NSW Innovation and Productivity Council

The Innovation Economy

Implications and Imperatives for States and Regions

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The Business of Cities Ltd

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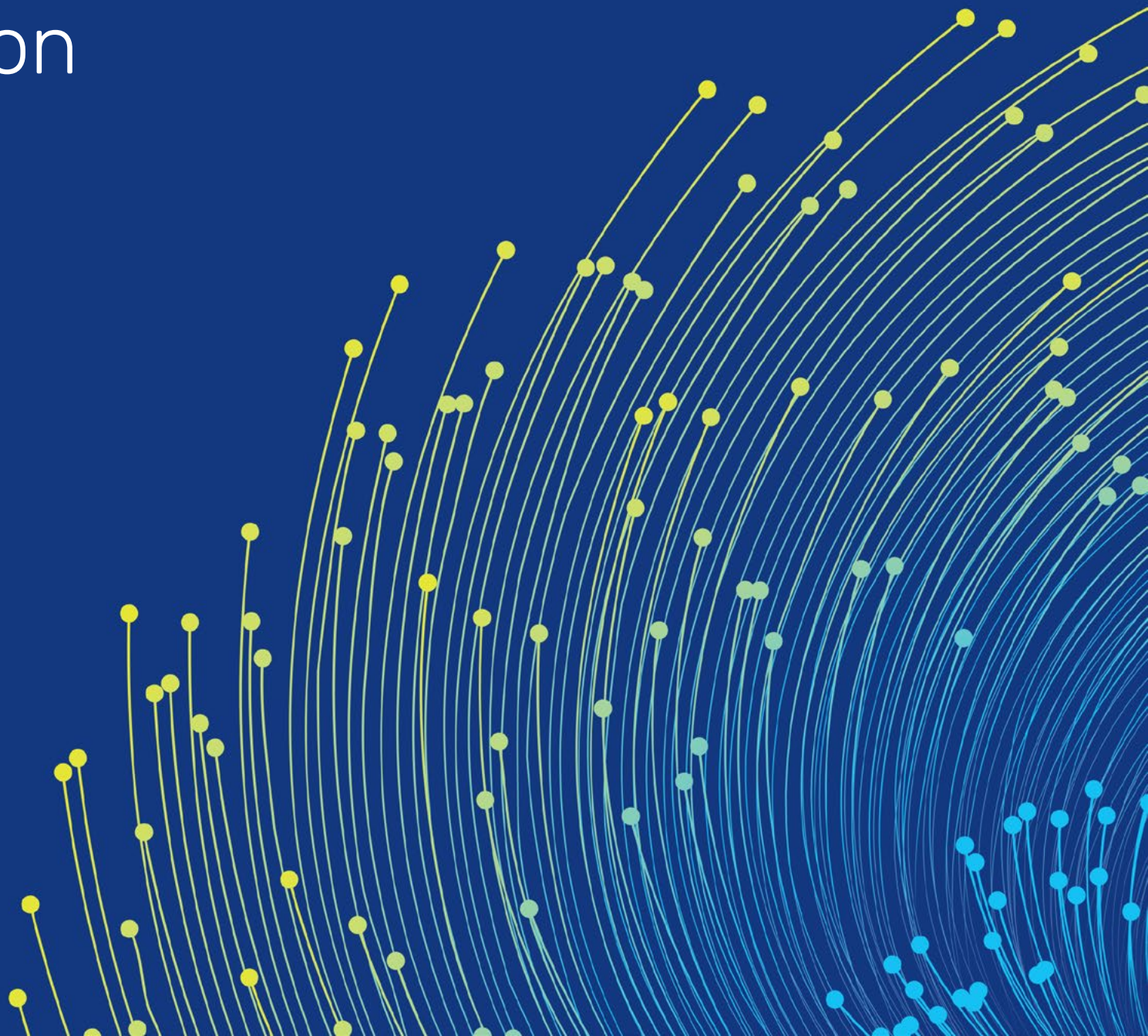
NSW GOVERNMENT



Foreword

Over the last few decades, new and growing technologies have connected our world and allowed us to better leverage creative and scientific expertise to solve problems. The scale, depth and speed with which these technologies and innovative enterprise are spreading are driving the emergence of a globalised innovation economy.

Innovation can increase productivity, create new business opportunities and raise the standard of living. It can also disrupt the business models that economies have traditionally relied upon. NSW can make the most of the positive opportunities and manage the disruption by creating the right market conditions for its innovation economy to succeed.

The NSW Government is already working to support innovators across the state. Under the NSW Innovation Strategy, multiple agencies deliver a range of policies and programs to make it easier to start a business, connect entrepreneurs to research institutions and build a responsive and innovation-friendly regulatory environment. The innovation economy is fast-moving and we want NSW to continually learn, improve and remain competitive.

The NSW Innovation and Productivity Council is tasked with providing independent advice to the NSW Government on ways to boost innovation and productivity. Our approach is to work collaboratively to build an understanding of broader trends and the needs and opportunities for NSW.

The Council commissioned this report by The Business of Cities to provide a contemporary picture of the innovation economy and how governments around the world are working to support it. I would like to thank Professor Greg Clark and the Business of Cities team for this report.

The Council have considered the insights from this report in developing their forward research program. This program will conduct in-depth investigations into the NSW innovation ecosystem to build an evidence-base on how to best understand and support our innovation economy.

There are currently four research streams:

- **Ecosystem-wide** indicators of performance, to understand drivers of innovation across the NSW economy.
- **Segment-specific** research, to identify the barriers and opportunities for innovation-led growth in high potential areas of the economy.
- **Place-based innovation** and clustering research, to support the hosting of innovation activity in specific locations and precincts.
- **Firm-level** growth, productivity and innovation measures, to investigate the characteristics of growing and productive firms.

I hope you enjoy reading this report, and the IPC research series that follows.

Mr. Neville Stevens AO
Chair, NSW Innovation and Productivity Council

1 The innovation economy

2 Fostering the innovation economy

3 What are leading states and regions doing?

4 Conclusion

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Executive Summary

The speed of technological change coupled with increased global integration and competition have dramatically spurred innovation across the world economy. The 'innovation economy' describes what happens when new generations of technologies and business models emerge at unprecedented speeds and scales to disrupt existing sectors, create new products and processes, and foster advanced and high-growth industries.

In the innovation economy, improved access to venture capital and expanded investment pools, along with the recent rise of global crowdfunding, is making it easier to market ideas and obtain finance. Another feature of the innovation economy is the agglomeration of businesses in specific geographic areas, attracted by knowledge intensive institutions, talent and skills, and opportunities to collaborate and share insights. These trends are supported by improvements to the business climate for entrepreneurship and small dynamic firms, and better legal protections for intellectual property.

Many high-income countries are finding that innovation and global competition have disrupted the job intensity of the established commodities and manufacturing economies. Many jobs have either become unnecessary or have moved off shore. They now seek to grow the innovation economy as one of the means to diversify their activities, provide a new base of jobs, boost wages, profits, and tax revenues, to be more competitive, and provide greater resilience to global economic shifts and shocks.

The world's leading innovation regions highlight different pathways to innovation economy success. Some have emerged more organically as a result of strong fundamentals, such as publicly funded research, inherited pro-enterprise culture, and high quality of place that attracts talent. Others have been supported by successive cycles of evolving and intentional government intervention in Science, Technology, and Enterprise.

California is known for its unique appetite for risk supported by collaborative networks, while Israel's high-tech specialisations are underpinned by its military R&D programs. Singapore has focussed on a small number of innovative industries, providing substantial tax, training and infrastructure support, while Finland has made long-term investments to build comprehensive end-to-end innovation systems. The innovation ecosystem in Bangalore, India emerged from incentives and policies to encourage the relocation of global IT and biotech firms to technology parks on the edges of the city.

The leading innovation economies of states and regions such as Bavaria, Ontario and Massachusetts have made consistent long-term public-sector investment in technologies, infrastructure, public education and a commitment to build on their regional strengths. They have made sustained attempts to respond to the gaps and needs of the innovation economy and intervene in targeted ways to best support it.

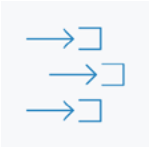
In these regions, government's role is to 'nudge' the market to intervene effectively in five main ways:

1
Adjust business climate and institutions

Pro-enterprise and pro-productivity reforms can protect IP and reduce the regulatory time and cost burden on innovative businesses. Public consultations are used to help identify areas for reform and pro-commercialisation approaches can incentivise universities to shift from R&D to commercialisation. Government land use adaptions and support for anchor institutions, such as hospitals, universities and military installations, can provide the catalyst to help foster the innovation ecosystem.

2
Address infrastructure gaps

Governments can provide the general and specialised infrastructure for new technologies to be tested and taken to market. This includes improved transport connections, better energy and data systems, high-speed broadband networks and university partnerships that grow the number of graduates in emerging fields.



3
Tackle investment deficits

Governments have a role in encouraging capital allocation and investment flows towards growth companies and intangible assets. The scale of investment varies, but public 'voucher' programs that support specific innovation sectors are a commonly used mechanism. The top innovation regions support this with a clear evidence-based proposition about their region's competitive strengths and investment readiness that includes how their science and technology assets can be optimised for the new economy. They identify the scale of investable opportunities and the support systems that attract investors.

4
Gear up for global competitiveness

Global leaders have talent attraction and retention strategies that address the global competition between markets for high value firms and skilled workers. They attract high-skilled migration, and support them to set up businesses and access resources in the region by increasing the visibility of the innovation within the region, tackling the migration and investment barriers, and championing reforms.

5
Correct information and coordination failures

Building the innovation identity and reputation of the region is a task that can be led by Government in alliance with industry players. Brokering networks enables actors to come together, build trust and improve information about innovation opportunities. Leading innovation regions adopt strategies that make the innovation process more visible and accessible to outsiders to improve the success rate of start-ups. Branding of strategies and emerging locations is a method that signals to the market that innovation is occurring. They also coordinate state and federal level innovation efforts.

Typically, leading innovation regions target a smaller number of strategic sectors and locations – sometimes as few as three sectors and three locations. This is matched by a shared recognition from all levels of government that key innovation locations require bespoke and complementary interventions.

Most fundamentally, the world's leading regions demonstrate a long term and deep commitment to driving innovation as the key source of future prosperity, fostering a more resilient and diversified economy, with the ability to adapt to shocks and future advancements. For many of the leading regions this is already a commitment spanning more than 50 years.

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1

The innovation economy

1.1
What is the innovation economy?

‘Innovation’ conveys the ways that workers, entrepreneurs, companies and industries embrace fresh knowledge, utilise new technologies, and promote change.

Such approaches may foster new business processes and create new products, stimulating and/or serving demand in novel ways. Such developments can increase the overall performance of workers, firms, sectors, or whole economies, and in doing so they raise productivity. This can increase demand, stimulate supply, and enhance trade. Innovation can create jobs, raise skills, deepen rates of enterprise and investment, and improve business efficiency and competitiveness, boosting wages, profitability, and tax revenues.

Definitions of the innovation economy

“New ideas that turn into companies that change the world in ways large and small.”

Prof Enrico Moretti

“The period in the early 21st century marked by radical socioeconomic changes brought about by (1) globalized commerce, (2) democratized information, (3) exponential entrepreneurship growth, and (4) accelerated new knowledge creation.”

Nortech, USA

“The synergistic relationship between people, firms, and place that facilitates idea generation and advances commercialization.”

Bruce Katz and Julie Wagner, Brookings

“There has always been an innovation economy, we just haven’t put a name on it before… it is here, in the innovation economy, that there will always be jobs.”

Kailey Raymond, Startup Institute

“Innovation is more than a single ‘tech sector’ or ‘start-up scene’ – it’s a way of describing how whole portions of an economy embrace technologies and change.”

