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## **The Cambridge Phenomenon – Fulfilling the Potential**

### **Executive Summary**

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An Executive Summary prepared by

## **PACEC**

on behalf of

Greater Cambridge Partnership,  
Cambridgeshire County Council and East of  
England Development Agency



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## X1 Introduction

- X1.1 There has been a period of dramatic economic change and upheaval in the Greater Cambridge economy<sup>i</sup> over the last thirty years. In 1971 about 200,000 people worked in the area; three decades later this has increased to nearly 360,000. Population over this period has expanded from about 420,000 to 635,000. This performance identifies Greater Cambridge as one of the most dynamic parts of the UK economy, generating nearly £12billion GDP in 2001. Moreover, in the period 1993 to 1998, data from ONS shows that the growth of real GDP in Cambridgeshire of 6.3% p.a. was significantly higher than that of the US at 3.8%p.a. Important structural changes have also taken place as Greater Cambridge has transformed itself into a key growth node for high-technology industry in the UK economy. By 2001 over 50,000 jobs were provided by this sector (including some 5,000 R&D jobs in the University of Cambridge), and the wider knowledge-based sector accounted for close to one third of the area's total employment.
- X1.2 The purpose of this report is to develop further our understanding of the Greater Cambridge economy, its past performance, the dynamics of its operation and the role of the high-technology and knowledge-based sector.<sup>ii</sup> Most importantly, the report aims to provide an informed basis for assessing the critical requirements necessary for the economy to fulfil its potential and meet future challenges and opportunities. In this respect the report builds on a number of recent reports which either directly or indirectly have implications for Greater Cambridge and its future development. It is clear from those past reports and this report that the Greater Cambridge economy is poised for further expansion. However, important choices have to be made if it is to sustain its past dynamism and continue to deliver economic prosperity and an enhanced quality of life for those who will live and work in the area in the future. In particular, long term growth and changes in the structure and composition of Greater Cambridge's economy have produced a situation where infrastructure is now severely stretched and capacity constraints facing a number of sectors are likely to put the continued future success of the economy at risk.

<b>Panel X1</b>	<b>Greater Cambridge economy at a glance in 2001</b>
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| <ul style="list-style-type: none"> <li>• £12billion GDP</li> <li>• Total employment, 360,000 (total population 635,000)</li> <li>• 50,000 high-technology jobs</li> <li>• 3,500 businesses in high-technology sectors</li> <li>• Unemployed, 9,700 (equal to 3% of economically active)</li> </ul> |
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## **X2 Laying the foundations: evolution of the Greater Cambridge economy in the past three decades**

### *Past performance*

X2.1 The Greater Cambridge economy has turned in an impressive performance in the past three decades. It has delivered rapid economic growth, near full employment and a relatively high level of well-being. On average the economy generated some 5000 additional jobs each year over the period 1971 to 2001 and the stock of jobs rose from about 200,000 to some 360,000. The relative performance has also been very solid, with 80% job growth in Greater Cambridge compared with 16% in the UK over the three decades.

X2.2 An encouraging feature of Greater Cambridge's past economic performance is that it has been relatively broadly based, embracing a wide range of sectors, with growth by no means limited to the heavily publicised high-technology and knowledge-based part of the economy. On a twenty two sector breakdown of the economy, only in agriculture and extractive industries did job growth under-perform that of the UK economy. Knowledge-based industries, including the high-technology sector, experienced relatively fast growth with the number of jobs more than doubling since 1971 compared with a much more modest 16% increase nationally. Within the knowledge-based sector the number of jobs in high-technology industries also more than doubled from about 20,000 to 50,000, whereas in the UK employment in this sector declined.

<b>Panel X2</b>	<b>Greater Cambridge economic performance</b>
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| <ul style="list-style-type: none"> <li>• GDP growth (1993 to 1998), 6.3% p.a. (US 3.8%)</li> <li>• Employment growth 160,000, 1971 to 2001, ( 5,000 p.a.)</li> <li>• Population growth 215,000, 1971 to 2001, (7,000 p.a.)</li> </ul> |
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X2.3 Driven in part by technological advances, but also by other factors such as globalisation and internationalisation, the high-technology sector in Greater Cambridge has undergone a continuous process of change and adaptation. Instrument engineering and electronics have a long history in the area and arguably were the important and dynamic high-technology sectors through to the 1970s. In the

1980s contract design and computing services emerged as the key growth sectors. Advances in computing technologies and increasing convergence of different technologies (computer technologies, communication technologies and biotechnology) in the late 1980s and 1990s provoked a redefining (and blurring) of industry boundaries, which not only gave a new impetus to computing services but also supported the emergence of biotechnology as a major source of job growth in the area.

