The National Significance of the Cambridgeshire Autonomous Metro

Cambridgeshire and Peterborough Combined Authority

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1. Executive summary

1.1 Summary

The Cambridgeshire and Peterborough science and technology cluster leads the UK in innovation and productivity. The conditions behind this success are hard to replicate elsewhere in the UK, with Cambridge already leading the way in the UK's competition against tech clusters globally. However, local constraints threaten the region's continued economic success, and investment is needed now in the Cambridgeshire Autonomous Metro (CAM) to overcome congestion challenges, unlock housing and protect the local environment.

The CAM is much more than just a transport scheme. By connecting people and places, it will increase access to skills and unlock the continued growth and increased density of the region's strategically important tech cluster. Investing in the CAM will foster growth in high-value jobs in the UK, allow the nation to attract global talent and investment, and help ensure the UK remains competitive against fast-growing tech clusters in cities around the world. The development of the CAM also provides an opportunity to spur domestic innovation and expertise in smart transportation, which can be commercialised in growing markets overseas. This all comes at a critical time for the UK, as it seeks to position itself to maximise the opportunity – and guard against the risks – of Brexit, and to accelerate its economic recovery after the economic shock associated with COVID-19.

1.2 A leading regional economy

The Cambridgeshire and Peterborough region has a long history in innovation and is internationally recognised as being home to one of the world's leading tech clusters. The region specialises in life sciences, agri-tech, digital and information technologies, and advanced manufacturing and materials. These sectors are critical for UK prosperity, as set out in the UK's Industrial Strategy and the region's Local Industrial Strategy.

The region's tech cluster and reputation has emerged from a combination of complementary economic, historic and geographic characteristics, which are difficult to replicate elsewhere in the UK. These include the presence of the University of Cambridge, renowned for technology and science and one of the world's oldest and most prestigious universities, and the region's proximity to London, Oxford and the other UK tech clusters. These factors have enabled Cambridgeshire and Peterborough to become a net contributor to the UK economy, and a leader in five distinctive areas that contribute to its success and the prosperity of the UK:

- **A leader in high value-added science and technology sectors:** The region has the highest rate in the UK of professionals employed in professional, scientific and technical activities (13%) and in information and communication technology (5%). These sectors have high productivity and significantly contribute to national prosperity – professional, scientific and technical activities in the region contributed around £3 billion GVA in 2018 to the national economy, whilst communication and information contributed around £2 billion[1].

- **A leader in research and development:** The region leads the UK in research and development (R&D), with the highest number of jobs in R&D compared to other combined authorities in the UK. The region employs around 18,000 experts in this sector, and its share of R&D jobs in overall employment is more than ten times that in the next ranked combined authority[2].

- **A leader in innovation:** The region's highly-skilled workforce, presence of world leading high-tech businesses, and top-class educational facilities has enabled it to become the UK's leader in innovation. Cambridge city has the highest number of patent applications per 100,000 residents in the UK, at 341, compared to an average of 18 for the UK as a whole[3].

- **A leading career destination for skilled workers:** The region is internationally recognised and attracts highly-skilled individuals. Cambridge is the most highly-skilled city in the UK, with 69% of its working age

population qualified to National Vocational Qualification (NVQ) 4 equivalent and above (Higher National Diploma, Degree and Higher Degree level of qualifications or equivalent)[4].

- **A leader in local economic growth:** The region has recently experienced high economic growth, 9% between 2016 and 2018[5], faster than any combined authority area in the UK and far above the UK rate of 3.4%. This is due to its leadership in knowledge-intensive and high value-added sectors described above.

1.3 An internationally competitive cluster

The Cambridgeshire and Peterborough region is home to an internationally recognised tech cluster – the 'Cambridge Cluster' – which ranks 58th in the top 100 tech clusters globally[6]. This is despite the relatively small population of Cambridgeshire and Peterborough (around 850,000 people), which competes with leading tech clusters in Shanghai (24 million), Tokyo (14 million), New York (8 million), Berlin (4 million), Silicon Valley (3 million), and Paris (2 million). At the same time, continuous growth of other international clusters may endanger Cambridge's international standing.

To stay competitive, further build on its economic success and achievements, and support the growth of wider UK clusters that the region is connected to, it must attract even greater numbers of skilled people and continue to attract inward investment. Growth in the region, building on its history, brand, and expertise, will also complement economic growth across the UK, by strengthening its supply chains in high-value sectors.

1.4 A critical moment for prosperity

Cambridgeshire and Peterborough is at a critical moment for its prosperity. Threats to its growth, if not addressed appropriately, may result in the region's stagnation or decline[7]. Increases in house prices and congestion have already forced many out of the region, and risk its ability to attract people and investment.[8] Unless tackled, this trend will continue, further decreasing the region's ability to concentrate economic activity, and hindering the growth of its world-leading tech cluster at a detriment to the UK economy. Thanks to powers granted by central Government under the Devolution Deal, the region can now tackle these strategic challenges at a local level and remodel the economy for another period of exceptional growth in innovation, productivity and jobs in the region.

1.5 The need for the Cambridgeshire Autonomous Metro

The Cambridgeshire and Peterborough Combined Authority (CPCA) is working to overcome the risks to the region's growth by developing the Cambridgeshire Autonomous Metro. The vision of the CAM is to 'act locally, impact nationally, and attract globally'. The CAM will act locally by delivering a fast, reliable, convenient, integrated transport network made world-class by deploying the latest technologies. It will support the sustainable growth of the local economy, unlocking new homes, creating new jobs and opportunities for more people, while protecting and enhancing the environment.

However, the benefits of CAM extend far beyond the region – it will have national and global impact.
Through connecting employment sites and increasing the region's attractiveness to highly-skilled experts, tech companies and international investor capital, the CAM will make the region's tech cluster larger and more concentrated. Additionally, the first-mover benefits from the development of the CAM, including the accumulation of skills and intellectual property, could birth a new growth industry, complementing existing sectors, and offering commercial opportunities if applied to small and medium-sized cities across the globe. These factors will enable future growth of knowledge-intensive sectors, stimulate entrepreneurship activity and help Cambridgeshire and Peterborough compete with tech hubs globally, supporting greater economic growth across the UK as a whole.

Figure 1: The vision and objectives of the CAM

ACTS LOCALLY	IMPACTS NATIONALLY	ATTRACTS GLOBALLY
Improving transportation	Supporting strategically important sectors	Encouraging inward investment
Unlocking housing	Improving productivity	Attracting experts to the region
Facilitating local economic growth		Boosting innovation
Protecting the environment		

2. Introduction

As a transport scheme, the Cambridgeshire Autonomous Metro is proposed as a high-quality, fast, sustainable and reliable 'metro-style' transport network, which will transform connectivity across the Cambridgeshire and Peterborough region. The vision is for an expansive network that will seamlessly connect regional settlements, major city-fringe employment sites and key satellite growth areas across the region with key mainline railway stations and Cambridge city centre.

Although the CAM aims to improve local transport, support the development of new housing in the region, and improve the local environment, this report focuses on the national picture – the scope to support the region's contribution to the national economy. It first sets out the unique economic characteristics of the region within the context of the UK economy. Second, it sets out how the region links to the UK's other tech clusters, and how these sit in the context of the international economy. Third, it sets out how the region's success, and therefore the UK's success, is at risk without investment in transport infrastructure. Fourth, and finally, it explains how the CAM aims to overcome the region's key growth challenges, and how this will benefit the wider national economy.

