

5. Digital Economy

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- 5.1 This section discusses the rationale for the inclusion of the Digital Economy goal and priorities in the RES. The objective for this goal is:

Accelerating the use of digital technologies in public services, society and commerce

- 5.2 The narrative that follows shows how the goal and priorities contribute to the achievement of this objective. It discusses the context for the choices made, and sets out the rationale for intervention.

Rationale for the goal

This goal helps to deliver RES objectives

Knowledge and knowledge management has a profound effect on growth

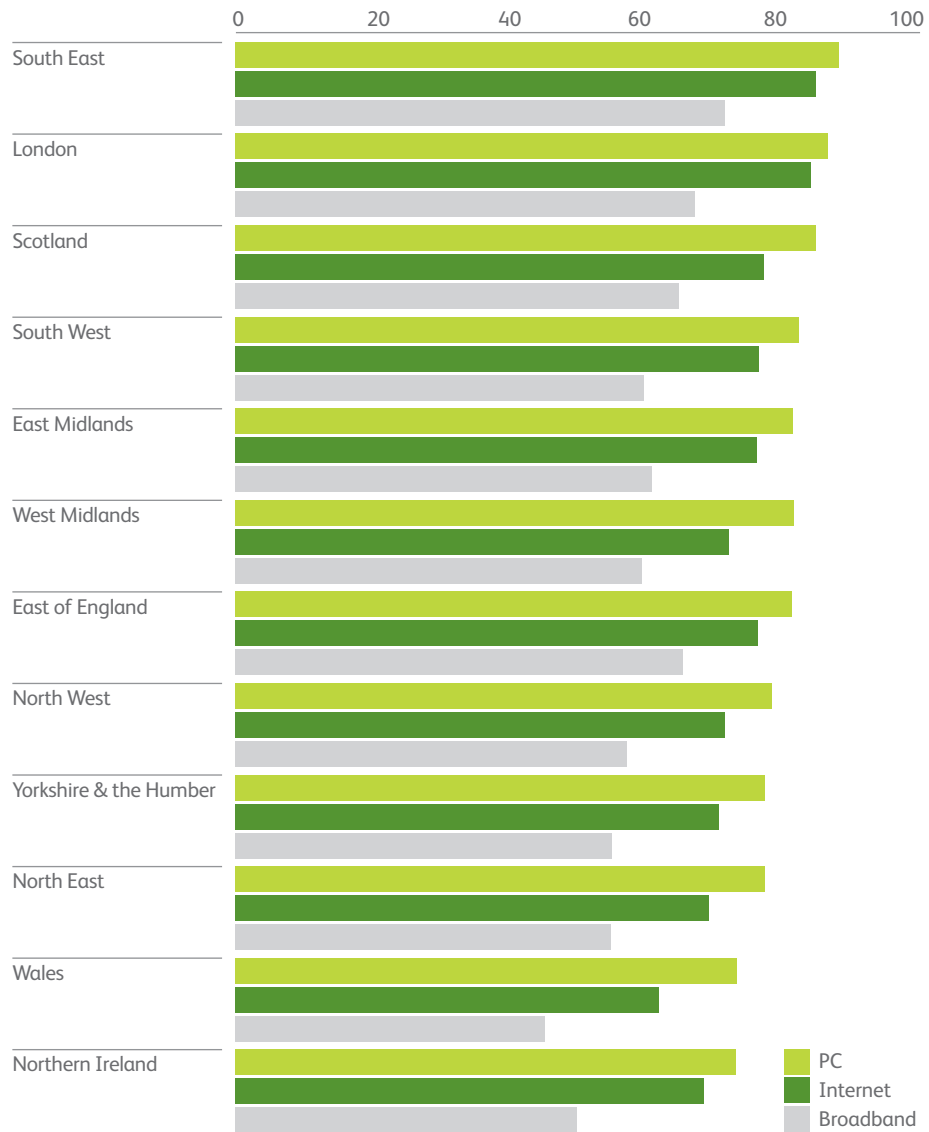
- 5.3 Research suggests that long-run growth is driven primarily by the accumulation of knowledge. (This research is particularly convincing because it provides an explanation for historically experienced patterns of growth.)¹³⁷
- 5.4 Information and communications technologies (ICT) has been identified as having a profound effect on the way that economies are able to process and communicate knowledge. The contribution of ICT to growth should not be under-estimated: after a period of disagreement in the literature, there is now a consensus that computer-related technologies have led to an acceleration in long-term growth in the US and a few other economies since the mid 1990s.¹³⁸ The Treasury highlights research which suggests that industries which use or produce ICT contributed to most of the productivity surge in the US.¹³⁹ One paper has compared the effects of ICT on productivity growth in their first twenty years with the early impacts of steam in the mid 19th century and electricity in the early 20th century. The research finds that the impacts of ICT are larger.¹⁴⁰

The context

Business use of ICT is not as intensive as it could be

- 5.5 Business adoption of ICT in the region is broadly in line with the average for the UK. The Digital State of the Region report¹⁴¹ cited DTI data which suggested that in 2004, the proportion of businesses in the East of England with a website was the lowest of all the English regions. However, data released later by Ofcom¹⁴² indicated that by 2006, the region's SMEs had adopted computers, internet and broadband at levels somewhat higher than the UK average – though lagging behind the South East and London.