### *Wider benefits to the UK economy*

X2.4 Significant spill-over benefits to other parts of the UK have also resulted from economic activity in Greater Cambridge. These wider benefits arise in a number of ways. They include:

<b>Panel X3</b>	<b>Wider benefits to the UK economy</b>
	<ul style="list-style-type: none"> <li>● The attraction of inward investment to the UK that might otherwise have located in other countries, particularly investment tied to R&amp;D activity, e.g. Microsoft.</li> <li>● The transfer and diffusion of technology from the University of Cambridge and numerous other research institutes which raise the productivity of companies operating in other parts of the UK e.g. TWI assisting the advanced manufacturing centre in Sheffield.</li> <li>● The Greater Cambridge economy is an important supplier of a wide range of innovative intermediate goods and services which are inputs into many products and services provided by firms located in other parts of the UK, e.g. ARM where for every job in Cambridge 20 are created elsewhere.</li> <li>● The development of high-technology industry and the wide variety of initiatives supporting the commercialisation of the science/technology base, have established Greater Cambridge as a 'role model' for economic development organisations with high-technology ambitions, e.g. St Johns Innovation Centre providing the knowledge to establish a new innovation centre in Luton.</li> </ul>

### *Industrial structure*

X2.5 The most distinctive feature of the structure of the Greater Cambridge economy is its specialisation in knowledge-based industries. These industries account for just under one third of economic activity (measured by employment), some 30% above the share of this sector nationally. The R&D sub-sector within high-technology, shows the greatest relative concentration, with six times the UK's share of jobs in this sector. A number of other high-technology sectors such as sound and vision, pharmaceuticals, scientific instruments, computing services, office machinery and aerospace are also concentrated in Greater Cambridge more highly than in other areas of the UK. This report confirms oft-made observation of the predominantly small firm structure of the high-technology sector in Greater Cambridge. Some 78% of the businesses provide fewer than 5 jobs, and 87% less than 11 jobs. For the UK the comparable figures are 83% and 90% respectively. Greater Cambridge has yet to spawn a major global high-technology company.

**Panel X4 Greater Cambridge – a knowledge-based economy**

- One-third of employment is in the knowledge-based sector compared with about one-fifth nationally.
- There are about five times as many R&D jobs in Greater Cambridge compared with nationally.

*Drivers of change*

X2.6 Understanding more about the forces propelling the Greater Cambridge economy and the more enduring factors underpinning the competitiveness and vitality of the sub-region is critical in providing a basis for charting future possible economic trajectories. The report identifies six key drivers:

**Panel X5 Key drivers of the growth of the Greater Cambridge economy**

- Population growth linked to net inward migration from London and other parts of the South East and UK has been important, not only in raising the demand for 'non-tradable' or locally provided goods and services, but also in facilitating economic growth more generally. Up to 50,000 jobs may be linked to the population increase of 215,000.
- Globalisation and European integration have raised cross border investment flows, and the presence of a number of MNCs such as Schlumberger, Microsoft, Hitachi, Toshiba and Monsanto testifies to the competitiveness of Greater Cambridge as a location for certain corporate functions, notably R&D.
- Greater Cambridge possesses a business environment conducive to innovation and high-technology entrepreneurship which is underpinned by a diverse science and technology base, international inter-connectedness, a high quality technical and scientific labour force and ready availability of specialist financial/legal services.
- The presence of a large number of small and medium sized enterprises, which is widely recognised as an important source of employment growth, technological change and innovation.
- An important source of competitive advantage for high-technology companies is their insertion in a local cluster affording close proximity to research establishments, specialist business services support for R&D and innovation, supported by well established processes and networks for knowledge diffusion and collective learning.
- The international orientation of many local companies, particularly high-technology companies, which although embedded in the local and national innovation system are also engaged in the internationalisation of their markets, research, labour recruitment and product innovation.

X2.7 In summary, the major sources of competitive advantage of the Greater Cambridge economy are its innovative capacity, supported by a diverse science base and research infrastructure; the capacity to diffuse this knowledge across the local economy through effective collective learning mechanisms creating a functioning knowledge-based cluster and entrepreneurial business community, participating in local, national and international innovation systems and with access to high quality advanced business services.