This report comes at a critical time for the UK economy, when it is both seeking to position itself to maximise the opportunity – and guard against the risks – associated with its exit from the EU, and whilst it seeks to accelerate its recovery from the economic shock associated with COVID-19. Now is the time for concerted investment in the strategic national infrastructure of the CAM, to support the dynamic tech clusters in Cambridgeshire and Peterborough, to foster the growth of innovative activity, and to protect our nation's international competitiveness.

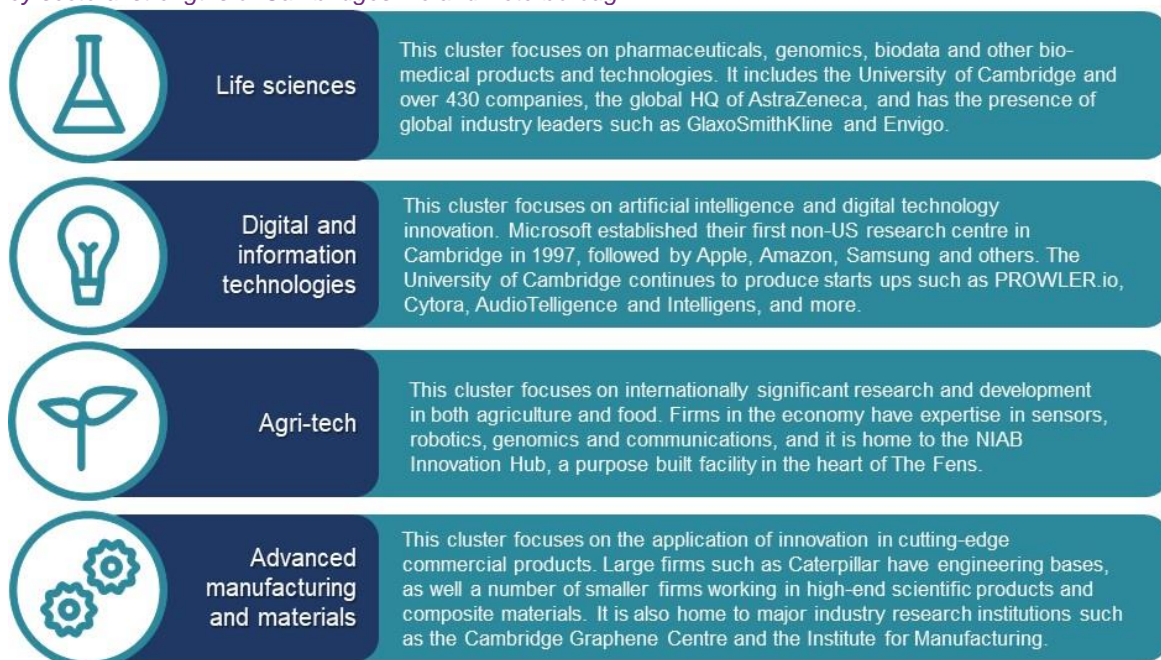# 3. Cambridgeshire and Peterborough: leading the UK

3.1 Summary

> *The Cambridgeshire and Peterborough region leads the UK economy. Behind this are a unique set of factors that cannot be easily replicated elsewhere in the country.*

The region of Cambridgeshire and Peterborough is home to one of the UK's world-leading technology clusters – a concentration of activities in strategic, high value-added industries. It also leads the nation in key factors that provide significant benefits to the wider economy: high value-added sectors; research and development; innovation; skilled workers; and local economic growth.

3.2 Introduction to the region's tech cluster

Cambridgeshire and Peterborough comprises over 4,700 knowledge-intensive firms, generating a combined turnover of £12 billion and employing 60,000 highly skilled workers. This cluster is renowned for innovation in the areas of science and technology, with four sectoral strengths in life sciences, agri-tech, digital and information technology, and advanced manufacturing and materials.

Figure 2: Key sectoral strengths of Cambridgeshire and Peterborough

Life sciences	This cluster focuses on pharmaceuticals, genomics, biodata and other bio-medical products and technologies. It includes the University of Cambridge and over 430 companies, the global HQ of AstraZeneca, and has the presence of global industry leaders such as GlaxoSmithKline and Envigo.
Digital and information technologies	This cluster focuses on artificial intelligence and digital technology innovation. Microsoft established their first non-US research centre in Cambridge in 1997, followed by Apple, Amazon, Samsung and others. The University of Cambridge continues to produce starts ups such as PROWLER.io, Cytora, AudioTelligence and Intelligens, and more.
Agri-tech	This cluster focuses on internationally significant research and development in both agriculture and food. Firms in the economy have expertise in sensors, robotics, genomics and communications, and it is home to the NIAB Innovation Hub, a purpose built facility in the heart of The Fens.
Advanced manufacturing and materials	This cluster focuses on the application of innovation in cutting-edge commercial products. Large firms such as Caterpillar have engineering bases, as well a number of smaller firms working in high-end scientific products and composite materials. It is also home to major industry research institutions such as the Cambridge Graphene Centre and the Institute for Manufacturing.

Source: Cambridgeshire and Peterborough Local Industrial Strategy (2019)

The region has a history of innovation, with its tech cluster being part of a network that contains the University of Cambridge – founded in 1209, and one of the world's leading tech and science universities that ranks fourth in the world for natural sciences[9]. The university has long been associated with many of the world's important inventions and intellectual contributions, and was a place of study for Sir Isaac Newton, Charles Darwin, Rosalind Franklin, Alan Turing, and Stephen Hawking, among others. The University has more recently 'spun out' a number of successful businesses, reflecting its important role in turning innovative ideas into leading enterprises that support the region's growth[10]. As part of a wider network of businesses, it also provides pioneering research and knowledge, building on its long and impressive history.

The city of Cambridge has had 96 Nobel Prize laureates since 1904, mostly in the fields of physics, medicine and chemistry. This includes Frederick Sanger, two-time winner of the Nobel Prize in chemistry, after who the Wellcome Sanger Institute for genomics and genetics research in Cambridge was named. Cambridgeshire and Peterborough is today characterised by an abundance of highly-skilled workers, drawn to a region that is located close to the UK's other leading tech clusters, including London and Oxford (as set out in section 4).

The factors that lie behind the region's success are multiple, and cannot be easily replicated elsewhere in the UK. The region's international 'brand' is recognised across the world, and powerful brands like these can only emerge from sustained investment over long periods of time.

What is a 'tech cluster'?

A tech cluster is a concentration of economic activity that helps to create the conditions for technology companies and start-ups to innovate, by encouraging experimentation, networking and exchange of knowledge. Tech clusters are engines of growth for high value-added sectors, and to emerge, they require a special blend of four characteristics:

- First, the region must show geographical and sectoral concentration of enterprises, specialising in a particular sector compared to other regions in an economy[11]. This is due to the fact that geographic proximity allows firms to better catalyse innovative activity, and experience faster growth[12].

- Second, the region needs a reputation for innovation, which is stimulated by the presence of universities with strong expertise in science, technology, engineering and mathematics. This allows the region to attract young people that wish to study in those areas, and later supply the local workforce with their expertise.

