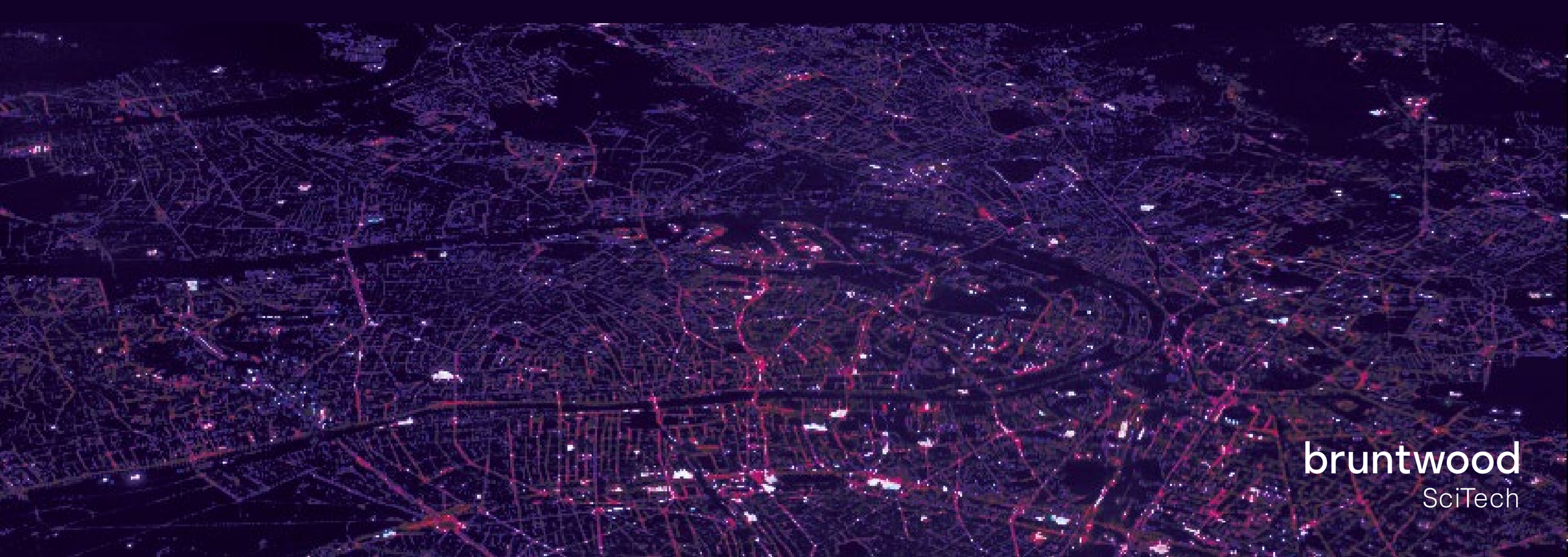
PLACE MATTERS

Innovation & growth in the UK



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SciTech

FOREWORD

We commissioned this report at a crucial moment for the UK. With a new Government and Prime Minister, and as we exited the EU, we knew this was the right time to focus on innovation in our economy. Over the last decade, productivity growth in the UK has lagged behind other countries, and the gap between our cities and the innovation hubs of the rest of the world has grown. This report argues this is due to a failure to balance innovative activity across the country, even as our science base has remained globally leading. Many of our cities led the global economy's first modern leap in productivity – they should participate in the next. It is a timely diagnosis of where innovation is flourishing, where it is being held back, and presents the beginnings of a plan to unleash it.

The world has changed a lot in the last few months. The country is facing an unprecedented threat to life and livelihood, and the emergency social distancing measures enacted to prevent the spread of COVID-19 have suspended the economy. If innovation, in plain terms, is the successful adaptation to changing circumstances, then this crisis has made it even more important than it was three months ago. Businesses across the country must innovate simply to return to work – the economic challenge has grown. We are convinced that we can emerge stronger from this crisis – industry has responded to the Government's call to increase testing and both business and public services have accelerated digitalisation – but not without creative thinking and bold action. It is a fine example of how corporate Britain can, and has, reacted to a global crisis. This innovative response to COVID-19 perhaps shines a light on how we as a country could respond to the longer-term challenge of climate change.

Bruntwood SciTech was formed by Bruntwood and Legal and General to build the innovation districts that technology-focused businesses need to grow. But this is only part of what we do: the right accommodation alone will not help businesses create new products or find novel solutions to our problems. Innovation districts are located within innovation ecosystems, which are themselves located within place ecosystems, each with unique characteristics and dynamics. Each needs to function for the businesses in our districts to do productive and innovative work. It is why so much of what we do is about connecting our districts to place, encouraging interaction between our tenants and the city, and helping them contribute to urban life, and what we will demonstrate through our major investments in Liverpool and Oxford, working with Government, universities and businesses to increase innovative activity in both cities.

This report is addressed both to local and civic leaders, and to central Government and its institutions who lead on innovation policy. It is about how we begin to improve the UK's innovation performance from the ground up. To local Government, businesses and institutions in places, we ask that you take a hard look at where you currently are and what you want to achieve in innovation, using the checklist of recommendations to start.

Our new Government has made clear that its priority is the levelling up of all parts of our economy: this will be impossible without a better distribution of innovation. Business-as-usual is not good enough, and if we repeat what we have done in the past, the potential of our places will remain untapped. The Government must begin by reviewing our innovation infrastructure, returning to experts to investigate the border between research and commerce. We need to understand how research is translated into products and services in close detail, learning from other countries to build a truly national innovation infrastructure.

We are balanced on a pivot, and the direction in which we tilt depends on the actions we all take in the next weeks or months. As we emerge from the current crisis, we will face uncertainty and recession, and must adapt our behaviour to new constraints. Although the challenges are serious, there is an opportunity now to empower our businesses to innovate and for Government to invest in long-term transformation that will support them to do so. We can do things differently, but we need the courage to start and the conviction to follow through.

Phil Kemp
Chief Executive, Bruntwood SciTech

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EXECUTIVE SUMMARY

This is a report that is fundamentally about place. We believe that many of our cities and towns have or have had a key role in the creation of the innovation-based global knowledge economy. Some places are already innovation rich and others have the potential to drive the innovation which is now essential to the future well-being of the British economy. The purpose of this report is to help more cities understand the importance of innovation activity to drive their economies forward and close the productivity gap.

The report has been written not for innovation experts, but for civic leaders, partners in Local Enterprise Partnerships and their like across the country. It has been written at an important moment in our country's history, as COVID-19 has taken its toll, claiming the lives of thousands of Britons, virtually closing our economy and, in so doing, changing all of our lives in ways we cannot yet fully understand. This is a period of change in other ways too. The global pandemic took hold shortly after the election of a new British Government, committed perhaps more volubly than any before it to the objective of levelling up the economic fortunes of different parts of our country.

Innovation is fundamental to both tackling the pandemic and to the cause of levelling up. A well-functioning health and innovation economy can save lives and generate economic well-being, written through our economy like letters through Blackpool rock. In some places, over recent months, the frenetic search for solutions to the pandemic have mobilised legions of the world's finest researchers and technologists. In others, industry leaders have sought to adapt their companies to produce much needed resource for the health and care services. Yet in other places, including many that have proud innovative and industrial track records, there has been less capacity to act and to respond. Our cities and towns are sharply different places from each other, both now and from what they have been in the past. This is about how we can change this for the better.

Our debates on place over recent years have, at times, recognised these differences but have too often pitched cities against towns, north against south and, at its most populist, migrants against those born in Britain. In play have been debates about whether the market or the state should determine spatial outcomes and what the balance should be as to the role of each. We examine all these issues in this report in the search for answers about what to do to promote widespread, successful, place-based innovation. We advocate that, alongside a continuing focus on global pre-eminence in fundamental scientific enquiry, we need an even stronger focus on ensuring the distribution of this excellence across the country. Making scientific excellence sustainable in the long term, in places outside our traditional research centres, should translate into the productivity growth we need.

We advocate the development of innovation districts in places throughout the country and issue a plea that these must be genuinely based on the strengths and potential of each place. Innovation must be seen in the context of place-based development. We must be realistic about each place; future innovation potential is highly likely to be based on its economic foundation, not on an externally imposed vision, however well-funded it may be.

We strongly endorse the now often used notion of an innovation ecosystem as a central element of growing innovation in place. As in natural ecosystems, vulnerable young firms need the right conditions to germinate, survive and grow: a supply of capital, talent, premises, and support helps these firms as they mature. Our focus is on the steps needed for places to be more absorptive of innovative potential, on how we improve the ability of more places in the UK to absorb and thereby productively use innovation by mobilising the capital and labour that drive it.

This is where we believe the commissioners of this report – Bruntwood SciTech, a Joint Venture between Legal & General and Bruntwood – along with others, have a vital role to play in the shaping of existing and new innovation hubs across the country: creating successful innovation districts with supportive innovation ecosystems.

We start in Chapter One with the role of innovation in productivity, setting out why, if we care about our long-term prosperity, we should see these issues as fundamentally important in our national and local economies. In short, it is first because productivity drives wealth and second because innovation is a key driver of productivity.

Chapter Two: Innovation, Growth and Place – Then and Now looks at how Britain played the leading role in creating modern innovation driven productivity, the role of place in this process and how modern places, such as Shenzhen in China and Cambridge in the UK, have become innovation powerhouses. Innovation happens in real places, understanding what has worked in the past will be central to unlocking the potential of places in the future.

Our own experiences and observations of different places, both nationally and internationally, can tell us much about how innovation happens in practice and what we need to do in the future. We think it would help if there was a greater focus on debating the issue of absorptive capacity and on how places can improve it. We draw from examples of places where innovation has been a central part of the reinvention of an already large place: Manchester in the UK, Boston in the USA and Eindhoven in the Netherlands.

Chapter Three examines innovation policy, considering how it might have had limited effectiveness. Innovation policy is an area in which there has been much debate over recent years, not only in this country but globally. Learning from how innovation policy has adapted over the years in the UK and how it has played out in practice needs to guide any future approach to policy. We focus on the key issue of translational activity (between the creation of knowledge and its adoption in the economy). Our conclusion is that too often innovation policy has appeared to have been spatially blind and in doing so, limited in its effectiveness. This has contributed to both larger-than-justified imbalances and lower than desired economic benefit. Where regional and other bodies have sought to create economic success through innovation, often through clusters, the consequential impact has been much lower than expected. This needs to change if levelling up is to be delivered.

In Chapter Four we consider the conditions needed for innovation to thrive in our cities. We fuse this into a single framework, ‘the power of three’, based on what we have learnt about innovation and place-based economic development. Innovation districts and innovation ecosystems must be accompanied by the third factor of successful place-based ecosystems. This is where Councils, Combined Authorities, LEPs, Government and other anchor institutions have a fundamental role to play in making places attractive and inclusive, creating desirable destinations to attract the people needed in innovation ecosystems while providing for existing resident populations. We conclude that it is the power of three policies combined that really generate success.

We end the report with a practical checklist for places, setting out how places themselves and the institutions in them might best go about developing a new and successful innovation journey. Finally, we provide recommendations to place leaders, and to the Government. Our recommendations are set out below.

RECOMMENDATIONS

This analysis has shown that the UK must reform innovation policies if it is to remain a world leader in science and innovation. To this end, we propose that any reform should make a demonstrable contribution to achieving the following outcomes:

1 Add to the UK's world leading excellence in fundamental science research with a more robust programme of translational research. This should improve our national performance in the commercial application of ideas, with a real impact on productivity performance.

2 Address the reluctance of too many UK firms to take on innovation activities by encouraging reform of business models and processes.

3 Ensure the distribution of scientific research and innovation activity more accurately reflects the distribution of potential around the country, providing towns and cities with the tools to deliver it.

The following recommendations have been written in light of this approach.

To the Government

The Government's commitment to raise R&D spending to 2.4% of GDP by 2027 is welcome, but without support for places to develop their innovation ecosystems, meeting the target will still miss the point. Within 20 years, each region should have world class research infrastructure that this is feeding into growth throughout the country. This will take time, commitment and collaboration between organisations and funding bodies towards the same goal.

- Establish translational research infrastructure which capitalises on local strengths and opportunity. Funding must be accompanied by support to increase the absorptive capacity of places, using Government investment to work with SMEs and anchor institutions.

- The Government must review existing innovation infrastructure, starting with Catapult Centres, to ensure that it is working for business and places. Hermann Hauser has twice been asked by the British Government to review this issue, and should be asked to look again and joined by someone of Jürgen Maier's standing - the recently retired Chief Executive of Siemen and, an industrialist with international experience to ensure that globally leading research translates into business.

- Government and UK funding bodies should collaborate to achieve the goal of levelling up, and funding bodies should be empowered to distribute scientific excellence throughout the country. This should not abandon the principle of investing in excellence but take a much clearer and more detailed view of the innovation potential of places outside of our research hotspots. This should include, but not be limited to, reform of Green Book appraisal methodologies to enable economic rebalancing.

To local leaders

The leaders of cities and towns across the country must recognise the central importance of science and innovation to their future prosperity. To improve performance, they must take measures now to understand their strengths and address their weaknesses.

- Evaluate the local innovation strengths and areas of excellence. There is no ready-made model for success, and every town and city in the country will have different advantages and challenges to overcome. Do detailed research into science and research potential, looking at innovation performance through the lens of the power of three and identify what measures need to be taken.

- Build a coalition of willing leaders. This will look different depending on the nature of each place but should involve multiple organisations in informal and formal leadership and governance. Reach out to people who have experience in doing this and build capacity in a community of entrepreneurs, high net worth individuals, scientists, and institutional investors.

- Plan for long term success. Places will need to be prepared to create big ideas and fail along the way. Be thoughtful about what analysis needs to be commissioned – research is successful only when used as part of a coherent strategy.

- Think creatively about investment. Investors are invaluable to places which require the capital to scale nascent science and innovation strengths. Major institutional investors can be more willing to invest than Government in innovation. Work to create a knowledgeable investment community which understands the potential of science and innovation.

- Understand the importance of creating an attractive place to retain and attract talent, an endeavour in which schools and parks matter as much as Business Schools and Science Parks. Experiment and adopt new models for property and business space. Reach out to successful former residents, and work on the aspects of place which encourage skilled people and graduates to stay and make their lives there.

CHAPTER ONE

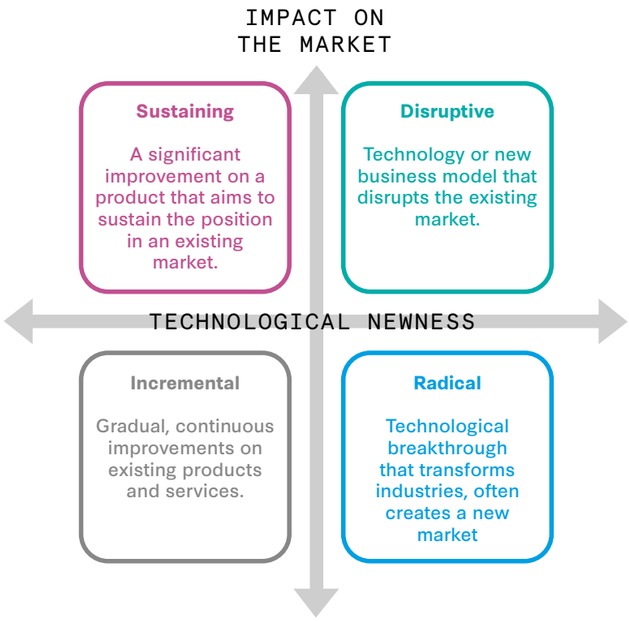
The Role of Productivity in a Modern Economy

This report is about innovation and place. Both are important – productivity levels must be raised across the country and an innovation agenda that focuses on place can help achieve this.