### *Greater Cambridge; a sustainable economy*

X2.8 The evidence marshalled in this report demonstrates that Greater Cambridge has achieved a remarkable degree of economic success, both absolutely and relative to other parts of the UK. An important question remains however as to whether this economic success has been paralleled by comparable improvements in social wellbeing. Our findings here are quite positive and demonstrate that the strong economic performance has also delivered enhanced social wellbeing to those that live and work in Greater Cambridge relative to those in many other areas of the UK.

<b>Panel X6</b>	<b>Indicators of social and environmental conditions in Greater Cambridge benchmarked against England</b>
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| <ul style="list-style-type: none"> <li>● High quality of human capital reflected in number of graduates and NVQ4s in labour force</li> <li>● Low unemployment and long-term sick</li> <li>● Good health</li> <li>● Low crime rates</li> <li>● Relatively low area of derelict land</li> <li>● Good quality housing, limited overcrowding but affordability declining</li> </ul> |
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X2.9 However, disturbing facets of social wellbeing concern deprivation arising from poor accessibility (for example, to shops and other amenities), growing congestion and increasingly unaffordable housing for first time buyers and inward movers, where Greater Cambridge compares (relatively) unfavourably with some other areas of the UK. In addition the benefits are only slowly seeping out to some of the more remote and disadvantaged parts of the sub-region.

## **X3 Emerging technologies and their exploitation**

X3.1 The role of the universities and the various research institutes located in Greater Cambridge in helping shape the local economy and contributing to its past success is well known. However, this dimension has assumed much greater importance in recent years for several reasons. Firstly, a number of recent reports and statements by the UK Government and the European Commission have emphasised the importance of the science and technology base for business innovation and competitiveness. Secondly, there is increasing pressure to capture more value from the commercial exploitation of the science base. Thirdly, there is a revolution under way in which three basic technologies (information technology, biotechnology and nanotechnology) are converging to usher in a new wave of innovation in the coming decades. Convergence of information and bio-technology is already creating new opportunities in genomics and proteomics and biomaterials. Nanotechnology and biotechnology are combining to produce new drug delivery systems and biosensors, and all three technologies are intersecting to produce biosensors and biochips. The market potential for these new products is huge. If successfully exploited, these emerging technologies would strengthen the competitiveness of the sub-regional

economy and provide the basis for consolidation of growth in the future, to the benefit of the whole of the UK.

X3.2 In researching those emerging technologies in which Greater Cambridge has a real advantage, the aim has been not only to identify areas in which Greater Cambridge has technical and scientific strengths but also to shift the discussion away from technical merits and to view emerging technologies by focusing on market potential and business value.

X3.3 Greater Cambridge has a wide range of research institutes, a diverse science base and a portfolio of high-technology companies and specialist business functions to facilitate the exploitation of these emerging technologies. In ICT, Greater Cambridge has strengths in photonics, opto-electronics, switching systems, operating systems development, pervasive computing, artificial intelligence, network security and voice recognition. Life sciences are a major strength in Greater Cambridge with the Genomics Campus at Hinxton (Sanger Centre, Human Genome mapping Project Resource Centre, European Bioinformatics Institute), world class research at the University of Cambridge (Departments of Biochemistry, Pharmacology, Immunology and Parasitology and the Institute of Bio-technology). In nanotechnology Greater Cambridge hosts one of three main national centres of nanotechnology research and is strong in areas such as nano-photonics and molecular nanotechnology.

X3.4 The diversity of the science base in Greater Cambridge is seen to provide a relatively well balanced portfolio of research of obvious importance, in the context of increasing convergence of technologies. However a lack of critical mass, limited interdisciplinary activity and potential flight of key staff threatens to limit both local and national economic benefits from emerging technologies such as nanotechnology.