- Third, a region must provide their highly-skilled residents with a dynamic and entrepreneurial environment, to encourage experimentation, creation of cooperative linkages, and networking between institutions and enterprises involved in the creation of knowledge and innovation[13]. This highlights the importance of location and transport infrastructure for the development of tech clusters – they rely on quick exchanges of knowledge, requiring infrastructure to link enterprises within and outside of the region.

- Fourth, tech firms tend to grow in regions that offer high 'quality of life'. This helps attract and retain the most high-skilled experts, and requires affordable housing, local amenities and suitable environmental factors.

Investments in organisations within clusters are associated with 'positive externalities' – benefits to wider organisations in the cluster. As clusters enable collaboration between institutions and firms located in close geographical proximity, higher geographic concentration of production results in a greater propensity for innovative activity, leading to wider economic benefits[14].

3.3 The region's economic leadership

With the development of its tech cluster, the region of Cambridgeshire and Peterborough now leads the UK in five critical areas that provide benefits to the wider national economy. These are: high value-added sectors; research and development; innovation; skilled workers; and economic growth. These factors further enhance the region's tech cluster and enable it to develop further.

A leader in high value-added science and technology sectors

The Cambridgeshire and Peterborough economy is highly productive, with Gross Value Added per job of around £52,200[15], and it leads the UK in the sectors of professional scientific and technical activities and information and communication. As of 2018, 13% of the region's workforce was employed in professional scientific and technical activities – the highest rate of any combined authority in the UK. 5% of the region's workforce is employed in the information and communication sector – also one of the highest rates in the country – across over 3,000 information technology and communication companies active in the region.

Figure 3: Share of employment in professional, scientific and technical activities and information and communication by Combined Authority in 2018
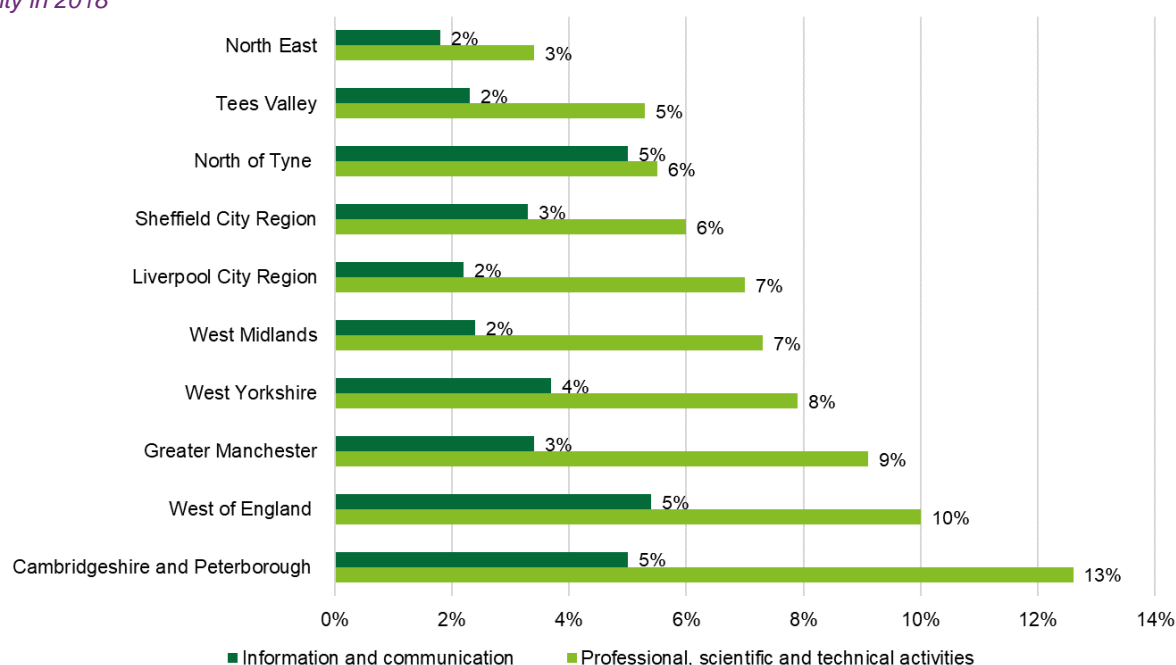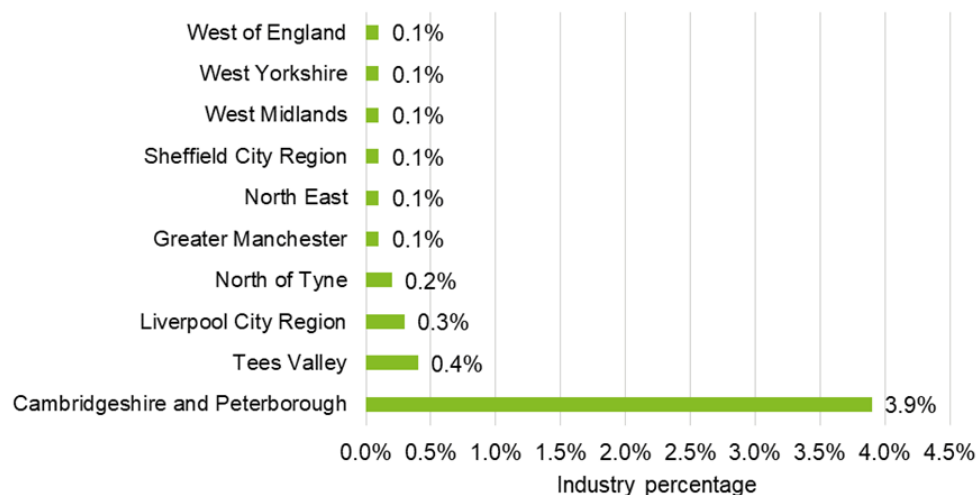

Source: NOMIS, 2018

These sectors are highly productive – the region's professional, scientific and technical activities contributed around £3 billion GVA in 2018 to the national economy, whilst communication and information contributed around £2 billion[16]. This helps explain why the Cambridgeshire and Peterborough region is a net contributor to the UK economy in terms of its business rates balance, with a net contribution of £58.6 million in 2016/17[17]. The region also sits within the East of England, which is one of only three regions in the UK that are net contributors to the overall UK public sector fiscal balance (along with London and the Southeast). The other nine regions all have a negative net public sector balance[18].