Figure 5-1:
Percentage of SMEs adopting PCs, internet and broadband, 2006



Source: Ofcom The Communications Market 2007: Nations and Regions (2007)

- 5.6 In 2004, the then-DTI found that the main barriers to adoption of ICT were overwhelmingly related to cost. In the East of England, the reasons given by businesses for not implementing ICT were set-up costs (43 per cent), lack of time and/or resources (26 per cent), and running costs (25 per cent). Lack of skills and lack of knowledge were not considered as major barriers, with 10 per cent and 7 per cent respectively of businesses quoting these reasons.¹⁴³
- 5.7 Other research, looking at rural areas in the East of England, has shown that cost concerns, lack of time to assess what the firm should invest in and uncertainty of benefits to the business hold back investment (62 per cent, 52 per cent and 50 per cent respectively).¹⁴⁴

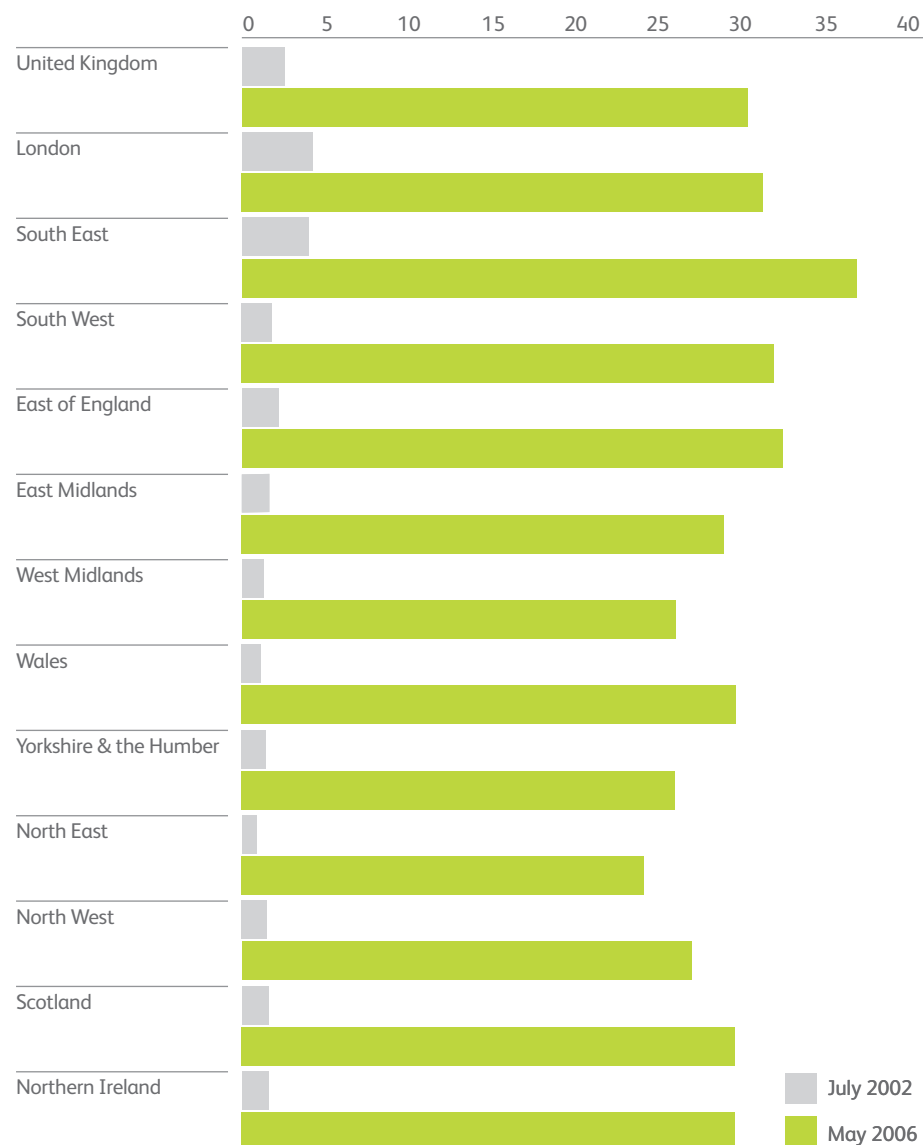
Broadband coverage is good

- 5.8 There have been regional successes. 99.7 per cent of the region's population can now get broadband and the region is below the UK average for no-broadband 'notspots'.^{145 146}

Broadband take-up is good

5.9 The East of England has now overtaken London for ADSL broadband take-up and stands in second place nationally.

Figure 5-2:
Percentage of premises taking up ADSL broadband by region (2006)



Source: BT Take-Up Report (2006)

Rationale for intervention

Market failures on information, time preference and risk provide the rationale for intervention

5.10 Public-sector intervention on the issue of knowledge and information with small firms (both social firms and private enterprise) is justified on market failure grounds. In this case, the knowledge lacking is how to make best use of ICT.

With regard to the Digital Economy goal, key market failures are set out below.

- **information failures relating to investment decisions:** Work for then-DTI has shown that decision making at small firm level is often subject to information failure.¹⁴⁷ Imperfect information can lead to uncertainty and reduce the ability of small businesses or potential entrepreneurs to assess the risks of a particular investment project – in this case ICT investment. This affects their ability to assess the rates of return to investment. It also affects perceptions about the value of externally available expertise and advice.