Prof Greg Clark and Dr Tim Moonen

“Today, many people think of innovation only as the creation of a new commercial product suffused with advanced technology. [But] not every region has what it takes to be a technology innovation hub like Silicon Valley, and not every worker currently can get a high-paying, secure technology job working at Google. But these regions and workers still have untapped capacity to be part of the innovation economy… Innovation is the process of creating new things that people care about – business is the way we give it to them.”

Jonathan Aberman, University of Maryland’s Robert H. Smith School of Business [1]

“Innovation is often thought of as the adoption by everyone else of the inventions of scientists and technologists. But today… the sources and sauces of innovation have never been more varied…In reality, our innovation economy is not a Roman aqueduct but a “muddy pond”. Rich but obscure. Innovation requires of all actors, corporate, academic, civic and political, the instinct of the hunter-gatherer, not the farmer; a longer and broader view of needs and opportunities; an enterprising portfolio of risk-taking in place of fixed plans”

Robert Madelin and David Ringrose, for European Commission [2]

Although sometimes equated with a single ‘tech sector’ or a ‘start up scene’, innovation refers to changes that can span multiple industries and many different kinds of company. The ‘innovation economy’ describes what happens when such changes emerge at large scale and come to dominate or disrupt pre-existing sectors, and commerce or trade, to foster advanced and high-growth industries.

1.1.1
Cycles of change and waves of technology

Innovation is a feature of open market economies. Each new cycle of technologies and knowledge influence the business and enterprise models and the capital systems, products, services, and infrastructures that are required to succeed. The cyclical processes of disruption, adoption, adaptation and commercialisation by companies brings new sectors into being and resets the boundaries between the industries that were already well-established.

1.1.2
A new age of discovery

The new generation of technologies, increased connectivity, the powers of growing consumer demand, and the appetite of global capital mean that the current scale, depth, speed and spread of innovation across industries is unprecedented. The growth of the internet and digital systems, breakthroughs in life sciences, the emergence of smart systems, AI and big data, robotics and autonomous vehicles, as well as progress in energy production, storage, and utilisation, are all driving new commercial applications. We are witnessing, to varying degrees, the emergence of a globalised innovation economy, and this is increasingly recognised in inter-governmental and academic spheres.[3]

This can be evidenced in the rate of formal innovation now taking place. The number of patents filed worldwide has increased from under a million a year in 1990 to 3 million today, while the number of innovations produced through global collaboration has increased from 1,600 to 11,000 a year in the same period. Venture capital investment over the last 30 years has also soared from less than $20 billion to more than $120 billion a year.[4]

But these figures represent just the visible aggregates in terms of innovation activity today. In many companies, and most industries, innovation is something that happens on an everyday, ubiquitous, tacit, and unrecorded way. By some estimates, there are today 20 million innovation economy employees in the United States alone, and well over 100 million worldwide, all making “intensive use of human capital and human ingenuity”.[5]

1.1.3

Why does the innovation economy matter?

As the global economy becomes more deeply integrated, with larger number of goods and services traded across borders, the competitive challenge is to grow or attract high-value-added activity in traded industries. Nations and regions seek to capture such higher value activities in order to benefit from the **spill-overs and multipliers** that they can induce. Nearly all national and sub-national governments are therefore recognising that their long-term growth depends on developing a competitiveness strategy oriented around such innovation economy activity.

For public policymakers, the innovation economy specifically matters because it supports:

Jobs

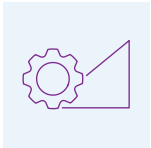
Innovation provides a source of jobs that are comparatively well paid and able to withstand global cost pressures better than jobs in the industrial or services economy. A higher concentration of innovation economy jobs is likely to achieve stronger overall jobs growth.

Multipliers and spillovers

The interactions among the sectors and firms in the innovation economy trigger larger chains of multiplier effects for the rest of their economy. Jobs in the innovation economy have been shown to create many additional professional and non-professional jobs in other parts of the economy.[6] Supply chains for the innovation economy are deep and diverse. The innovation economy efficiently re-uses and restructures land uses and the built environment.

Exports

Innovation economy activities are well positioned to drive exports of high value goods and services, increasing the balance of trade, and foreign currency earnings.



Productivity

Innovation drives skills, enterprise and investment. Together these add up to productivity improvements, diversification that aids economic resilience, increased labour mobility and better utilisation of knowledge technology.

Tax Revenues

These productivity improvements and multipliers can expand the rate of job growth, earned incomes, company profits, sales, and intensified land uses, and thus increase tax revenues for government.

As a result, nations, states, regions, and cities across the OECD and around the world are now focussed on how to harness the innovation economy to support their wider policy goals.

1.1.4

Which sectors are evolving within the innovation economy?

There is no strict or exclusive definition of the sector composition of the innovation economy. It can include, but is not limited to, advanced materials, biopharmaceuticals, business services, smart system and utilities, energy, waste, and water, advanced manufacturing, construction and materials, financial services, healthcare, scientific instruments, software and communications, and many more.

More broadly, leading economists have argued that all innovation sectors have two things in common:[7]

- they tend to employ workers with a high level of education.
- they make a product or service that is unique in that it cannot be easily reproduced or outsourced.

This definition encompasses the established knowledge and technology industries that experience new pressures and opportunities as a new generation of technologies come to the fore. Thus, much of the process of innovation change comes when existing industries embrace IT, robotics, big data, new materials, virtual reality, artificial intelligence, and utilise new energy, waste, water, distribution, transport and smart infrastructure systems.

1.1.5
The historical spatial and territorial requirements of innovation

Through history and across different types of economies and industry, innovation has shifted attention towards both different formats and different locations. Innovation has played a key role in both how industries have developed and in how the transition from one kind of industry, and location, to another has occurred.

Agricultural innovation systems

have become better understood. Although agricultural innovation has tended to take place in more dispersed geographies, the rise of large specialised equipment has fostered clustering and specialised production in agriculture.[8]

Military innovation

has taken place in distinct geographies, often shaped by proximity to military installations, and availability of large tracts of land to test equipment or protect IP.[9] This has enabled some key locations to capture and commercialise military innovation for market use.

Resource extraction innovation

has enabled the commodities industries to become much more productive and less labour intensive over the past 20 years. Although commodities continue to be extracted and contribute significantly to trade, the activity is much less job intensive.

Industrial ecosystems

have played a critical role in advanced economies for well over a century. These were described as industrial districts more than 100 years ago,[10] and many scholars have highlighted the contemporary role of clusters of small- and medium-sized manufacturing, often in suburban or peripheral locations.[11]

1.1.6

The role of cities and the urbanisation of innovation and agglomeration

Cities provide many of the essential conditions for trade, specialisation and innovation to thrive. The emergence of cities and the process of urbanisation has helped to facilitate trade, innovation, the capitalisation of firms, efficient labour markets, knowledge transfer and industrial specialisation.[12]

This is essentially the process of agglomeration – the way that businesses decide to locate in one specific area because of physical, raw material or locational advantages. When businesses concentrate spatially, they are able to match up with the skills they need, learn information more easily, and share equipment and resources in a more cost-effective way. When workers observe these aggregations of business they also decide to co-locate in the same markets that offer the largest employment prospects, choices, and job 'liquidity' (the ability of workers to move seamlessly between a large number of employers, and a wide range of jobs options, without changing residential location), the biggest return on their skills and knowledge, and the best opportunities for rapid advancement or promotion.

Thus, agglomeration also begets innovation. World-changing innovations such as cartography, navigation, currencies, insurance, stock exchanges, and banking came about because cities entered into short and long-distance trade and knowledge exchange. More modern innovations occur in places with local businesses and populations that are well connected to national and international markets and which serve these markets as "thinkers, makers or traders."[13]

1.1.7

The shift to cities and city-regions

During much of the period from the 1980s to the mid-2000s, innovation was viewed as something that mainly happened in small university towns, in special innovation incubators, and in special purpose science, technology, and media parks. Although spatial concentration became increasingly important, innovation in that period was largely expected to take place in controlled semi-urban or non-urban environments. Analysis at the time then showed that the innovation rate produced by clusters of firms working with knowledge rich organisations was becoming critical to the competitiveness of nations and of regions.[14] This meant that local and higher tier governments looked to create an environment conducive to innovative cluster performance rather than just individual firms.[15] This paved the way for our current cycle where innovation activities have rapidly migrated to metropolitan areas.

The current cycle of the innovation economy since 2008 is seeing the rapid urbanisation of innovation. Innovation activity has made a decisive shift to the big city environment to benefit from its deeper labour pools, larger customer base, urban fabric and proximity.

Although different sectors and different innovation models have distinct and specific spatial requirements, they all share:

- substantial dependence on proximity between firms, institutions, and investors
- a talent pool that benefits from larger urban markets, and which increasingly prefers the scale of urban environments and the choice of lifestyles
- adaptation of existing buildings, centres, and districts to support its model. In most parts of the world this is largely an organic, incremental, and messy process. It is one where the market takes a lead and planning authorities and development agencies rush to catch up.

1.1.8

The pre-conditions of an innovation economy: demand drivers and effective ecosystems

Not all cities can host innovation economy activities, especially if they lack fundamental economic demand drivers. These drivers include a company base with ambition to compete and evolve, proximity to customer and supplier markets, access to higher-risk investors, regular interactions between firms, and specialisation in sectors that experience pressures to improve their productivity.

No city can accommodate the innovation economy without a strong innovation ecosystem – the networks of firms, institutions, customer communities, infrastructures, supply chains, labour markets and investment systems that coalesce across a city or region. A strong ecosystem is able to sequence these factors to drive business formation, capitalisation, and growth.

International evidence suggests that cities which lack these industry, firm and investment dynamics, or which do not possess a critical mass and breadth of skills, are unlikely to succeed in establishing themselves as hotspots for innovation. This remains the case even if cities prepare very high quality stand-alone locations dedicated to innovative uses. Ecosystems also have a much wider geography than a single location, and responsibility for fostering and co-ordinating them is usually shared by many different organisations and tiers of government.

1.1.9

The rise of innovation precincts and districts

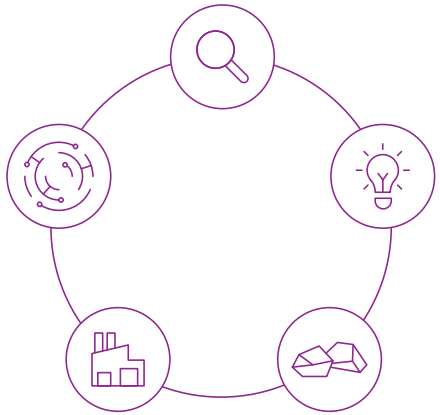
Innovation ecosystems can benefit from proximity and can give rise to specific concentrations of innovation activity. 'Innovation districts' are perhaps the best-known term, but there are also precincts, quarters, zones, campuses, hubs, triangles, parks, corridors and many other types of locations.[16]

Innovation districts have been observed since the late 1990s. The current literature on the practical ingredients of innovation districts has been headed by Brookings scholars Bruce Katz and Julie Wagner, as well as by the World Bank and Centre for London. This research identifies the importance of "networking assets" in these districts that generate positive relationships between start-ups, incubators, research, education, and public policy institutions. Subsequent research has identified several types of location: those organically embedded in urban neighbourhoods, those which are adapting from a self-contained campus or science park format, and those which grow out of the sharing of assets, facilities and "traffic" among anchor firms and institutions.[17]

Numerous cities around the world are keen to establish one or several of these locations, but they do not evolve and succeed just because city governments, universities, or landowners wish to designate them. They require careful interventions at different points in their development: to spot promising firms and locations, create the initial conditions, activate their growth, and later on to sustain their momentum. As innovation systems mature they take on multiple locations and develop both metropolitan and wider regional geographies. As the range of specialised locations increases they build network effects that often lead to regional 'networks', 'triangles', 'corridors', or 'diamonds'. These new regional geographies of innovation are clearly visible in mature regions such as Massachusetts, Bavaria, and Ontario which are profiled in **Section 3** of this paper.