A leader in UK research and development

Cambridgeshire and Peterborough leads the UK in research and experimental development in natural sciences and engineering (here also called R&D in life sciences)[19]. R&D constitutes a key part of professional, scientific and technical activities, explaining why around 4% of the region's workforce is employed in R&D activities, which is almost ten times the rate of the combined authority ranking second in this category – Tees Valley.
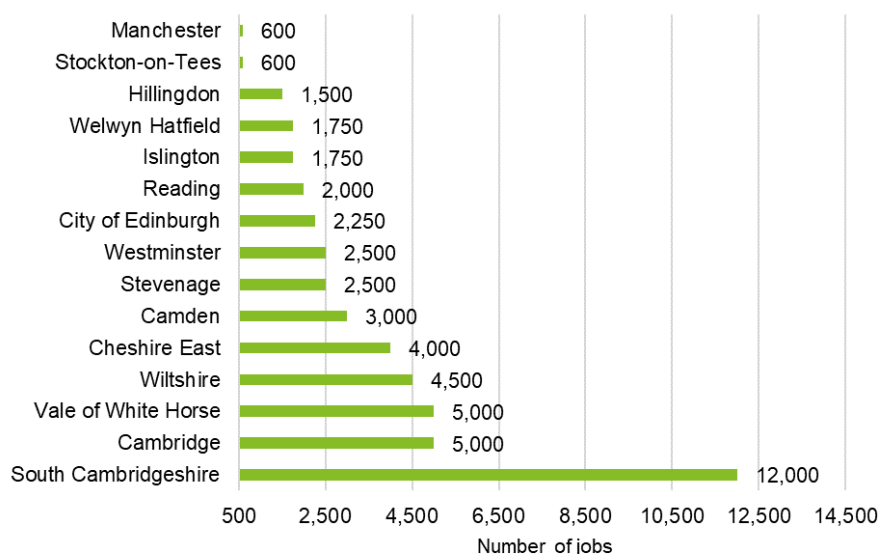

Figure 4: Share of employment in research and experimental development on natural sciences and engineering (R&D) by combined authority in 2018

Region	Industry percentage
West of England	0.1%
West Yorkshire	0.1%
West Midlands	0.1%
Sheffield City Region	0.1%
North East	0.1%
Greater Manchester	0.1%
North of Tyne	0.2%
Liverpool City Region	0.3%
Tees Valley	0.4%
Cambridgeshire and Peterborough	3.9%

Source: NOMIS, 2018

The Combined Authority region has approximately 18,000 R&D jobs, with 17,000 R&D experts across both South Cambridgeshire and Cambridge. It makes Cambridgeshire the most prominent location for R&D across all areas of the UK.

Figure 5: 15 UK regions with the most jobs in research and experimental development of natural sciences and engineering in 2018


Region	Number of jobs
Manchester	600
Stockton-on-Tees	600
Hillingdon	1,500
Welwyn Hatfield	1,750
Islington	1,750
Reading	2,000
City of Edinburgh	2,250
Westminster	2,500
Stevenage	2,500
Camden	3,000
Cheshire East	4,000
Wiltshire	4,500
Vale of White Horse	5,000
Cambridge	5,000
South Cambridgeshire	12,000

Source: NOMIS, 2018

A leader in UK innovation

The region is one of the most innovative in the UK. Patent data is a widely used as an indicator of innovation, and in 2015, Cambridge had the highest number of patent applications per 100,000 residents in the UK. In that year, the city submitted 341 patent applications – almost three times more than the next leading city of Coventry (118 applications published per 100,000 residents). Cambridge exceeds other tech clusters, such as Oxford, where there were 80

patent applications per 100,000 residents in 2015, and far exceeds the UK average of 18 patent applications per 100,000 residents.

Figure 6: 10 UK cities with the highest number of patent applications published per 100,000 residents in 2015
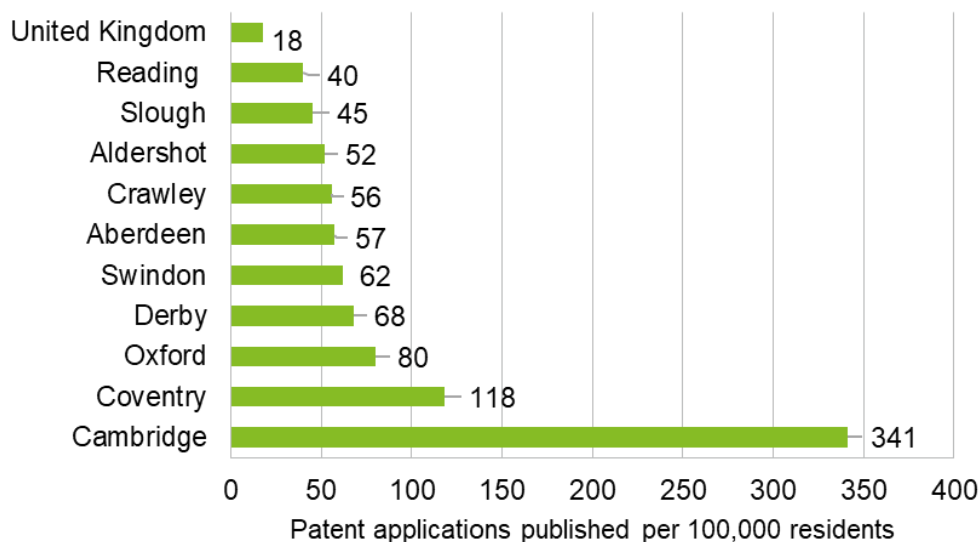
Source: Cities Outlook 2017[20]

A leading career destination for skilled workers

As of 2018, there were approximately 853,000 people living in Cambridgeshire and Peterborough. The region is characterised by high levels of economic activity and low unemployment. Around 80% of the region's working-age population (aged 16-64) is economically active, and 78.5% is in employment, exceeding the national average by three percentage points[21]. The region's workforce is highly-skilled – in 2016 as much as 68.8% of the working age residents of Cambridge held a higher degree, which is 6 percentage points more than the second most skilled city in the UK, Oxford[22]. Those highly-skilled individuals contribute to the region's expertise, working across its exceptional educational institutions, start-ups and enterprises.

Since the turn of the century, Peterborough's population grew by 28%, making it the fourth-fastest growing city in the UK. Other areas of CPCA are experiencing growth in their populations at around 1% per year[23]. One of the reasons for such rapid population growth is the region's ability to offer employment opportunities. This helps explain why immigration into Cambridge and Peterborough has been well above that seen in other regions of England. In 2016, Cambridge and Peterborough had 53 and 43 National Insurance Number (NINo) migrant registrations per thousand residents respectively, compared to an average of 22 for England (NiNo registrations are a measure of in-flow to the UK, primarily for employment, including both short-term and long-term migrants)[24]. Immigration to Cambridge is at a higher rate than London, Oxford and Coventry, the UK's other most innovative cities.

Figure 7: National Insurance Number (NINo) migrant registrations per thousand residents, age 16-65
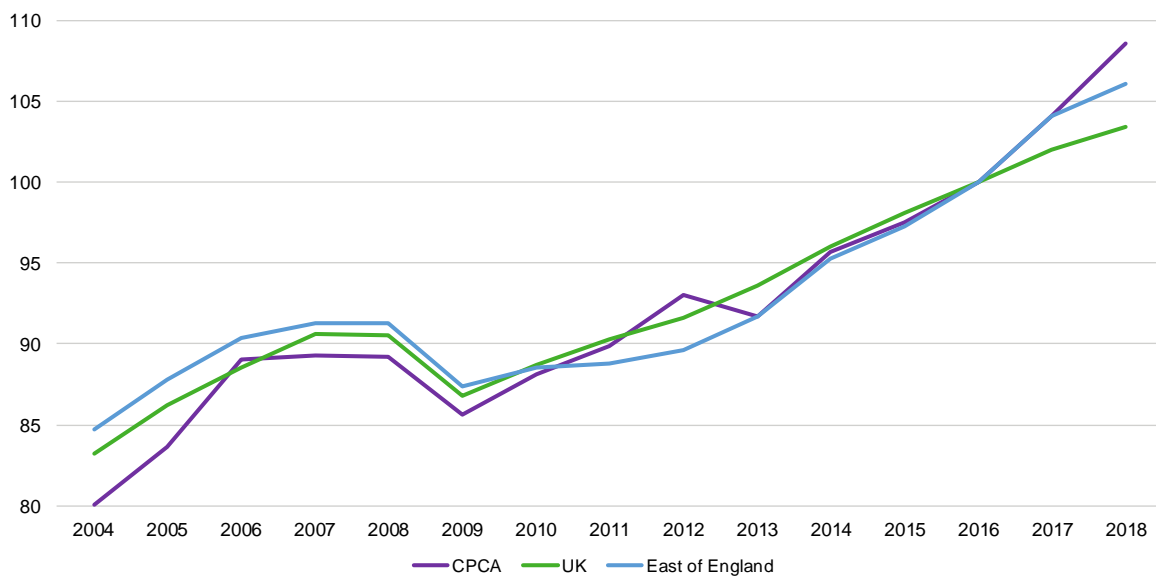