Productivity, at its core, is a measure of economic output. It is typically defined as the quantity of goods and services produced per unit of labour input, where labour input is measured using output per hour worked or per filled job. Ultimately, it is a measure of efficiency; if an economy can produce more output using the same quantity of input, it will become more productive. Innovation has a central role to play here, helping unlock long term growth through improved or new processes and products.

Innovation is the process of developing technologies and implementing them to stimulate growth, Figure 1 illustrates the impact it can have on the market. Innovation can comprise of building on existing capabilities, establishing new, smarter ways of doing the same task, or it can be the creation of new tasks and processes altogether. It is these processes which fuel productivity growth: learning to do the same work but more efficiently and with fewer resources, or building new, more valuable products. Productivity growth in turn makes the business or institution which achieves it more competitive. When this is achieved across an economy, the productivity of that economy will accelerate.

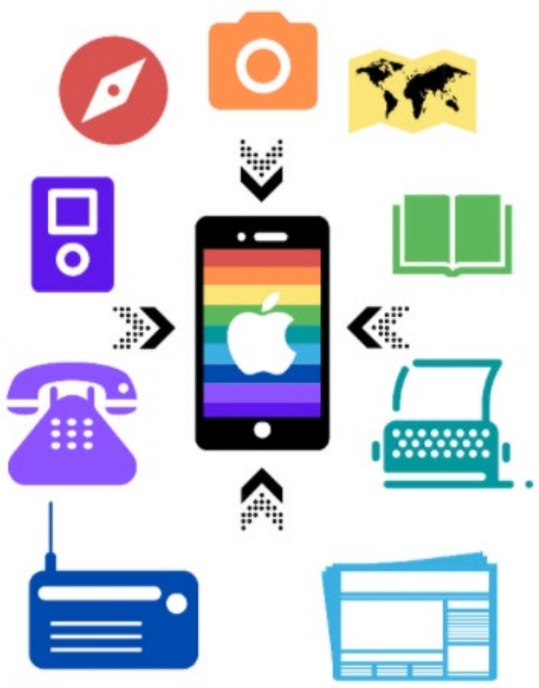
FIGURE 1. INNOVATION MATRIX



Source: Adapted from Viima, *"Types of Innovation – The Ultimate Guide with Definitions and Examples"*, 2019

The importance of innovation to economic growth today is demonstrated by the success of the iPhone.[1] Decades of investment in Silicon Valley by the US Department of Defence funded the development of computer technology, the Internet, hard disk drives and voice activated technology – all of which are features of the iPhone.[2] The creativity of Apple, taking existing technologies developed initially for defence purposes, revising them and packaging them into one commodity, has led to the development of a device which changed how we live our lives. It demonstrates that productivity growth today can stem from the ingenious application of ideas to solve our everyday problems or fulfil new needs. The power of innovation is clear to see in the current prosperity of Silicon Valley.

FIGURE 2. THE IPHONE



This initial government investment lies behind Silicon Valley's stellar productivity performance, the concentration of highly skilled people that live and work there and the excellence of the products and services they create. Apple, Google, Cisco and many other Silicon Valley giants are thriving as a result of this highly accessible talent pool, but as economist Mariana Mazzucato and others have argued, their foundational success is built on prior innovation and public funding.

[1] *The Entrepreneurial State.* Mariana Mazzucato, 2013.
[2] *This economist has a plan to fix capitalism. It's time we all listened,* Wired, 2019.

Productivity is becoming more important than ever. McKinsey estimates that in order to maintain GDP growth at the level of the past 50 years, about 90% of future growth will need to come from productivity gains.[3] Between 1964 and 2014, employment and productivity grew at annual rates of 1.7% and 1.8% respectively, but now, employment growth is forecast to be just 0.3% per year over the next 50 years. This will intensify the global competition for talent. In order to maintain continued economic success, productivity needs to step up and shoulder the burden of growth.

"Productivity isn't everything, but in the long-run it is almost everything. A country's ability to improve its standard of living over time depends almost entirely on its ability to raise its output per worker."

Paul Krugman [4]

Yet productivity growth has been slow in recent years. The UK in particular is experiencing what has been described as a "productivity puzzle", where productivity has not grown at projected rates and is showing little sign of accelerating. This is a major risk to the long-term growth of the UK economy.

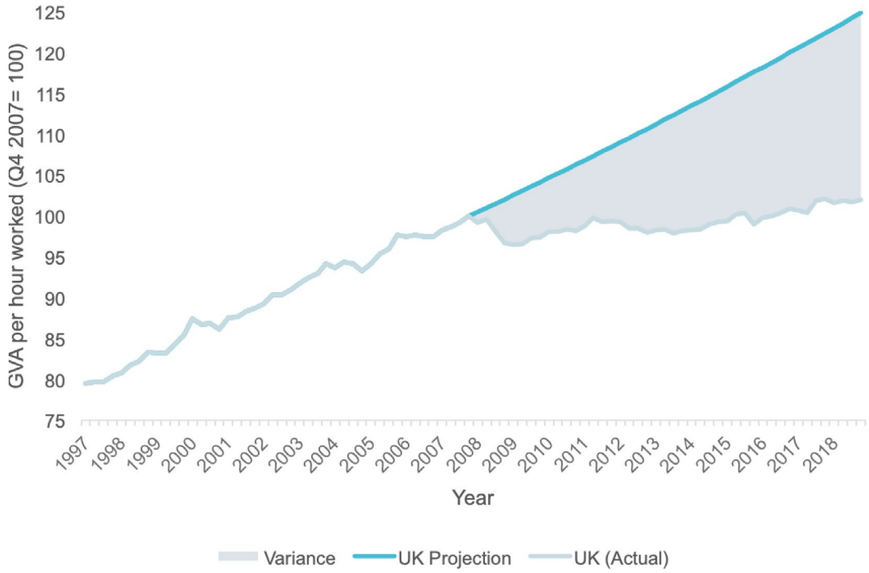
TOTAL PRODUCTIVITY: THE ONGOING PUZZLE

In the UK, productivity has historically been a strong driver of high wages and economic growth. From the Second World War up until the mid-2000s, productivity in the UK increased by such an extent that British workers were producing as much as five times of their counterparts 100 years prior.[5] In the decade prior to the 2008 financial crash, this amounted to a productivity growth rate of just over 2%.

But productivity levels have not recovered following the 2008 financial crisis, despite increases in GDP, employment and total hours worked. It is not unusual for productivity levels to fall during a crisis but the absence of improvement during recovery is unusual. Had productivity continued to grow at its previous rate post-crisis, GVA per hour worked would be 20% above current levels. In simpler terms, we could produce the same output as we currently produce in five days, in a little over four. Economists of every kind, most notably Andy Haldane of the Bank of England, are united in their focus on the long tail of poorly performing British firms and the places in which they are located.[6]

[3] *Global growth: Can productivity save the day in an aging world?* McKinsey Global Institute
[4] Krugman Paul, *The Age, of Diminished Expectations*
[5] *Why are UK workers so unproductive?* – in 5 charts, Financial Times 2018
[6] See Andy Haldane's speech *The UK's Productivity Problem: Hub No Spokes*

FIGURE 3. UK PRODUCTIVITY VS PRODUCTIVITY FORECASTED ON PRE-2008 RATES (1997-2018)



Source: Produced by Metro Dynamics using ONS Productivity Data

Not only has a clear productivity gap emerged, as shown by the shaded area in Figure 3, it is also widening and shows no sign of a change in direction. Between 2010 and 2015, UK productivity growth flatlined at 0.2% per year, far below its long-term average of 2.4% from 1970 to 2007. [7] This low productivity, paired with the uneven nature of economic growth across the UK, has powerfully different implications in different parts of our economy.

What is particularly concerning is that the UK's productivity struggles are not a reflection of the international picture. Whilst most economies experienced a productivity fall during the crash, many G7 countries have since experienced faster growth than the UK. Even accounting for different calculation methods between OECD countries, UK productivity lags behind other major economies such as the USA and France as well as every G7 country.[8]

[7] *Solving the United Kingdom's productivity puzzle in a digital age*, McKinsey Global Institute.2018
[8] *Productivity gap narrows*, Richard Heys 2018

Why does this matter? A German worker produces 36% more for every hour worked than a British worker. 67% of British workers are employed by firms with below average productivity compared to 55% in Germany. For the UK to remain competitive, this productivity trend must change.

THE RELATIONSHIP BETWEEN PRODUCTIVITY AND INNOVATION

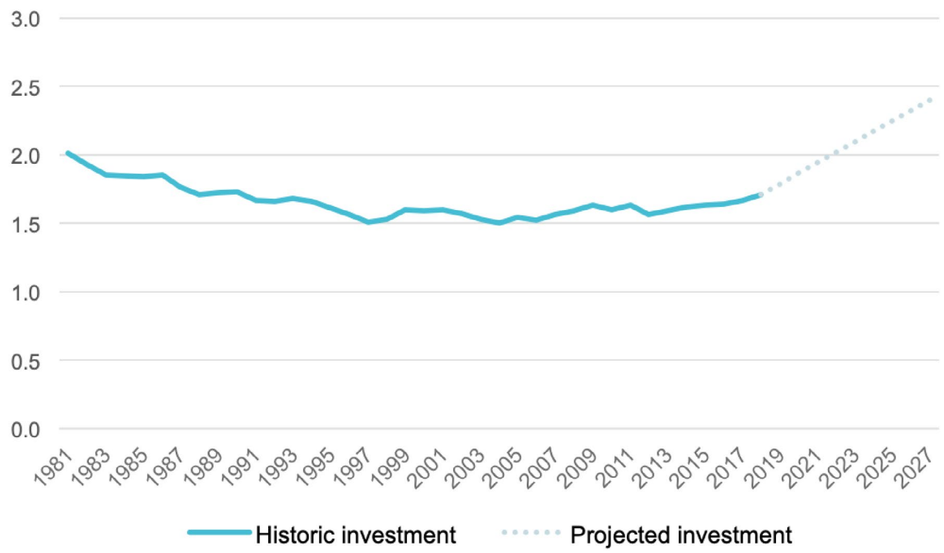
Raising productivity relies, in part, on the ability to innovate. The more a business or institution trades on knowledge and its ability to bring innovative products to market quickly, the more resilient and competitive it is likely to be. Innovation requires both knowledge and skills but also stimulates their creation and encourages new product development. The role innovation can play in fuelling productivity, through the introduction of new technologies and functions to the labour market, must be central to government economic policy. With UK productivity levels as they stand, innovation is more important than ever before.

Sectoral analyses of the economy show that the UK productivity slowdown may indeed have been caused by a relative decline in the ability to produce more value from existing materials, leading to these lower levels of innovation. The UK has also seen high employment growth in low productivity services as opposed to high productivity manufacturing, with more of a focus of more total jobs rather than high quality employment.

Innovation is notoriously difficult to measure. R&D expenditure can be used as a proxy for measuring innovation, in that it shows the amount of investment in the activities which fuel innovation. In 2017, UK R&D expenditure stood at 1.7% of GDP, [9] below the OECD average of 2.4% of GDP. In fact, the UK is ranked 17th out of 37 OECD countries in terms of R&D expenditure, behind Germany, France, and the Netherlands. While economies in China and Korea have greatly accelerated their R&D expenditure relative to GDP, the UK's has fallen over the past 30 years (Figure 4).

[9] *Research & Development spending Briefing Paper*, House of Commons Library 2020

FIGURE 4. GROSS EXPENDITURE ON RESEARCH AND DEVELOPMENT (UK, AS A % OF GDP)



Source: ONS Gross domestic expenditure on research and development time series

The general trend of R&D expenditure has been one of decline in the UK as other countries accelerate. The UK Government has recognised this and has pledged to increase R&D expenditure so that it reaches 2.4% of GDP by 2027, meeting the current OECD average. This is a welcome acknowledgement that the UK's R&D performance has slipped and must be reversed.

But we must consider not just what the UK's R&D expenditure target should be, but also how and where it is deployed. Since the 1980s, the UK public policy focus has been placed centrally on pure research, as we discuss later. As fundamental as this is, the wider question of how R&D is applied through innovation can and should matter more, particularly if innovation is to play a role in the Government's ambition for growth and levelling up the lower performing areas of the country.

THE ROLE OF PLACE, INNOVATION AND ECONOMIC GROWTH IN CITIES

In many cities in Europe, larger size equates to higher economic productivity. This is not the case in the UK, where instead the largest cities, with the exception of London, tend to underperform economically. One reason for this is the decline of old industries. More cities need to understand the importance of innovation in order to drive their economies forward and close the productivity gap.

We need more innovative activity from the places where it is already happening, increasing knowledge spillovers while supporting the areas that have innovative potential, deepening their absorptive capacity for investment. Some cities already have high-functioning innovation economies, for instance Oxford and Cambridge, where factors combine to power an innovation ecosystem which benefits their whole economy. Other cities have potential to become centres of innovation. Many have good research-intensive institutions and complex knowledge-based economies but are missing one or more of the building blocks necessary for innovation success.

More places need to be supported in mobilising their innovation assets. As Richard Jones argues, there must be a greater focus in the UK on the support networks which enable innovation to take root in places, establishing research institutions as the source of new ideas and connecting businesses. Such an approach works well in knowledge economies such as Cambridge and could work well elsewhere if targeted support was applied to the places with potential.[10] We agree, and later set out an approach to achieving this.

The success and investment in some places are a positive sign, but this type of activity and national investment has been piecemeal across the country. Perhaps most importantly, it has yet to make a significant contribution to lessening the disparity in economic performance between the South East and the rest of the country. We need to consider how to generate and foster innovation in places. In order to understand this, it is important to first take a look at how innovation has developed through the history of our cities, and what that means for where innovation is today.

[10] *A Resurgence of the Regions: rebuilding innovation capacity across the whole UK*, Richard Jones, 2019.

CHAPTER TWO

Innovation, Growth and Place – Then and Now

Britain has a productivity problem, an innovation problem and a pattern of regional knowledge intensive growth that is highly skewed. Had we shown this data to economists in the mid-nineteenth century, they probably would not have believed that this was possible.

At that time, the great cities of the North, Midlands and lowland Scotland were unsurpassed in their innovation-driven productivity: they led the creation of the modern global economy. Today these cities are lagging, not just behind the more prosperous parts of the UK but a great many other places too. We look at the lessons we can learn from our own past experience, but also at how other cities at home and abroad have developed knowledge-based economies more recently and at how some large centres of excellence have rebounded using innovation as a driver.