1.2
Why is the innovation economy emerging now?

A number of long-term and shorter-term drivers have been proposed to explain the rise of the innovation economy over the past decade. Within the global literature the eight most commonly observed of these are:



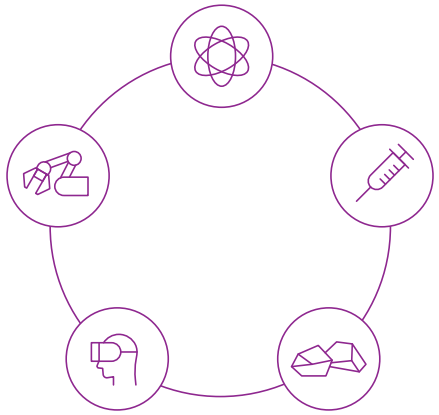
1
Competitive pressures

Many higher-income nations are experiencing a structural imperative to shift from a shrinking commodities or industrial economy to one built around services and innovation.

As the OECD has detailed, many countries have seen their manufacturing sector competitiveness decline, not only because exports have become more expensive, but also because industry has come to have less of a role in value added and employment.[18] Emerging countries have gained market share in both traditional manufacturing industries and higher technology industries.

Because of growing competition in global manufacturing, manufacturers have had to build new competitive advantages to compensate for the high-cost environment they operate in. This means greater innovation in terms of products/processes/services in niche markets, especially in terms of quality, design, organisational capital, business models, and brand.

At the same time, the tailing-off of the recent commodities boom has forced many countries to accelerate the transition to a knowledge economy. The policy focus in these countries has become much about investment in research, in-firm innovation, and more technology and knowledge transfer between knowledge generators and business.[19]



2

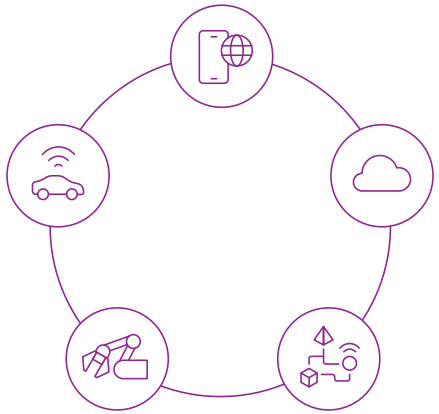
Technology: a new cycle of technologies with exponential effects

The current cycle of technologies is distinctive for their exponential growth and development potential. For a technology's growth to be considered "exponential", its power and/or speed doubles, or its cost halves, within two years. The doubling of the rate of computing power every 18-24 months suggests that within 20-30 years, computers might be microscopic, ubiquitous, and low cost.

Progress in synthetic biology is resulting in rapid customisation of foods, fuels, and vaccines. Artificial intelligence is forecast to gather huge volumes of data to inform real-time decisions. Other technologies that are set to build exponential capability include augmented and virtual reality, data science, nanotech and robotics.[20] Although the exact impact of these technologies is unclear at the current time, on their own and in combination they will have game-changing effects on some of the world's everyday activities and most urgent challenges.

This context impacts on the appetite for innovation globally in two ways. Firstly, many goods and services that cost a lot of money are becoming lower cost and more accessible. This allows more individuals and companies to innovate on a par with firms that have much more resources. Secondly, the effects of exponential change are hard to observe and predict, and therefore there is a great deal of value that accrues to those that spot them first. The ability of companies and institutions to be the first to adapt will help them avoid becoming obsolete.

Getting to grips with exponential technologies is a particular challenge for public institutions, as they look to make informed decisions about how and where to support economic development and innovation in their regions. Some of the leading decision-making knowledge is now held by private equity firms and venture capital firms, as institutions that focus on intermediate value creation and have learnt the ability to change at the scale and pace of the market to achieve returns.[21] The exponential and non-linear character of technology underlines the need for policies that foster institutional learning within public and private institutions.



3

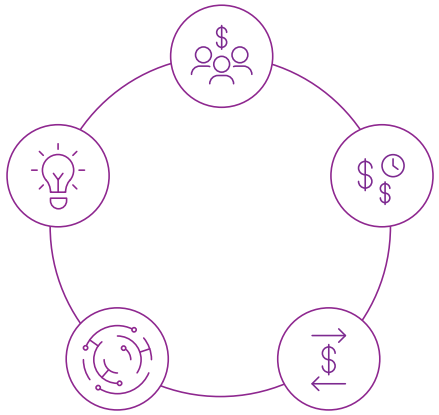
Speed of change: accelerated business cycles and pace of technology change

Technological innovation has often disrupted incumbent industries and established business models, producing new winners and losers along the way.[22] But over the last 50 years, and especially the last 10, the world has seen a dramatic increase in the pace of technological innovation.

This is due mainly to the growth of the ICT sector in combination with a suite of other technologies – including smart manufacturing, robotics, artificial intelligence (AI) and the Internet of Things (IoT).[23] Together, the applications of 12 new major disruptive technologies will have a potential estimated economic impact of between $14 trillion and $33 trillion a year by the year 2025.[24] In order of estimated impact, these 12 technologies, in order of estimated impact, are mobile internet, cloud technology, the Internet of Things, advanced robotics, autonomous vehicles, automation of knowledge work, next-generation genomics, energy storage, 3-D printing, advanced oil and gas exploration, advanced materials and renewable energy.

When the first Standard and Poor's (S&P) index of 90 major US companies was created in the 1920s, the companies on that original list stayed there for an average of 65 years. By 1998, the average anticipated tenure of a company on the expanded S&P 500 list was just 10 years. If this trend continues over the next 25 years, no more than one third of today's major corporations will maintain anything like their economic importance.[25]

New studies highlight an accelerating pace of creative disruption and the sorting effect of shorter business cycles. Analysis of millions of patents issued over the past century shows a strong correlation between a company's rate of innovative activity and its future growth trajectory and competitive edge. Less innovative firms are experiencing weaker outcomes compared to much of the 20th century, confirming that the imperative to innovate has increased.[26]

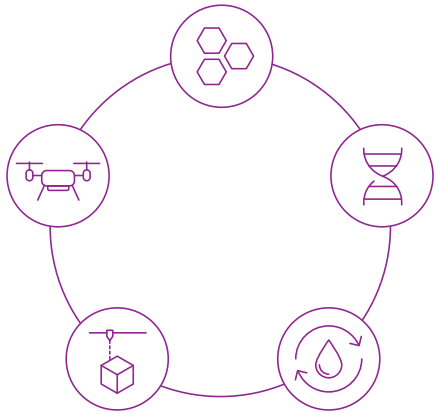


4

Economic diversification and resilience

The desire to diversify the economy has been a key trend among upper income countries since the 2008-2010 financial crisis, driven by widespread recognition that more diversified economies are more resilient to exogenous shocks. This has led to very deliberate attempts to reduce or contain the growth of financial services, real estate, and commodities-driven sectors, which are perceived as more volatile, and expand the sectors with a strong technology, knowledge and services component.[27]

In recent years, understandings of what constitutes a diversified economy have shifted away from purely sectoral definitions to include other dimensions, such as savings and consumption patterns, concentration of human capital, and trade profiles. Studies have focused on the importance of unrelated or 'non-correlated' variety (sectors not sharing the same cognitive base), as opposed to related variety (like sectors) in strengthening resilience to shocks.[28] Efforts have also been made to reduce the economy's reliance on household consumption and increase the small-business share of the business economy to boost resilience.[29] Together, these approaches have driven a cycle of policymaking throughout OECD countries that aims to foster interaction and spill-overs across existing branches of economic activity.



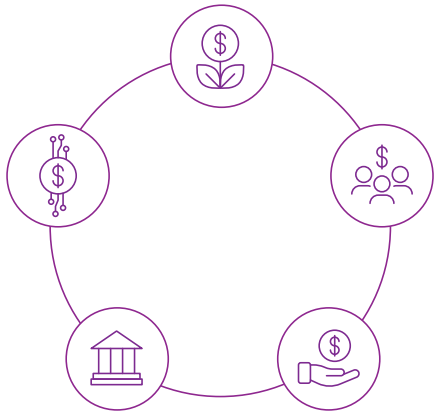
5

Sustainability: recognition of technology as a means to achieve sustainability and improve wellbeing

The social and political momentum behind innovation has been propelled in part by the fact that in the last decade, technology's uses to achieve sustainability and improve wellbeing have become much more tangible. New capabilities in materials science have created a whole generation of products that are more energy efficient, consume fewer mineral resources, and are lighter, stronger and more widely recyclable. Biotechnology advancements have produced new strains of crop resistant to disease and drought and revolutionised pesticide production.[30] Many of the World Economic Forum's top 10 most promising technologies have a clear environmental and social focus, from energy-efficient water purification and carbon dioxide conversion to precise drug delivery and nanoscale engineering.[31]

Digital technologies associated with AI, the IoT (e.g. augmented reality, drones) and 3D printing have also been pinpointed as key solutions to the global 2030 Sustainable Development Goals (SDGs). Tech solutions to support gender equality, access to learning, digital healthcare have generated significant public and private investment.[32] The impact of tech and data systems on physical and mental health have also encouraged healthcare providers to invest in innovative solutions.[33] The promise of tech to solve many kinds of complex issues also drives investment to combine disruptive technologies rather than adopt siloed uses.[34]

Cities themselves are also endorsing innovative technology activity partly because of the potential of new applications to have a dividend on cities' sustainability, infrastructure optimisation, transparency and inclusiveness. There are many examples (e.g. Buenos Aires, Delhi, Boston) where cities' efforts to accommodate socially useful innovation have fostered a cluster of innovations that drive the wider ecosystem.[35] This ranges from better integrated transport ticketing, to remote systems for supporting elderly populations, to better utilisation of energy in buildings. The rise of the smart cities and future cities captures the multiple ways that such technologies are enhancing city management and governance.



6

Capital appetite: improved access to venture capital and global financial markets

The wider availability of seed capital and other kinds of start capital is helping the 'tech start up' to spread across different geographies. In previous cycles the concentration of venture capital (VC) in only a small number of locations such San Francisco, New York, London, and Singapore effectively prevented the spread of the innovation economy in many other cities.

But VC funding and other global financing mechanisms for start-ups and innovation, (including crowdfunding) are on the rise. More investors, including corporates, investment banks, development banks, and institutional funds (pensions, sovereign wealth, insurance) are gaining interest in investing equity in early stage and small firms.

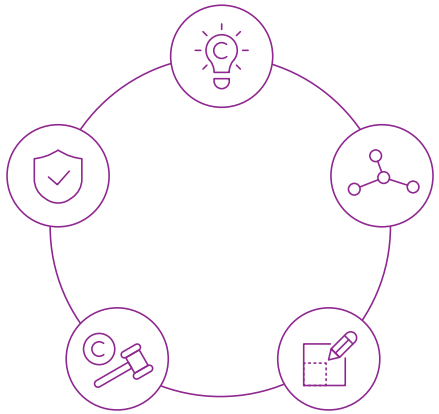
Total venture capital for growth companies has been rising consistently for the last 5 years and reached a new high in 2017 with $148 billion invested. The spread is becoming more global and explicit policies aimed at scaling-up venture capital funding have also helped to increase access to enterprise finance across the world. The EU and Australia, for example, have both recently agreed new rules to increase eligibility and incentives for investing in venture capital funding for SMEs.[36, 37] Large VC deals have had a big impact in Australia in fostering innovation in safe driving technology, bacterial testing, and online jobs searches.

Meanwhile the expansion of global crowdfunding has made it much easier for anyone to market their ideas and obtain funding. In 2015, the total worldwide volume of crowdfunding reached $34 billion. Kickstarter, one of the most popular platforms, has launched nearly 400,000 projects, and over $3 billion has been pledged on the site.