Source: ONS, 2017

A leader in local economic growth

Another distinguishing feature of the Cambridgeshire and Peterborough economy is its recent economic growth. Between 2016 and 2018, Cambridgeshire and Peterborough experienced 9% growth in its Gross Value Added (GVA)[25], faster than any combined authority in the UK and far above the UK rate of 3.4%.
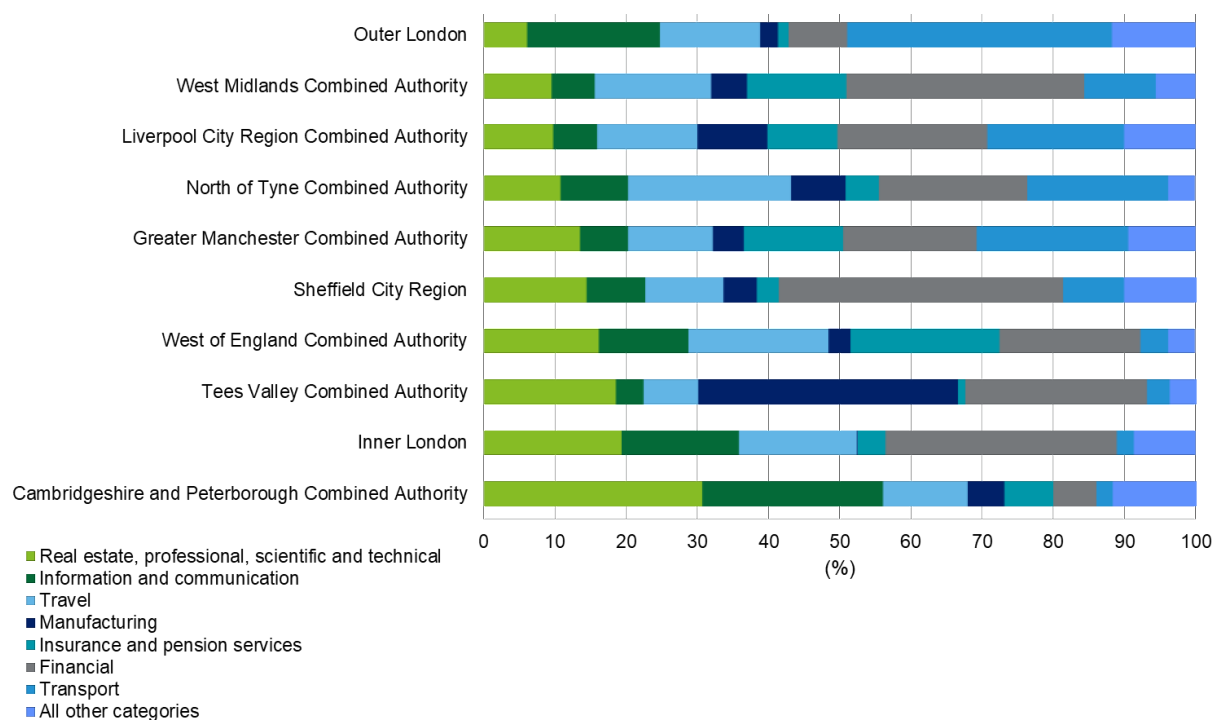
Figure 8: Real Gross Value Added index, 2016=100

Source: ONS, 2019

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Part of this growth is explained by developments in knowledge and advancements in technology, which allow for the region to manufacture and export to different regions in the UK and abroad. In 2016, 31% of the region's exports came from real estate, professional, scientific and technical activities, and 25% from the sector of information and communication – the highest rates in the country, and contributing £1,084 million and £895 million to the UK economy respectively.[26]

Figure 9: Percentage of service exports for each functional category by Combined Authority in 2016

Legend:
- Real estate, professional, scientific and technical
- Information and communication
- Travel
- Manufacturing
- Insurance and pension services
- Financial
- Transport
- All other categories

Source: ONS, 2017

4. The international opportunity

4.1 Summary

To continue to grow its tech cluster and remain internationally competitive, the region must have access to ever-increasing amounts of talent

Cambridge ranks 58th in the world's top 100 tech clusters. However, its success cannot be taken for granted – faced with fierce international competition, the region must make every effort to capitalise on its sectoral strengths and continue to concentrate economic activity in its tech cluster. The expansion of this cluster could also complement growth in the clusters of London and Oxford, and enable the UK to stay at the forefront of dynamic markets that provide opportunities for export-led growth.

4.2 The international comparisons

Tech clusters are valuable nationally but they compete internationally. Governments around the world are aware of the value they bring through the innovation they generate, and are competing in a global economic race to capture a share of high value-added markets. The Cambridgeshire and Peterborough region scores highly across a range of indicators that demonstrate its position as home to an internationally competitive tech cluster, including its rankings on patents, university innovation, business innovation and skills.

International context

In 2019, 27 countries around the world contained the top 100 tech clusters. The US has the most in the world (26), followed by China (18), Germany (10) and France (5). With four UK cities identified as clusters, the UK ranks fifth.[27] In terms of 'quality of innovation'[28] the UK also ranks fifth position amongst high-income economies, behind the US, Germany, Japan and Switzerland. At the same time, the UK ranks second in the 'quality of universities' ranking, largely thanks to the University of Cambridge. The UK shares first place on the quality of scientific publications with the US, and has done so for six consecutive years.

Comparing the clusters

The strength of the Cambridge tech cluster is reflected in international league tables. The Global Innovation Index 2019 ranks Cambridge 58th of the world's top 100 clusters, behind London (15th position) and ahead of Oxford (71st position). Since 2016, Cambridge has risen one place in this ranking, but this may not be enough to compete with many Chinese clusters, some of which have moved up by 11 places since 2016. However, the international standing of Cambridge is impressive given that it is relatively small and is competing with global 'megacities'.