INNOVATION THROUGH HISTORY

When looking back at the history of UK innovation, a major turning point was the Industrial Revolution. As Robert Allen put it in 2009, "the Industrial Revolution was Britain's creative response to the challenges and opportunities of the global economy that emerged after 1500". [11] In the early eighteenth century, British industries were generally small scale, for instance, most textile production took place in the homes of spinners, weavers and dyers, or in small workshops. [12]

This changed. Advances in technology led to the rapid improvement in steam engines that began to influence other forms of manufacturing, perhaps most importantly the weaving process, and led to the mass production of goods. The combination of new and enhanced processes and a rapidly growing workforce led to the birth of factories and mills, shifting production from the home to the city. This combination of factors led to the growth of industrial cities such as Manchester, where the trio of innovation, people and place enabled production on a scale the UK had never seen before.

By the early 1800s, the area around Manchester was what has been described as "the world's first innovative milieu: an environment which gave rise to a constant, synergistic ferment of technical and organisational improvement in products and processes".[13] One prominent economic historian went even further, arguing that cotton was the exceptional industry of the time, associated with the clustering of the industry in Lancashire, driven by the agglomeration effects of a "micro-innovatory hothouse". [14] Manchester had the infrastructure and scale to test and evolve ideas, processes and products, and, because of these, grew rapidly.

In the Industrial Revolution Britain had the know-how and, in plentiful cheap coal, the key factor endowment. But by the late-nineteenth century, Britain had begun to lose its comparative advantage and the products of the Industrial Revolution were being produced in other countries. A failure to innovate is almost certainly a part of the story.

[11] *Why was the Industrial Revolution British?* Robert Allen, 2009.
[12] *The Industrial Revolution, Matthew Wright*, British Library, 2009.
[13] Emmerich, Mike, *Britain's Cities, Britain's Future,* 2017
[14] Peter Hall and Nick Crafts, quoted in Britain's Cities, Britain's Future, Mike Emmerich, 2017.

In the Industrial Revolution Britain had the know-how and, in plentiful cheap coal, the key factor endowment. But by the late-nineteenth century, Britain had begun to lose its comparative advantage and the products of the Industrial Revolution were being produced in other countries. A failure to innovate is almost certainly a part of the story.

One thing only is certain: as the examples of Manchester and Glasgow show, cities that falter in the innovative process soon stumble, and their industrial base dies. Leaders in one generation will soon be harried by new competitors, coming up from behind; and unless they either develop new ways of producing old specialties, or better still derive entirely new products out of old traditions, they will be overtaken and disappear into industrial oblivion.

Peter Hall [15]

Although factor endowments were certainly important in the nineteenth century, it was ultimately the places that created the innovative environment that won out over those that didn't. What has changed is that factor endowments such as coal have become less important, while internationally mobile talent is now the pre-eminent factor of production. What remains the same is that places which slip and lose their place in the world innovation economy can fail and decline every bit as quickly as they rose to pre-eminence. This has been the story of too many UK cities.

This takes us to the heart of our study, looking at the places in which innovation happens and why; how innovation has thrived in some places but not in others; and the specific conditions needed for innovation to grow. To understand this better, we need to understand modern centres of innovation in more detail.

Shenzhen, China

One of China's largest cities, Shenzhen, was a remote village in 1980. In just 40 years it grew rapidly to become one of the world's centres of innovation, the city where the most Chinese patents are filed and a magnet for international investment. While its rapid transformation over the last half century from a remote village to modern economic powerhouse is the result of a deliberate and consistent strategy from the Chinese authorities towards industrialisation and manufacturing, in the last few decades Shenzhen has emerged as a national science and innovation hub.

[15] Cities in Civilisation· Peter Hall, 1998.

There are now around 10,000 start-ups, 100 incubators and approximately 200 maker spaces across the city.[16] These companies are supported by a high number of quick prototyping workshops to develop short runs of products. These innovative sectors now account for 1% of China's GDP but 20% of overall growth.[17] In the first half of 2018, they grew 30% faster than overall national growth. Shenzhen has shown how central government policy and direct investment can rapidly transform what was a sleepy village to a thriving innovative district.

In 1980, China implemented reforms that opened several areas to limited free enterprise. Labelled as Special Economic Zones, these permitted overseas investment and development without central government control. Through its proximity to Hong Kong, Shenzhen had a ready source of international investment. As this began to flood in, Shenzhen rapidly expanded: its population grew from 30,000 in 1979 to 1 million in 2000, and it is now home to 11 million, with a higher GDP than Ireland or Portugal.[18]

Initially Shenzhen's growth was built on industry; there was a process of rapid industrialisation, boosted by investment from Hong Kong, and within 10 years was providing over half of the city's GDP. [19] In recent decades, Shenzhen has pioneered a method of innovative manufacturing, with networks of tightly packed factories producing components quickly and iteratively to develop goods for Western markets. Using this method, businesses rapidly create different designs of the products and software that powers them. Now, thanks to this development, Shenzhen's economy is shifting again, driven by government and investors.[20]

Shenzhen has been at the centre of China's attempts to reorient its economy towards innovation. Since opening up, the city has been a prime location for foreign investors; the average growth rate of foreign capital investment has been nearly 30% per year. [21]

But over the years this has changed, and the Chinese Government has deliberately cultivated Shenzhen as an innovation hub in the last two decades. After the Great Financial Crisis, China started investing resources in strategic emerging industries: the digital sector, advanced business services and robotics, all with a particular focus on Shenzhen.

[16] *Insight - Shenzhen: China's technology and innovation hub,* Australia Trade and Investments Commission
[17] *Rising Innovation in China, China Innovation Ecosystem Development Report,* Deloitte, 2019
[18] *Shenzhen – from rural village to the world's largest megalopolis*, The Guardian, 2016; *Insight - Shenzhen: China's technology and innovation hub,* Australia Trade and Investments Commission·
[19] *Building Engines for Growth and Competitiveness in China Experience with Special Economic Zones and Industrial Clusters,* The World Bank· 2010
[20] *Inside Shenzhen's race to outdo Silicon Valley,* MIT Technology Review, 2018
[21] Ibid.

Shenzhen, already an investment hub, was the ideal location. These resources have established it as one of the centres of China's AI and digital industry. Tencent, China's technology giant, is based in the city, as are 32% of the start-ups which emerge from it. [22] Despite lacking elite universities, the Chinese Government has driven innovation and specialisation in Shenzhen, locating national institutions in the city, such as the Shenzhen Academy of Robotics and the Shenzhen Institute of AI and Big Data. The city is a manufacturing giant and as products have become more sophisticated, so have the skills of its workers. In late 2019, China announced Shenzhen would be the home of its fourth major national science centre.[23] Without its strong financial market to support the innovation ecosystem this would not have materialised. Now, its stock exchange has over 2,000 listed companies and market capitalisation of $3.6 trillion. [24]

Shenzhen's path is a unique one, and the rapid opening of its economy cannot provide direct lessons to UK cities. But, as with other more mixed innovation economies closer to home such as those of Germany and France, Shenzhen does show that the role of the state can be more than just in the funding of pure research. Recent experience in the UK during the COVID-19 crisis shows that university and private enterprise can be mobilized to achieve technological goals, translating fundamental research into viable products and services. There are lessons, good as well as bad, from this if we want to support the creation of innovative places.

We needn't look as far as China for an example of how historically sleepy places can become hotbeds of innovation. Cambridge may be one of the oldest and most venerable universities in the world, but until recently, it too relatively less productive or commercialised. That has changed profoundly in recent years, now booming with industry expertise and world-class research.

[22] *Rising Innovation in China, China Innovation Ecosystem Development Report,* Deloitte, 2019
[23] *Shenzhen takes on new role as basic research centre after earning reputation for rapid product development,* South China Morning Post 2019
[24] *Insight - Shenzhen: China's technology and innovation hub,* Australia Trade and Investments Commission.

Cambridge, UK

Over the last half century, Cambridge has grown from a renowned university town to a centre of business innovation and one of the UK's most productive economies. Nicknamed 'Silicon Fen', Cambridge has led the way on creating the collaborative innovation ecosystem modern economies need to thrive.

Compared to other cities across Europe with innovation-rich environments, like London or Paris, Cambridge is relatively small with a population of only 126,000. When cities across the UK industrialised during the nineteenth and twentieth centuries, Cambridge remained underdeveloped, as much by choice as by accident, limiting both its size and its economic performance. Yet despite this, in the period leading up to and after the Millennium Cambridge has thrived and today is home to more than 5,076 knowledge-intensive firms, employing 61,808 people and generating more than £15 billion in revenue. [25]

Its recent economic success and its rapid development as a leading innovation ecosystem is the result of successful commercialisation of the university's research strengths. After pioneering work from researchers in the university's STEM departments, working against resistance from more traditional academics, a group of academics set up Cambridge Consultants in 1960 to build links with industry and find commercial applications for their research. This brought businesses to the city and established a precedent for university researchers.

In 1970, the university's Trinity College opened Cambridge Science Park as a site for both spinout businesses and existing businesses wanting access to Cambridge research. After a slow start, partly due to unfamiliarity with the concept, multinational companies began to move in. By the end of the 1970s, there were 25 companies on the site. Today, the park is bursting at its boundaries, home to over 100 companies and a new Bio-Innovation Centre. [26]

Cambridge's strength now lies in its innovation network. Its size facilitates interactions, allowing the informal gatherings where knowledge is shared and partnerships forms; the city functions as one campus. Large businesses interact with the university's researchers and start-ups through the 'Cambridge Angels,' a group of supportive, specialist tech investors. The best ideas are able to access the capital they need. Major international businesses have come to recognise the value in this approach to innovation, and giants like Apple, Microsoft, Google, IBM and AstraZeneca have established bases in the city.

Central to this process has been a relaxation of the city's previously tight planning rules. New campuses have developed in and around every part of the city's very tight urban boundary. But Cambridge's success is built on human capital; the quality of people in Cambridge and its institutions, and the interaction around and between them – the ecosystem, rather than the component parts.

[25] *Cambridge Cluster Insights,* Cambridge Ahead, 2019. This data current for the year 2017-18.
[26] *48 years of history & 700 years of heritage*, Cambridge Science Park.

Cambridge is not Shenzhen. It has benefitted massively from government investment in research and development, but its development as an economic success story and centre of innovation was never planned. Cambridge's research base is heavily funded by the public sector, but its economic growth has been driven heavily by entrepreneurship and innovation; government, both national and local, have been playing catch-up. This raises the question of whether more supportive government policy, applied earlier, might have allowed Cambridge's rise to happen sooner.

To understand how to develop innovation economies in British towns and cities, we need to look at other examples. Developing new, transformative and successful approaches to innovation in an older city in a western country, and one with an industrial heritage like most of ours, is another and more difficult challenge. This has happened in Boston, where similarly strong leadership has paved the way for the city to become one of the leading innovation hubs in the United States.

Boston, USA

The rise of Silicon Valley in the last few decades has put California at the centre of American innovation, eclipsing the established economies of the East Coast cities for science and technology. With an innovation ecosystem fuelled first by defence funding and a ready source of talent from its leading technology universities, then sustained through a collaborative culture of investment where successful entrepreneurs would invest their profits in the up-and-coming businesses of their younger peers, it has arguably established the norm for 21st century innovation economies.

In Boston, traditional structures and a sprawling geography had limited the development of an innovation ecosystem. Now, thanks to civic leadership, the city is quickly emerging as a biotech hub, with the Greater Boston area estimated to be home to at least 1,000 biotech companies. Boston has become the ninth likeliest city globally to become the "leading technology innovation hub outside of Silicon Valley over the next four years.[27] In 2018, Boston had more start-up investment than New York, at $5.3bn, second only to Silicon Valley. [28]

Boston has long had the ingredients of a successful innovation economy. The high concentration of world-leading research universities means that there is no shortage of researchers and entrepreneurs from different disciplines or places for them to regularly interact. It has world-class facilities, such as the Lincoln Lab for advanced tech and the Leg Lab, famously the nursery of Boston Dynamics.

Starting in 2010, Boston's authorities started to pull together these assets into a programme which would jumpstart innovation across the city's economy. The universities in the greater Boston area were spread out, without a central start-up or business district to focus their spinout activities. The city government has led the development of innovation districts to address this, encouraging the collaboration of business with higher education and residents on development projects. The Boston Waterfront Innovation District development is located on 1,000 acres of underdeveloped land on South Boston's waterfront peninsula. Together with South Station and the Back Bay area, there are now three substantial start-up clusters in the city.[29]

Through civic projects, government has helped to re-focus the city on the importance of innovation. The Mayor's Office of New Urban Mechanics (MONUM), founded in 2010, aims to bring the approach of a start-up to urban government, collaborating with businesses, universities, and ordinary citizens to run small-scale, experimental pilots. Non-profits do their part too, with Masschallenge funding entrepreneurs and start-ups from the area.

Many commentaries on the success of Boston focus either on the Massachusetts Institute of Technology or Harvard University, both located in Cambridge, MA. What is so important from the UK context about Boston waterfront is that the benefits of the innovation that were created are now taking place in the hub of an old part of the city. This part of Boston's story is genuinely about the renewal of the city rather than its outward expansion. Most of our cities have old industrial areas with rich histories but potentially fewer successful present uses. Of course, not every city has two globally pre-eminent universities at its heart, but neither does the city of Eindhoven in the Netherlands. There, the emphasis is much more on securing the legacy from a former major industrial employer working with civic and academic leaders to secure adaptation.

Eindhoven, Netherlands

Eindhoven is where Phillips was founded, and where its headquarters was based for a century before its move to Amsterdam in 2001. The city has had a tough time, but Eindhoven's bustling technology and science parks have turned the city into a world-renowned innovation hub.

In 2012, Eindhoven, the Netherlands' fifth largest city, had the third highest number of high-tech patents per member of the population in Europe, and the fourth highest in the world.[30] A specialist centre in technology and design, Eindhoven's high-tech systems and materials sector comprises more than 60,000 employees and nearly 7,000 companies.

Eindhoven's ascent came relatively recently, as city authorities and universities pursued a deliberate innovation strategy, promoting collaboration between organisations. Following an approach dubbed the 'triple helix', government, higher

[27] *Technology Industry Innovation Survey,* KPMG, 2019.
[28] *Boston-area startups are on pace to overtake NYC venture totals,* Tech Crunch 2018

[29] *The Boston Waterfront Innovation District,* Smart Cities Dive.
[30] *Top 30 metropolitan areas in terms of total patent applications to the EPO,* Eurostat 2012

education and business worked together to establish institutions focused on innovation and technological development and built sites where collaborative research between businesses and higher education institutions could take place.[31]

This was a crisis response: the recession in the early 1990s had hit Eindhoven's dominant business Philips, and the company eventually transferred its manufacturing base from Eindhoven to China and its headquarters to Amsterdam. Before the 1990s, Eindhoven's economic fortunes had closely followed those of its most famous firm, growing with it as it became one of the world's most important technology developers, covering everything from lighting to X-rays to the DVD. Throughout this period, Eindhoven was the location of its headquarters as well as the centre of its manufacturing.

Faced with the decline of its biggest businesses, the city forged a partnership to transform the economy. The triple helix was an attempt to change the model of innovation, encouraging collaboration between different firms and institutions and the pooling of effort. This would mark a shift from the practice of technology giants keeping their R&D to themselves, developing technology in secret. It was hoped that this new approach would allow more interaction and increase innovative activity across a broader base of firms, making the local economy more resilient and driving researchers on to newer and more creative ideas.