Equity crowdfunding is also increasingly popular, with worldwide volume exceeding $4 billion in 2016 and expected to grow to $20 billion by 2020, surpassing worldwide angel capital.[38] Goldman Sachs has described crowdfunding as "potentially the most disruptive of all the new models of finance" for its ability to democratise funding, allowing any good idea, regardless of its origin, to become a reality.[39]

In the last decade sovereign wealth funds have also stepped into the VC realm, hoping that investing at an early stage will yield higher returns if the firms they finance experience exponential growth. In 2016, there were 42 sovereign wealth fund deals with start-ups worth around $16 billion. And the cryptocurrency market is offering entrepreneurs new ways of accessing finance, through new tools such as initial coin offerings (ICOs) or token generation events (TCEs). Like crowdfunding campaigns, companies offer 'coins' or 'tokens' which allow their buyers to access blockchain-based software services.

Access to funding for future innovation has therefore dramatically increased, although it can grow much further still across different sectors and stages. In the digital tech sector, the pace of venture creation is around 200-300% more than even just a few years ago, whereas in biotech it is only about 3%.[40] And while seed funding has improved, the environment to support growth phase companies is likely to improve considerably in many countries, adding to the scalability of innovation.[41, 42]



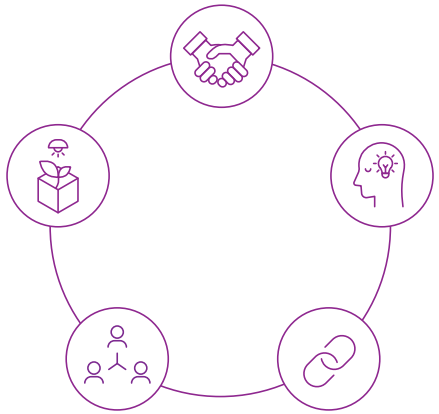
7

Stronger global IP frameworks

Over the last 30 years a global framework based on the protection of Intellectual Property Rights (IPR) developed by the World Trade Organisation (WTO) has emerged which enabled greater innovation to occur and get to the market. By providing a strong global legal basis for protecting IP, and by attracting more countries to comply with IPR protections, increased confidence in the ability of innovations to protect their unique formulas, designs, and technologies has accrued.

This has provided vital incentives for investment in innovation because it protects the potential for commercialisation by inventors and through licenses that cannot be so easily forged or copied. Companies have been able to build a “freedom-to-operate” strategy in a wider number of IPR compliant markets, a key step for scaling up globally.

Intellectual property has become a critical corporate asset – companies that own the most IP in their sectors are extraordinarily valuable. This had led to the situation where many companies are valued by their IPR rather than by their trading results.



8

Changing enterprise systems

The last decade has seen significant changes in the ways new enterprises are formed and business formations take place. Accelerated company life cycles means that there is more pressure for firms to trade immediately from start up. As a result, there has been a big rise in corporate venturing, entrepreneurship, VC engagement, team enterprise, and incubation. These models of start-up are accelerated in the sense that they involve deliberate strategies to bring together the best available teams, technologies, finance and strategies, backed by powerful companies and investors to exploit and capture a new market or opportunity with a start-up offering.

Other important changes have occurred in terms of enterprise models.

- There are new ways through which companies generate revenues, either by reconfiguring offerings, e.g. Cirque du Soleil which has moved to be provider of bespoke and corporate participative entertainment and online entertainment, or introducing new pricing models e.g. Netflix, which through its subscription service has been able to generate huge capital sources to invest in unique programming, creating a world first global online tv channel that also produces content.
- There are new kinds of enterprise structure and ways to work in value chains, either through integration, specialisation, or external collaboration via network plays. This has been a useful strategy for older established companies in the recent cycle.
- There is a growing trend towards participative investment models, which involve more external partnerships such as club deals, JVs, syndicated investment groups.[43] This gives rise to the imperative for collaborative innovation, but it also means that care must be taken to forge partnerships effectively. Failure rates for strategic partnerships often exceed 50%, with problems related to collaboration across organisations consistently emerging as a key cause.[44]

1.3
Confusion about the innovation economy

The innovation economy is interpreted in a variety of ways around the world. This partly reflects different attitudes to enterprise, distinctive roles played by the state in the economy, and the varied appetite of stakeholders to align their efforts with key global trends. However, some activities that are commonly described as the innovation economy, do not, on their own, meet the fundamental criteria of promoting enterprise and productivity change.

Some examples of what the innovation economy is *not* include:

- **The labelling of locations and buildings** as centres of 'innovation districts/precincts' with limited or only aspirational attention to what enterprise processes occur within them.
- **Activity wholly funded by the public sector**. Public investment in R&D, IP, and even in growth companies may be beneficial, but it not sufficient for an innovation economy to thrive. Some commercial risk and return is required to induce the 'innovation economy'.
- **The internationalisation and commercialisation of higher education**. Expanding higher education, and trading education and knowledge within global markets is good for innovation because it increases skills and may raise the propensity to enterprise or investment. It is an important ingredient, a necessary condition for innovation, but on its own traded higher education does not necessarily induce the innovation economy to occur.
- **Primary research and scientific discovery**. Science and discovery are key foundations of an innovation economy but are not sufficient on their own to drive trade, productivity, profit and jobs.

2 Fostering the innovation economy

Effective public interventions to support the innovation economy can take a variety of forms. In this section we detail the main reasons that governments opt to intervene, and some of the main ways that they act to support the innovation ecosystem in their states and regions.

2.1
What is the rationale for intervention and government support?

Although much of the innovation economy is organised through market-based processes which work effectively most of the time, the nature and speed of innovation change, the mobility of assets and competitiveness between locations, the pace of adoption of new processes, and the adjustments required in both institutional frameworks and business climates necessitate smart government interventions to support innovation processes. Governments that observe the innovation economy recognise that it requires distinctive support elements and can necessitate ongoing reforms in institutions and policies.

There may be up to five different rationales for intervention that need to be assessed in each context, and an objective evidence-based assessment is essential:

1. **Adjust business climate and institutions**
2. **Address infrastructure gaps**
3. **Tackle investment deficits**
4. **Gear up for global competitiveness**
5. **Correct information and coordination failures.**

In each of these cases, the government roles are not to intervene unilaterally and with a 'heavy hand'. Most positive effects ultimately come from well guided markets. Governments can provide the 'steering hand', the nudges and the tactical support that encourage the market towards a threshold that enables a more positive equilibrium to take shape. But the case study evidence shows that long term leadership commitment to the agenda, which means sustained effort to build up credibility and acquire reputation, is essential.

Therefore, a key priority for government is building the evidence base, analysis and benchmarks to inform private action and guide public reform. An initial step involves understanding and auditing the full range of innovation assets in the region, the business climate performance, enterprise processes, the value chain of existing industries, and the potential to move up those chains. This then informs analysis of the global opportunities, domestic and international competitors, and potential constraints associated with optimising these assets. These approaches are not usually high cost in terms of money but do involve extensive outreach and co-ordination between different actors and systems to continually monitor change.

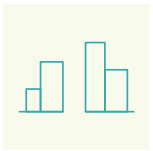
1
Adjust business climate and institutions: reforms to support innovation and new enterprise models

The innovation economy requires a business climate that supports the new models of enterprise, corporate restructuring, and small companies to set up and grow.

This includes adequate protection of Intellectual Property, simplified processes for investment in smaller firms, and streamlined bureaucratic interface. It also involves removing obstacles to enterprise and regularly addressing disincentives to growth that appear in regulation, for example, administrative obligations based on company size.[45] These kinds of adjustments have been a particular priority in European nations and state/provincial governments over the last decade, especially in terms of speeding up licenses in tech-related sectors and fast-tracking litigation processes for small firms to defend their IP.[46]

One key mode of government intervention here is **promoting reforms**. Pro-enterprise and pro-productivity reforms in policies, climates, infrastructures and institutions are commonly taken. Governments look to make adjustments to the regulatory framework to support reduced time and cost burdens on innovative businesses. They also seek to adjust institutional rules and regulations to help them be more innovation friendly and enterprise oriented.

For example, governments can create the **incentives and requirements** for key institutions such as **universities, banks, museums, data-centres, and hospitals to embrace innovation and enterprise**. Such reforms can firstly encourage these institutions to open up and share their data, which can be an important spur to innovation. They can also provide these institutions with the flexibility to commercialise their know-how, access venture capital, and to develop explicit policies and programmes to support entrepreneurs. A typical reform process involves increasing incentives and removing barriers for universities and other higher education and research institutions to work with business, foster enterprise, commercialise IP, and draw in co-investment.



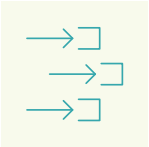
2

Address infrastructure gaps: ensuring adequate supply of infrastructure and facilities

The development of infrastructure and facilities can be an essential precondition for new technologies to be tested, proved and taken to market. Many industrial innovation sectors experience a shortage of sites or of specialist equipment and rely on public providers to help fill the gap. It can also be important to provide transport and increase the rate of investment in connecting infrastructure between key locations.[47]

Meanwhile several digital and scientific innovation sectors have **very specific place needs, power needs and accommodation needs** (e.g. wet labs for life-sciences, shared systems for earth sciences and circular economy, co-working for digital and creative start-ups) that in some cases the market can be slow to adapt and provide. The key challenge in this area is for government to intervene at the right level and scale in order to nudge the market rather than substitute for it.

One mode of government intervention is **enhancing capabilities** by investing in infrastructure, business foundations, and in application processes. Public policy remains an essential source of investment in the core infrastructure, education, skills and training of local populations, and into the high-end research, discovery and technology that drives invention and innovation.



3

Tackle investment deficits: encouraging capital allocation and investment flows towards growth companies and intangible assets

Public policies can also play a role in encouraging capital holders to consider enterprise investment rather than continuing to invest in tangible assets. Investment markets are often underdeveloped in relation to the intangible assets of smaller companies. Investors may find it difficult to access and appraise such businesses and the sheer range of investment opportunities and average size of the transactions involved are often too diffuse or too small to command market attention.

Government intervention may take a number of forms. Firstly, governments can make the depth of demand more visible to capital by building a **strong evidence base**. Secondly, they can make the **deal flow** easier for venture capital firms to access. Thirdly, they can help **provide training** that improves financial skills and literacy in small firms. This then helps the firms to become more 'investment ready' and reduces risks for investors.

Another form of government intervention to meet this need is **fostering new investment mechanisms**. Tackling investment deficits is not usually solely about more public investment. In both tangible and intangible assets it may more be about stimulating and guiding a market response such as more effective PPPs, greater support for venture capital players to enter a market, and increased 'signposting' of demand and supply of capital to one another.

Governments often need to support the commercialisation side of the equation, whether by providing seed capital, enterprise finance, IP protection or trade promotion. These reflect an observed requirement of advanced economies to increase investment in intangible assets and not just tangible assets, because they are more likely to be scalable, more likely to create synergies, and more likely to generate spill-overs.[48]

4

Gear-up for global competitiveness: measures to address competition for talent and firms from other markets

It is a common pattern in the innovation system of many countries (especially smaller economies) that larger overseas markets ultimately absorb their 'sunk public investments' in education, talent, science, and technology if the overseas market or ecosystem is stronger than the 'home' market.

This can be a significant net loss to countries or regions that invest substantially in graduate talent, universities, R&D and technology systems.

As a result, governments in smaller economies have to consider how they can **make their ecosystem more competitive** in order to attract more mobile talent and capital, and also to retain more of the talent and firms that they have nurtured, and therefore capture more of the returns on their sunk investments. Increasing the visibility of the innovation within the region, tackling the investment barriers, and championing reforms can all contribute to this. Monitoring competitor locations and being willing to compete proactively for firms and talent is a key part of the approach needed.

Fostering leadership at the industry and cluster level is a primary tool of governments. A strong and cohesive cluster identity, and fora and mechanisms for the cluster to be unified and led, is an important prerequisite to the innovation development of many of the world's leading regions. In examples such as Seattle, public authorities have found that successful cultivation of industry leadership involves empowering key firms and leaders, and reducing the public role in the process.[49] This has the effect of signalling to workers and investors that the scale of the opportunities remains attractive despite the lure of larger markets.