Figure 10: World's top clusters

Rank	Cluster name	Country
1	Tokyo-Yokohama	Japan
2	Shenzhen-Hong Kong	China
3	Seoul	South Korea
4	Beijing	China
5	San Jose-San Francisco	USA
6	Osaka-Kobe-Kyoto	Japan
7	Boston-Cambridge	USA
8	New York City	USA
9	Paris	France
10	San Diego	USA
15	London	UK
30	Hangzhou	China
31	Eindhoven	The Netherlands
32	Stockholm	Sweden
33	Moscow	Russia
34	Raleigh	USA
35	Melbourne	Australia
36	Frankfurt Am Main	Germany
50	Zürich	Switzerland
51	Montréal	Canada
52	Chengdu	China
53	Heidelberg-Mannheim	Germany
54	Istanbul	Turkey
55	Copenhagen	Denmark
56	Atlanta	USA
57	Rome	Italy
58	**Cambridge**	**UK**
59	São Paulo	Brazil
60	Tianjin	China
68	Helsinki	Finland
69	Vienna	Austria
70	Delhi	India
71	Oxford	UK
72	Vancouver	Canada
99	Dublin	Ireland
100	Warsaw	Poland

Source: Global Innovation Index, 2019

Silicon Valley vs Silicon Fen

Although the region is home to a highly innovative cluster, dubbed 'Silicon Fen', it has significant differences compared to the world's most successful clusters, such as Silicon Valley. One key difference is scale – Cambridgeshire and Peterborough has a population of around 0.8 million (in 2018), compared to a population of over 3 million in Silicon Valley. Enabling the region's tech cluster to increase the pool of talent that it can access, as well as continuing to attract businesses and investment, is fundamental to increasing economic concentration and its innovation potential, and spreading growth further into the region.

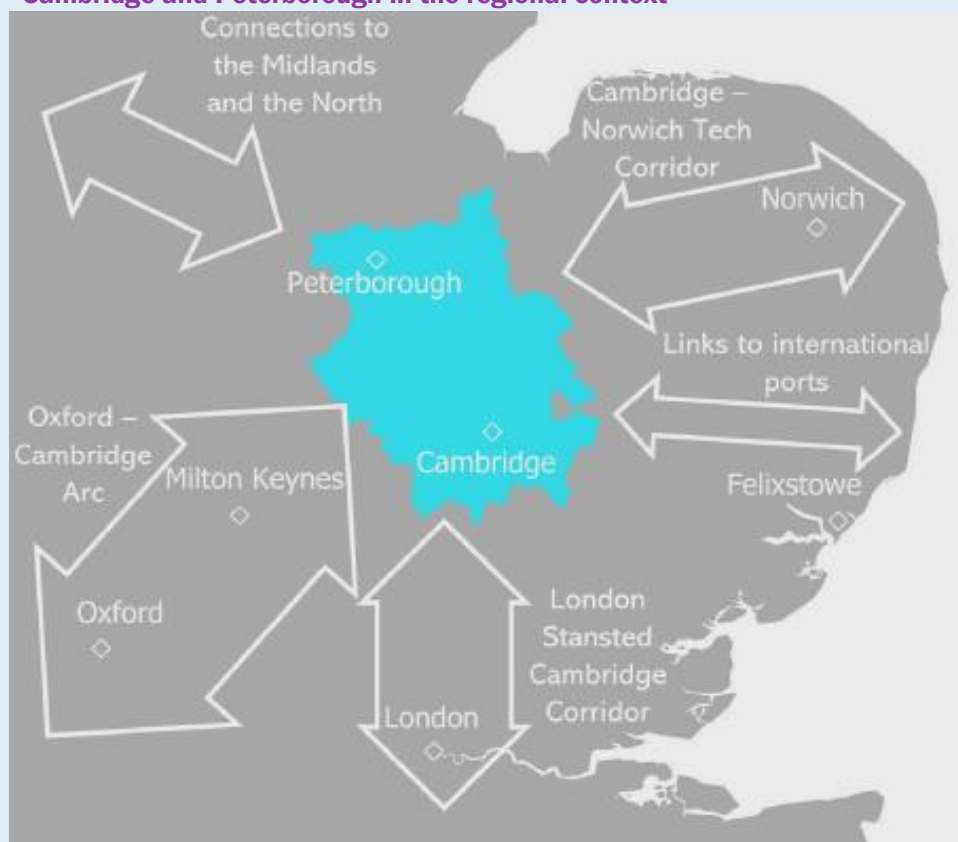# 4.3 Cambridgeshire and Peterborough as a complement to other UK clusters

The strength of the Cambridgeshire and Peterborough economy should not be seen as a threat to other cities or regions in the UK. Instead, it should be seen as enabling the UK to position itself for global market opportunities, and as a complement to the development of other regional clusters. A key opportunity is around clustering across Oxford, Cambridge and London.

The Oxford-Cambridge-London cluster

The Connected Places Catapult identifies Cambridge, London and Oxford as three areas that have high potential to become growth centres for the UK. No other regions in the UK exhibit such a combination of strengths that would allow them to reach similar levels of growth[29]. They stand apart from other areas in the UK, showing high performance in innovation, as seen in data around patent strength, trademarks strength, university innovation, business innovation, skills and spill-overs, and infrastructure.

These regions, home to the UK's leading tech clusters, are being increasingly integrated. This could give rise to a 'super cluster' between the three areas, with a joining up of the Oxford-Cambridge Arc (OxCam Arc) and the London-Stansted-Cambridge Corridor[30]. Growth in any of the areas could provide 'spillovers' to the others, in terms of knowledge sharing and networks, facilitating wider national economic growth.

Cambridge and Peterborough in the regional context

Source: Cambridgeshire and Peterborough Local Industrial Strategy

Oxford-Cambridge Arc

The OxCam Arc covers the regions of Oxfordshire, Buckinghamshire, Northamptonshire, Bedfordshire and Cambridgeshire. The government designated the Arc as a key economic priority, based on the breadth of economic opportunities that the region offers to the national economy. As set out in the Cambridgeshire and Peterborough Local Industrial Strategy (2019), the key growth sectors that are relevant to Arc's international competitiveness include life sciences, space and satellites, advanced manufacturing and the future of mobility. The Arc is characterised by a wealth of knowledge, stemming from the presence of two of the world's leading universities and a concentration of high-value employment. If better connected, the region has an opportunity to become an 'engine of ideas' for the UK, delivering high levels of economic growth for the UK as a whole[31].

London Stansted Cambridge Corridor

The London Stansted Cambridge Corridor – the area between those three regions in the East of England – is another leading region in the UK for ideas, innovation and entrepreneurship. London and the East of England are the fastest growing economic regions in the UK, and the corridor exhibits particular strengths in technology and life sciences sectors. At the same time, the region faces barriers to further growth that include lack of appropriate infrastructure and housing. In order to overcome those barriers, the London Stansted Cambridge Growth Commission recommends that transport infrastructure investments be made and a new strategy for Stansted Airport be developed. Appropriate investments that enable the region to reach its potential could create 400,000 additional jobs in the corridor by 2036[32].

For the region to continue to compete with highly competitive clusters overseas, thereby supporting wider UK growth, Cambridgeshire and Peterborough must act now. It needs to attract and retain even more science and technology experts, businesses and investment, ensuring improved entrepreneurial conditions and quality of life for its residents. In order to do so, Cambridgeshire and Peterborough has to overcome its transport and housing challenges, as set out in the following section.

5. Challenges to growth

5.1 Summary

Investment in transport infrastructure is needed to enable the region to keep growing and competing globally.