Pooling resources, local government, higher education, and industry financed the Brainport Development, established in 2006, which has focused on creating a productive environment for businesses to grow and change. Brainport works with the research campuses in the region to form specific clusters which encourage innovation and developing research for commercial gain. These have been extremely successful: The Technical Campus Eindhoven, initially owned by Philips, is now home to 185 companies and institutes, including IBM, Intel and Shimano, and the University of Eindhoven has a track record of finding commercial applications for academic research.

These centres encourage businesses to collaborate on projects and share their successes. Rather than do their research in secret, aiming to beat their competitors to market, this model of open innovation encourages firms to collaborate and share their findings. Any party can start a project, and Brainport Development will assign a firm or institution to manage it. This increases the chance of new technological discoveries and is a draw to other businesses anxious to benefit from the fast-paced research environment. Today, Eindhoven attracts the highest level of investment in the Netherlands and accounts for almost a quarter of all Dutch exports, while one of its business parks is known as the 'smartest square kilometre in the world'. [32]

If action was taken sooner, a number of UK cities could have secured a lasting legacy and maintained a functioning innovation ecosystem as Eindhoven has. But our regeneration efforts, starting in the 1990s, came too late. By then, companies in the worst hit cities had long since closed and urban populations had contracted.

[31] *The Knowledge-Based Economy and the Triple Helix Model, Loet Leydesdorff.* According to the model, for innovation to occur universities, industry and government should interact and collaborate to support
[32] *The smartest square kilometer in the world,* Kim Voets, 2016.

More places should be seeking to get ahead of this curve – working with their anchor institutions to make the changes necessary to encourage them to stay, or to manage the process of change should they leave. Elsewhere, where the major companies are long since gone, the challenge is to rebuild an innovation economy from a low base. The starting point is to work with what is there, which for most cities means their university. Manchester has done this, with innovation now joining the more mature sectors of the economy in driving growth.

Manchester, UK

Like many cities in the north of England, deindustrialisation in the second half of the twentieth century hit Manchester hard. The city's industries, which had been steadily declining, collapsed in the 1980s, as the manufacturing sector succumbed to overseas competition. This changed the city and led to the rise of poverty and low productivity: between 1971 and 1981, Manchester lost almost 50,000 full-time jobs and 17.5 per cent of its population. Younger, more educated and higher-earning individuals were more mobile, and thus more likely to leave. They found jobs elsewhere: the city failed to retain these people, so they could no longer be relied upon for its renaissance.

Commercial development has played a far bigger role than science and innovation (a process in which Bruntwood played a leading role). Manchester remained a popular student city through the years of its decline, and the strength of its university and the quality of local research endured. Recognising the strength of the city's universities, the city's leadership began in early 2000s to discuss collaboration with local universities and commission research into the city's innovation strengths.

The city established Manchester Knowledge Capital, a partnership between the city and University. The partnership had successes but did not provide a blueprint to match the by now well-established commercial development of the city. That came with the Nobel Prize for physics being awarded in 2010 to two Manchester academics for the isolation of a new material, graphene. This galvanized the civic and academic leadership of the city into a more radical science/economic agenda, bringing finance, property, and other local players with them. Together, they successfully applied for innovation assets, building the National Graphene Institute, a research hub to focus on the further advancement of graphene technology, which opened in 2015. With the government-backed Graphene Enterprise and Innovation Centre, the city is now looking to encourage the growth of businesses which can make commercial use of the technology. More than 300 people now work on graphene and 2D materials across the city and the first fruits of commercialisation are being seen in new companies and products leveraging this world class science.

By coordinating powers and talking to investors, Manchester's stakeholders have managed to build physical bases for its researchers to work. A public-private partnership approach has been at the forefront of the city's wider development and approach to building science parks, reacting to what it believed was the failure of the private market to react to the city's scientific strengths. Manchester Science Park, now part of Bruntwood SciTech, is now opening new campuses across the conurbation, attracting over 300 businesses, exchanging knowledge and ideas. Manchester is now recognised once again as a science and innovation hub. Perhaps central to this was the response to AstraZeneca's departure from Alderley Park. A fast response ensured that Alderley Park remains a centre of science and research and even more enterprising than it was before.

Not every city has the scale of Manchester, or Nobel Prize-winning science. Even just a few years before the prize, this agenda seemed improbable in Manchester. The last Nobel Prize won in the city was in 1947, and for all its hard work, there was little that was exceptional about the city's innovation profile in the early 2000s. The city did what every other city can do: it identified what it was good at, seized its opportunity and exploited every bit of its network of businesses and international contacts to raise its game. In Manchester, government responded, funding the Graphene Enterprise and Innovation Centre. This should be an option open to every place.

LESSONS LEARNED FOR PLACES

Not everywhere has the potential to become a centre of innovation. The trick is to understand the starting point and possibility for any place, its assets and how it can best use these to grow the local economy. There are many ways that places can, and are starting to, better understand their economies. We suggest two areas which are important here: the economic complexity of places and their absorptive capacity.

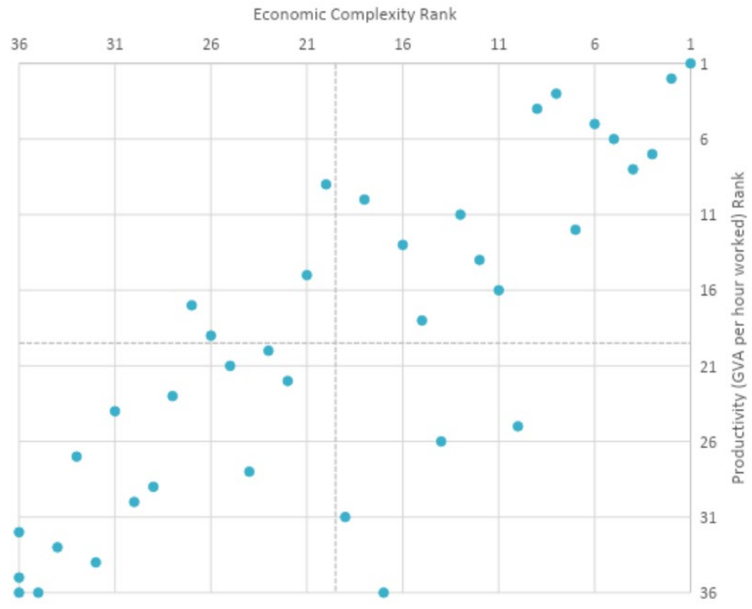
Economic Complexity and Innovation in the UK

Identifying the places which have potential to develop successful innovation economies is not straightforward, there is no one metric which can act as a proxy indicator for success. We can however analyse the innovative potential of a place by measuring its economic complexity. The Economic Complexity Index (ECI) is a cutting-edge measure, developed in the last couple of years to help us understand how much productive knowledge is contained within an economy. It works by analysing a matrix of economic specialisms – by connecting places to the products they specialise in.

Knowledge is central to economic development and growth. It is the basis for innovation where the creation of complex goods and services requires greater knowledge in their production. However, the capacity of individual human beings to store knowledge is no greater than it has ever been. Instead, our economy responds to the need to store greater knowledge by becoming more complex. Because knowledge is intangible and invisible, we can instead look to measure the complexity of an economy to get a sense of the knowledge it contains. The ECI works by analysing a matrix of economic specialisms – by connecting places to the products they specialise in as nodes in a network. Specialisms are defined as when a place has a concentration of employment in a particular industry greater than the national average in that industry. Combining those specialisms with a measure of how unique these specialisms are and the diversity of them in a particular place gives us a measure of economic complexity.

The ECI does not give any information about the output of different sectors or places, but its findings align very closely with various measures of economic success, particularly productivity. The most economically complex places tend also to be the most productive. This strongly suggests that economic complexity is a driving factor in determining productivity. Following this, the more economically complex a place is, the more innovation, and innovation potential that place will have, and we can use the ECI as an indicator for where innovation can grow if conditions are right.

FIGURE 5. ECONOMIC COMPLEXITY MODEL



Source: Metro Dynamics analysis of ONS BRES and Regional GVA (Balanced) (2017)

Complex economies are those with a greater diversity and ubiquity of production. The modern economy is not clearly defined by sectoral differences, and many businesses will find themselves delivering products and services at the frontiers of various different disciplines. The most complex economies are those which have the most interactions between businesses.

In the UK, the most economically complex places tend to be close to London. Many of these, such as Oxford and Cambridge, are internationally renowned for their knowledge economies, others, such as Milton Keynes, less so. Wherever they are in the country, urban districts also have higher levels of complexity. Manchester, Birmingham, Coventry, Nottingham all are more economically complex than their wider region, likely a result of the agglomeration of varied economic activity in city centres and the interaction that this proximity facilitates.

Government intends to level up underperforming areas of the economy outside of the South East but faces a challenge in using innovation policy to do this. Increases in innovative activity tend to occur in places that are exhibiting it already, meaning the already prosperous places in the South East will continue to grow while the rest of the country is left behind.

The ECI starts to give us an indication of areas with the most innovation potential. An important way of making places more complex is increasing the ability of local economies to absorb innovation and the smart capital it can bring. If its capacity to do so is low, and there is nothing in place to change matters, then even perfectly functioning capital, talent, and other markets will yield little change. Similar to a natural sea sponge taking in water to grow, successful places absorb and retain the capital and people they need to make them stronger.

Absorptive Capacity: A Barrier for Innovation in Places

Supporting a place to become innovative is not simply a question of redistributing existing funds towards research and development, nor is it pursuing the same investment strategy as somewhere else. Places need to map out their own economic conditions, assets and institutions, understanding the local opportunities and challenges as a prerequisite for writing an innovation strategy. It is therefore important to understand the absorptive capacity of places to generate the best results via the right kind of investment.

Absorptive capacity describes the ability of individual firms to recognise the value of new ideas and apply them to commercial ends.[33] Economic conditions can change quickly, and therefore so can the commercial viability of firms themselves: what makes money today may not do so tomorrow. At the level of the individual firm, this means recognising the need to evolve, adopt new ideas and exploit existing expertise to new ends .

The presence of absorptive capacity can determine whether places and firms can use investment effectively in order to scale. In places with low absorptive capacity, companies will struggle to turn financial backing into meaningful growth, SMEs without this knowledge will forever remain the same, meaning places will stagnate. The key indicators of absorptive capacity include levels of R&D expenditure; education and skill levels of employees; adoption of new management practices within firms; collaboration between firms, whether regional, national or international; and the natural markets within which firms compete. [34]

Ultimately, whether a place has the capacity to innovate depends on the attitudes of its businesses and investors and whether they see the necessity in backing new ideas with investment. The places that are most innovative in the UK – London and the South East – are those with the most capacity. Those places which lack capacity, which lack a body of innovative businesses or institutions with the research pedigree and onus to successfully commercialise ideas, will not see their innovation performance improve through funding alone. What matters is the ability of a place to make optimal use of inputs, such as state investment, to maximise outputs: innovation, jobs and economic growth. Again, we see that innovation breeds further innovation.

This makes it essential to consider the existing strengths and capabilities of a place when focusing investment. The story of Shenzhen highlights if places have the conditions to thrive, with the right support they can quickly develop into strong and knowledgeable economies. For Shenzhen, the proximity and investment from Hong Kong, the strong and interventionist Chinese Government leadership, and the infrastructure of a modern industrial economy together delivered the capital and infrastructure necessary for the city to become a successful innovation economy.

Achieving sustainable innovation is hard and not everywhere has the absorptive capacity to make it a success. This is a swift moving and competitive field; technologies, particularly digital technologies, are evolving at an extremely fast pace which require constant adaptation in research processes and business organisation. Effective innovation ecosystems have the flexibility to adapt and the raw resource to take advantage but places which cannot adapt are left behind. If given £100 million in funding, Oxford would do different things than Sheffield or Glasgow. We should welcome this: each place is different with its own set of priorities. But not everywhere knows exactly how it would spend the money, nor would they prioritise this area of investment.

Places must become aware of how innovation can transform their economy into an environment that attract highly skilled people and industry. The most innovative economies around the world are complex machines with different networks, inter-relationships, and personal connections. They can absorb new investment and translate it into productive growth for sustained periods.

[33] *Absorptive Capacity: A New Perspective on Learning and Innovation.* Wesley M. Cohen and Daniel A. Levinthal, 1990.

[34] *Absorptive Capacity and Regional Patterns of Innovation.* Maria Abreu, Vadim Grinevich, Michael Kitson and Maria Savona. Centre for Business Research (CBR), University of Cambridge, 2008.

CHAPTER THREE

Place and Policy, National and Local

A CONSIDERATION FOR UK CITIES

Having the raw materials is not enough for places to succeed at innovation. In our view, too few have considered absorptive capacity. This failure is a direct consequence of not knowing enough about how businesses can be supported to act smarter, to be open to and embrace innovation and to put in place public and privately incentivised risk capital and talent to enable them to change. Until now, this has not been a concern of public policy.

The next section looks at the policy that has been in place to support innovation in the UK. While it is clear that R&D investment and activity in the UK is imbalanced towards the South East, correcting this disparity must be about adding to the excellence of places like Cambridge and London by supporting other places to develop opportunity into success. This requires a careful identification of those places that have the building blocks in place to become thriving and innovative places.

Productivity matters in economic growth and innovation matters in place. The history of innovation here and around the world shows that change, and significant change, can happen. The UK needs to maintain its global excellence, catalysing growth in its cities and towns which have potential to become innovative economies. Until now, the concentration of research and development support on specific areas has contributed to a lack of resilience and productive growth in the UK economy. Over decades, UK policy has tried to distribute innovation across regions but with patchy results: in an economy like ours with comparatively laissez faire attitudes, change will not be easy. In part, this because policymakers have misunderstood how innovation works or how to create innovative places.

THE RECENT HISTORY OF INNOVATION POLICY

Using innovation to spark economic growth has a relatively long history. Since the 1990s, there have been attempts by the UK Government, governments abroad and pan-national organisations such as the EU to increase the levels of innovation with policy interventions. Policymakers understood the significance of science and innovation to economic growth, though the assumptions about the commercial potential of particular fields have since shifted.

Throughout the twentieth century, UK science and innovation policy broadly followed the Haldane principle. First emerging in a 1918 report by the eponymous Liberal Politician, the principle advocates that the direction of research activity should be taken by researchers themselves through processes of peer review. In the UK this has been reflected in the idea that funding for scientific and technological research should be taken by research councils made up of experts, and not by Government ministers.[35] There can be no problem of supporting the principle of world class research, This has had a spatial implication, confining much of the spending of the research councils to places where scientific research is strong –the South East and London, the so-called Golden Triangle.

This is partly a reflection of academic research and the primacy of curiosity-driven research, a cornerstone of policy since the 1980s and the then Government's decision to withdraw state support from near market research:

[35] "*House of Commons Hansard Ministerial Statements for 20 Dec 2010 (pt. 0001)*". publications.parliament.uk, 2010.