#### *Market opportunities*

X3.5 Inevitably, we have had to be selective in our choice of emerging product areas linked to the evolving science and technology base. It should also be recognised that to a significant extent the focus is on nascent markets where clear product areas often have yet to be defined. Ten product areas are identified to illustrate the changing market opportunities :

**Panel X7 Emerging technology product areas**

- New materials developed at a nano level including stronger and lighter plastics for staple products (countertops, autoparts, toys).
- Drug and gene delivery systems which enable drugs and genes to be targeted at specific sites within the body to counter, for example, tumours and incorrect proteins.
- Sensors and actuators for use in a variety of consumer electronic devices, cars, medical devices, pollution monitoring.
- Electronic communications and informatics for data transmission.
- Instrumentation, tooling and metrology for manipulation and assembly at the nanoscale.
- Tissue engineered medical products and artificial organs, medical implants and devices, new materials to replace bones and teeth.
- Light emitting polymers with applications in inkjet printing thin-film polymer transistors and circuits onto plastic and other substrata for use in flat screen TVs, packaging and smart cards.
- Computer-based methods for the identification of drug candidates.
- 'Bluetooth' short range wireless providing device-to-device (entertainment systems, security systems and control systems) communications in the home and in the office.
- Sentient computing using components (mainly sensors) that can respond and interface with the external environment. For example, computing systems distributed throughout a building detecting, responding and interpreting the environment.

**Panel X8 Recommendation**

- It is recommended that one of the ten sectors should be taken forward as a pilot to see how the sector can be developed to exploit the science and technology base, through partnership of research institutes, business support providers and the private sector.

### *Commercialisation of the science and technology base*

- X3.6 Retention of more of the value added from the commercialisation of the science base is of obvious importance for both the Greater Cambridge economy and the wider UK economy. The report identified both positive and negative features of the commercialisation and technology transfer process. The capacity of the universities to engage with industry has been significantly upgraded in recent years, and much greater efforts are now being made, for example, to encourage major multinationals to collaborate with university engineering and science departments and to support academic spin-offs. In addition, more formal links with overseas research establishments, such as the link provided by Cambridge-MIT Institute have been forged with central government support, and other initiatives (e.g. The Cambridge Entrepreneurship Centre) have been set up to encourage entrepreneurship and exploitation of the science base. The report also highlights the fact that Greater Cambridge is somewhat unusual in hosting a number of technology consultancies acting as 'technology transfer agents' and intermediaries between industry and the research establishments.
- X3.7 Notwithstanding the progress made in developing more effective conduits and processes of technology transfer, constraints to commercialisation persist. Conflict between requirements for academic advancement and those for commercialisation clearly remain an obstacle to effective and efficient commercialisation, and within departments there is insufficient recognition and kudos from 'going commercial'. Moreover a continuing lack of alignment of organisational cultures at the academic-industry interface does not help the commercialisation process. One important constraint, for example, is the lack of a structured approach to risk management of commercialisation and, in general, a lack of experience by research establishments in building 'families' of intellectual property to spread product risk for the private sector. Babraham Bioscience technologies is a notable exception here. Finally, despite the presence in the sub-region of venture capital and angel-funders, there is often a funding gap in the early stages of the commercialisation process.

#### **Panel X9**

#### **Constraints to commercialisation**

- Too few qualified people to start new companies and need for clearer guidelines in research establishments on the commercialisation process.
- Lack of alignment of organisational cultures at the academic-industry interface constrains effective and efficient commercialisation.
- Lack of structured approach to risk management of commercialisation.
- Limited experience by research establishments in building 'families' of intellectual property to spread product risk for the private sector.
- Inadequate finance to cover funding gaps early in commercialisation.

## X4 Constraints on business development and economic growth

X4.1 A high quality physical and information infrastructure is a prerequisite for establishing a competitive and prosperous economy. Growing congestion of roads, soaring house prices and persistent unsatisfied demand for specialist business premises, are some of the familiar and clear manifestations of an emerging infrastructure deficit in Greater Cambridge. This problem is not unique to Greater Cambridge, and Silicon Valley strategists are facing similar challenges. In addition these problems have been exacerbated by the lack of a coherent planning framework and a consensus on how planning policies should be used to accommodate development pressures arising from economic growth.

<b>Panel X10</b>	<b>Infrastructure constraints</b>
<ul style="list-style-type: none"> <li>● Rising traffic congestion within the sub-region with inadequate east-west transportation links to other regions and limited air transport connections to international destinations.</li> <li>● Need for improved access within the core Cambridge urban area particularly between research institutes, universities and various science parks and innovation centres.</li> <li>● Limited local public transport particularly outside Cambridge.</li> <li>● Insufficient housing of an appropriate quality and relatively high housing costs constrain recruitment (particularly of technical staff and lower-paid public sector staff) and results in increased commuting and traffic congestion.</li> <li>● Inadequate stock of specialist business premises, including incubator space for start-ups.</li> </ul>	



