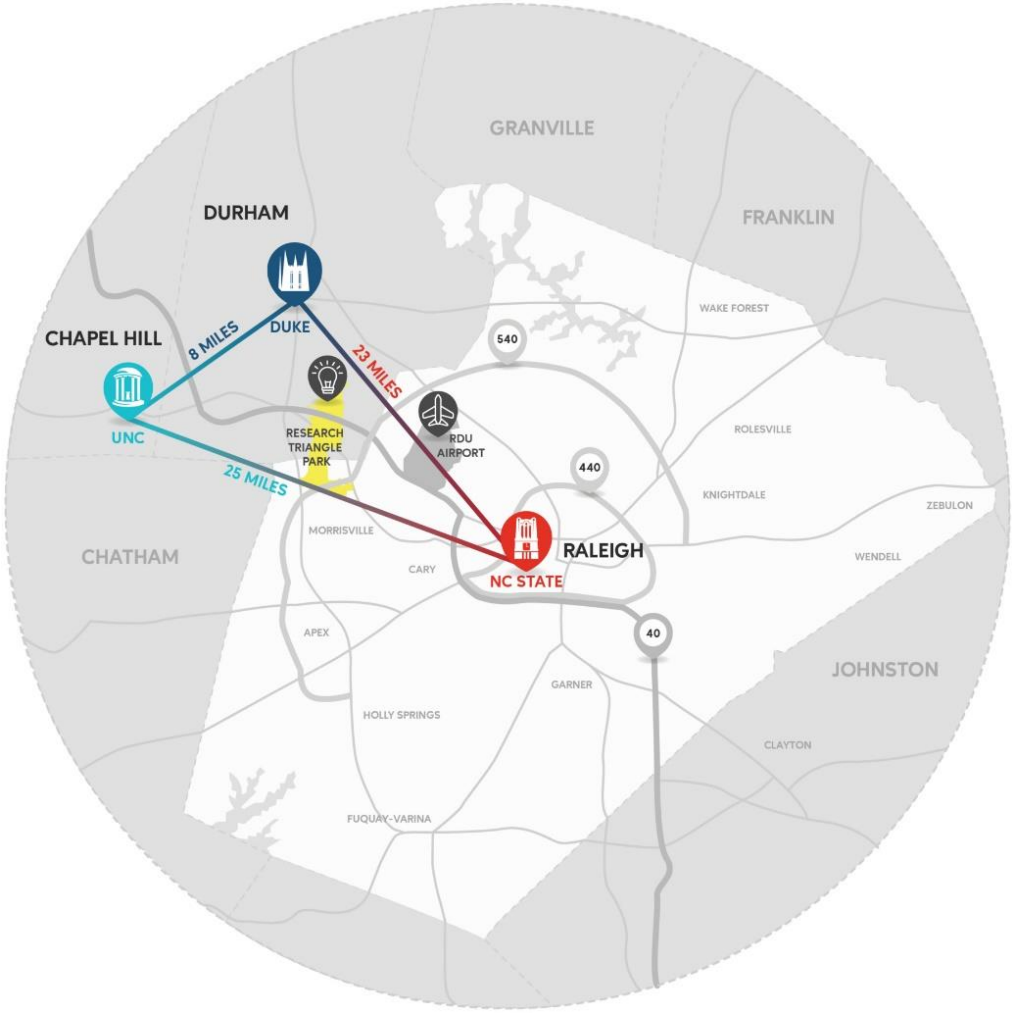
North Carolina is considered a world leader in biotechnology, with its success driven by skilled workers, educational institutions and an innovative business environment. The Research Triangle region employs over 64,000 people and hosts over 700 life science companies, ranging from start-ups to multinational corporations. A key anchor institution is the North Carolina Biotechnology Centre (NCBioTech), a private, non-profit, state-funded corporation providing access to the people and resources companies need to establish themselves in North Carolina. This includes identifying local talent and collaborating with local government and economic development agencies to overcome biotech-specific challenges. NCBioTech offers office spaces in its 'Landing Pad' for relocating companies and grants to address infrastructure gaps.[24] The global corporation Novo Nordisk is another anchor institution that acts as an economic engine for the Durham Research Triangle, providing jobs and research opportunities.

In addition, there is a collaborative system for learning between the North Carolina Community College System and the Durham Research Triangle. This collaboration system provides diverse industry options for new growth and career pathway development, providing practical and job-ready experience in the biological and pharmaceutical manufacturing fields.[25] The creation of the Research Triangle Park resulted from large, sustained life sciences investments that enabled the state to transition to a technology-based economy. Over the last 38 years, North Carolina has grown and financially supported the health and biotech sector through grants for university research, loans for emerging companies and significant investments in economic and workforce development.[26]

The research triangle is a regional level precinct and is defined by the three research universities that anchor the triangle. The research triangle park is located between these universities which are approximately 40 kilometres apart as shown in Figure 5.