"My belief is that we have already done harm to British innovation by removing much of the R&D burden from industry since the war. That which is not paid for, or earned, is rarely valued and the poor status of engineers today is in part because industry has not had to pay for and nurture them in order to stay ahead in the market place…It is a vicious circle. The more Government featherbeds technical research, the less top management will value it and the lower our innovative standing will be. Those in […] the endless quangos who lobby Government for technical support will continue to present this as evidence that more money is needed. The cure has been exacerbating the illness!" [36]

This became subject to considerable scrutiny, often referred to as 'the great debate'. [37] The scientific community, who saw the funding going to universities conducting research cut by the Government as part of a wider reduction of public spending, loudly voicing their frustration through the establishment of the Save British Science group. Colin Blakemore wrote the "*great damage that is being done … to the research base of this country by the Government's funding policy was a national disaster that has unthinkable implications … for Britain's industrial performance in the coming decades.*" [38]

This view came to underpin British Government policy from the 1980s onward. Innovation policy became a blend of two principles. First, that public funding should reward excellence, with no consideration for spatial factors such as regional imbalance. Second that the private sector could and should bear more of the cost of innovation related investment.

The policy debates we examine next mark something of a change in these principles, but a modest one. The post-war policy of publicly funded but industrially led near market research ended. It is debatable whether the new approach worked any better. It seems hard to argue that it did anything to sustain innovative economies across the country.

Industry often looks towards policy to understand what government is prioritising and, in some cases, reacts accordingly. A reduction of public expenditure in research and development does not incentivise the private sector to continue innovating, the UK's experience shows it had quite the opposite effect. What we can learn from previous government policy is that innovation not only requires commitment from a multitude of sources but also a clear strategy which puts it at the centre of economic growth.

[36] George Guise, Adviser to Margaret Thatcher quoted in Science *Policy under Thatcher,* Jon Agar, 2019. p101
[37] *Science Policy under Thatcher*, Jon Agar, 2019.
[38] Blakemore to George Walden, 13 March 1987. CaSE archives.

Cluster Theory

In recent decades policymakers have attempted to redress the UK's regional innovation imbalance. Perhaps the most influential of the theories enacted has been Cluster Theory. Developed by US academic Michael Porter in the early 1990s, clusters describe concentrations of activity in a particular sector in a particular place, arguing that this concentration led to increased productivity and boosted competitiveness. Firms from the same industry, for instance advanced manufacturing, benefit one another when concentrated in one place and especially so when they share premises, for example through co-location on a technology park. This sectoral concentration, or cluster, leads to positive spillovers of useful knowledge between firms to their mutual benefit, increasing the growth of the businesses and the local economy. [39]

Governments throughout Europe saw growing clusters as a means of increasing innovation activity across their economies. Though the Danish, Dutch and Finnish Governments were the pioneers, setting up programmes which focused on boosting SME activity in clusters, the UK Government was also a subscriber for a time. In the late 1990s, UK Government aligned a new cluster policy with the establishment of the Regional Development Agencies (RDAs), with the intention of promoting economic growth across the regions. The Department for Trade and Industry began a cluster mapping exercise in 1999, and £50 million was made available to the RDAs in 2001 through the Innovative Clusters Fund.

Building on Porter's theories by identifying areas of sectoral strength in the UK's regions, policymakers could target specific funding and support to developing sectoral specialisms in specific places, helping them to emerge as specialist areas of excellence. This in turn was expected to benefit the national economy and the local economies of the places in which the clusters were based through further innovation. [40]

Over time cluster policy has evolved, emphasising the dynamics of local economies and the emergence of cluster ecosystems, where the turnover of large and small firms drives an innovative economy. This has been popular in Europe, with the EU focusing on clusters for its economic development through the smart specialisation programme, stipulating that from 2014 it would be compulsory for any region accepting Structural Funds to have in place a regional smart specialisation strategy cluster policy.[41] With this approach policymakers aimed to identify the industrial specialisms of a region and nurture these through investment to become world leading.

This focus on clusters has had mixed and often inconclusive results. Reviews of various Governments' approaches to regional economic development have shown that attempts to support the clusters have often been counterproductive, boosting short term activity but having limited long-term effect on regional innovation or productivity growth. Absorptive capacity – or lack thereof – must play a part here. An early survey of cluster policy found that, among 750 clusters, there was little benefit from targeted cluster policy, which were indeed "the least important determinants in competitive clusters, while they play a much more important role in uncompetitive clusters," and only one competitive cluster was established through Government policy.[42]

This trend has also played out in the UK. One of the recent flagship cluster policies was to build on an emerging technology cluster in Shoreditch in East London, pushed by both the Prime Minister and Chancellor, with the ambition of developing it into a world leading tech centre. By opening new coworking space in redeveloped land in East London, alongside supportive policies for tech firms, they aimed to grow it into a much larger cluster of tech innovation.

However, these supportive policies largely failed. The new coworking space was too far away from any existing activity to prove useful or provide the positive spillover effect that was necessary for innovation to grow. Highlighting the tech hub status of the core of the cluster actually led to landlords increasing rents and forcing out the existing firms which had sat at its centre and driven its economy. [43]

Overall, reviews of cluster policy have emphasised that a focus on sectors misinterprets the nature of innovation and how it can develop. Focusing on sectoral activity, rather than the general conditions that allow innovation to thrive in places, provides funding to places which lack the conditions for ideas to develop and be commercialised. Rather than address the fundamental limitations of a local economy, cluster focused policies direct funding towards specific goals, as opposed to supporting the activities that create those goals. By fixating on only the result, i.e. the creation of a specialist IT cluster as in Silicon Valley, ignores the importance of the conditions which create it: the development of the ecosystems that allow innovation to thrive. Doing this requires much clearer understanding of local areas, what their science and innovation strengths are, and what obstacles stand in their way. [44]

Recognition of the limitations of cluster-based policy has inspired a pivot towards supporting translational research, namely through specialist catapult centres. Over the last decade these have become the focus of the UK Government's innovation activity.

[39] *The Effects of Cluster Policy on Innovation,* Elvira Uyarra Ronnie Ramlogan, Nesta, 2012
[40] *Michael Porter's Cluster Theory as a local and regional development tool – the rise and fall of cluster policy in the UK. Local Economy.* 28 (4). 367–381, Jon Swords, 2013
[41] *Agglomeration, clusters, and industrial policy,* Max Nathan and Henry Overman, 2013
[42] *The demography of clusters - findings from the cluster meta-study,* Van Der Linde, 2003.
[43] *Agglomeration, clusters, and industrial policy,* Max Nathan and Henry Overman, 2013
[44] *Agglomeration, clusters, and industrial policy.* Max Nathan and Henry Overman, 2013

Catapults

The Catapult programme was established to connect research and the market via a new network of technology and innovation centres to bridge the gap between research findings and their development into commercial propositions.[45] The idea is to foster strong collaboration between enterprise and research, with the infrastructure providing knowledge, technology and resources for innovation to prosper. Described by Hermann Hauser as a “translational infrastructure”, which facilitates the commercialisation of the UK’s most innovative ideas to benefit the economy, the programme was established in 2011 by Innovate UK, following a review by Hauser himself. He undertook a further review in 2014 which sought to evolve the Government’s policy further. [46]

The implementation of the Catapult programme established a network of innovation centres. Located across the country, covering a variety of disciplines and themes, each centre received "core" funding of £10 million per year for five years, to be supplemented by a sustainable investment from commercial and private funding. The programme has supported over 12,000 collaborative projects with industry, over 2,000 academic collaborations and over 4,000 SMEs. Catapults bring research expertise, skills and investment and are central to the UK’s agenda for innovation and economic growth.

A 2017 Ernst & Young review into the Catapult programme found that some Catapults had supported innovation by demonstrating a contribution to innovation outcomes.[47] It highlighted that, through the creation of leading facilities with access to advanced technology, the innovation network was stronger.

However, the Catapult programme has not yet had its expected level of impact on innovation or economic growth. This is largely due to the implementation of the programme; a lack of purpose statement and governance around how the Catapults are run, alongside inconsistencies on how they are run or measured, have proven to be significantly limiting factors. There are variations in performance between the different Catapults, and many examples of success, which we discuss further below, but, ultimately, there have not been enough links between Catapults and the knowledge engine of a place, which has meant that neither have fully benefited from the other.

This was a matter of design; even where Catapults are successful there is neither the mechanism nor the intent to reach out to smaller local employers. This limits their ability to make a transformative difference to the innovation landscape and further limits their ability to drive economic growth. Hauser outlined this limitation in a review of the Catapult programme, stating there was much more work required to bridge the gap between pure research and commercialisation. The programme’s successful examples prove the model can be effective, and it should provide the base from which the UK can expand its innovation infrastructure and become a world-leader at translational research.

[45] *Catapult Programme: A Framework for Evaluating Impact,* Department for Business, Energy and Industrial Strategy & InnovateUK, 2017.
[46] *Review of the Catapult network,* Dr Hermann Hauser, 2014.
[47] UK SBS PS17086 Catapult Network Review, Ernst & Young LLP, 2017.

Catapults themselves are based on the German Fraunhofer model, which was first opened in 1948.[48] This programme operates 74 institutes across Germany with an annual budget of £2.8 billion, with its success largely down to sustained government funding.[49] In the UK, despite the Government announcing more than £1.1bn investment in the Catapult Network over five years, the UKRI 2018-2019 annual report states that Institutes, centres, facilities & catapults were given only £567,362,000 in funding across 9 catapults.[50] Their commercial output remains significantly behind the Fraunhofer model.[51] If we want to get serious about Catapults, they need a radical uplift in investment.

As Oliver Ambacher, Director of the Fraunhofer Institute for Applied Solid State Physics, put it: governments need to provide core funding for a long period of time in order to generate success. With the first Fraunhofer Institute now open in the UK, in Glasgow, the Catapult programme has a long way to go if it is to reach something close to the model’s success, but Government needs to be prepared to work through initial teething problems if it is to develop a successful long term model.

Nevertheless, there are some positive examples from the Catapult programme. The Medicines Discovery Catapult (MDC) at Alderley Park, established in 2017, effectively connects the UK pharmaceutical community and accelerates innovative means of drug discovery by linking SME biotechs, academics and innovators with world-class laboratory facilities and collaborative research programmes. It is working to develop new technologies to advance drug discovery, including digital and AI approaches, supporting SMEs in securing funding for new, innovative drug technologies and facilitates a Virtual R&D Discovery Services platform.

Crucially, MDC was selected by the Department for Health and Social Care as the national coordinator for the UK Government’s three official COVID-19 testing facilities – the ‘Lighthouse Labs’ - at Alderley Park, Milton Keynes, and Glasgow. The Alderley Park facility pulled together the pharmaceutical industry, academia, the NHS, SMEs and private sector Bruntwood SciTech, to create, build and deliver the testing of up to 50,000 samples per day. The creation of this facility at such pace and scale would not have been possible without the input of all the partners, led and co-ordinated by the MDC.

The High Value Manufacturing Catapult (HVMC) is a group of manufacturing research centres in the UK. In 2013/14 it had 1,515 private sector clients, generating a private sector income of £65 million, plus £44 million of collaborative R&D, putting the combined R&D and commercial leverage per £1 of Catapult core expenditure at £2.98. By 2016, HVMC had already exceeded the two non-core funding income targets.

[48] *UK reviews its innovation strategy: of Catapults and Fraunhofers,* Michael Kenward, 2014.
[49] *Fraunhofer Facts and Figures,* Fraunhofer-Gesellschaft, January 2020
[50] UK Research and Innovation Annual Report and Accounts, 2018-2019
[51] UK Research and Innovation Annual Report and Accounts, 2018-2019

One of the research centres that forms part of HVMC is the Advanced Manufacturing Research Centre (AMRC) based in Sheffield. Sheffield City Region has established itself as a centre for advanced manufacturing and innovation by helping businesses across the country tackle challenging research problems. With AMRC the city region has its very own 'lab-for-hire'. it has attracted high-tech businesses to the region and allowed firms to cut costs of R&D but is still yet to make the expected impact on the city and regional economy.[52]

FIGURE 7. CATAPULT UK NETWORK MAP

Source: Catapult.org.uk

[52] *Parks and innovation: Lessons from Sheffield's Advanced Manufacturing Park,* Centre for Cities, 2019.

UKRI and Innovate UK

Innovation and research are funded through the non-departmental public body, UK Research and Innovation (UKRI), which operates across the whole of the UK with a combined budget of more than £8 billion. UKRI was established in 2017 from the seven existing research councils, Research England, formerly the Higher Education Funding Council, and InnovateUK.

InnovateUK is a key part of UKRI, providing funding to research projects for private and public sector institutions across the country. Established in 2004 as part of the Department of Trade and Industry before becoming an independent organisation in 2007, InnovateUK has invested £2.5 billion in research partnerships, with a purpose to support collaboration between higher education and businesses. [53] InnovateUK's funding supports the commercialisation of research, de-risking innovation for businesses and providing the necessary breathing space to develop ideas into commercial propositions.

UKRI and InnovateUK do not have a regional policy, nor do they consider rebalancing R&D funding as part of their remit. Instead, projects are funded on an individual basis, assessed by expert panels from business and academia for excellence. Due to the disparities in R&D activity in the UK, namely the concentration of science and innovation in London and the South East, this 'place-blind' approach concentrates funding in these places. [54]

Those places which have the potential to grow, but have not yet demonstrated research excellence, will fail to access funding through UKRI or Innovate UK, leaving local businesses empty handed. While funding flows to higher education institutions, the crucial element of translational research and business support is missing. There is a clear opportunity to develop functioning innovation ecosystems which convert new ideas into commercial applications, but without an appropriate, targeted funding stream this cannot yet happen.

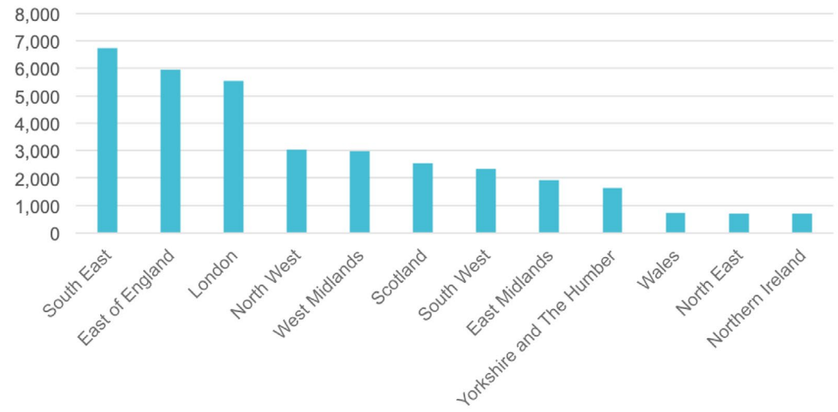
[53] UK Research and Innovation Annual Report and Accounts 2018-2019
[54] *A Resurgence of the Regions: rebuilding innovation capacity across the whole UK*, Richard Jones, 2019..

WHAT DOES THIS MEAN FOR THE STATE OF PRESENT-DAY INNOVATION?

The UK's innovation policy approach has consequences. In the last 20 years, 16 other OECD countries have achieved an equivalent or greater increase in R&D intensity compared to the UK.[55] The approach taken towards clusters and catapults has failed to embed innovation in place. The cycle of excellence rewarding excellence continues. Whilst we are clear that the innovation hotspots in the UK are to be celebrated and supported, it is hard to avoid the conclusion that innovation policy has not been effective when swathes of the country and its businesses are missing out.