X4.2 Business development constraints impact on a company's productivity and competitiveness in a variety of ways; for example, through reduced commitments to R&D, lower rates of innovation and more difficulty in addressing key market opportunities. Surveys of high-technology companies in Greater Cambridge and of the organisations which support them (finance, professional services, general business support and networking organisations) show that the main business development constraints are connected with finance and funding gaps and with shortages of skilled and experienced labour, particularly labour with management, marketing/sales and engineering/technical skills. The underlying supply-side constraints are as follows:

**Panel X11 Business development constraints****Supply side**

- Investment and finance lacks the scope, depth and complementary services (e.g. venture capitalists with technology specialisms) to facilitate the growth of large, new, high-technology companies or blockbuster products.
- Labour market inflexibility which for example, limits mobility between universities / research institutes and the business community, or the scope to hire and fire more quickly as a company develops.
- Difficulty in recruiting managers with the necessary skills, experience and understanding of a technology based company which is business oriented and adequately funded.
- Shortages of skilled technical staff and people with degrees and laboratory experience.
- More positive attitudes by academics should be encouraged towards commercialisation, without detracting from the value of fundamental science research.

**Demand side**

- Overall growth of demand and too few large customers demanding high levels of innovation and which would provide routes into global markets particularly the US.
- Too little Government procurement of R&D, compared, for example, with the US defence research agency DARPA, which provides support continually from research to commercialisation.

**X5 What can we learn from the competition?**

- X5.1 This part of the report aims to identify what lessons might be learned from successful high-technology clusters in other parts of the world which might benefit the Greater Cambridge high-technology cluster. The report identified a number of interesting initiatives and practices undertaken in each of these areas of potential relevance to some of the perceived needs and constraints apparent in Greater Cambridge. Examples include the integrated infrastructure approach of Singapore, developed around entrepreneurial activity (Technopreneurship 21); Swedish and German experiences in developing satellite sites linked to a 'branded core'; the negative experience in Germany for funding new ventures; focused networks that support a specific cluster such as the Silicon Manufacturing Group in Silicon Valley; and the linking of cluster specialisms in different regions such as the Kompetenznetze in Germany.

**Panel X12 Examples of initiatives in competing overseas high-technology centres**

- Leadership and governance: the role played by San Jose City Manager, Anthony Hamann, whose relationship with the City electorate was designed to reflect that between a CEO and the company's shareholders.
- Balanced enterprise population: by using the reputation of advanced and robust nature of Israeli high-technology (particularly in IT and telecommunications) Israel was able to attract numerous multinational players for R&D purposes, but also in some cases to act as a hub for the Middle East markets.
- Infrastructure: the way in which the cluster around Stockholm has been able to grow through the strong links with the nearby city of Uppsala, and expansion of the Kista science park illustrate some ways in which it is possible to combine development in an inner 'hot spot' with expansion into more remote areas.
- Service providers: one specific example is that of Silicon Valley Bank – a bank that has found a way to provide a balance of investment and business services that provide the bank with an appropriate risk profile yet does more than a regular commercial bank.
- Funding: the 'Startup Enterprise Development Scheme' (SEEDS) for matched equity investments at the start-up phase, and the related 'Technopreneur Investment Incentive Scheme'. These programmes form an integral component of the 'Technopreneurship 21' programme for the development of technology entrepreneurship in Singapore.
- Networks: Singapore is forming an external network of other clusters and related organisations to allow it to become 'the nerve centre for an Asian Silicon Valley'
- Technology transfer: in Germany, the Max Planck Institutes and universities largely focus on pure research, the Fraunhofer Gesellschaft on applied research, and organisations such as the Steinbeis Foundation support technology transfer. This allowed for the differing organisations to focus on their particular area of comparative advantage.

X5.2 The regions examined were:

**Table X1 The competition from selected high-technology clusters**

Region	High-tech companies	High-tech employment	Main industry sectors
Cambridge	3,500	50,000	ITC, Biotech, Instrumentation
Kista (Stockholm)	700	29,000	IT, telcoms
Singapore	6,000	93,000	IT, telcoms, electronics
Taiwan (Hsinchu)	287	102,000	IT, electronics
Israel	4,000	100,000	IT, telcoms
Sophia Antipolis	1,200	22,000	IT
Silicon Valley	7,000	780,000	IT, electronics defence/aerospace

Sources: Koepp (2002), Saperstein and Rouch (2002), PAXIS website ([www.cordis.lu/paxis](http://www.cordis.lu/paxis))