5

Correct information and coordination failures: activities to improve collaboration and address informational failures for workers, enterprises, investors and customers

It is a commonly observed challenge in innovation systems that buyers and sellers, workers, entrepreneurs, and innovators do not know how to find each other, and more broadly lack the basis for making informed decisions.[50]

Information failures are common in new industries where there is immature organisation for collecting, analysing and sharing information about innovation opportunities. Public support may be needed to provide coordination mechanisms that spread information and create partnerships that overcome knowledge barriers between different actors and along supply chains.

Enhancing visibility, identity, reputation, and brand building is an important ingredient to help inform international players, stimulate demand and drive collaboration locally. Many emerging innovation activities have been supported by effective efforts to create a unifying and evidence led story around the cluster or the region. This provides confidence to actors within the system and also gives the innovation system the presence and 'benefit of the doubt' among international audiences.

A critical role of public intervention is to encourage and ensure that the business, capital, knowledge, and government sectors work together appropriately. Coordination failures have been observed in sectors such as renewable energy and electric vehicles, where the update and commercialisation of innovation has been dependent on business coordinating better with early stage research initiatives and Government regulators.

Matching and sequencing ecosystem elements, collaboration, and conditions including sector and cluster groupings and place-based approaches are key public sector interventions. It is important to closely monitor and foster the ecosystem in order to provide the right injection of support at the right time. This can include approaches to unlock or activate particular precincts as and when needed.

Smarter communication: communication and network/community activation. Providing the information, networking and place functions to enable actors to come together, build trust and reduce co-ordination failures and missed opportunities is a key responsibility of government especially in newer industries. This intervention is important to help firms engage firms in related innovation (when they move into related fields and markets) and also in unrelated innovation (when they move into completely unrelated markets).[51]

3

What are leading states and regions doing?

3.1
Emerging leaders in the innovation economy

The innovation economy is now global in scope and scale, but a number of regions and nations have developed more mature ecosystems over the past 30-50 years. These regions and nations pursued a 'first mover advantage' that has brought them dividends.

They illustrate the variety of pathways through which regions can grow their innovation economy. These nations and regions have achieved some first mover advantages which offer interesting insights for other regions to observe. In particular they offer newly 'innovating' nations and regions a lens with which to view the longer-term cycles and leadership commitments needed to succeed.

In this section we examine three examples in detail – Bavaria, Ontario and Massachusetts. Others among this group of world-leading regions and nations include:

California

California, and especially Silicon Valley, has developed a unique innovation economy underpinned by collaborative networks, mentorship and appetite for risk. Northern California's ecosystem is premised on the fact that entrepreneurs have built support networks outside of existing companies that have proven to be mutually beneficial and durable, and leaders and institutions have willingness to adapt and evolve. Today the region benefits from headquarters of technology giants, world-class universities and laboratories, abundant venture capital, and large supply of technical expertise both domestic and international.[52]

Israel

Some regions and nations have harnessed their military and technical capability to become innovation leaders. Israel's ecosystem is underpinned by the crossovers between its military economy and civilian economy that have been fostered by national service. Supply side support for military R&D programmes has created commercial specialisations in cyber-security, IT and smart infrastructure, serving remote target markets. In turn these have attracted major domestic and foreign business R&D, as well as North American venture capital. Today Israel's innovation economy is characterised by close geographical and institutional proximity, a global investor base, and a national culture that encourages resourcefulness.[53]

Singapore

Many regions have been focusing their manufacturing effort on high quality infrastructure and specialised international talent in a small number of innovative industries. Singapore has adopted this approach, increasing its R&D project dramatically in a handful of areas – life sciences, materials, clean tech, and digital media. The government provides substantial tax relief, infrastructure support and training subsidies. The city-state searches for scientific thought leaders and postdoctoral students to work in its major innovation parks, and provides a high quality of life and residential amenities nearby or on-site.

Finland

Others have developed more comprehensive end-to-end innovation systems. For more than 25 years, Finland has invested in the fundamentals of school education, science, and technology. The country has consistently focused on a variety of public/private innovation funds, mechanisms to boost business and academic collaboration, and very well-managed alliances of players in the system. This has bred world-class capability in user-centred design, advanced health care services, food and nutrition, and energy conservation.

Bangalore, India

In the Indian state of Karnataka, an ecosystem in Bangalore emerged due to the initial foundation of a government–industry–academia triple helix. It was then kickstarted by reforms to incentivise the arrival of global IT and biotech firms relocating their R&D functions,[54] and state policies to establish software technology parks on the edges of the city. As the ecosystem has matured, Bangalore's firms began to invest in training professional development programmes, infrastructure and process and people management initiatives, and sponsored master's degree programs to improve the supply of talent.

These leaders highlight the different pathways to innovation economy success. Some have emerged more organically as a result of strong fundamentals, inherited pro-enterprise culture, and a high quality of place. Others have been supported by successive cycles of evolving government intervention, while long-standing leaders are increasingly observing the importance of positive public policy adjustments. In regions that are seeking to 'catch up' and compete effectively, it is usually imperative that government plays an enabling and catalytic set of roles and applies long term commitment to driving the context for innovation to thrive.

3.2
Case Study 1 Bavaria

State population

12.8 million

Main metropolitan areas

Munich (5.5 million)

Nuremberg (3.5 million)

3.2.1
Overview

In recent decades, Bavaria has emerged as an international leader in technology R&D and innovation – including in biotechnology, medical, automotive, and energy. Over a period of 40 years technological knowhow, outstanding higher education provision and high levels of human capital have made it Germany's leading technology region.

The Munich metropolitan region, which occupies a third of the state but creates half of its economic output, rates first in Europe for specialist knowledge. But much of the innovation system lies outside of Munich, as the Bavarian innovation system is highly decentralised. The main responsibility for regional innovation policy in Bavaria lies with the **Ministry of Economics, Infrastructure, Transport and Technology** which is in charge of the **Bavarian RTI strategy**, the development of key instruments, and their implementation.[55]

New startup centres and Cluster activities in the Digitalisation sector

Figure: Map showing new start-up centres and cluster activities in the digital economy, Bavaria [56]

3.2.2
History of innovation and innovation policy in Bavaria

The story of Bavaria's innovation ecosystem is 60 years in the making. While the city of Munich in particular benefited from the exodus of firm headquarters from Cold War Berlin (e.g. Siemens, Knorr-Bremse), what has really benefited the region is long-term state government investment in human capital and infrastructure development.[57]

From the 1970s, the state of Bavaria implemented a long-term R&D and innovation policy based around adjusting for future technologies, and public funding was specifically directed towards the growth of the education sector. At the same time, the 1972 Olympic Games emerged as a strong catalyst for investment in public transport improvements, which helped to expand the innovation system by improving connections across the region.

3.2.3
Programme investment in the ecosystem

From the early 1980s, state government, motivated by a strong desire to not fall behind economically, emerged as being critical to a second and third cycle of investment in the innovation ecosystem. Several state-wide programmes were launched to develop the high-tech sectors such as life sciences, ICT and mechatronics by supplying specific R&D, training and infrastructure.

In 1986, the Bavarian government launched the **Bavarian Innovation Programme and Bavarian Technology Introduction Programme (BayTP)**. The programme was aimed not only at supporting technology transfer, but also at providing dedicated support for the region's main innovation sectors, which had by this time grown to also include media and medical equipment.

In the early 1990s, Bavaria's defence and aerospace industries were at risk because of low demand following the end of the Cold War. Moreover, the region's manufacturing and electronics base was threatened by German reunification and the turbulence of new global markets.[58] To respond to this, regional agencies such as the **International Technology Forum Bavaria, Bayern International and Invest in Bavaria** were established, to prepare for the region's third cycle of internationalisation as a mature science hub.

In 1994, the state government launched the €3 billion **Future Bavaria Initiative (FBI)** and, later, the €1.4 billion **High Tech Initiative (HTI)**. Cumulatively, these schemes served the growing network of research facilities and enabled universities and polytechnics to expand, new start up centres to be set up, and a new generation of digital infrastructure to be rolled out.

Today, Bavaria's high-tech industries (automotive, medical instruments, pharmaceutical, machinery, ICT) are highly internationalised in nature. Their links are visible not only with European centres such as Zurich, Paris and London, but also inter-continental locations such as Sydney, Singapore and San Francisco. Large, globally oriented firms and SMEs are dispersed widely throughout the region and complement one another in such a way that the innovation ecosystem effectively consists of a "**cluster of clusters**" in which no one sector is overly dominant.

3.2.4

Bavarian innovation policy today: retaining the institutional thickness of the 'Munich Mix'

The fourth cycle of Bavaria's innovation policy began in the early 2000s. It is **more explicitly defined** and focuses heavily on **cluster management** and **digital infrastructure**. From 2006 onwards, a small (~€50 million) programme known as the **Cluster Initiative** was set up to manage 19 clusters throughout the region. Its aim was essentially to retain the region's unique "institutional thickness", by helping to sustain the already deep forms of collaboration that exist between universities, institutes, employers, and venture capital firms. But the small scale of the scheme, together with the fact that it has not proven particularly successful at engaging global industry players, led some to argue that mid-2000s state economic and research policies could only ever play a marginal role in stimulating growth sectors.

In this vein, the Bavarian state government in 2011 developed a more explicitly defined overarching concept for a research, technology and innovation policy.[59] The strategy, which was developed as a cross-departmental concept with the contribution of various ministries, is not a single document. Rather, it is embedded in a series of RTI initiatives from the past, including the Cluster Initiative and the Future Bavaria Initiative. Its overall objective is to secure Bavaria's leading position in the competition for innovation leadership in Germany and Europe.

Policy instruments cover all phases in the innovation process, from funding of research and technology infrastructures, to diffusion and transfer activities and supporting RTI activities in the business sector. The new RTI also advocates for a more explicit focus on certain sectors, including life sciences, efficient production technologies, and new and intelligent materials. Specific funding streams are available for these new fields.

As part of this overarching strategy, the state of Bavaria has **established over 50 technology centres and business incubators** throughout the region and has also introduced new dedicated funding streams to encourage growth. These include the new Programme for Supporting Technology-oriented Business Start-ups (BayTOU), and the Bavarian Regional Investment Grant Programme for Commercial Enterprises (BRF).

Finally, the state government has also recently launched a strategy explicitly devoted to digital infrastructure. The **Digital Bavaria Strategy** aims not only to expand high-speed broadband networks, but also to establish new digital infrastructure throughout the region, for example by expanding the field of digital engineering through establishing a centre for digital production. The strategy also covers the new research programmes into big data and e-Health, and forms yet another example of how strong state-level leadership can help grow a regional innovation ecosystem.

3.3
Case Study 2 Ontario

Population

13.6 million

Main metropolitan areas

Toronto (6.1 million)

Ottawa (0.95 million)

Waterloo (0.5 million)

3.3.1
Long-term public investment in fundamentals

Ontario's innovation sector benefits not only from an established history of very strong public-sector investments in healthcare planning and environmental technologies, but also a highly proficient network of universities led by the world-renowned University of Toronto, which acts as a major magnet for medium and high-skilled migration to the region. Although arguably embedded in Ontario's DNA, the province's reputation as an emerging world-class innovation location was strengthened further following the creation of Ontario's Ministry of Research and Innovation (MRI) in 2005. This was the first time that the provincial government had prioritised a coherent province-wide innovation agenda.

3.3.2
Focus on the key corridor

In the past, despite having some of the world's leading research universities, Ontario consistently struggled to convert research strength into commercial success. This was due to IP ownership and management rules: most universities retained IP ownership, controlled the transfer of technology, and retained a share of future revenue from research undertaken on campus. Together, this limited the incentive to pursue commercialisation.[60]

Today, 12 out of the 20 most innovative Canadian technology companies are from Ontario, and all of these are from the Toronto-Waterloo technology corridor.[61] Furthermore, world-class innovation locations have emerged throughout the province in recent years, spanning sectors including software, life sciences and green economy (e.g. MaRS Discovery District, Downtown Waterloo, Mississauga). Moreover, Canadian universities account for approximately 40% of total Canadian R&D – and much of this originates in Ontario.