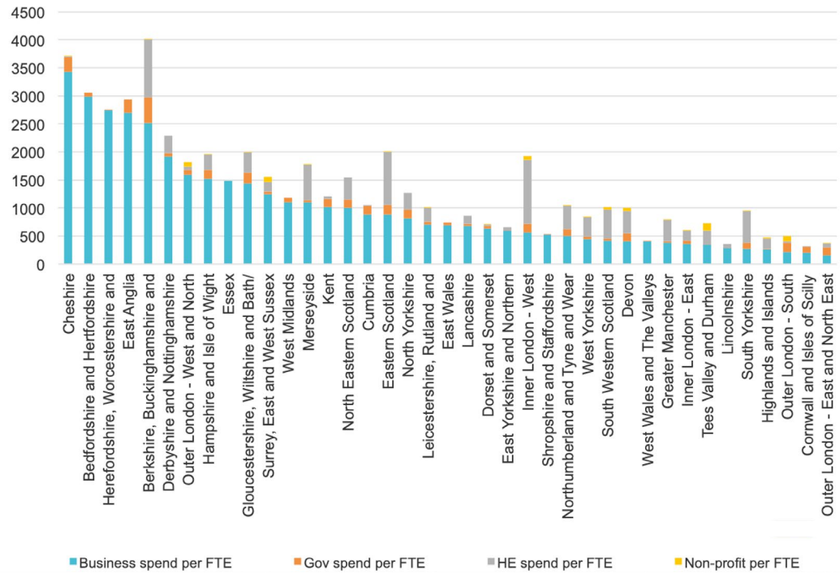
If anything, innovation policy has resulted in more concentrations of innovation activity in only a few places, to the exclusion of most. The UK is ranked 17th out of 37 OECD countries in terms of R&D expenditure and more than half of that goes to London, the East, and the South East of England (Figure 7), while the North-West, North-East and Yorkshire and Humber combined equate to only 16%. Innovation infrastructure is equally as imbalanced with over half of the accelerators in the UK concentrated in London.[56] We do not spend enough on R&D nationally, and we don't spend it in a way that generates growth across the country.

FIGURE 8. GROSS EXPENDITURE ON R&D BY REGION (£M)



Source: Eurostat Intramural R&D expenditure (GERD) by NUTS 2 regions (2017)

FIGURE 9. R&D EXPENDITURE BY NUTS2 REGION BY ORIGIN OF / SPENDING PER FULL-TIME EMPLOYEE (£) (2016)



Source: Produced by Metro Dynamics using Business Register and Employment Survey data (2020) and Eurostat Intramural R&D expenditure (GERD) by NUTS 2 regions (2017)

Where there is a concentration of knowledge within a place, something we later describe as the knowledge engine, there is a greater incentive and likelihood of attracting private sector investment and more knowledge spillovers. There is the need for more effective translational infrastructure with Catapults or their successors focused on securing the adoption of innovative practice as a high priority.[57] Policy needs to look at increasing the absorptive capacity of these areas, stimulating innovation in local areas through research institutions and accessible funding routes, supplementing and complementing the private sector efforts.

Ministers must look to increase, broaden, and deepen innovative policy and funding if the aim is to achieve economic prosperity. The pattern up until now shows the UK failing to do two things: firstly, to produce world-class translational research institutions; and secondly to understand the absorptive capacity of places, the regional differences across the UK or how to properly facilitate innovation in fundamentally different areas.

[55] *Gross Domestic Spending on R&D,* OECD, 2018
[56] *Business incubators and accelerators: the national picture,* BEIS, 2019.
[57] *A Resurgence of the Regions: rebuilding innovation capacity across the whole UK,* Richard Jones, 2019.

RECENT POLICY

In the 2020 Budget, the Government announced its commitment to investing in infrastructure, innovation and skills to level-up regional economies. Though many of its other measures will have an impact on innovation, the Government's flagship approach is to increase public R&D investment to £22 billion per year by 2024-25. This is the largest expansion of support towards researchers and innovative businesses, taking funding for R&D to 2.4% of GDP.

This is an ambitious agenda and a clear recognition from Government that the UK needs to make up ground after years of undervaluing the importance of innovation to the economy. Much of this investment will and should go on fundamental, theoretical, and otherwise blue-sky research, but it is a golden opportunity to build strength in depth beyond the Golden Triangle too. The 2.4% target, allied to the commitment of levelling up the economy and supporting regional economies outside of the South, is an opportunity to correct the disparity in innovation infrastructure and performance across the UK.

We will need to do more than just increase research and development to the 2.4% target in order to rebalance the economy. This expenditure will need to be accompanied by other measures backed by an unprecedented level of policy intent. Part of this will involve reforming the way Government allocates funding, revising the Green Book investment appraisal methodologies to recognise the potential gains of economic rebalancing rather than only awarding funding to existing, evidenced growth. [58] Some cities are beginning to make the reforms and investments necessary to develop their own innovation assets, as Manchester has shown, but these places need support. What this suggests is that we need to do far more as a country to expand and embed innovation in places, investing not only in physical infrastructure but ecosystem which sits around it.

Translational research is a crucial element in the diffusion of good ideas to the wider economy in a place, allowing businesses to take ideas and find clear applications for them. This has been neglected until recently, with the introduction of schemes like the Strength in Places fund, however it is still too early to determine its success. With the right understanding of the conditions for success, and the capacity of individual places to succeed, translational research can boost the productivity performance of places that have lagged. It is vital therefore that the new research and development funding is used to create much more effective translational research infrastructure. Similar to when the Government asked Hermann Hauser to review the issue, leading to the creation of what we now know as the Catapult network, renewed effort in resourcing and a revised approach is needed to make these institutions suitable for modern day requirements. There is a case for asking Professor Hauser to update his thinking, perhaps working with the recently departed CEO of Siemens UK Jürgen Maier. His experience of continental and US innovation policy allied to Hauser's deep knowledge of the Cambridge phenomenon would be ideally placed to design a new and well-informed approach.

[58] *Levelling Up: Making Investment Appraisal Fit for Purpose,* Metro Dynamics for Peel and North West Business Leadership Team, 2020.

Where Next?

The key in the area of place-based policy is to understand the local obstacles to innovation, and whether and how these are surmountable. The announcement of an innovation target and increased funding is a welcome change, but Government, businesses, and investors must show the same seriousness of intent in relation to translational research as there is in every aspect of science policy. Extending out to the cities and towns of the UK, the absorptive capacity of places must be considered when determining when, how and where to invest.

Achieving the goal of levelling up cities and towns across the UK requires collaboration and an understanding on the potential of places outside of the greater South East to develop innovative economies. The UK's funding bodies should be empowered to distribute scientific excellence throughout the country, not abandoning the principle of investing in excellence, but taking a much clearer and more detailed view of the innovation potential of places.

CHAPTER FOUR

The Conditions Needed for Innovation to Thrive in our Cities

We have discussed the role that innovation can play in levelling up the UK economy and kickstarting productivity growth, but not the local factors that need to be in place to achieve this. In this section, we walk through the wider set of conditions that innovation needs in order to thrive in our cities and towns. These are not a set of static requirements, but rather a consideration of three interlinking sets of factors that define innovative places: Districts, Ecosystems, and the places themselves.

THE POWER OF THREE

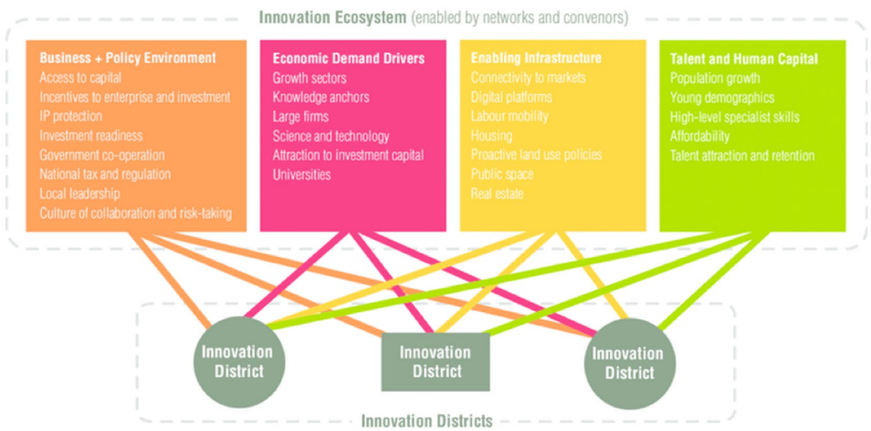
FIGURE 9. THE POWER OF THREE MODEL

Innovation can happen anywhere, given the right conditions are in place. It often occurs in an innovation district, a physical space which facilitates the clustering and the curation of innovative activity, aiding the commercialisation of research. Quite often, these are SMEs collaborating across industry or with academia. In many places the endeavour is led by business, building new ideas by utilising new or emerging technologies.

An innovation district is the environment in which businesses and entrepreneurs come together, an urban area that consists of co-working spaces, catapults, and research institutes. But an innovation district can only thrive when it is supported by a wider innovation ecosystem. This ecosystem should consist of the supportive networks, professional services, finance, and leadership that make innovation happen. While the innovation district provides the physical space and infrastructure, it is the wider ecosystem in which it operates that enables innovative activity to flourish

An innovation ecosystem refers to the wider elements which support innovation, rather than the physical infrastructure within a district itself. Figure 10 begins to explain what these elements are and how these align with an innovation district. Whether it is local leadership driving forward innovation through policy or opening up access to capital, investment and real estate, a successful innovation ecosystem directly correlates to a district's success. [59]

FIGURE 9. AN EXAMPLE OF AN INNOVATION ECOSYSTEM



Source: Peek, Gert-Joost & Clark, Greg & Moonen, Tim. (2016). Building the Innovation Economy: City-Level Strategies for Planning, Placemaking and Promotion.

[59] *Building the Innovation Economy: City-Level Strategies for Planning, Placemaking and Promotion, Peek*, Gert-Joost & Clark, Greg & Moonen, Tim, 2016

But having a successful innovation district and a supporting innovation ecosystem is not enough. **The wider place ecosystem** is the final element that determines the success of innovation within a city. This is about making a place attractive, a place where people want to live and work, that provides a leisure and cultural offering with the physical and social infrastructure that attracts and retains workers.

This is not easy. Creating an innovation rich place with the right institutions, networks and business takes time, leadership, investment, and commitment from public and private sectors to one vision. Understanding place is an essential part of this but curating an innovation ecosystem to support a complex innovation district is equally important. Each of these elements is a cornerstone of innovation; places must consider all three if the levelling up agenda proposed by the Government is to be achieved.

How a place functions, its connectivity, heritage, and local skills base must be central in any innovation agenda. Before creating any type of innovation district, there must be an understanding of a place's characteristics and its industry. Manchester and Cambridge took heed of their research-intensive universities to do this, whilst Eindhoven harnessed its existing assets of education and business to focus on technological development. Places that understand their existing strengths have paved the way for successful innovation ecosystems.

FINDING OUT WHO YOU ARE

"What is your world class institution? Who are your leading businesses? What are you really good at?"

These are questions inherent in most academic calls for funding, commercial sales pitches and the recent Science and Innovation Audits. They nearly always elicit a chorus of replies from researchers, yet in many cases these responses are unlikely to be relevant to the purpose behind the question. The question should help academic, industry and civic leaders to consider what knowledge there is within an area that either does, or plausibly could, form part of the core strengths for commercial exploitation. Getting to a group of often cognate, corporate, and academic strengths is the first important step, but it takes further quantitative research and hard-headed judgement to arrive at a viable answer. Very few places have done both, yet without this step, much else that follows in this section of the report is based on little more than guesswork.

INNOVATION DISTRICTS

Creating a new innovative environment in a place is hard; knowing how to properly support and maintain it is even harder. Places struggle in understanding what the right conditions are to do this, it isn't about throwing money at a solution nor is it constructing expensive buildings that have no clear purpose. One solution that offers a step towards understanding how to grow this environment is found in well curated innovation districts.

These innovation districts are a combination of entrepreneurs, academia, start-ups, open workspaces, and private sector industries predominantly operating within an urban area. At the heart of an innovation district is an anchor institution, usually a university or knowledge driven business, with a clear vision in how to drive forward research and development.

This anchor institution not only facilitates innovation through open collaboration and workspaces, but also in attracting businesses and entrepreneurs alike to work within the boundaries of the district. We have seen the role of Boston Massachusetts Institute of Technology in creating an explosion of spin-off companies and entrepreneurs whilst, at the same time, attracting private sector firms. We must learn from this in the UK, quality of investment, quality of leadership and absorptive are all vitally important. Even in the golden triangle where Oxford produces quality research, it only generated 26 spin-outs in the four years up to 2014, comparatively poor when you look Stanford in the US, which created 24 in 2015 alone.[60] Transforming places and creating innovation districts needs a quality figurehead, a leading organisation which brings together key players to achieve a common goal. Without local ownership, direction or leadership, an innovation district will fail.

The agglomeration of businesses within a district, linked together through an anchor institution, creates strong networks across different economic sectors and industries that would otherwise not exist. Most importantly, it acts as a catalyst for new ideas and technological advancement. At its heart is the idea of organised serendipity: putting smart people in the same place means they will get to know one another and each other's ideas.

These linkages across an innovation district provide a catalyst for knowledge spillovers, that is, a greater exchange of ideas among individuals or businesses which stimulate technological improvements in products and services and innovation across industry. Greater innovative activity quite often leads to spillovers across a supply chain; this has been a significant influence in increasing labour productivity in British firms in recent years.[61] Some studies correlate the magnitude of spillovers directly with the amount of investment by businesses into their own R&D, further arguing that the social returns generated are equally as rewarding, if not more so, than the initial investment.[62] Either way, an innovation district not only creates strong networks internally, it affects a much wider ecosystem.

[60] *UK universities getting better at commercialising research,* Neil Tyler, New Electronics.
[61] *R&D spillovers in a supply chain and productivity performance in British firms,* Yuxin Li & Derek Bosworth, The Journal of Technology Transfer, 2018.
[62] *Cumulative Innovation and Dynamic R&D Spillovers,* David Colino, MIT

This is the primary role of an innovation district – to foster innovation by bringing together different organisations to share knowledge, develop new products and create the conditions for business growth, whether formally or informally. Innovation districts play an important role in reshaping and, in some cases, regenerating UK cities and urban areas. With a strong research core supported by both large and small companies, each with their own innovative practices, innovation districts are attracting skilled individuals into high quality jobs. A virtuous cycle is created: fast growing firms are established in a district, attracting high skilled labour which creates an environment that attracts more businesses, a mobile internal labour market that creates the diffusion of knowledge.