[24] Bullock (2022) *North Carolina is taking the next big step as a global life sciences leader.* https://wraltechwire.com/2022/06/19/north-carolina-is-taking-the-next-big-step-as-a-global-life-sciences-leader/
[25] Bullock (2022) *North Carolina is taking the next big step as a global life sciences leader.* https://wraltechwire.com/2022/06/19/north-carolina-is-taking-the-next-big-step-as-a-global-life-sciences-leader/
[26] Bullock (2022) *North Carolina is taking the next big step as a global life sciences leader.* https://wraltechwire.com/2022/06/19/north-carolina-is-taking-the-next-big-step-as-a-global-life-sciences-leader/

FIGURE 5: DURHAM RESEARCH TRIANGLE MAP



Source: Research Triangle Regional Partnership, 2023.

3.5 BioRegion (Catalonia, Spain)

TABLE 6: BIOREGION KEY INSTITUTIONS

Universities	The University of Barcelona-Bellvitge, Autonomous University of Barcelona, Pompeu Fabra University
Hospitals	Bellvitge University Hospital, Sant Joan de Deu Hospital
Research Centres	Catalan Institute of Oncology, Bellvitge Biomedical Research Institute
Companies	Novartis, Roche, MSD, AstraZeneca, Janssen, GSK, Bayer, Pfizer, Amgen, Sanofi, AbbVie, Boehringer Ingelheim

Source: CataloniaBio & HealthTech (2021)

The BioRegion is located in Catalonia and specialises in digital health, medical technologies, pharmaceuticals, biotechnology professional services and consultancy. The region currently accounts for half of Spain's pharmaceutical laboratories and over 60 per cent of its production and companies employed in fine chemicals. It hosts around 91 research institutions and over 1,300 companies and contributes around 8.7 per cent of Catalonia's GDP.[27] The health innovation hub has contributed to its associated start-ups attracting €226 million in financing in 2020.[28] The Bioregion operates across an extremely large geography and encompasses a population of more than 7.5 million people and a land mass of around 32,000 square kilometres. A geography over three times the size of Greater Melbourne's land area.

The BioRegion is experiencing significant growth due to its scientific and industrial base, combined with more recent government policies. The Departmental Commission on Innovation and Transformation of the Health care System oversees the sector. The Commission captures and uses European funds to help catalyse health innovation. Its role is also to facilitate public-private collaborations on projects and foster innovation in health care system services and processes.[29] As with the Greater Boston Life Sciences Corridor, the future of the BioRegion is directed towards digital health and personalised medicine, as well as making advancements in AI and Big Data. Since 2021, several new initiatives have been announced, including promoting new facilities and hubs in the Barcelona metropolitan area to attract talent and international R&D projects.[30]

An important lesson for the Eastern Region is ensuring that relationships and partnerships between public and private institutions are facilitated to enable project innovation. The other elements that make the BioRegion attractive are its competitive property, workforce and public service costs; widely available and high-quality facilities; efficient logistics systems; and talent in life sciences and health care.[31]

3.6 BioValley (Switzerland, Germany & France)

TABLE 7: BIOVALLEY KEY INSTITUTIONS

Universities	The University of Basel, University of Upper Alsace, University of Strasbourg, University of Freiburg
Research Centres	Institute of Genetics and Molecular Cellular Biology, Centre for Applied Biosciences, The Biozentrum
Companies	Novartis, Roche, Eli Lilly, Sanofi-Synththelabo, DSM Nutritional Products, Amersham, Johnson & Johnson, Dow, DuPont, Syngenta, Pfizer

Source: BioValley France (n.d.)

[27] Biocat (2021). 2021 *BioRegion Report.* https://report.biocat.cat/?_ga=2.50146342.1802152625.1673504487-1615893420.1673504487
[28] Biocat (2020). *What is the BioRegion?* https://www.biocat.cat/en/about-bioregion/what-bioregion
[29] Biocat (2022) *Commission on Innovation and Transformation of the Health care System kicks off to boost innovation in the sector*. https://www.biocat.cat/en/news/commission-innovation-and-transformation-health care-system-kicks-boost-innovation-sector
[30] Biocat (2021). Ibid.
[31] Biocat (2021). Ibid.

The BioValley is a tri-national health and biotech cluster comprised of more than 40,000 workers across the Alsace in France, the South Baden region in Germany and north-western Switzerland (the Upper Rhine Valley). The main objective of BioValley is to facilitate greater research collaboration between companies and academia in the life sciences sector.[32] Key sectors include pharmacology, pharmaceutical biology, nanotechnology, medical technology, chemistry and agricultural biotechnology.