Clusters in Ontario

Creating an ecosystem for prosperity

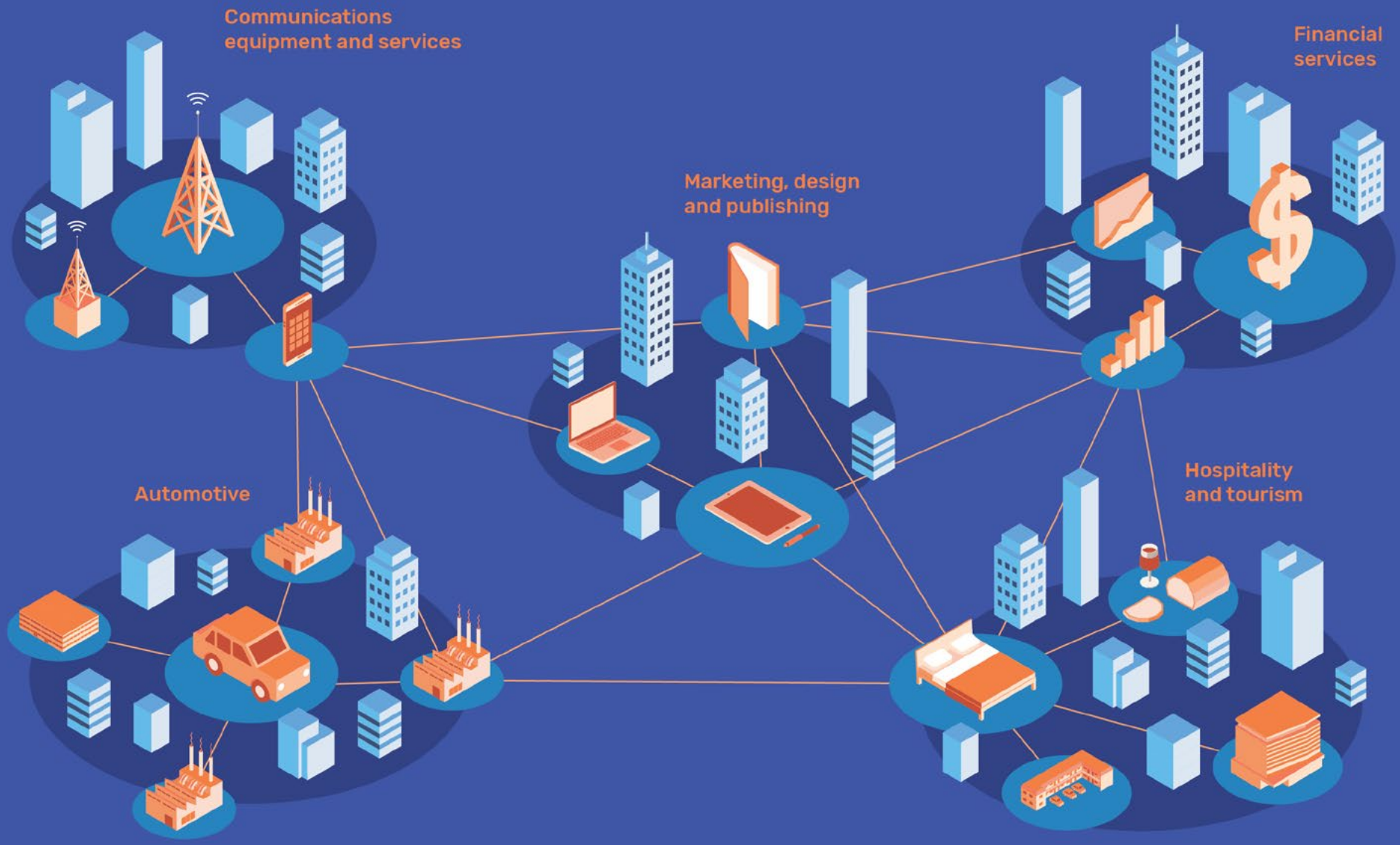


Figure: Diagram showing five of Ontario's strong, traded clusters [62]

3.3.3 Commercialisation and community activation

Much of this shift has come from an increased focus on commercialisation and offering scale-up incentives to SMEs, which have become mainstays of the provincial government's innovation policy in recent years. A $29 million Investment Accelerator Fund has provided seed capital to early-stage companies. In 2009 the Ontario government introduced the Ontario Network of Excellence (ONE), which later became the Ontario Network of Entrepreneurs.

The ONE is effectively a collaborative network of over 130 organisations across Ontario designed to help entrepreneurs, businesses and researchers commercialise their ideas.[63] It connects businesses with free services such as workshops and seminars on topics such as marketing and branding, expert advice and mentoring through direct one-on-one access to experienced business executives, and financial opportunities coaching through consultations covering topics such as business plan review, access to resources and advice on government support programs.[64]

Since its launch, the ONE has helped to create over 73,000 new companies, create or retain over 190,000 jobs, establish over 2,500 technology licenses and patents for new intellectual properties, and develop more than 15,000 prototypes. In 2015 alone, ONE leveraged $575 million from the private sector.[65]

The provincial government's dedication to supporting commercialisation became even more pronounced following the launch of a $650 million Business Growth Initiative, aimed at growing the innovation economy and creating jobs. A key part of the initiative involves **modernising regulations for businesses and helping SMEs to scale-up** their operations. An Ontario Scale-up Voucher Program allows companies in specific sectors generating between $1 million and $50 million in revenue to obtain grants of up to $250,000 to overcome specific scale-up challenges, and provides specialised scale-up advice to help develop and execute tailored growth plans.[66]

Ontario's innovation approach has become more focused on a smaller number of strategic sectors and locations in recent years. The government of Ontario is now a willing partner in the "Toronto-Waterloo Innovation Corridor 2025" initiative, aimed at developing the Toronto-Waterloo "supercluster" into one of the world's top innovation ecosystems. One of the key ambitions of the initiative is to triple venture capital investments in sectors of strategic interest – namely, HealthTech and FinTech.

The government of Ontario supports cluster development through anchor investments. In January 2015, the MRI signed a five-year, $25 million operating funding agreement with the Institute for Quantum Computing to help make the Waterloo Region a global centre for the development and commercialisation of quantum technologies, while in June 2015, they announced a $25 million commitment to the Ontario Institute for Regenerative Medicine to help Ontario become a global leader in the commercialisation of stem-cell based products and therapies.

The new Business Growth Initiative partly succeeded the $1.15bn Next Generation of Jobs Fund which also focused on scaled-ups in strategic sectors. The Next Generation of Jobs Fund delivered a five-year program through the MRI, the Ministry of Economic Development and Trade and others to help fund strategic, industry-led programs and projects in four areas of strength for Ontario:

- Bio-economy and clean technologies;
- Advanced health technologies;
- Pharmaceutical research and manufacturing;
- Digital median and ICTs.

Meanwhile, the new Low Carbon Innovation Fund, as part of the Business Growth Initiative, is designed to support emerging, innovative technologies in areas such as alternative energy generation and conservation, new biofuels and bioproducts, and novel carbon capture and storage technologies.[67]

Overall, Ontario's innovation strategy has become much more focused on improving commercialisation, scale-ups, and intervening tactically in key strategic sectors. Together with continuing to promote partnerships between business and academia, Ontario has now established itself as a leading innovation ecosystem in North America.

3.3.4

Ontario: State policy to support an innovation anchor

State government has played a critical role in the success of the MaRS Discovery District, one of the leading innovation locations in the world. After a successful first stage which was primarily privately funded (2000-2005), the provincial government sought to anchor the 2nd stage of development by relocating Public Health Ontario back into the downtown core in order to better tackle a future epidemic. The project experienced significant challenges as the developer stopped the project at the height of the global financial crisis. The fundamental strengths of the ecosystem, nurtured by the management team ensured that the project has returned to stability and the cluster continues to thrive.

Ontario province has successively relocated key anchors into the District, and provided gap support during periods of cyclical downturn. The province has taken advice on several occasions and each time resolutely invested in the long-term vision. By 2017, the Ontario government had three-quarters of its loans repaid, after the successful private sector refinancing of the government bailed-out building project. As a result of the tower becoming 100% leased, MaRS is now three years and $65 million ahead of its repayment commitments.[68]

The initiative benefited from:

- **Deliberate clustering:** Medical institutions can act as important anchors of innovation district and a wider innovation economy when there is a deliberate attempt to build dense clustering around them. Through a combination of adapting land uses, tactical relocations, reconfiguring real estate assets, and increasing proximity and interaction between research and entrepreneurship, hospitals and medical research institutes can form a potent innovation economy in NSW cities that possess the wider ecosystem requirements.
- **Single point of interaction with stakeholder:** The creation of a non-profit management association, that can act as a partnership vehicle to engage multiple tiers of government can be an effective way to ensure that there is consistent support for the patient anchoring of a cluster. A single partnership into which all stakeholders invest has provided the clout and unity of focus required.
- **Incremental, iterative expansion:** The incremental expansion of the district illustrates the benefits of an agile and iterative anchor strategy when relocating innovation clusters into new or up-and-coming districts. Toronto has shown the value of adding new institutions, new blocks, and new entrepreneurial capital at the right time, and adjusting the balance sensibly between the public and private sector presence.
- **Relocate agile functions before large infrastructure:** Toronto (and others) have shown that the strategic relocation of public sector medical assets should prioritise moving the R&D functions which have more opportunities for productive spillovers, rather than big hospitals.
- **Deliberate district branding:** Branding a district in a way that leverages the anchors provides a degree of visibility and focus that is important. Toronto's bold approach to branding the street signage and providing other cues about the Discovery District, has given the area a profile that resonates across North America and a confidence that comes with it.
- **Long term investment and support from all levels of government:** Higher tiers of government sometimes may have to be patient and entrepreneurial with financing and anchoring development projects. Amid the controversy over financial arrangements in recent years, the Toronto case highlights the belief shown by the higher tier of government in the District as a long term bet for the future of the Toronto region.