Innovation District Models

Research from the Metropolitan Policy Program at the Brookings Institute suggests there are three different models which innovation districts tend to adhere to:

i. *The anchor plus model:* districts located in downtowns of cities where mixed-used development is centred around major anchor institutions and a rich based of firms, entrepreneurs, and spin-offs.

ii. *The re-imagined urban areas model:* found primarily in historic waterfronts where industrial districts are undergoing massive transformation, driven by new housing and research infrastructure, attracting start-ups and SMEs.

iii. *The science park model:* these are in suburban, out-of-town complexes where there are significant amounts of space to develop testing and manufacturing facilities.[63]

Each model has its own advantages and drawbacks but more importantly, rather than solely thinking of the infrastructure of the district itself, there must also be consideration given to the connectivity to the wider place. Researchers for the Metropolitan Policy Program have studied the rise of innovation districts and have identified several place-based dilemmas that contribute to the development of underwhelming or disappointing districts; a common theme is the lack of connectivity.

This connectivity refers to the physical proximity of people working but also the absence of a shared vision for people to strive towards. Ensuring institutions are aligned, well-connected and near each other to initiate collaboration is essential. Without connectivity, there is no cross-sector collaboration, hindering one of the main functions of the district.

[63] *The Rise of Innovation Districts: A New Geography of Innovation in America,* Bruce Katz and Julie Wagner, Metropolitan Policy Program at Brookings, 2014.

Ideally, innovation districts should be easily accessible to residents, located in areas which are attractive to work in, with a vibrant leisure offering and connected to the wider place by efficient public transport. The offer must be enticing to both industry and labour, in terms of appropriate workspace and the work environment itself.

There are caveats. Constructing a new building in the centre of a city does not guarantee success. Making changes too rapidly, creating infrastructure unaligned with local industry needs or replacing historic buildings with shiny but jarring structures, can be detrimental to a place. Innovation districts are heavily dependent on where people want to live and work, controlled by economic, cultural, and demographic forces. To create an innovation district which attracts business and entrepreneurship, it must be suited to their needs, rather than something which ultimately results in the erosion the character of a place.

A successful innovation district will have considered various elements of place: location, connectivity, identity. These districts are built on the existing localised economic strengths, tapping into local industry, heritage, and academic expertise, harnessed by a strong anchor institution at its core. For places looking to cultivate a new innovation district, existing work on local industrial strategies, Science and Innovation Audits, and smart specialisation are important here; places must identify their strengths and specialisms.

The Role of Higher Education

As discussed elsewhere in this report, an anchor institution tends to be situated at the heart of the district. This is a university, research body or knowledge driven business bringing together other fundamental institutions to ensure its continued success.

Universities play a critical role in many innovation districts, acting as an anchor of knowledge, skills and funding while providing the physical infrastructure in which research and collaboration can take place. These centres create entrepreneurship through assimilating students into technology or start-ups during their academic career, playing a prominent role in localised economic development.

By providing students with access to high-tech lab and workspaces, alongside opportunities to work with industry, universities can build the skills and talent pool to support innovative practices in research institutions and industry alike. Higher education plays a key role in this; however, curriculums must be modernised in order to provide the appropriate skills that industry needs.

While the presence of a university can be highly influential in driving R&D, it is much more beneficial to have more than one anchor institution operating within a district, such as a research-intensive industry leader. Universities often instigate this, bringing together private and public sector bodies via informal networks and knowledge transfer partnerships.

Universities are constantly developing partnerships with world-class companies, foundations, and research institutions to transfer knowledge and enable collaboration with the private sector. The value of this cannot be understated; the European Commission has recognised this, doubling down on university-industry partnerships via the European Institute of Innovation and Technology, releasing more funding for university R&D.

If places are unaware of who can act as their district leader, looking towards their higher education institutions can be a perfect start. This is currently happening in Newcastle. After recognising the city's existing public sector strengths in healthcare, a new partnership of Newcastle University, the city council and Legal & General has formed with the intention of establishing a new innovation district in the heart of the city.

Newcastle, UK

Despite the city's obvious advantages, its industrial heritage, architecture, and cultural and sporting reputation, Newcastle's economy lags behind many other core cities. It has lower productivity, lower levels of exports, lower wages and higher numbers of people claiming welfare than many of its peers.[64]

With a determined focus on innovation, Newcastle aims to revive its economic performance by transforming one of its former industrial sites into a centre of collaborative, cross sector activity. The Newcastle Helix, built on the site of the former Tyne Brewery located by St James's Park football stadium at the edge of the city centre, is a new innovation district in the heart of Newcastle, designed to transform the district into a science and research hub.

Developed by a partnership of the city council, Newcastle University and Legal & General, Helix's purpose is to bring together multiple disciplines in one district of the city, allowing researchers and businesses to collaborate informally and subsequently commercialise ideas. Businesses are provided with lab space and research infrastructure, giving small businesses access to high-end facilities where they can develop new ideas and test their business models. The project is one of the largest urban regeneration schemes of its kind in the UK which will eventually create more than 4,000 jobs, 500,000 sq. ft of office and research space, and 450 new homes.[65]

Helix is a deliberate attempt to use the strengths of Newcastle and the surrounding region's public sector to push innovation that benefits economic growth but also delivers civic benefit. The North East is home to the UK's largest research active public health system, providing a research base from which entrepreneurs and small businesses can build new commercial enterprises. This is reflected in the makeup of the site itself, whose flagship building is

[64] *So why isn't Newcastle booming?* CityMetric, 2018.
[65] *Legal & General break ground at Newcastle,* Newcastle City Council, 2018.

the Biosphere, a life sciences innovation centre and laboratory space where researchers can commercialise life sciences research. These in turn can find applications for their products in the local health system.

The site also houses the Lumen, the largest city centre office building with private sector funding to be constructed in the last decade, three national innovation centres, offices, lecturing facilities for the university, and residential buildings, all based in large and green public squares. This will transform Newcastle's city centre, relocating business activity in the urban core, which has lost out in the last decades to out of town business park developments. As this comes to completion over the next year or two, and as the offices start to fill up, the next challenge is curating the area to bring the excellence from the new buildings out into common spaces, for retail and leisure opportunities that create the agreeably organized serendipity discussed earlier.

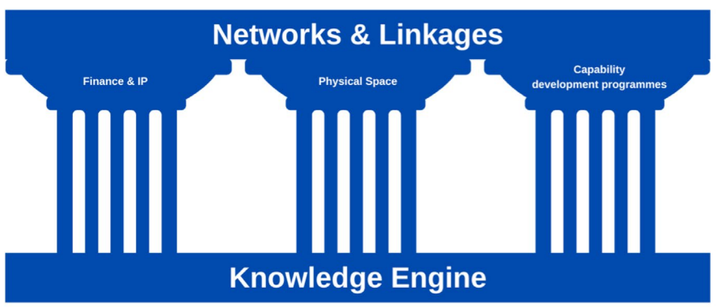
THE INNOVATION ECOSYSTEM

The Cambridge Model

Successful innovation districts are often associated with established innovation ecosystems – these ecosystems are characterised by the fuel of innovation: supportive capital and talent development programmes, the informal networks, formal institutions, and supporting programmes which provide the wraparound support that encourages growth, knowledge diffusion and innovation between businesses, academia and research institutions.

The evidence and recommendations from the Cambridgeshire and Peterborough Independent Economic Review set out an innovation ecosystem model, designed by David Cleevely and Andy Neely.[66] The model outlines what clusters of innovation need to grow, how they can be supported and how an innovation ecosystem should be unique to each place.

FIGURE 11. THE CPIER INNOVATION MODEL



[66] *Cambridgeshire and Peterborough Independent Economic Review,* The Cambridgeshire and Peterborough Independent Economic Commission, 2018.

The Knowledge Engine

Positioned at the base of the model, supporting the three pillars of innovation, is the knowledge engine. Innovation ecosystems need knowledge engines that drive development, acting as fuel or power for innovation at the heart of an innovation district. This is usually a leading organisation, whether a public institution, a business, or a university.

Often, the knowledge engine is largely research focused, hosting an experienced set of researchers and people with the expertise to exploit opportunities in their field. The knowledge engine acts as a hub for talented and highly skilled people, attracting them to one place, providing the right resources to undertake high quality research. This creates a localised labour pool that businesses and institutions outside of the knowledge engine can extract talent from, producing a healthy foundation for an innovation ecosystem to develop.

In many places the engine is a university, but it can also be a major inward investor looking to build a supply chain or an existing core of specialist businesses, perhaps with historical roots, to build out from. The key point is that the base engine must be anchored in the area, embedded into local heritage, talent pools, businesses and capitalising on local activities that will provide the basis for further innovation.

Finance & Intellectual Property

The knowledge engine can draw in the talent, whether researchers or entrepreneurs, but in order to develop their ideas, each of them requires capital. No matter how efficient a place is at producing people with brilliant ideas, without the right resources, commercial opportunities, product development or spinouts cannot emerge. To grow an entrepreneurial ecosystem, there needs to be a source of capital that businesses can access at every stage of their development. In successful ecosystems like Silicon Valley and Cambridge, there are large support groups of investors, from angel investors to venture capital funds, who vet ideas and create an environment where ideas can develop from a lab into commercialised products.

Most places have potential investors, but few understand the way technology and science investment work and fewer still have the risk appetite to invest. The caveat to this is that it does not take many to make a difference. It seems likely that the capital generated from the sale of Skyscanner, based in Edinburgh, to Chinese buyers for $1.7bn, will provide seed capital and know-how to the next generation of tech entrepreneurs in lowland Scotland. It is better that finance and stewardship comes from local sources, but where that isn't an option, places need to find ways to substitute local investment to come from working with those in other places. Oxford Sciences Innovation (OSI) has raised over £600mn for investment in the start-ups and entrepreneurship emerging from the city and its

universities, providing vital funding for science ventures at an early stage, but also the mentorship needed to help engineers and scientists succeed in business. It may be easier for Oxford than for other cities to raise funds on this scale, but every city has capital, and in most, a far bigger role could be played by local pension funds in backing investment in innovation and catalysing the development of innovation ecosystems.

This is not only a matter of funding but a matter of intellectual property. Start-ups and spinouts need to be able to protect their intellectual property – either through traditional means, such as trademarks and patents, or by scaling their business quickly. Mentoring is crucial in this; entrepreneurs need help in finding the right people to back an idea and advice on how to make a success of a start-up business. If the right finance and IP structure exists, an entrepreneurial environment with clusters of scaling, innovative businesses can begin to develop.

Physical Space

Alongside funding streams, start-up businesses and entrepreneurs need space to work and grow; co-working spaces and incubators are often central to the success of innovation ecosystems. The clustering of businesses and entrepreneurs and the melding together of different sectors and disciplines is what supercharges innovation. This is why space is so important to an innovation ecosystem.

Entrepreneurs require space and access to technology for testing and developing their products and to bounce ideas off their peers and socialise amongst other like-minded individuals. As a business develops, it needs space to scale. However, businesses in early stage development rely on the connections they have built up over the years to continue progressing, which means location is important. Innovation ecosystems must have the space to attract and scale business. This path from start-up to growth is crucial.

Research has also indicated the need for the right type of space. For instance, start-ups that have access to incubators, accelerators or co-working spaces have been found to be more likely to survive and grow than those that are not part of a formal programme.[67] While there are obvious variations in the type and the quality of these programmes, more often than not the businesses that have access to the physical spaces designed to support their growth and deliver funding, experience greater levels of success than those outside of those programmes. In Oxford, L&G's £4bn investment in science parks and accommodation in partnership with the University of Oxford is an investment in innovation, providing the space for the city's researchers to develop businesses.[68]

Important too is grow-on space. Several of the cities we know are acutely aware that this is a limiting factor for them. Places we have worked with, Brighton, Edinburgh, Oxford, Reading, all have identified grow on space as something that is preventing exciting businesses from advancing to the next stage of their progression. This is clearly not a London specific issue; it is a national issue. The ecosystem in which businesses start and grow is critical to their success. Moving out of this ecosystem to be able to scale, particularly at an early development stage, not only creates major cost ramifications that companies cannot necessarily afford but also moves away from the important networks that have aided the growth of the business in the first place. Places must be able to provide the space to achieve healthy and successful business growth.

Others are also concerned that there is too big a gap between the relatively flexible terms on offer in incubators and science parks and the rigid letting practices prevalent in many commercial office markets. Fifteen-year leases for fixed premises are unlikely to be fit for purpose offers for many tech and science businesses. Property development managers should be prepared to flex traditional business models when thinking about innovation districts and portfolio investment, exploring commercial offers that work for them as a business but are flexible enough to work for start-ups and scale-ups from a variety of sectors.

Capability Development Programmes

The final pillar is capability development programmes, providing industry with the tools necessary to scale. Not every innovator is the right person to set up or manage a company and a greater number need help in order to grow. As businesses grow beyond an original idea and begin to expand their product portfolio, they discover the need to specialise. With this comes the recruiting of new employees with different talents alongside upskilling current staff that will help gain a competitive edge.

For businesses to upskill at speed, they need programmes and initiatives to support them in their local area. These are designed to support businesses in specialising, advising on how to improve their product offering, run their business more effectively or open up opportunities to use new technologies. With the right business schools, specialist technology centres and business incubators, aspiring businesses have the tools available to thrive.

Networks & Linkages

Sitting on top and tying all these factors together is the final element – networks and linkages. Informal connections between people from different organisations, often including investors, helps strengthen the ecosystem. These relationships between people bring new perspectives and ideas to larger businesses and financial support and practical advice to the smaller ones. Networks bring the community together in a place, where aspiring entrepreneurs can meet the right people who can support them to grow while larger businesses can connect with

[67] *The impact of business accelerators and incubators in the UK,* BEIS, 2019.
[68] *L&G and Oxford University team up for £4bn housing scheme,* The Guardian, 2019.

smaller, more flexible companies to work together on joint ventures. At their best, as seen in Cambridge, they can become powerful advocates for the place, helping to secure investment and other support to grow the knowledge economy.

CREATING AN INNOVATION ECOSYSTEM

The model presents a theoretical viewpoint, we can also look to practical examples where places have achieved this. Creating an innovation ecosystem is extremely difficult, requiring all the elements above and the right leadership to achieve it. However, in some rare cases, places can naturally become a breeding ground for innovation. Berlin is one such example, evolving from a popular tourist destination for young expats into one of the most sought-after destinations for innovative start-ups in Europe.

Berlin, Germany

Berlin, almost out of nowhere, has become one of Europe's most active start-up hubs. Between 2012 and 2016, the number of start-ups shot up, more than doubling in size from 270 to 620; [69] today, 17% of Germany's start-ups and 42% of Germany's start-up jobs are in Berlin, around half are in the digital sector.[70] In addition, Berlin hosts the greatest concentration of university and institutional research facilities in Germany.

However, unlike Germany's other major cities, Berlin does not have a history of economic success, either as an industrial or a white-collar city. This makes its development in recent years all the more dramatic, as its technology and innovation economy has shot up from a low base. So how has an innovation ecosystem seemingly developed out of thin air?

Since the demolition of the Berlin Wall in 1989, Berlin has been reinventing itself as a technological hub, aided by Germany's national innovation policy, the prioritisation of R&D funding and recent venture capitalist investment. For decades Berlin's counterculture has attracted young expats to the city and now, with the low living costs and significant investment it is more popular than ever. It was only a matter of time until companies took notice and took advantage of such an opportunity.