<b>Panel X13</b>	<b>Further research for Greater Cambridge strategy development process</b>
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| <ul style="list-style-type: none"> <li>• Specific examples could be investigated in more detail to determine their applicability to Greater Cambridge.</li> </ul> |
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## X6 Conclusion and future scenarios

- X6.1 The final chapter of the report develops three alternative linked scenarios of the future evolution of the Greater Cambridge economy, focusing on alternative futures for the knowledge-based sector of the economy. These scenarios are predicated on an interpretation of the past evolution and success of the Greater Cambridge economy that identifies its distinctive capacity to support innovation as its major source of competitive advantage, with the knowledge-based sector as the key engine of growth of the economy.
- X6.2 The capacity for supporting innovation is located in a wide variety of organisational mechanisms and capabilities. These include, *inter alia*,
- the maintenance of a strong research and technology base in selected areas such as biosciences, information and communication technologies, and in the emerging nanotechnology;
  - more effective commercialisation of the research and technology base;
  - the international interconnectedness of many firms and institutions in the economy;
  - increasingly mature and effective processes of collective learning, and
  - a large number of innovative technology-intensive SMEs engaged in collaborative ventures and networks of cooperation.
- X6.3 These features of the Greater Cambridge economy are assumed to remain centre stage, providing a common 'core' for each of the three scenarios developed. Other features common to each scenario are persistent demographic pressures which continue to increase the growth of population-related economic activity while at the same time, placing increased pressures on public services and infrastructure (particularly in the main cities and towns of the sub-region).
- X6.4 The economic, social and environmental consequences for each scenario will differ, but each scenario is based on a potentially plausible and realistic future. Each scenario will raise particular policy issues at different tiers of policy-making, central, regional and local. The three scenarios are also designed to encourage debate and the development of an agreed final scenario setting out what a successful Greater Cambridge economy of the future might look like, the appropriate policy framework for achieving it, and the strategic adjustments necessary on the part of public policy makers at all levels, the business community and other 'stakeholders'.
- X6.5 The first scenario, '**Creative Catalyst**', assumes an enhanced importance of Greater Cambridge's research capacity and capability, and an increased specialisation of economic activity at the 'cerebral' end of the value added spectrum. The expanding

science base and research infrastructure, increasing pressures to commercialise research findings, combined with potential opportunities (and visions of significant profits) from the development of new products and services, raises the output of new inventions and gives rise to a proliferation of research and corporate spin-offs. These spin-offs are heavily research- and technology-driven and typically remain very small, with relatively few emerging as successful and viable medium sized companies. Ultimately, their primary function within the Greater Cambridge economy is to act as knowledge channels or distribution nodes for potential commercial applications and innovations emerging from the science and research base. Some will collaborate with larger companies elsewhere in the UK, others will find their technologies being harnessed by companies operating in, for example, the Oxford to Cambridge arc, the Cambridge to Ipswich corridor and overseas. Few will move to production activities further downstream. Overall, the high birth rate of new technology start-ups and the expansion of the research base will sustain relatively rapid growth of the Greater Cambridge economy but, arguably, at a slower rate than in the past three decades. For historical rates of growth to be achieved, the other drivers of growth (namely population growth, increased inward investment and more rapid expansion of the conventional sector) will have to play a greater role than in the past.

- X6.6 The second scenario, '**Maturing Sub-region**', adopts a number of the assumptions of the first scenario, including the expansion of the science base and continuing pressures for its effective commercialisation. However, there are several important distinguishing features of this scenario.
- X6.7 First is the enhanced capacity of the Greater Cambridge high-technology sector to capture more of the downstream value added (beyond the R&D and early prototyping stages), hitherto appropriated disproportionately by companies operating in other parts of the UK and overseas. The emergence of new business models (such as those of Cambridge Silicon Radio and ARM), which have made the transition from essentially R&D locally-based companies to become niche (small) global players are, perhaps, indicative of developments in this element of the scenario.
- X6.8 Second is the ability of Greater Cambridge to compete successfully for large multinationals that move to key locations within the sub-region, but with access to the Cambridge core and the universities / research institutes and small technology-based SMEs. These MNCs engage in research and the development of new products/services but also early-stage prototyping and manufacturing.
- X6.9 A third feature is the maturing of the high-technology cluster. The agglomeration benefits from being in the cluster increase with the scale of the cluster, accompanied by the presence of more specialist players/participants and increasingly selected company functions rather than whole companies and industries.
- X6.10 Fourth is the 'thickening' of the skilled labour force and the emergence of many more entrepreneurs with both scientific knowledge and business development skills increasing local capacity to drive the innovation process.