3.4
Case Study 3 Massachusetts

State population

6.8 million

Main metropolitan areas

Boston (4.8 million)

3.4.1
Overview and brief history of Massachusetts innovation system

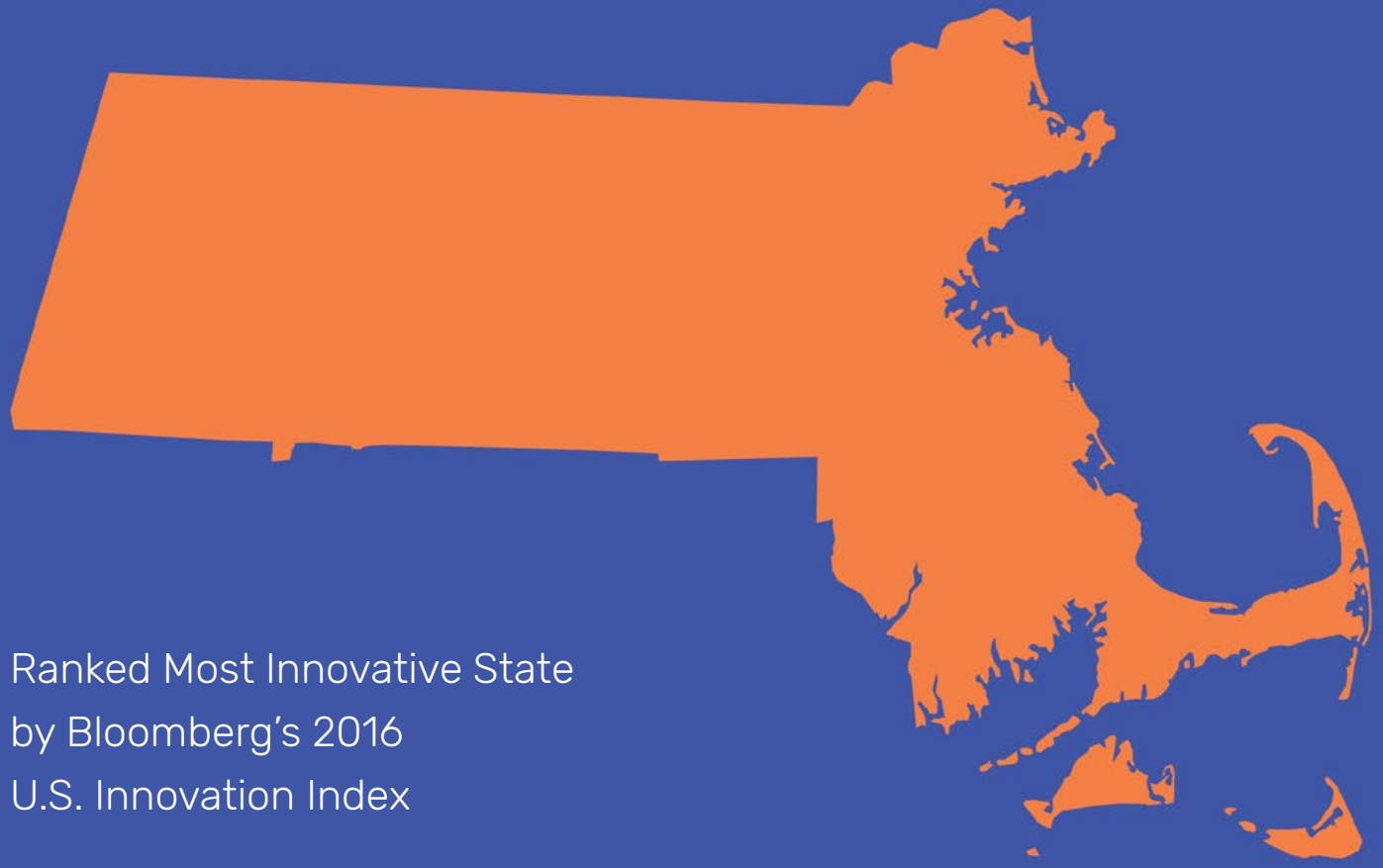
Massachusetts has a 100-year long history of innovation. One of the state's most influential universities – Massachusetts Institute of Technology (MIT) – emerged as an innovation powerhouse in the 1920s, although it was not until the 1960s, when the MIT campus began to expand eastward, that the surrounding area began to develop into what would become the epicentre of a globally renowned innovation ecosystem.[69]

Today, Boston's university network forms the backbone of this innovation ecosystem, which, according to some R&D measures, is one of the best performing systems worldwide. Massachusetts is tied for first place with California in the US for patents per capita, and invests more than 5% of its Gross State Product (GSP) in R&D, making it the single best performing region in the world for this measure.[70]

But Massachusetts' high-performing innovation ecosystem is not only the result of university-led development: it has also benefited from decades of consistently dedicated state-level support. State-level intervention in innovation is two-pronged, carried out either directly through mandates enacted by state governors or the state legislature, or through the **Massachusetts Technology Collaborative** (MTC), the state's development agency for the innovation economy.

Founded in 1982, MTC supports the evolving needs of the state's innovation economy in numerous ways.[71] Today, it is considered as an innovative public agency working to enhance economic growth, accelerate technology use and adoption, and harness the value of research by engaging in meaningful collaborations across academia, industry and government. Its mission is to strengthen the innovation economy in Massachusetts – not only to generate more high-paying jobs and greater economic growth, but also to encourage higher productivity and improved social welfare.[72]

Massachusetts



Ranked Most Innovative State
by Bloomberg's 2016
U.S. Innovation Index

#1

in the **Milken Institute's** annual **State Technology and Science Index** every year since 2002

Mass. **robotics firms** generated

$1.6bn

in revenue in 2015

Massachusetts employs

12,370

workers in **cybersecurity**

Boston #2

for **digital health funding**

1,328,199

workers in the **Mass. Innovation Economy** (the largest concentration in the U.S.)

#1

nationally in **STEM graduate** and **professional degrees** granted per capita

Figure: Stylised map showing innovation system of Massachusetts[73]

3.4.2 Recent and current state-level innovation policy in Massachusetts

Since the early 2000s, a key part of the MTC's innovation policy has been investing in state-level industries, of which there are now three. The institutes created by the MTC now play a very important role in spurring regional innovation policymaking. Indeed, the MTC now carries out all its functions through these three institutes, which have effectively become its three major constituent divisions – the Innovation Institute, the Massachusetts e-Health Institute (MeHI), and the Massachusetts Broadband Institute (MBI).

The **Innovation Institute** was the first to be created in 2003, and aimed to improve the conditions for growth in the innovation economy by enhancing industry competitiveness and providing data and analysis to stakeholders to promote understanding and inform policy development. Since its inception, Innovation Institute interventions have attracted the participation of more than 9,000 stakeholders and leveraged the investment of more than $250 million in private and federal dollars.

The second institute to be created, following the signing of the Broadband Act in 2008, was the MBI. The Act essentially gave the MBI the authority to invest $40 million of state bond funds into necessary and long-lived infrastructure assets such as fibre-optic cables and wireless towers. Such infrastructure projects are being used to extend high-speed internet access across the state. The key project has been the construction and rollout of MassBroadband123, a 1,200-mile fibre-optic network that has helped to deliver high-speed internet access to over 1,000 key facilities in more than 120 communities across Western and Central Massachusetts.

The MeHI was also created in 2008, as the state provided $15 million in funding to implement electronic health records and achieve a state-wide interoperable health information exchange. In 2016, MeHI leaders announced $3 million in grants to seven projects across the state as part of the Connected Communities Program, an effort to enhance collaboration and communication among healthcare providers.[74]

Today, the MTC is experimenting with novel approaches to promoting **public-private partnerships (PPP) for collaborative innovation policymaking**. In 2016, the MeHI team interviewed over 60 digital health ecosystem stakeholders to develop an understanding of the Massachusetts digital health ecosystem, including its participants and market inefficiencies. This process then informed the MeHI's digital health cluster development initiative, which came together with the Massachusetts Competitive Partnership to form a unique public-private digital health partnership. This, in turn, resulted in the state government announcing the creation of a new Massachusetts Digital Health Initiative, in which MeHI was designated as the state's lead agency to work with the private sector and build and support a strong connected digital health cluster.

3.4.3

State-level interventions to support the innovation economy

State governors and the state legislature have played a pre-eminent role in supporting the Massachusetts innovation ecosystem. In 2006, the Massachusetts Legislature created the Massachusetts Life Sciences Center as the focal point for Governor Patrick's $1 billion life sciences initiative. In 2008, it created the Massachusetts Clean Energy Center to help build a state-wide clean energy cluster and aid clean-energy economic development.[75] Governor Patrick has also recently announced the launch of the Massachusetts Big Data Initiative in order to help entrench the state's reputation for big data. Under the initiative, the MTC and the newly formed Massachusetts Big Data Consortium of 100+ firms will create a matching grant programme for big data research.[76]

In recent years, the state government has also been instrumental in creating links between state- and federal-level innovation. In 2016, Governor Baker announced the launch of the Massachusetts Innovation Bridge, a partnership between the state and the MITRE Corporation, a public interest non-profit that operates R&D centres sponsored by the federal government. The Innovation Bridge, a first-of-its-kind collaborative business portal, provides a dedicated space for leadership forums and workshops, technology scouting, and venture capital portfolio and university research exchanges. Ultimately, it allows federal agencies to create new relationships with innovative academic institutions, established companies, and companies that previously did not work with the federal government.[77]

3.5
What do these three regional approaches share?

Leading innovation regions typically benefit from a consistent long-term approach of public-sector investment in technologies, infrastructure, public education, defence and health systems. These are observed to be the fundamentals that attract international innovative businesses to relocate and domestic firms to stay in the region. This is augmented by a long term (usually bi-partisan) commitment to the processes of commercial innovation with the R&D and science/technology strengths of the region. In addition to these fundamentals, the regional approaches in Bavaria, Ontario and Massachusetts demonstrate a sustained attempt both to respond to a set of deficits and imperatives, and to intervene in targeted ways to support the regional innovation economy.

1
Adjust business climate and institutions

Leading regions respond to the imperative to improve their business climate and co-ordinate government activity more effectively. Many recognise that their regulatory environment is not always conducive to new businesses and need modernising. They also respond to the need to co-ordinate regulatory adjustments across departments and ministries by creating specialist teams to address silos and bottlenecks.

Examples of priority areas of the business climate governments are responding to include:

- Excessive levels of extra compliance for small business when new or amended regulations are introduced.
- The need to harmonise standards with other jurisdictions and international standards.
- Insufficient rewards to firms with good compliance records.
- Over-reliance on costly paper submissions to governments, and low digitisation of documentation.

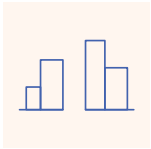
These regions lead reforms. They embark on public consultations to identify what regulatory burdens need lifting while protecting the public interest. For example, Ontario has enacted more than 150 regulatory changes in five innovation sectors since beginning consultation in 2016.[78] Regions also look to identify regulatory best practices from around the globe and promote them in the state/province. Several also develop a fund for modernising government that is dedicated to improving service delivery and regulatory processes for business owners in innovation sectors. Some also require ministries to offset each extra dollar of new administrative costs to business by removing a higher sum of old and unnecessary costs.

Regions are also promoting public sector reforms and innovations by setting up programmes to fund technology solutions that help states/provinces deliver better services. Typically, these involve up to AUD 1 million in funding per firm, before testing solutions in real-world settings.

Top innovation regions have recognised that they cannot only rely on the research output of their universities and research bodies to grow the innovation economy. They therefore have tried to both retain their scientific leadership but at the same time shift towards a pro-commercialisation approach that incentivises their universities, to adjust IP ownership and management regulations, foster technology transfer, host and partner with spin-offs, and release their monopoly on revenue generated from campus research.

- The Massachusetts Technology Collaborative is an excellent example of an institution which not only provides the visibility to bring together academia, industry and government, but uses its convening power to encourage technology adoption, and disseminate leading research.[79]
- Meanwhile in Bavaria, the role of BioM AG is often highlighted – a financing and consulting company which set up a network including all important players in the biotech sector (representatives from public offices, scientific institutions, venture capitalists and biotech companies), and which had a relentless focus on providing Munich-based companies with the right contacts and partners.[80]
- In Israel, innovation leadership is now consolidated within the Israel Innovation Authority, an independent public entity that manages a yearly budget of around AUD 570 million, with a clear mandate to shift innovation firms from R&D to production.

A common government intervention is often to **support an anchor institution** (e.g. a university, hospital, defence or scientific institute, or cultural body) to act as a catalyst in a location that is already in transition (e.g. into a new lab, a relocated government R&D facility, or an institute whose commercial capability needs upgrading). These anchors are supported if they help foster the ecosystem, especially in a context where innovation is re-urbanising to more central locations and the anchor needs to access and promote this new geography. Interventions can include making public land available, adapting land uses, and reconfiguring real estate assets. These investments in anchor facilities tend to be in the range of AUD 30-100 million. Usually they do not involve wholesale relocations of institutions but tactical relocation of functions that have the most potential to participate in the innovation system.



2
Address infrastructure gaps

The leading regions prioritise the importance of improving transport connections across the leading hubs, and to rolling out high-speed broadband networks, especially to areas that are poorly connected, and which need 'last mile' infrastructure.