With Factory Berlin, a co-working space and campus for businesses and start-ups in the heart of the city and the Silicon Allee campus, the city has innovation infrastructure in high demand by ambitious tech start-ups. This led the charge in creating high quality co-working spaces that support collaborative environments. Elsewhere, innovative multinationals including Audi, Siemens and Google, set up teams to hunt out talent, new ideas and acquire start-ups. In 2012, Google began supporting Factory Berlin, citing Berlin's creativity and openness as reasons for its investment.[71]

Tesla's recent announcement that it would be building a major assembly plant just outside of Berlin epitomises the transformation of the city. Shunning Germany's existing car industry and manufacturing expertise in the south, Tesla has gravitated towards Berlin's innovative environment, young demographic, and software focus.

Driven by national and private sector investment, Berlin now stands as one of the hottest cities in Europe for start-ups, hosting high-quality workspace and exciting innovative companies. The investment, workspace and support given to businesses demonstrates how an innovation ecosystem can be built effectively given access to the right tools.

However, this type of development cannot happen everywhere and requires an essence of luck. Conversely, Coventry and Warwickshire built on its industrial heritage and existing sector strengths to create an innovation ecosystem around automotive manufacturing.

Coventry & Warwickshire, UK

Following the country's deindustrialisation in the 1970s, Coventry, a longstanding centre of the UK's automotive industry, was hit hard. By the 1980s there were only two assembly plants left in the city, illustrating the harsh impact of an economic restructuring. Similarly to Eindhoven, policy aimed to support the area as it experienced major company downsizes, minimizing the capital wastage and loss of talent.

In the early 2000s the multinational Tata group purchased Jaguar Land Rover (JLR) and set up in Coventry. This investment expanded the company's R&D and design activities, reviving automotive production in Coventry and Warwickshire. This has since resulted in the development of one of the UKs long-standing automotive clusters, with Aston Martin Lagonda and the London Electric Vehicle Company since locating in the area.

This cluster is focused on innovation, particularly in automation, low emissions and design, accounting for 10% of employment in the local economy and 10% of all UK automotive manufacturing. JLR are a key player, utilising entrepreneurial knowledge for product development and investing in technological research.[72]

This is further bolstered by Coventry and Warwick universities, which apply their research to commercial innovation in the city, alongside Catapult investment. The Warwick Manufacturing Group in particular is a key institution in transforming research into commercial innovation and is central to facilitating interactions between engineering research and industry leads.

[69] *How Berlin Rose Up to Become Europe's Startup Hub,* Maxi Knust, 2018
[70] *Booming Berlin,* Institut für Strategieentwicklung, 2016; *Berlin Startup Monitor,* 2018.

[71] *Ladehemmung in Deutschlands Start-up-Hauptstadt? Dominik Reintjes,* Wirtschaftswoche, 2019.
[72] *UK Regional Productivity Differences: An Evidence Review,* Robert Zymek and Ben Jones for the Industrial Strategy Council, 2020

A consequence of this automotive cluster saw the UK Government awarding a consortium of local government and key institutions £80m in 2017, setting up the UK Battery Industrialisation Centre in Coventry. This created a new national facility to push forward battery manufacturing development, further solidifying Coventry and Warwickshire as the centre of manufacturing and automotive expertise in the UK.

Coventry and Warwickshire serve as a firm indication of how building on a place's industrial heritage can be a foundation for growth. It represents how a knowledge engine combining private sector industry, public investment, and higher education, can drive forward innovation, attracting further investment from public and private sector alike. Bolstered by university involvement, Coventry and Warwickshire is now one of the UK's hotpots for investment in innovation and R&D in automotive manufacturing. This isn't unique to the Midlands. As this report was being finalised Bruntwood SciTech concluded a deal with Liverpool to take a 25% stake in the company that runs Liverpool Science Park, a move which will bring capital and the know-how developed in cities across the country to the developing innovation ecosystem in the city.

PLACE ECOSYSTEM

Much of the literature we have referenced heralds the importance of innovation districts as driving forces of innovation. Innovation ecosystems are widely recognised as important entities and are not a unique or new creation, common across public policy and academia. However, the importance of place to growing successful innovative environments has received much less attention.

Innovation districts within supporting innovation ecosystems constitute primary elements of success, but the identity of the place is vital in the early on ongoing development of these ecosystems. An innovation district or science park created in isolation, and which ignores the attractiveness of its place, is going to struggle.

Many of those in charge of innovative companies have a great deal of choice as to where they operate, requiring access to international labour and capital markets in order to be successful. It matters that the location they choose will not only benefit them as a business, but it is a place that their employees are prepared to live too. Places need to make themselves attractive to skilled people, to make them want to live and work there. Places that are seen as aspirational and upwardly mobile will attract bright, skilled, often young people as they are seen as attractive, stimulating places to be. An analysis of workforce composition in US cities shows that innovation thrives where STEM workers and creatives - such as artists and performers - mix. Cities, as sites of varied economic activity, are places that can host this productive mixture and through it support innovation.[73] Such places will also then do a better job of retaining the graduates who study at their universities, as there are the jobs available that the graduates want to do alongside the environment that they want to live in.

This is a set of new elements to consider: the housing offer has to be right in quality and price; education for their children is an important factor, as is the concentration of amenities and open spaces; and the quality of the leisure and cultural offer. Of course, these issues matter for everyone, but if a place wants to attract and retain people who can choose anywhere to live, they need to be 'sticky' for businesses and workers. This means we must consider the identity of the wider place – the place ecosystem.

Funding, whether public or privately sourced, should be based on evidence, track record, and absorptive capacity. Successful innovation will be built on the economic strengths and skills base of a place, as we've seen in places like Coventry and Warwickshire.

Places must understand what their specialisms are first if they are looking to become the next innovation hub of the UK. Currently, work in Local Industrial Strategies and previously on Science and Innovation Audits is a step towards that, but local leaders must work with local industry and take ownership of driving forward what they want their place to be known for.

Towns and cities which have formed a successful, functioning innovation ecosystem will see it grow to eventually become part of the identity of the place itself. As places become more successful in both an innovation and economic sense, they become known for that success, which in turn entices both businesses and people to the culture and environment. There are transformative benefits for the broader economy and productivity in the places that take this approach. The knowledge spillovers and the culture stemming from innovative activity, further encourages industry and human capital to gravitate towards a place, wanting to become part of its success.

Considering the wider place ecosystem in conjunction with the innovation ecosystem during development, can be paramount for success. Creating innovation in a place isn't about creating a shiny new build in the middle of a city centre; it isn't about spontaneously choosing a sector for your place to become world class in. It is about understanding the identity of the place first, its culture, heritage, economy, skills, people, networks, infrastructure, and the need to build something different from what exists already. This is the most effective way to establish an innovation district. With the buy-in of existing people and anchor institutions, the wider innovation ecosystem will flourish.

[73] *Hipsters vs. Geeks? Creative workers, STEM and innovation in US cities, Andrés Rodríguez-Pose and Neil Lee, 2020*

Innovation and Inclusive Growth

Whilst the place ecosystem creates the right conditions for innovation to thrive, this cannot and should not be a one-way transaction. Innovation can be marshalled to help address local challenges. The presence of new institutions will likely be focused in part on strengthening relationships between academia and industry – with the knowledge engine acting as the hub for skilled researchers and businesses. But it has the potential to impact far wider than this across the whole economy of a place, reaching a far wider set of people (and potential innovators) in the process.

This could include inviting the foundational economy in to access the facilities and expertise, generating new opportunities and technologies to advance process and product development. An innovation skills strategy – spanning traineeships, work placements, apprenticeships, education visits and higher-level qualifications – can widen participation by being inclusive to local residents. There is a great opportunity for the levelling agenda to influence local skills and talent – diversity is good for growth and innovation ecosystems must have one eye on an inclusive approach. A place can set local inclusive innovation challenges, opening up data and problems to which the innovation community design new solutions.

We have yet to find a successful innovation ecosystem in the UK which has managed to transfer the benefits of innovation to deliver inclusive growth, but there are some examples that places can build from. The societal challenge-based approach of the Industrial Strategy Grand Challenges and missions provides an interesting format. There are accelerator programmes which focus on societal challenges. In Auckland, the innovation precinct in Wynyard Quarter have been increasing their efforts to leverage the investment in the precinct to support the wider inclusive growth agenda. Specific initiatives include Digmyidea, an innovation challenge launched by the city's economic development agency to encourage the growth of Māori tech entrepreneurs.[74] And there are cities – such as Chicago – who have opened up their data to encourage creative solutions to public service transformation.

We recognise that innovation ecosystems risk sitting in a bubble within their place, characterised by highly skilled people who work and socialise together. This can mean that there is relatively little involvement with the people outside of their institution, start-up, or social group. High value businesses do generate jobs for those on lower incomes, but these may be lower skilled, paid or without clear career pathways which require higher level STEM qualifications.

This paper is about complementing the successful and innovative cities and towns of the UK through innovation policy. It would be a bitter irony if, in doing so, we further entrench inequality in newly successful places. Creating a successful innovation district is as much about place-making in a more holistic sense as it is about creating a successful innovation ecosystem. It can deliver jobs at every level of the economy and reset local opportunities for all.

Our suggestion to places who are considering their innovation path is to consider how to make this inclusive from the outset. Impact is frequently measured in terms of jobs added, but who is getting these jobs? Are they benefiting local communities and residents? Innovation, we've shown in this report, is a major factor in productive growth, increasing the number of quality jobs and wages within an area. We also believe this can be inclusive, productive growth.

[74] *Innovation and inclusive Growth — an imperative for cities,* MartinJenkins, 2019.

CHAPTER FIVE

Checklist for places

Developing your innovation district

- ☐ The innovation offer may not be what people think. Have you agreed locally your strengths and specialisms? Is this an accurate representation that has been developed through a science & innovation audit, local industrial strategy, or smart specialisation research strategy?
- ☐ Innovation Districts are generally tightly bound places with knowledge assets at their centre. Do you have a physical space which you identify as your Innovation District? Does it function as an Innovation District?
- ☐ Innovation Districts do not usually exist in isolation. They feed off other things around them. How accessible is your innovation district – is it well connected to the rest of your urban areas via national/international transport?
- ☐ Not all Innovation Districts are the same. All need a fit for purpose property offer. What type of space is available in the Innovation District? Do your knowledge assets have what they need? Do they have more than they need? Have you got the space for: Start-ups? Grow on space? Labs? Office space, including space for scale-ups?
- ☐ Does the Innovation District have room to expand – what space can you identify for future growth?
- ☐ Assuming you're at this stage – do you have a brand for what you're doing? Does it capture what the Innovation District is and wants to be? Are you publicising your Innovation District – would visitors know what it is and recognise it as valid?
- ☐ Do you know who the anchor institutions are in the Innovation District other than the obvious knowledge asset(s)? What do they need? What can they offer? Have you asked them?

Cultivating the innovation ecosystem

- ☐ Do you understand your knowledge engine? How would you define it? Does this give you a sense of its key dependencies and what's needed to sustain it/ them?
- ☐ Innovation Ecosystems have networks that reach beyond the district. These can take different forms. What innovation networks exist in your place? Could they be stronger? Do they need your support to strengthen?
- ☐ Can businesses get access to the right sorts of capital and skills including IP protection? Are you sure you know? Have you asked businesses and lenders?
- ☐ Is your innovation support and capability development offer working well? What is local uptake like?
- ☐ What % of your start-ups have high growth potential? Do you know who your scale up companies are and what their requirements are to grow?
- ☐ What is your area's track record on innovation related bids – for example, Innovate UK? If it is not as strong as others, why? What do you do about it?
- ☐ What % of national R&D spend is invested locally – how & where? If it is not as strong as others, why? What do you do about it?

Understanding the place ecosystem

- ☐ Where does innovation feature within your overall agenda?
- ☐ However big or small, what is your narrative? Is it both plausible and bold?
- ☐ Who monitors progress and makes decisions about economic growth priorities and funding? What do they know about innovation? Do you need to broaden your skill base?
- ☐ What are your priorities around attracting and retaining talent and skills?
- ☐ What does success look like for you in innovation? Do you already link it to social policy objectives?

CHAPTER SIX

Recommendations

This analysis has shown that the UK must reform innovation policies if it is to remain a world leader in science in innovation. To this end, we propose that any reform should make a demonstrable contribution to achieving the following outcomes:

- Add to the UK's world leading excellence in fundamental science research with a more robust programme of translational research. This should improve our national performance in the commercial application of ideas, with a real impact on productivity performance.
- Address the reluctance of too many UK firms to take on innovation activities by encouraging reform of business models and processes.
- Ensure the distribution of scientific research and innovation activity more accurately reflects the distribution of potential around the country, providing towns and cities with the tools to deliver it.

The following recommendations have been written in light of this approach.

TO THE GOVERNMENT

The Government's commitment to raise R&D spending to 2.4% of GDP by 2027 is welcome, but without support for places to develop their innovation ecosystems, meeting the target will still miss the point. Within 20 years, each region should have world class research infrastructure that this is feeding into growth throughout the country. This will take time, commitment and collaboration between organisations and funding bodies towards the same goal.

- Establish translational research infrastructure which capitalises on local strengths and opportunity. Funding must be accompanied by support to increase the absorptive capacity of places, using Government investment to work with SMEs and anchor institutions.
- The Government must review existing innovation infrastructure, starting with Catapult Centres, to ensure that it is working for business and places. Hermann Hauser has twice been asked by the British Government to review this issue, and should be asked to look again and be joined by some of Jürgen Maier's standing - the recently retired Chief Executive of Siemen and, an industrialist with international experience to ensure that globally leading research translates into business.
- Government and UK funding bodies should collaborate to achieve the goal of levelling up, and funding bodies should be empowered to distribute scientific excellence throughout the country. This should not abandon the principle of investing in excellence but take a much clearer and more detailed view of the innovation potential of places outside of our research hotspots. This should include, but not be limited to, reform of Green Book appraisal methodologies to enable economic rebalancing.

TO LOCAL LEADERS

The leaders of cities and towns across the country must recognise the central importance of science and innovation to their future prosperity. To improve performance, they must take measures now to understand their strengths and address their weaknesses.

- Evaluate the local innovation strengths and areas of excellence. There is no ready-made model for success, and every town and city in the country will have different advantages and challenges to overcome. Do detailed research into science and research potential, looking at innovation performance through the lens of the power of three and identify what measures need to be taken.
- Build a coalition of willing leaders. This will look different depending on the nature of each place but should involve multiple organisations in informal and formal leadership and governance. Reach out to people who have experience in doing this and build capacity in a community of entrepreneurs, high net worth individuals, scientists and institutional investors.
- Plan for long term success. Places will need to be prepared to create big ideas and fail along the way. Be thoughtful about what analysis needs to be commissioned– research is successful only when used as part of a coherent strategy.
- Think creatively about investment. Investors are invaluable to places which require the capital to scale nascent science and innovation strengths. Major institutional investors can be more willing to invest than government in innovation. Work to create a knowledgeable investment community which understands the potential of science and innovation.
- Understand the importance of creating an attractive place to retain and attract talent, an endeavour in which schools and parks matter as much as Business Schools and Science Parks. Experiment and adopt new models for property and business space. Reach out to successful former residents, and work on the aspects of place which encourage skilled people and graduates to stay and make their lives there.


bruntwood
SciTech