- X6.11 Fifth, the research institutes and the universities become much more pro-active and effective in commercialising their science, and the interface between industry and academia more easily facilitates speedier decision making.
- X6.12 Finally, the maturing of the high-technology cluster results in a strengthening and increased stability of local and regional innovation networks.
- X6.13 The third scenario, '**Global Player**', emphasises the following features. First, the much greater integration of the Greater Cambridge economy into the global economy and, in particular, more active participation by the technology-based firms in cross-border innovation systems. Creative use of IT will enable companies to more effectively penetrate overseas markets, reconfigure their supply networks and facilitate greater collaboration with strategic partners overseas.
- X6.14 A second feature of this scenario is a heightened role for technology-based SMEs as niche players, providing inputs and design and development tools, to be used in the creation of innovative products and services for overseas multi-national system integrators, producing for mass markets such as telecommunications or aerospace.
- X6.15 The third element of this scenario is the emergence of Greater Cambridge as a key global location for R&D functions in a world of intensifying territorial competition between regions in different countries. Enhanced IT capacity will permit companies much greater locational flexibility for different business functions (HQ, R&D, production, marketing, sales and distribution). The growing presence of overseas multi-nationals engaged in R&D in Greater Cambridge indicates that such trends are already under way and, for this aspect of corporate activity, Greater Cambridge already has a recognised competitive advantage in the global economy.
- X6.16 The final element in this scenario is the much greater scale and diversity of the high-technology cluster compared with either of the first two scenarios. Thus the cluster not only includes more downstream activity, including manufacturing, but also a much greater presence of overseas MNCs engaged in R&D and early stage manufacturing. In addition, the geographic reach of the cluster extends beyond the current Greater Cambridge boundaries along corridors into the East of England region. Within the EU, Greater Cambridge significantly emerges as a major technology area and, in the UK, its increased scale and geographic reach significantly strengthens its role and integration in the core triangle of high-technology activity within London, Bristol and Cambridge (the 'Golden Triangle').
- X6.17 Overall, there is a long run and inevitable trends towards greater globalisation which imposes a strong influence on the nature of business activity and economic development policy. The Greater Cambridge area in this context, in particular through the growth of the knowledge based and high-technology sectors, has increasingly become a global player, along with other key centres in the UK, EU and overseas. This is powerfully demonstrated by the analysis of past trends outlined in this report which shows the accelerated process of global integration and Cambridge's place within it.

- X6.18 The three scenarios and their potential implications for the future development of Greater Cambridge raise important policy issues and questions concerning the future development of the Greater Cambridge economy. Some are common to all three scenarios and others are more specific to the global player scenario. What is clear, is that under all three scenarios the important policies already in place will require to be built upon and adjusted in a creative way if the relatively successful performance of the economy and the rising prosperity of those that live and work in the sub-region are to continue rather than plateau in the coming decades.
- X6.19 A first set of key issues for the global player and other scenarios relates to the constraints currently confronting the Greater Cambridge economy, for in a number of respects the economy is struggling to maintain its dynamism. There is a massive infrastructure deficit to be addressed, the housing market is unbalanced with rocketing house prices, the labour market faces shortages of suitable skills, the research base is under-funded and top scientists are tempted to relocate, and the wider benefits accruing to the UK will most certainly attenuate if policy fails to deal adequately with these pressing constraints. The analysis in this report strongly supports the call for a significantly upgraded business environment, and an improved housing and social environment with the capacity to sustain a high quality of life.
- X6.20 Another key question, central to the debate about the future of the Greater Cambridge economy, is whether the longstanding focus on research based SMEs should remain, or whether the high technology sector should diversify by shifting more towards downstream activities, such as early stage manufacturing, marketing and distribution. The case for diversification offers an attractive route for maintaining the past economic momentum and the possibility of capturing much more of the potential downstream value added arising from the exploitation of Greater Cambridge's research base. This might be achieved by attracting more overseas MNC activities other than research functions. It would also provide an opportunity for strengthening the skills base and diversifying the range of employment opportunities in the high-technology sector.
- X6.21 Future policy will be required to recognise and shape the strengthening role of the Greater Cambridge area as a global player. This will place new demands on the existing policy stance and the initiatives, or outputs, which underpin this, to ensure that activity is positively and sensitively managed. Three key areas of policies will be important, i.e. business development, infrastructure, and quality of life and the environment. There will be the need to customise and develop initiatives in partnership for the high-technology and knowledge-based sector aimed at:

#### ***Business Development***

- Maintaining and strengthening the **research base and facilities** (including the universities, research organisations and R&D firms) and the multidisciplinary approach to spawn emerging technologies, and harness and exploit them.
- Developing the interface between the **research base** and firms with a focus on existing and emerging technology and sector clusters, as part of a UK and international network, to foster collaboration and **technology transfer**

through the flows of people, concepts, information and resources and brokerage between organisations.