- **information failures relating to training decisions:** Intervention on skills (in this case, ICT skills) is justified due to the existence of well-documented market failures with regard to skills which lead to both firms and individuals under-investing in skills training. Broadly, these related to time preference and understanding of risk. (These are considered in detail in the context of the Skills for Productivity goal.)

- 5.11 However with regard to the Digital Economy goal, there are certain issues for which intervention is not – as yet – justified. This relates particularly to the provision of next-generation broadband (NGB) and the consequent possibility (discussed later) of a new digital divide.
- 5.12 The public policy response to this issue demands consideration of a number of complex demand-side and supply-side factors, including understanding the economic and social implications of the key applications driving NGB, the incremental benefits of NGB over first generation services, and the competitive market dynamics – including BT’s plans for ADSL2+ (up to 24Mbit/s) roll-out, and the potential for VDSL2 and FTTH services, as well as Virgin Media’s 50Mbit/s plans.
- 5.13 There is considerable debate at national and regional levels regarding the appropriate policy response. A recent Ofcom consultation on NGB suggests that it is too early as yet for major public sector supply-side intervention in this market:
- ‘There is no sufficiently compelling evidence to justify direct public intervention to promote or accelerate deployment faster than the commercial rate of deployment. A lack of availability at present does not seem to be significantly detrimental – there appear to be few, marginal rather than substantial, benefits for individual users, business or the UK economy from the wider use of next generation access services, over and above current generation broadband access’¹⁴⁸
- 5.14 The responses to the consultation highlighted a wide variation in views on this. In general, major industry players (including content providers such as the BBC) agreed with Ofcom that it is not appropriate for the public sector artificially to accelerate deployment at this early stage of the market. Some public sector organisations were of the opposite view, arguing that, unless there was intervention, then UK plc would be left behind competing economies, and rural areas would be left unserved by the market.
- 5.15 In parallel with Ofcom’s development of its regulatory approach, BERR has recently commissioned an independent review of next generation broadband, led by the former CEO of Cable & Wireless. The review, due to report in autumn 2008 to BERR and HM Treasury, is intended to inform what the government needs to do to pave the way for the next generation of broadband services.

Rationale for priority 1: Improving efficiency and innovation through the application of digital technologies

This priority helps to deliver goal objectives

- 5.16 This priority will deal with the interface between ICT investment levels and the ability of managers to capitalise on that investment through effective management. The objective here is essentially three-fold:
- to raise awareness of the benefits of ICT to organisations
 - to develop a strong ICT support sector to ensure that firms have the necessary support to make and deliver good ICT choices
 - to ensure that firms are able to capitalise on ICT investments made.
- 5.17 These issues are discussed in the paragraphs that follow.

Raising awareness of the benefits of ICT

- 5.18 The awareness of the benefits of ICT to organisations needs to be raised. Priority 1 builds on the evidence that demonstrates that ICT is a key productivity driver. Research confirms that US productivity growth has largely been generated from those sectors that intensively use or produce information and communication technologies (ICT).¹⁴⁹ There is good evidence that companies adopting e-commerce processes are more productive.¹⁵⁰
- 5.19 Research has shown that use of computers by employees has a direct productivity impact which extends to both manufacturing and service sectors.¹⁵¹
- Research has found that in manufacturing firms, in addition to the productivity impact of IT investment itself, use of computers by employees raises productivity by 2.2 per cent for each additional 10 per cent of employees IT enabled. Use of internet enabled computers improves productivity by 2.9 per cent. In newer manufacturing firms the productivity impact of equipping employees is even greater
 - In services, the productivity effect of IT enabled employees appears smaller, partly because the overall level of IT enablement in services starts from a higher base. Provision of computers raises productivity by 1.5 per cent for each additional 10 per cent of employees enabled; internet provision for employees has a similar impact.

Delivering a strong ICT support sector

- 5.20 The evidence that would support building a strong ICT support sector is similar to that used by the Leitch Report to argue for the provision of training which responds to market demands. This is considered in detail in the context of the Skills for Productivity goal (later in the evidence base).

Maximising the efficiency of ICT investment

- 5.21 Evidence also demonstrates that the efficiency with which ICT is used has an important effect on productivity outcomes. The data suggest that not all economies are able to effectively exploit opportunities offered by ICT to increase efficiency. European economies have been found to be substantially less able to capture these benefits compared to the US economy.¹⁵² It is the role of this priority to ensure that SMEs, the public and social sectors in the East of England are able to capture these benefits.
- 5.22 The priority is built on an understanding of how the regional economy needs to adapt in order to capture the benefits of ICT as efficiently as the US. Research at the LSE has explored two broad possible causes for the differing performance.¹⁵³
- the first cause investigated was whether this was something about the US economy: if this was the explanation, then these regulatory and business environment advantages would be difficult to replicate in the East of England
 - the second cause investigated was whether the internal organisation of US firms has enabled better exploitation of IT. For example, US firms may be better managed or have adopted features that are better at exploiting IT (for example, more decentralisation or flatter hierarchies). If this was the case, then there would be scope for transferring US management practices to the region.
- 5.23 Findings confirm that US-owned establishments in the UK do indeed have significantly higher productivity of IT capital than either non-US multi-nationals or domestically owned establishments, making these findings relevant to the East of England. Indeed, the differential impact of IT appears to fully account for almost all the difference in total factor productivity between US-owned and all other establishments. This would indicate that it was the quality of management which worked with IT investment to drive up productivity.
- 5.24 Separate McKinsey research with the LSE finds that companies can get the biggest benefit by combining IT investments with good management. For corporations scoring in the bottom quartile of management practices, the deployment of more powerful IT is associated with productivity improvements of just 2 per cent. However, companies with increased computing power and improved management practices achieve 20 per cent higher productivity. This result shows that better management practices can raise productivity a good deal by themselves and increase the impact of IT investments on productivity as well.¹⁵⁴ The evidence indicates that the Digital Economy goal and the Enterprise goal will need to cooperate closely on crystallising productivity improvements from ICT at firm level.