The success of BioValley can be attributed to its central location in Europe and its provision of necessary facilities and infrastructure to set up businesses. The BioValley hosts several innovation parks which are well suited to the needs of biotech companies, including Allschwii, Reinach and Witterswil (Switzerland), the Freiburg BioTech Park, Lorrach Innovation Centre and Offenburg Technopark (Germany) and Illkirch Innovation Park, Strasbourg Bio-incubator and Mulhouse Technopole (France). BioValley also has strong universities, research institutions, a financial community, and technology transfer offices.[33]

The European Union (EU), and national and local governments, have each played a role in supporting BioValley. The Interreg II Program run by the EU provided BioValley with a €2.2 million budget in 1997. This was strengthened through the 2002 Interreg III Program. The programs aimed to help BioValley set up sustainable structures that could support cluster management and offered various other supporting services, including infrastructure maintenance.[34] BioValley fulfils the criteria for a successful health technology cluster, including having a saturation of high-quality tertiary education and research establishments, attracting a high density of world-class life science companies and start-ups, providing easy access to sites and offices for businesses to locate, and access to venture capital.

3.7 Biopolis (Singapore)

TABLE 8: BIOPOLIS KEY INSTITUTIONS

Universities	The National University of Singapore, Singapore Polytechnic, Institute of Technical Education
Hospitals	National University Hospital, Singapore General Hospital
Research Centres	Singapore Science Park, Genome Institute of Singapore, Institute of Molecular and Cell Biology
Companies	GlaxoSmithKline, Merck, Novartis, Procter & Gamble, Roche, Chugai, Takeda

Source: Alchetron (2022) Biopolis

Biopolis is a health technology and biomedical cluster purpose-built by the Singapore Government to attract innovation industries. The cluster specialises in cancer biology, bioinformatics, immunology, genomics, stem cell research and bioengineering. In 2019 Biopolis employed over 24,000 people and

[32] Claassens, M. (2004). BioValley: Life sciences cluster in the centre of Europe. *Chimia* 58, pp. 769-770. https://www.semanticscholar.org/paper/BioValley%3A-Life-sciences-cluster-in-the-centre-of-Claassens/823da4069db4778404e5392070fe4217f454c97f
[33] Claassens, M. (2004). Ibid.
[34] Claassens, M. (2004). Ibid.

comprised approximately 4 per cent of Sinapore's GDP.[35] The success of this cluster comes from open innovation partnerships between private laboratories and public research institutes, allowing for a merging of science, medicine and engineering.[36] The Biopolis covers around 200 hecatres of land, located close to the National University of Singapore.[37] In comparison, the Eastern Region Group covers a total land areas of 290,000 hectares.

In this case, the Singapore Government took on a proactive role in developing the biomedical manufacturing industry. A state initiative was established between the Economic and Development Board, the Agency for Science, Technology and Research, the Ministry of Trade and Industry, the Ministry of Education, the Ministry of Health and the National Research Foundation. Specific policies supporting Biopolis included attracting and sponsoring top scientists worldwide, publicly funding research institutes and a biomedical science park, creating scholarship programmes in global and local universities, investing government venture capital for private sector industrial projects and establishing tax incentives and IP frameworks.[38]

Overall this case study highlights that successful health technology clusters are supported by proactive policies that prioritise access to funding, skilled people, partnership with research institutions and foreign multinational companies and infrastructure provision. The establishment of a supportive regulatory environment underpins this.

3.8 Further implications

Geographic scale and collaboration

The case studies show that geographic scale can vary significantly between health innovation and care economy precincts and clusters. This raises the question of whether the ERG HI&C economy should be distinct through self-containment or operate as part of a broader network of clusters across Melbourne.

The international case studies identified in Section 3 are all examples of world-leading precincts. While the case studies differ in geographical size, most examples are larger geographically than the ERG area of 290,00 hectares. This shows that HI&C economy precincts successfully operate across large geographical areas. There is, therefore, an opportunity for the ERG to work in conjunction with other health and medical precincts within Melbourne, such as Parkville and East Melbourne.