- Supporting the start-up of new firms and the continued development of existing firms, especially SMEs, to improve their **high value-added** competitiveness and take advantage of national and global opportunities for research development and **production**. Support should be in-depth and comprehensive, combining **early stage finance, skills development, and direct assistance**.
- Shaping the Greater Cambridge area product to stimulate and accommodate the selective **high-technology inward investment research**, development, and early stage manufacturing firms from key locations overseas but especially from the EU and North America.
- Developing the **generic, vocational and basic skills of local residents** to take positive advantage of existing and emerging employment opportunities.

### **Infrastructure**

- Significant improvement of major transport, road, rail, and bus links and interchanges (ie with the key centres within Greater Cambridge, the Eastern and other regions with high-technology activity) together with the management of congestion, access and parking issues.
- Upgrading of local, regional and **international ICT links**.
- Developing the **housing stock** to provide an attractive range, including affordable and executive housing, primarily in key centres in the Greater Cambridge area co-located with key cultural, recreational, and education facilities and employment opportunities.
- Ensuring the bespoke and customised **premises needs** of the high-technology and knowledge based sector are met from integrated and flexible workspace and intermediate quality premises to sites for potential early-stage production and R&D inward investors.
- Building on the business support, training and educational infrastructure and initiatives by customising and integrating provision and ensuring that awareness of support is effectively promoted and communicated and access to it is strengthened at the premises of firms or in other key locations.

### **Quality of Life and the Environment**

- Maintaining, strengthening and managing the **environment** of the historic and core heritage of Cambridge, its green environment and the setting and environment of other towns, villages and new settlements.
- Ensuring the **cultural, recreational and educational facilities** are enhanced to meet the increasing role of Cambridge as a regional and international player.
- Ensuring an embracing approach to **community and social integration** and issues of social exclusion to ensure that all partners, and residents, of Greater Cambridge, have access to the benefits and opportunities of future development.

X6.22 The policy stance and outline of initiatives provides an opportunity to build on the key steps that have to date been taken by the partners in Greater Cambridge area. Their approach needs to be continued and coordinated to positively address the degree to which the strands of policy initiatives and resources will need to be more integrated and focused. This will necessitate the positive involvement of local, regional, and national agencies cutting across and defining their roles for each of the policies and

initiatives outlined above and others that emerge. **A new governance framework will be required, comprising of an implementation partnership focussed on delivering infrastructure on the ground and a broader strategic partnership with a strong co-ordinating and consensus-building role to achieve buy in from all sectors of the community to a strategy which benefits all.**

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<sup>i</sup> The Greater Cambridge Economy is defined as follows: all wards in Cambridge, South Cambridgeshire, East Cambridgeshire, and Huntingdonshire; in Uttlesford, the wards of Ashdon, Littlebury, Saffron Walden (Audley), Saffron Walden (Castle), Saffron Walden (Plantation), Saffron Walden (Shire), The Chesterfords, Wenden Lofts; in Fenland, the wards of Benwick and Doddington, Chatteris East, Chatteris North, Chatteris South, Chatteris West, Manea, Wimblington; in North Hertfordshire, the wards of Newsells, Royston East, Royston West; in Forest Heath, all wards except Brandon East, Brandon West, Lakenheath; in St Edmundsbury, all wards except Barningham, Cavendish, Clare, Honington, Hundon, Ixworth, Kedington, Pakenham, Rougham, Stanton, Whelnetham.

<sup>ii</sup> The high-technology sector is defined as Oil and gas; Petroleum and other fuels; Tobacco; Pharmaceuticals; Other chemicals; Computer hardware and software; Electrical components, Electric motors; Sound and vision machinery and equipment; Instruments; Office machinery; Aerospace; Electricity and water supply; Telecommunications; Research & development; and Architecture and engineering; Knowledge-based industries include all high-technology industries + printing and publishing, health and education.