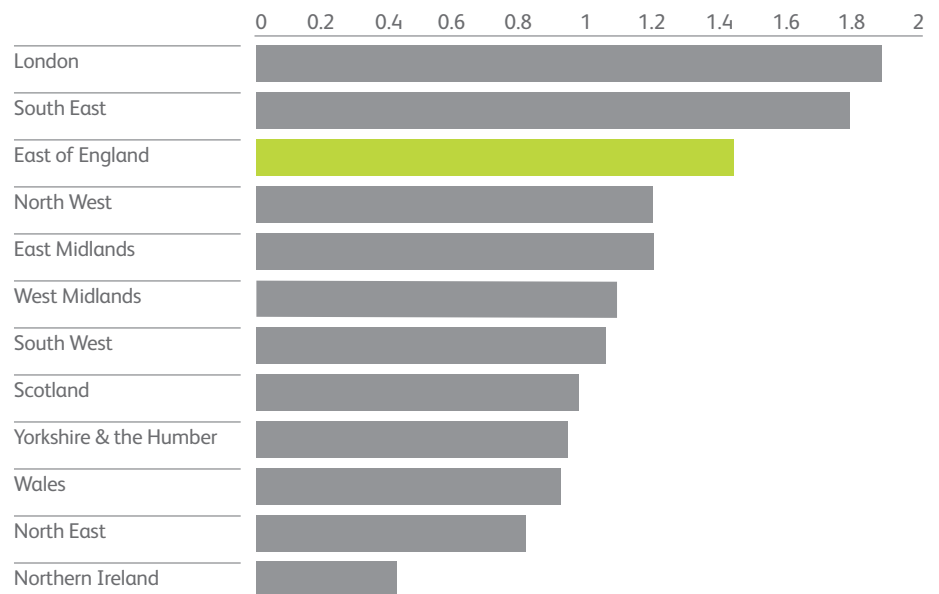
The context

- 5.25 The research agenda here has generally concentrated on national rather than on regional level research. It is safe to assume, though, that findings based on national level research will be readily applicable to the regional economy.
- 5.26 However, there are findings that are relevant to the ICT skills element of this priority.

The East of England performs reasonably strongly on the availability of skills for the IT sector

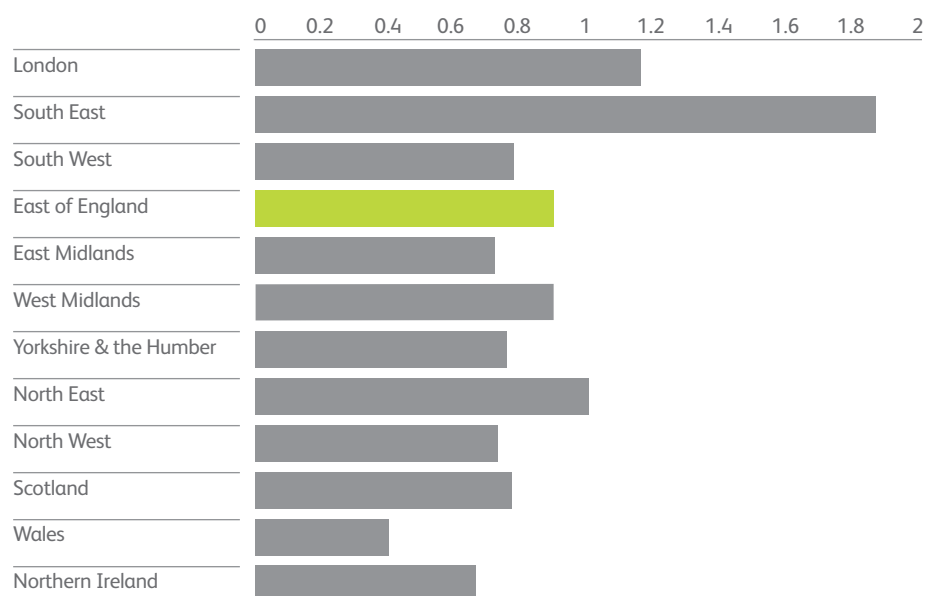
5.27 Research in the East of England finds that firms in the region experience fewer skills gaps, and lower levels of IT vacancies.¹⁵⁵ A slightly lower proportion of companies that employ IT professionals report that they have skills gaps (8 per cent in the East compared to 9 per cent in Britain), and the region also has a lower proportion of companies with IT vacancies than the national average (9 per cent in the East of England compared to 17 per cent in Britain). Across the East of England as a whole, the density of IT professionals is greater than the national average.