The continued economic success of Cambridgeshire and Peterborough is at risk. The region now faces multiple threats that, if not addressed appropriately, may result in the region's stagnation or decline, and the UK's leading tech cluster falling behind the international competition.

5.2 The region's challenges

The region has experienced rapid population growth in recent decades. At the same time, investments in housing and transport infrastructure in Cambridgeshire and Peterborough have struggled to keep pace. As a result, both house prices and commuting times have increased significantly, decreasing the quality of life of residents, and threatening the region's continued economic prosperity and ambition to foster greater inclusive growth.

The housing challenge
In order to accommodate its growing population and facilitate continued growth, the Cambridgeshire and Peterborough region must ensure that appropriate levels of housing are built to match demand. With 1.7% growth in housing numbers between 2015 and 2016, Cambridge ranks second in the country in terms of housing growth, and Peterborough ranks eighth[33]. Although the region has led the way in housing growth, it has not been enough to match the 3.3% annual increase in employment in the region. The region's efforts are held back by transport infrastructure constraints, and the gap between housing supply and demand have materialised in soaring house prices.

The ratio of the median house price to median gross annual workplace earnings in Cambridgeshire and Peterborough has been showing an upward trend since the turn of the century and is now at an all-time high. Cambridge has one of the highest house price to income ratios in the country. In 2019, this ratio was around 13:1 in Cambridge and around 10:1 in some of the other parts of Cambridgeshire, compared to 11:1 in Oxford, 12:1 in London and 8:1 in England and Wales overall.[34]

Figure 11: Housing affordability, as measured by the median house prices to median earnings ratio
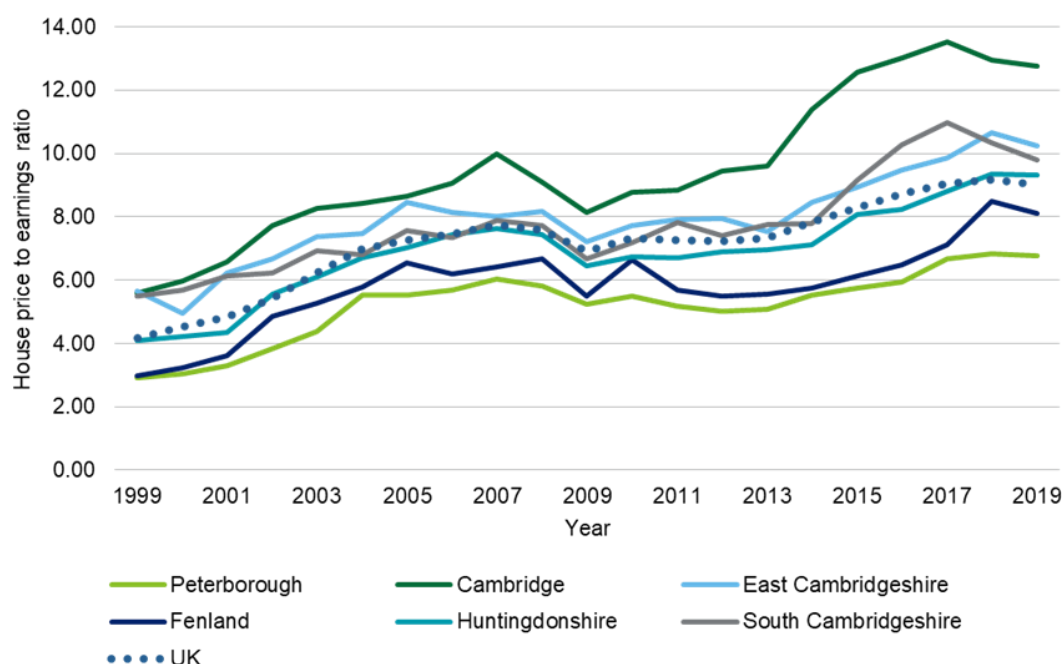
Source: ONS, 2020

Sharp increases in house prices since 2012 have driven some residents away from the area, with young workers in particular finding it less affordable to live and work in Cambridge. This risks the ability of firms to find and retain skilled workers, and the region is not far from the point that businesses will no longer be able to expand or find it an attractive place to invest. The Cambridgeshire and Peterborough Independent Economic Review (CPIER, 2018) warns that Cambridge is rapidly approaching the point where high-value business may even decide to leave the city, causing irreparable damage to local and national economic prosperity.

The congestion challenge

Cambridge and Peterborough are suffering from increasing congestion. Based on analysis from 2018, traffic is projected to increase by 30% by 2031, indicating that failure to deliver an appropriate public transportation system would result in continued mobility challenges related to the lack of appropriate transport[35]. This will decrease the quality of life for residents, encouraging some to leave the region, thereby hindering growth opportunities.

5.3 The region's power to act

In 2017, the Government announced the 'devolution deal', giving Cambridgeshire and Peterborough greater powers over transport, skills, business support and other areas. This entrusted the local government to deliver solutions to challenges at a local level, emphasising the partnership between different tiers of government. The region is now better positioned to tackle its challenges and reach its full potential, and it has committed to do so through its Strategic Spatial Framework.

The political will and powers to deliver the "UK's capital of innovation and productivity"

The Combined Authority has a significant role in addressing issues that are critical, not only for the future of Cambridgeshire and Peterborough, but the UK as a whole. The Mayor and the Combined Authority have established a bold vision for the future of Cambridgeshire and Peterborough to be "the leading place in the world to learn, live, and work", and the Cambridgeshire and Peterborough Strategic Spatial Framework sets out five 'big ambitions', including becoming "the UK's capital of innovation and productivity".

Growth of the region is enabled through the 'Devolution Deal' between the Combined Authority and Government which enabled the transfer of significant resources and powers to the CPCA, including:

£170 million	£20 million	Strategic transport powers	Responsibility for a strategic review
to deliver new homes over a five year period, focused on affordable rented and shared ownership housing.	a year funding over 30 years for investment to boost growth.	including leading the development of transport policy for Cambridgeshire and Peterborough through the Local Transport Plan.	of 16+ skills provision in the area.

Source: Cambridgeshire and Peterborough Strategic Spatial Framework[36]

These powers and political will can help position Cambridgeshire and Peterborough to overcome a set of interconnected strategic challenges around transport, housing, skills, economic growth and the environment, that will provide benefits far outside the region.

The challenges described above are considered the most prevalent threats to Cambridgeshire and Peterborough's future, and to its position as a globally competitive tech cluster. These challenges have motivated the Combined Authority's plans to develop a smart and clean transport system – the Cambridgeshire Autonomous Metro – to take decisive action at this critical moment in the region's history and to unlock its full potential.

6. The Cambridgeshire Autonomous Metro – overcoming barriers to growth and supporting the UK economy

6.1 Summary

By increasing the effective size of the Cambridgeshire and Peterborough's tech cluster, the Cambridgeshire Autonomous Metro will unlock growth and enable the region to compete on the global stage.

The Cambridgeshire Autonomous Metro will provide a solution to the region's transport and housing constraints, providing local benefits whilst supporting the wider national economy – ensuring that it achieves wider benefits and its vision that it 'acts locally, impacts nationally, attracts globally'.