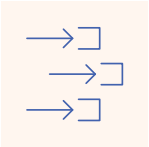
- In Massachusetts, a dedicated Institute was established by a State Act to invest about AUD 40 million of state bond funds into 2000 km of fibre-optic cables and wireless towers to more than 30 towns in rural parts of the state. The premise is to make it economically viable for private providers to serve these communities.
- Meanwhile Bavaria's digital infrastructure roll out of around AUD 2 billion aimed to establish new digital infrastructure throughout the region, especially the rural areas, and in so doing establishing new programmes for digital production, big data and e-Health. This investment deliberately included a strong push on childhood digital skills which were viewed as essential to accompany the infrastructure.

These regions' governments partner with colleges and universities across their territory to grow the number of professional applied masters' graduates in emerging fields, such as artificial intelligence and regenerative medicine. These investments are initially quite small – AUD 20-50 million is common – but designed to create a critical mass of 1,000-2,000 specialists in strategic industries.

Programmes to provide skilled residents and immigrants with funding and know-how to become successful entrepreneurs are key. Leading regions have invested in accelerator funds that provided seed capital to early-stage companies in specific sectors and with a clearly recognised global market.

These are often managed by expert investor teams within a tech incubator and delivered through a dedicated state-level agency or through official entrepreneurship networks. It is common for such funds to make 10-30 investments a year worth an average of AUD 300,000 to 1 million.

- Israel's example of this was run by the Office of the Chief Scientist and has been key in achieving success in accessing follow-on funding, with the private sector having invested over $2.5 billion in programme graduates, according to the OECD.[81]



3
Tackle investment deficits

The world leading innovation regions observe that there are not yet enough avenues for promising early stage companies to access the seed capital to scale up. They respond to the need for viable companies in the region to be able to be able to access private investment, but also see the need to intervene with public 'voucher' programmes of their own, in specific innovation sectors where the region has a specialisation. At the same time these regions also respond to the need to find mechanisms to do higher risk investments in tech-led businesses.

The scale of total investment in equity investments, new anchors, business support, research programmes, regulatory adjustments, community activation, and other interventions varies. It often depends on co-investment from federal governments and on private companies to at least match state investment.

- Ontario expanded their investment from AUD 80 million per year to AUD 130 million per year.
- Bavaria sold government owned shares to up their rate of investment to over AUD 500 million a year for a 10-year period.[82]

The top innovation regions also develop a clear evidence-based proposition about their region's competitive strengths, and proper auditing in relation to how their science and technology assets can be optimised for the new economy. This usually involves empowering departments or independent agencies to conduct full stakeholder engagement (build global comparative knowledge, and tackle head on the deficits of current arrangements).

- Finland is an example of an innovative government that has begun to adopt various kinds of foresight (future technology, global markets/demand, local socio-economic prospects) to inform its policy interventions.[83]

4
Gear up for global competitiveness

The leading global regions actively respond to the global war for talent and firms. They support their universities to act as a magnet for high-skilled migration, and also to find pathways for this talent to stay in the region and set up businesses that have the access to resources in order to grow without leaving the region. This also means investments in some elements of the liveability, openness and affordability equation.

- Leading regions such as California and Tel Aviv/ Israel have developed policies in recognition that their model for quality of life has to be culturally flexible and have the ability to attract and retain talent at multiple stages of their careers.

State governments often help create management agencies that act as a single point of interaction and leadership with stakeholders. These agencies have the clout and independence to engage multiple tiers of government and ensure consistent support. Many regions identified recognise that leadership has to work both at high levels of government to build the vision about how to harness research and innovation, and at the same time act as a convener that can coordinate implementation and continually update approaches.[84]

5
Correct information and coordination failures

Regional governments observe that the openness of information and rate of collaboration and support both among start-ups, but also between start-ups, large firms, capital and governments, can be improved if the start-up success rate is to increase. They respond to the fact that start-ups require mechanisms and institutions that bring them into regular contact with each other, understand the requirements of venture capital, and give them access to patenting and business planning advice.

- As seen in Ontario, Massachusetts and Israel, governments see opportunities of digitisation and interoperable information exchange to reduce communication challenges among actors in the innovation system.[85]

Leading regions adopt strategies that make the innovation process more visible and accessible to outsiders. The explicit branding of strategies, and of emerging locations (not undeveloped locations), is often a route to providing profile and confidence to the innovation system and to external investors.

Leading innovation regions prioritise the need to create deep forms of communication and collaboration. They commonly set up collaborative 'Networks of Excellence' to help entrepreneurs, businesses and researchers commercialise ideas, by providing free services (e.g. workshops, seminars, marketing, mentoring, financial advice, and other kinds of government support programme). Usually these collaborations involve 100+ organisations. These networks often prove key to increasing the rate of technology licenses and patents, prototype development, and leveraging private sector investment. The investment in these intra-cluster and cross-cluster initiatives is not usually huge (AUD 10-20 million p.a.), and usually diminishes over time. They usually involve:

- using existing associations as starting points for developing cluster platforms
- not excessively promoting specific sectors but promoting the whole chain of value creation
- specific structures for industry and science to co-operate
- a route to 80-100% private financing within 5 years.

Governments in the leading innovation regions have also been responding to inefficiencies in the way research institutions interact, and the way they engage with market actors.

By engaging with stakeholders within and across sectors, these governments identify slow processes or failures in the way providers communicate and exchange information, and opportunities to connect up different parts of the system, improve analytics, and build new management tools. These are motivated by a desire to boost innovation as well as to contain costs.

State governments also increasingly recognise the need to co-ordinate state and federal level innovation efforts. The Massachusetts Innovation Bridge is one example of this kind of response, that allows government agencies to create new relationships with innovative academic institutions, established companies, and companies that previously did not work with government.[86]

The leading regions maintain a coordinated focus on fostering and encouraging ecosystems, not on picking particular locations before they have become mature. They use region-wide economic development functions to ensure that innovation is integrated rather than a separate part of the system. Typically, leading innovation regions become more targeted on a smaller number of strategic sectors and locations – sometimes as few as three sectors and three locations. This evolution is matched by a strong recognition from all levels of government that key innovation corridors and locations require very bespoke and complementary interventions.

4

Conclusion

4.1
The growth of innovation regions

New South Wales has many of the important attributes required to foster the innovation economy. It has high calibre research institutions, a growing enterprise base, investment capital, and a famed life style, cultural and leisure offer that is a magnet for talent.

This short review of the innovation economy concept and literature, and the accompanying case studies, can be used to support the work of the NSW Government and the NSW Innovation and Productivity Council.

The innovation economy is rapidly emerging in the second decade of the 21st century, driving change in established economic sectors and accelerating the growth of new industries. The exponential nature of new technologies, coupled with global competition, new business and investment models, integrated and digitised markets, and the increased mobility of location and production, are all driving this growth.

As we have observed there are important advantages now available to Governments that decide to prioritise and facilitate the innovation economy. The dividends from the innovation economy include more diversified and resilient economies, increased job creation and higher paying jobs, boosts to company profits and government revenues, and other multipliers in the forms of supply chain activity, spill-overs between firms and institutions, and locational clustering that fosters paced based reinvestment. High innovation economies are also more likely to trade in international markets and earn export income. They may also attract substantial external investment through firm capitalisation and institutional locations.

Regions that succeed demonstrate common fundamentals at work. Such fundamentals include investment in education, science, and technology, an enterprise culture and business climate, and a long-term commitment to steward the commercialisation of new opportunities arising from both discovery and from new technological platforms.

Our review also highlights five key focusses for government leadership to support the innovation economy. The thrust of these interventions is about market building and enabling, partnering with knowledge institutions, entrepreneurs, and investors, and making adjustments that account for the different enterprise systems in the innovation economy.

These five areas are:

1. **Adjust business climate and institutions**
2. **Address infrastructure gaps**
3. **Tackle investment deficits**
4. **Gear up for global competitiveness**
5. **Correct information and coordination failures.**

Not all Governments need to do all of these things all of the time. Indeed, underpinning the successful calibration of these roles and interventions is the need to build a robust evidence base that reveals and signals which adjustments, infrastructures, investments, competitions, and coordination imperatives are the most important for any given state or region, given its sectoral composition, market access, and inherited territorial assets. Not all regions need to do the same things to succeed.

Our case studies of three leading State (Province or Region) Governments; Massachusetts, Bavaria, and Ontario, and our short reviews of successful interventions in Singapore, Israel, Finland, and Bangalore reveal that smart investments and reforms are key to success, and the ability to scale up and adjust through business cycles is essential. The underpinning value of partnerships with business and a long-term commitment to the agenda is underlined.

Much important work is already underway in New South Wales. The State has formidable innovation assets and many positive trends in talent attraction, enterprise formation, and the evolution of specialist locations.

The NSW Innovation and Productivity Council, first established over twenty years ago and recently refreshed with strong university and business membership, is itself a vehicle for coordination and collaboration, promoting evidence building and better knowledge to guide the government's tactical interventions in the innovation economy.

Taking an integrated approach to the innovation economy is an important first step in both building the evidence base needed for clear strategy and leadership commitment, and in creating the right context in which other interventions in, for example; business climate, research investment, skills and job creation, enterprise models, and innovation precincts can be informed and guided.

4.2
The future

Innovation is a feature of open market economies that respond to public imperatives, resource limitations, competition, and market constraints by doing things differently and inventing new tools and platforms to work with. Innovation is about the way that change occurs, and innovation produces advantages for the locations that are best able to host and foster it.

As all OECD countries make the shift towards diversified and high value-added economies, technology and new enterprise processes are critical drivers of success. The current global cycle is not just one of disruption, but also a period of profound opportunity for States and Regions that are prepared to support new industries with an equivalent commitment to the way they have done with more established sectors in previous cycles. But supporting the innovation economy is different to how Governments have traditionally supported other industries.

Subsidies, incentives, plant and machinery, equipment costs, and large infrastructure are much less useful to the innovation economy than are investments in science and research, skills and education, and a business climate that supports enterprise and smaller firms, and encourages public bodies to be more commercially orientated.

Thus, in many of the leading OECD Regions the innovation economy is now reinventing the ways through which States, Provinces, and other Governments support economic development. The trends point towards increased activity and investment in evidence building, the fostering of innovation ecosystems, convening and coordinating multi-sector activities, identity and reputation building, financing intangible balance sheets, and a focus on small areas where clustering might occur and new activities might be anchored.

These emerging economic development approaches are supported by city and region building activities such as good public services and education, transport and public space, and an urban form that is pro-collaboration and interaction, and not about the separation and dispersal of functions. The urbanisation of the innovation economy arises from the need for collaboration and interaction, and access to diverse skills and suppliers.

The innovation economy is not a short cycle phenomenon. The leading cities and regions of the past 3,500 years were the ones that fostered innovation and scaled up its applications to redefine the basis for trade and exchange. This observation provides a sound rationale for making a renewed commitment to support innovation today. All regions can benefit from effective innovation economy strategies and those with extensive innovation assets, such as New South Wales, have every reason to expect that investments made in this cycle will bear fruit for decades to come.

About the authors

Prof Greg Clark CBE, Emily Moir, Dr Tim Moonen and Jake Nunley are colleagues at The Business of Cities Ltd, an urban economics and intelligence firm based at University College London. They have advised more than 100 governments at city, metropolitan, regional and national level, spanning more than 20 countries. They collaborate and publish regularly with the OECD, the World Bank, the Brookings Institution, the Urban Land Institute, Jones Lang LaSalle, the Future Cities Catapult, European Investment Bank, National and State Governments, on topics including the innovation economy, metropolitan governance and leadership, strategic planning for cities and regions, global identity and the benchmarking of cities.

Prof Greg Clark has led 22 OECD Local or Territorial reviews and has chaired strategic advisory boards for 23 cities/regions around the world.

Among the books they have co-authored are *World Cities and Nation States and Global Cities: A Short History*. Current projects include; *The Future of Australian Cities*, *The Logic of Innovation Locations*, *The DNA of Cities* and *The Business of Cities: How Corporates and Capital are Re-urbanising Our World*.

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