Figure 5-3:
IT professionals per worker (UK average = 1)



Source: e-skills UK (Sector Skills Council) (2005) IT Insights – Regional Skills in the East of England / RTP analysis

Figure 5-4:
Distribution of IT & telecoms industry workforce by region, 2007
(UK average = 1)



Source: ONS Labour Force Survey

5.28 Given the centrality of skills and knowledge in growth theory, it will be important for the region to maintain this strong position in this important part of the economy.

Rationale for priority 2: Equipping people and businesses with the skills and capability to innovate through digital technologies

This priority helps deliver goal objectives

ICT skills need to be embedded in the wider workforce

- 5.29 It has been demonstrated above that the region is relatively well placed with regard to the availability of trained ICT professionals.
- 5.30 There is also the matter of ensuring that ICT skills are embedded in the wider workforce. ICT skills are taken as necessary for many industries. The CBI has stated that 'IT awareness must these days be regarded as essential'.¹⁵⁶ Detailed research with 6,000 companies in Wales shows that the fastest growing needs expected for the future were IT skills.¹⁵⁷

The context

There is a growing demand for an ICT literate workforce

- 5.31 Research finds that the growing demand for ICT skills in the East of England across the economy translates into a growing demand for ICT literate workers. In respect of the current East of England workforce, there is a need for the upskilling of 700,000 people to address current gaps, and 600,000 to address the three-year forecast. Of these around 60 per cent of the upskilling is up to level 2 and 40 per cent to level 3. The future skills required by IT professionals will focus on systems architecture. Solutions analysts and project managers who have a combination of business and IT understanding will also benefit.¹⁵⁸

Rationale for priority 3: Investing in a leading digital infrastructure

This priority helps deliver goal objectives

- 5.32 Next-generation broadband (NGB) is currently at a very early stage of its development; the incremental benefits and opportunities that it will bring, over and above the benefits of current generation broadband, will only become apparent over time. However, some of the mooted benefits include the following:
- for consumers:
 - high definition TV streamed over broadband connections
 - video on demand services, streamed over broadband
 - improved computer-based video-conferencing with friends and family
 - improved online gaming experience
 - faster downloads of large video files (including through peer-to-peer file sharing).
 - for businesses:
 - improved inter-site connectivity for multi-site SMEs (enabling better knowledge management, customer relationship management etc)
 - improved home access to corporate systems for employees (enabling more flexible working)
 - improved connectivity with customers and suppliers (enabling better supply chain management)
 - more resilient data storage, through the use of remote file hosting/back-ups
 - more use of video-conferencing (improving internal and external communications, and reducing the need for travel to meetings).
 - for public services:¹⁵⁹
 - improved connectivity for smaller schools, enabling access to a wider range of educational materials
 - improved connectivity for small health-sector sites, such as GPs' surgeries and pharmacies, enabling improved access to patient information (including large image files such as X-rays and MRI scans) and telemedicine applications
 - improved access to further education, through learners having improved home access to online learning materials (including video).
- 5.33 In its recent consultation on NGB, Ofcom summarised the potential applications of next-generation broadband in terms of their scope (how many people/businesses will be affected by their availability) and intensity (the incremental impact on consumers and businesses of their availability), as shown in Figure 5.5 overleaf.

Figure 5-5:
Potential next-generation access services and applications

Intensity	High	Virtual reality communities Remote healthcare: monitoring consultation and treatment Home-working: special needs	Multi-player gaming Peer-to-peer file sharing (Piracy of video)	HDTV programmes/ video on demand ?
	Medium	SME supply chain management Utility computing Distance learning Holographic TV	HDTV on IP Increased sophistication of advertising Home-working: general Web-cam surveillance	Video-conferencing with family/friends Richer web browsing experience Centralised file hosting Improved online shopping
	Low	Business location becomes less important Consultation with politicians	Online presence of communities	Less congestion/ air pollution IPTV E-government: voting, form filling ?
		Low	Medium	High
		Scope		

Source: Ofcom (2007)

- 5.34 It is important to note that the benefits most commonly cited for NGB are in the area of entertainment (HDTV, gaming etc). As with previous affordable broadband roll-outs it will almost certainly be the consumer – rather than business – market that will determine the speed and extent of commercial NGB implementations (though NGB is then made available to businesses as a spin-off).
- 5.35 As far as the regional economic strategy is concerned, however, the entertainment-related aspects are a minor consideration: it will be the potential benefits to SMEs which will offer the most important economic opportunities – although, as noted above, there will also be some skills-related benefits (including better access to FE services).
- 5.36 It should also be noted that, as NGB reduces the constraints associated with bandwidth, then other ‘bottlenecks’ in SMEs’ ICT configurations will become more apparent. For example, the configuration of its firewall could prevent a company from using computer-based video-conferencing even though their bandwidth is more than sufficient. As well as ensuring that SME owners and managers are made aware of the opportunities associated with NGB, it will therefore be important to ensure that they can access affordable high-quality expert advice and support in implementing and realising the benefits of NGB-enabled ICT applications.
- 5.37 The precise relationship between next-generation digital services and productivity growth is uncertain. Indeed, this uncertainty is recognised by industry groups, who admit that ‘We do not know how important, economically, socially, culturally, are the increments in speed of communications associated with next-generation broadband’.¹⁶⁰ That said, ‘the move to a globally connected world has clearly brought economic benefits [and] there is a strong possibility that expanding the range of services capable of being provided, as well improving the speeds with which they can be accessed and delivered, will further increase productivity and efficiency’.¹⁶¹
- 5.38 The possibility certainly appears to be sufficiently strong to justify inclusion of the issue in the RES.