6.2 The need for the CAM

"A package of transport, and other infrastructure projects to alleviate the growing pains of Greater Cambridge, should be considered the single most important infrastructure priority facing the Combined Authority in the short to medium term."
CPIER, 2018

The CPIER report concludes that improvements in infrastructure, for faster, more reliable journeys and to help unlock housing developments, are vital to ensure the region's economic prosperity. A mass rapid transit system – the Cambridgeshire Autonomous Metro – is required now to enable continued sustainable growth in the area.

What is the Cambridgeshire Autonomous Metro?

The Cambridgeshire Autonomous Metro is proposed as a high-quality, fast, sustainable and reliable 'metro-style' transport network that will transform connectivity across the region.

The vision is for an expansive network that will seamlessly connect regional settlements, major city-fringe employment sites and key satellite growth areas across the region with key railway stations and the Cambridge city centre. The CAM will comprise two main elements, delivered over time:

- The City Tunnel Section, comprising new underground tunnels and stations under the city of Cambridge planned major interchange hubs at Cambridge city centre and at Cambridge railway station.

- Four regional routes that will connect St Neots, Alconbury, Mildenhall and Haverhill with the city of Cambridge and, through the central tunneled section, with each other.

Figure 12: Planned CAM route

Source: CPCA, Proposals for the Cambridgeshire Autonomous Metro, Consultation Leaflet

The CAM aims to transform people's day-to-day lives across Cambridgeshire and Peterborough. By connecting communities and employment sites across the region, reducing journey times and improving journey quality, it will widen access to economic opportunities for those living across the region. By broadening this access, the CAM will help stimulate inclusive growth in the region, whilst also bringing an opportunity for well-planned communities via garden villages, connected with sustainable infrastructure.

The CAM will be a model of how to move people around small to medium sized cities. By adopting autonomous and connected technology, the CAM aims to deliver a transport solution with reduced operating costs and increased operational flexibility, safety and efficiency. Additionally, by seeking to employ emerging technologies, utilising Cambridge's brightest minds, and applying the region's capabilities in advanced engineering, R&D and automation, Cambridgeshire and Peterborough has an opportunity to create a new growth industry around the 'future of mobility', building on existing strengths in technology and accumulating new expertise.

6.3 The benefits of the CAM

The CAM will provide a long-term, environmentally sustainable and smart transport system, which will deliver a range of economic, social and environmental benefits. The vision for the CAM is that these impacts will be felt beyond the region, so that it 'acts locally, impacts nationally and attracts globally'.

- **'Acts locally:'** The CAM will act locally by unlocking housing opportunities in the region, improving transport, boosting the region's productivity and protecting its environment.

- **'Impacts nationally':** The CAM will impact nationally by nurturing the region's position as a net contributor to

the UK economy. It will do so through strengthening the clustering effects in the region and building on the area's sectoral strengths that allowed it to become one of the UK's leading tech hubs of high national economic significance. In doing so it will support national productivity, providing high-value jobs for future generations.

- **'Attracts globally':** The CAM will attract globally by making Cambridgeshire and Peterborough an attractive place to live and invest in, for experts and businesses from abroad. The region aims to attract more global businesses – the likes of AstraZeneca, one of the largest companies in the UK by market capitalisation[37] – who have a choice between the UK or clusters overseas. The CAM also has an opportunity to spur innovation in smart transportation, innovation that is of global importance and can also be exported internationally as a model for public transport in small and medium sized cities around the world. This potential opportunity is huge, with the market for intelligent mobility being estimated at around £1.4 trillion globally by 2030[38]. The three parts of the CAM vision, and how the CAM will realise these benefits, are summarised in Figure 13 below.

Figure 13: The vision for the CAM – 'acts locally, impacts nationally, attracts globally'

VISION	BENEFITS
ACTS LOCALLY By joining up housing and places of employment, levelling up communities and matching infrastructure to the quality of talent across Cambridgeshire	**Improving transportation**: The CAM will result in reduced journey times, improved reliability and journey 'quality', reduced congestion, emissions, noise, road accidents and road maintenance costs. **Unlocking housing:** The CAM will unlock and support additional housing developments in Cambridgeshire and Peterborough. In doing so, it will help improve affordability of housing by reducing the mismatch in the growth in jobs and housing. **Facilitating local economic growth**: By creating conditions that accommodate the region's population, and improving connectivity to employment sites, the CAM will enable economic growth in the region, stimulating the region's productivity and local output. **Protecting the environment:** By providing long-term, sustainable infrastructure for the next 100 years, the CAM will enable more sustainable urban development patterns. It will decrease congestion, carbon emission and air pollution.
IMPACTS NATIONALLY By nurturing our position as a net contributor to the economy	**Supporting strategically important sectors:** By connecting the main centres of employment with existing and future settlements across the cities and regions, the CAM will enable the growth of strategic industries that provide benefits to the wider economy. **Improving productivity:** By facilitating further clustering, the CAM will support productivity growth through a faster and more effective exchange of knowledge, improving supply chains in critical industries and benefiting the national economy.
ATTRACTS GLOBALLY By providing the right infrastructure to attract global knowledge intensive businesses	**Encouraging inward investment:** By decreasing the relative distance between key clusters around the city and across the wider region, CAM will link key growth areas, making the region more attractive to investment from people, organisations and businesses overseas. **Attracting experts to the region:** By delivering on the local and national benefits of the CAM, and strengthening the region's reputation for being an innovative and highly productive place, the CAM will attract international experts, making the region even more internationally competitive. **Boosting export opportunities:** By strengthening the globally competitive tech sectors, and building domestic experience in smart transport solutions that have global export potential, CAM will strengthen the UK's ability to reach into high value international markets.

6.4 A vital time to invest in infrastructure

This report comes at a critical time for the UK economy – when the country is seeking to position itself to maximise the opportunity associated with its exit from the EU ('Brexit'), and whilst it seeks to accelerate its recovery from the economic shock associated with COVID-19. Now is the time for concerted investment in strategic national infrastructure, and to support dynamic clusters of innovative activity.

The Government is seeking to realise the opportunity from Brexit, and has committed to strengthening the UK economy and its place in the world[39]. It has also set out, that in line with the Industrial Strategy, it seeks to make sure that the UK is "ready to lead the industries of the future and seize the opportunities of global trade". This cannot be done unless the UK's engines of innovation, such as the Cambridgeshire and Peterborough region, are supported to grow. However, regardless of the outcomes of the UK's exit from the EU, the UK must ensure that it is internationally competitive by helping its firms attain the best talent and inward investment to be able compete, to innovate, and to trade.

Furthermore, the UK is experiencing a severe economic downturn stemming from the situation around COVID-19. Two broad scenarios for economic impact are that it may be V-shaped (i.e. sharp decline followed by a sharp recovery) or U-shaped (i.e. an extended decline followed by a gradual recovery). The main difference between these scenarios will be government's actions over the coming months. If economic activity can be restored quickly, the long-term ramifications on employment will be far less severe – the V-shaped recovery. However, if the recession were to persist due to longer-term inactivity – the U-shaped recovery – the legacy of the crisis would be far more profound[40]. Investment in infrastructure should be a high priority for government, both as part of the immediate recovery from COVID-19, and to boost resilience in longer term[41]. By investing in the CAM, the UK has an opportunity to support jobs during its planning and development phase in the shorter term, to unlock jobs directly once the CAM is operational, and to enable growth in high-value employment in the longer term.

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