The Department of Industry, Science and Resources released a Statement of Principles for Australian innovation precincts in 2018, focusing on place-based partnerships building on competitive strengths. The study recognises that almost all of Australia's innovation precincts and clusters are small-scale and do not play a significant global role compared to other developed countries, stating that Australia ranks 39th and 40th in the Global Innovation Index and Global Competitiveness Index, respectively. The report

[35] University of Cambridge Policy Links Unit (2021). *Singapore's Biomedical Cluster: Lessons from two decades of innovation and manufacturing policy*. https://www.ciip.group.cam.ac.uk/reports-and-articles/singapores-biomedical-cluster/download/2021-02-19-SBS.pdf

[36] Agency for Science, Technology and Research (2013). *Biopolis: Ten years on*. https://research.a-star.edu.sg/articles/features/biopolis-ten-years-on/

[37] BtoBio Innovation, Singapore Biopolis (2018). *Singapore Biopolis Fifteen Years Later. http://btobioinnovation.com/singapore-biopolis/*

[38] University of Cambridge Policy Links Unit (2021). Ibid.

found that it was essential that innovation precincts in Australia were integrated into local, regional, national and international networks and supply chains, not isolated.

Adverse effects of specialisation and clusters

The positive economic effects of clustering and precincts are well founded. They can include boosting productivity, increasing access to employees and suppliers, co-location with complimentary services, higher levels of innovation and increased business formation. However, one concern is the pricing out of SMEs and other essential and supporting businesses in the area if the cluster becomes successful. Managing adverse effects relies heavily on the best practice land-use planning principles outlined in Section 2.3 of this report.

To ensure the best economic outcomes, flexible zoning and more affordable industrial land protection should be explored to accommodate ancillary and complementary uses. This helps to protect second-order precincts that have critical roles to play in supporting the development of the HI&C economy.

4. Summary of findings

4.1 Best-practice HI&C economy development

This paper has identified the formation and characteristics of health innovation precincts, including in the Australian context. The strategic co-location of HI&C industries, universities, hospitals and research centres is a driving theme in the success of HI&C economy regions and clusters.

Other major findings from the paper are outlined below.

The emergence of health innovation and care clusters

Since the 1980s, HI&C economy clusters (also known as biotechnology and life sciences hubs) have formed around major cities and regional centres in Australia and around the world. They tend to be located close to universities which provide the 'enabling' intellectual property; close to established biotech or medical device companies that act as incubators for new talent; and where investors can impart knowledge to new start-ups.

HI&C economy clusters can be challenging to initiate and develop

The sole presence of a hospital does not mean that a health cluster is bound to form, expand, and thrive. Developing and solidifying clusters requires consistent efforts from public and private sector stakeholders to assess the market and strategic injections of funding and other resources in support.

Case studies and research reveal the best practice needs to develop a leading regional cluster of activity in the HI&C economy.

Best practice land use planning for a HI&C economy

A strategic location is critical for forming successful health precincts and creating a competitive advantage. A strategic location includes access to major health and education institutions and a large pool of knowledge workers. Co-location of health anchors and industry is critical for innovation and commercialisation.

For knowledge workers, accessibility is an essential aspect of best-practice land use planning for HI&C clusters. Accessibility includes efficient public transport, arterial road corridors, and proximity to airports for domestic and international connections. Suitably zoned land suitable for laboratory research, prototyping and small-batch manufacturing to accompany advanced manufacturing or biotechnology processes is also a need.

One concern from cluster formation is the pricing out of SMEs and other essential and supporting businesses in the area. Affordable industrial land should be protected to accommodate ancillary and complementary uses. This helps to protect second-order precincts that have critical roles to play in supporting the development of the HI&C economy

Best practice infrastructure provision

It is essential to align land use with infrastructure planning to maximise the use of existing transport infrastructure and plan appropriately for the future.

Best practice infrastructure also includes shared facilities to support various activities, including R&D and early-stage businesses. There should be a focus on different types of facilities to suit the diverse needs of industry communities, such as wet labs, clean labs, access to specialised computing infrastructure, precision manufacturing spaces and machinery. It is likely that over time, research and development will become increasingly technologically complex and require ICT infrastructure such as data centres, high-capacity fibre connections and high-speed internet to enable high-tech industries and operations.

Best-practice government funding and policy support

Governments play a critical role in funding and leading the development of HI&C economy clusters and regions. The case studies of leading HI&C economy clusters all identify strong government leadership in providing roadmaps for future development, developing infrastructure, attracting international investment and collaborating with research institutions as critical to success.

Best-practice workforce development

A critical element of developing a leading HI&C economy is a skilled and deep workforce. Providing pathways from education to employment is also an important element of best-practice workforce development, as is ensuring that the HI&C economy is an industry that skilled workers are attracted to work in through good employment opportunities, high-quality workspaces and great liveability.

The right geographic scale

The geographic scale of a successful HI&C economy can vary significantly. Many world-leading precincts are larger geographically than the ERG area and cross whole cities or multi-city regions. This shows that HI&C economies can operate across large geographical areas. There is, therefore, an opportunity for the ERG to work in conjunction with other health and medical precincts within Melbourne, such as Parkville and East Melbourne. For innovation, it is also essential that precincts are integrated into local, regional, national and international networks and supply chains, not isolated on their own.

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