The context

Broadband coverage is good, but line speeds can be low

- 5.39 As shown above, 99.7 per cent of the region's population can now get broadband, and the region is below the UK average for no-broadband 'notspots'.^{162,163}
- 5.40 However, line speeds are relatively slow in many instances. Whilst national average line speeds doubled in the year to the end of 2006 (and further technological innovation may improve connection speeds over some longer connections which currently experience slow speeds), new applications are likely to need significant extra bandwidth.^{164,165} Industry groups suggest that by 2012 the most bandwidth intensive households will demand capacity that is beyond the capability of existing access infrastructures (downstream, 23 Mbit/s, upstream, 14 Mbit/s). This capability is being developed on the continent. France Telecom is already trialling broadband speeds of up to 100 Mbit/s in Paris, and Deutsche Telekom has plans to offer speeds of up to 50 Mbit/s in 50 German cities.¹⁶⁶

Large areas of the region could be stuck with slow line speeds in future

- 5.41 In many parts of the region, such speeds are likely to be beyond the incremental technological improvement which may be possible. The Digital State of the Region report finds that, while around 50 per cent of the region will be able to purchase affordable services of 50Mbit/s or more, technical constraints mean that around 20 per cent of the region will only have a choice of services below 5 Mbit/s. In this context, there is the prospect of a new digital divide opening up in terms of access to NGB services. Rural areas are likely to be particularly affected.
- 5.42 In considering the differences in the quality of broadband services, it is helpful to use a clear definition of the successive generations of broadband. SQW has developed the definition below, which distinguishes between first-, second- and third-generation broadband.

Table 5-1:
Definitions of broadband generations, used for next-generation
broadband modelling

Generation	Label	Description
Dial-up		Bandwidth in the order of 0.05Mbit/s
First-generation broadband	1B	Downstream peak bandwidth of at least 0.5Mbit/s ¹⁶⁷ (10 x dial-up), but less than 5Mbit/s, at a price affordable by households and SMEs
Second-generation broadband	2B	Downstream peak bandwidth of at least 5Mbit/s (100 x dial-up), but less than 50Mbit/s, at a price affordable by households and SMEs
Third-generation broadband	3B	Downstream peak bandwidth of at least 50Mbit/s (1000 x dial-up), but less than 500Mbit/s, at a price affordable by households and SMEs

Source: SQW

First-generation broadband

- 5.43 While first-generation broadband is available throughout the East of England, there remain some 'notspots' of unserved premises – primarily due to the lines between the customers and the BT exchange being too long to support broadband. Nationally this affects c. 0.5 per cent of the population. The majority of these lines are in rural areas, as rural exchanges cover larger areas than urban exchanges.

5.44 Additionally, at the edges of broadband availability, where the service is being delivered over long lines, some customers may find that their service suffers from reliability issues. This is essentially due to the service operating at the extremes of its capability, in terms of the line loss between the exchange and the customer: changes in conditions (including wet weather or electro-magnetic interference from household devices) can then make the difference between the service working and not working. It is noteworthy that BT is currently trialling the use of a self-installed 'interstitial plate' which would filter out more noise, and could potentially improve the reliability of such lines, without the need for engineering visits.

Second-generation broadband

5.45 Virgin Media has been offering second-generation broadband services over its cable network since 2005, and with the launch of BT's 'up to 8Mbit/s' ADSL Max services throughout its network in 2006, second-generation broadband became widely available. As with BT's first-generation broadband services, however, the speed available depends on how far the customer is from the exchange: it is estimated that c. 80 per cent of the East of England's households are able to obtain download speeds in the order of 5Mbit/s or higher. Many of the remaining 20 per cent will be in rural areas, due to their relatively large exchange areas (and hence longer loop lengths).

5.46 In areas served by Local Loop Unbundlers¹⁶⁸, some 'up to 24Mbit/s' services are already available, using a technology called ADSL2+. Furthermore, BT plans to roll-out ADSL2+ to all its exchanges over the next few years, in the course of its '21CN' upgrade to its core network. Nationally, BT expects the coverage of these services to rise from 5 per cent of households in April 2008 to 55 per cent by May 2009, and the upgrade is due to be complete across BT's network by 2011. This is an important development, as it will extend these higher bandwidth services to areas unserved by either Local Loop Unbundlers or Virgin Media's cable network.

Third-generation broadband

5.47 Virgin Media has recently announced a national roll-out of a 50Mbit/s service in 2008, which will mean that much of the population will be able to purchase a 50Mbit/s service by the end of the year, but the proportion of rural households and businesses with access to this service will be low, as there is relatively little cable coverage in rural areas.

5.48 The cost of addressing this divide by rolling out fibre-to-the-premises (FTTP) throughout the UK has been estimated at £15 billion – a sum which no operator is willing to bear, given the current market demand uncertainties.

5.49 Even if competitive pressures lead to BT introducing third-generation broadband services (through Fibre to the Premises or VDSL2 technology¹⁶⁹) in urban areas, there is little prospect of BT or anyone else extending such services to rural areas in the short to medium term.

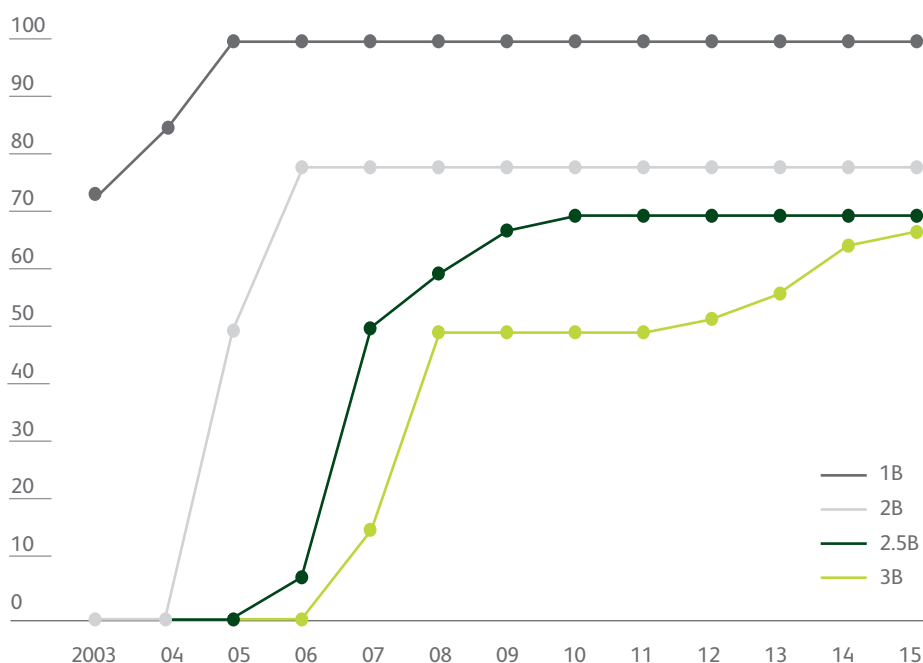
The reasons for this include:

- the heavy costs of digging up roads to lay new ducts and fibre in the access network, and (for VDSL2) installing new street cabinets capable of housing DSLAMs¹⁷⁰
- the lack of infrastructure-level competition in rural areas (leading to BT's existing 1B/2B wholesale revenues facing little competitive threat)
- the relatively small incremental benefit to consumers of 3B+ services versus 2B or 1B services, and the likelihood that the premium that BT Wholesale will be able to charge for 3B+ services (versus 1B or 2B services) would be insufficient to provide a reasonable return on the incremental investment required in rural areas.

Coverage projections

- 5.50 In work completed for EEDA in early 2007, SQW adapted a model (to estimate the economic impact of various generations of broadband) which had been developed for Scottish Executive. The model used an analysis of cable coverage and of the distance of postcode centroids from the nearest BT exchange. Data were input into this model, while retaining the core assumptions regarding the reach and rate of roll-out of various broadband generations to varying population densities, in order to derive estimates of the future coverage of next-generation broadband services in the East of England.
- 5.51 SQW also modelled an intermediate '2.5B' generation, of at least 15Mbit/s downstream bandwidth but less than 50Mbit/s (a subset of '2B'), noting that Virgin Media launched a 20Mbit/s service nationally in May 2007. Regarding 3B+, SQW assumed that the adoption of DOCSIS 3.0 or Ethernet to the Home will allow Virgin Media to offer peak bandwidths of 50Mbit/s and above across their network by the end of 2008.
- 5.52 Indicative coverage projections for the region are shown in Figure 5-6 below.

Figure 5-6:
 Indicative projections of next-generation broadband coverage in the East of England



Source: SQW (2007)

- 5.53 In summary, it is likely that a new – more persistent – broadband divide will open up in the East of England over the next few years: while about 50 per cent of the region will be able to purchase affordable services of 50Mbit/s or more, c. 20 per cent of the region will only have a choice of services of below 5Mbit/s.

Footnotes

- 137 Romer (1986) Increasing Returns and long-term growth *Journal of Political Economy* 98.
- 138 Coyle, D (2007) *The Soulful Science* p61
- 139 Treasury/DTI (2006) *Productivity in the UK 6: Progress and new evidence* p52
- 140 Crafts (2004) Steam as a general purpose technology: a growth accounting perspective *Economic Journal* 114: 338-51 quoted p30 Coyle, D (2007) *The Soulful Science*
- 141 *Digital State of the Region Report* by SQW Consulting for EEDA, 2007
- 142 Ofcom (2007) *The Communications Market 2007: Nations and Regions*
- 143 DTI (2004) *Business in the Information Age: The International Benchmarking Study* p119
- 144 SQW (2005) *The Role of ICT in Rural Economies* quoted EEDA/SQW (2007) *The Digital State of the Region Report*
- 145 http://www.eeda.org.uk/press_pub_793.asp
- 146 *Community Broadband Network (2006) Notspots: A study of Britain's broadband-free areas.* p16 Overall, the East of England was ranked well below average by the survey with only two regions reporting fewer notspots per capita.
- 147 DTI (2003) *A government action plan for small business: Making the UK the best place in the world to start and grow a new business – the evidence base*
- 148 Ofcom (Sep 2007) *Future broadband – Policy approach to next generation access*
- 149 *ibid*
- 150 See, for example, National Institute for Economic and Social Research findings <http://www.statistics.gov.uk/events/EnterpriseMicroData/downloads/Vecchi.ppt#5>
- 151 Clayton et al 2005 *IT Investment, ICT Use and UK Firm Productivity* (ONS)
- 152 *ibid*
- 153 Nick Bloom, Raffaella Sadun and John Van Reenen (this draft: July 2005) *It Ain't What You Do It's The Way That You Do I.T. – Testing Explanations Of Productivity Growth Using U.S. Affiliates* Centre for Economic Performance, London School of Economics ESRC reports the early findings from uncompleted collaboration between McKinsey and the LSE that a study of management in the manufacturing sector identifies a variety of superior management practices and organisation which the research team believes are responsible for the higher level IT productivity in US firms. The US firms are far better at three things: effective target setting, clear incentives linked to performance, and efficient monitoring. US firms favour flatter structures and devolve responsibility further down the hierarchy – hence those at the front line can use IT more productively. It appears that the superior management practices of US multinational subsidiaries may explain their ability to extract higher returns from IT. http://www.esrcsocietytoday.ac.uk/ESRCInfoCentre/about/CI/CP/the_edge/issue20/it_aint_what_you_do.aspx?ComponentId=13055&SourcePageId=13114
- 154 http://www.mckinseyquarterly.com/article_page.aspx?ar=1477&L2=13&L3=11
- 155 e-skills UK (Sector Skills Council) (2005) *IT Insights – Regional Skills in the East of England* p7
- 156 CBI (2007) *Time Well Spent* P11 [http://www.cbi.org.uk/ndbs/press.nsf/38e2a44440c22db6802567300067301b/9647f9e680f19b8c802572a000364328/\\$FILE/Time%20Well%20Spent%20-%20CBI%20Report%20on%20Work%20Experience.pdf](http://www.cbi.org.uk/ndbs/press.nsf/38e2a44440c22db6802567300067301b/9647f9e680f19b8c802572a000364328/$FILE/Time%20Well%20Spent%20-%20CBI%20Report%20on%20Work%20Experience.pdf)
- 157 quoted CBI (2007) *Time Well Spent* p76 [http://www.cbi.org.uk/ndbs/press.nsf/38e2a44440c22db6802567300067301b/9647f9e680f19b8c802572a000364328/\\$FILE/Time%20Well%20Spent%20-%20CBI%20Report%20on%20Work%20Experience.pdf](http://www.cbi.org.uk/ndbs/press.nsf/38e2a44440c22db6802567300067301b/9647f9e680f19b8c802572a000364328/$FILE/Time%20Well%20Spent%20-%20CBI%20Report%20on%20Work%20Experience.pdf)
- 158 e-skills UK (Sector Skills Council) (2005) *IT Insights – Regional Skills in the East of England* p7
- 159 Note that larger public sector sites are more like large corporate sites, in that it is cost-effective for them to be served by more expensive corporate higher bandwidth services, without having to rely on the mass market affordable NGB services.
- 160 *Broadband Stakeholder Group (2007) Pipedreams – Prospects for Next Generation Broadband.* p4 <http://www.broadbanduk.org/content/view/236/71>.
- 161 *ibid*
- 162 http://www.eeda.org.uk/press_pub_793.asp
- 163 *Community Broadband Network (2006) Notspots: A study of Britain's broadband-free areas.* p16 Overall, the East of England was ranked well below average by the survey with only two regions reporting fewer notspots per capita.
- 164 The estimated average headline connection speed was 3.8 Mbit/s at the end of 2006, up from 1.6 Mbit/s at the end of 2005. http://www.ofcom.org.uk/media/news/2007/04/nr_20070402
- 165 *Community Broadband Network (2006) Notspots: A study of Britain's broadband-free areas.* p16 As signal processors improve the ability to listen for weak signals this distance limitation may move further from the exchange.
- 166 Andrew Edgecliffe-Johnson and Andrew Parker *Financial Times* April 16 2007 UK urged to seek investors in higher-speed broadband <http://www.ft.com/cms/s/8b1de7d6-ebb6-11db-b290-000b5df10621.html>
- 167 Note that this differs from Ofcom's definition of broadband referring to higher speed always-on services, offering data rates of 128kbit/s and above.
- 168 *Local Loop Unbundlers* use BT's copper local access network, but add their own electronics to each end of the line, which gives them considerable scope for innovation in the services and prices they offer to customers. There were c. 3.7 million unbundled local loop lines in the UK as at December 2007.
- 169 VDSL=Very high speed Digital Subscriber Line – a technology which would extend fibre from the exchange to the street cabinet, and then use active electronics in the cabinet to deliver higher speed broadband over the relatively short remaining length of copper into customers' premises.
- 170 *Digital Subscriber Line Access Modules*