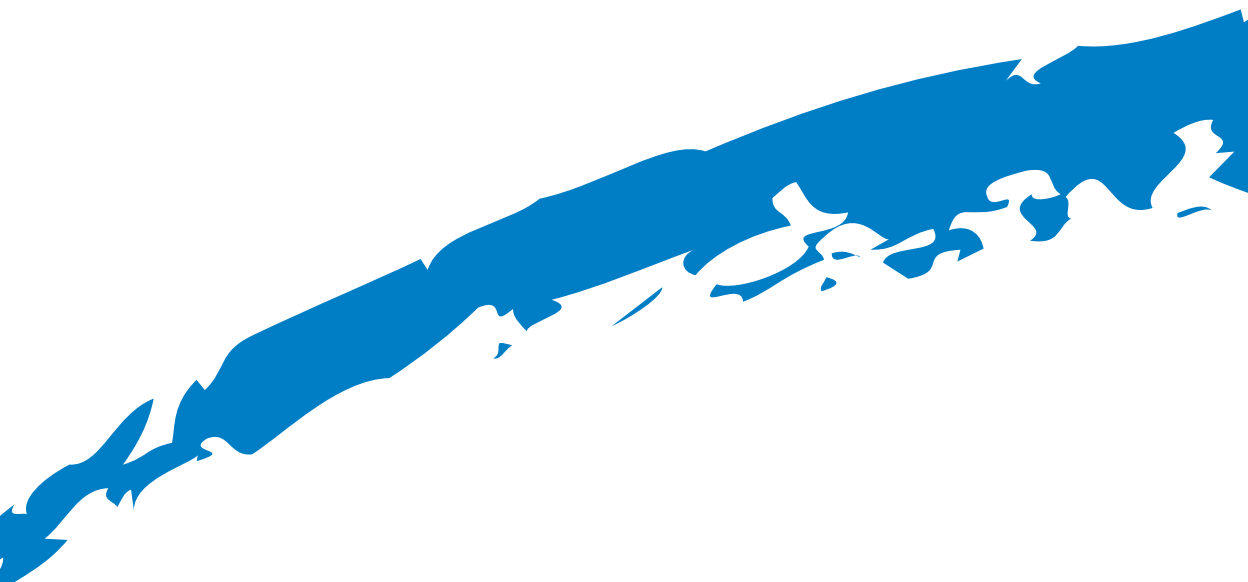


Capturing the Cloud

Technology-Driven Growth and Innovation in the UK



Tim Cowen



ResPublica
changing the terms of debate

About ResPublica

ResPublica is an independent, non-partisan UK think tank founded by Phillip Blond in November 2009. We focus on developing practical solutions to enduring socio-economic and cultural problems of our time, such as poverty, asset inequality, family and social breakdown, and environmental degradation.

Our research combines a radical civic philosophy with the latest insights in social policy analysis, economic modelling, behavioural economics, management theory, social psychology and technological innovation to produce original, implementable solutions. We would like to foster new approaches to economic inequality so that the benefits of capital, trade and entrepreneurship are open to all. We believe that human relationships should once more be the centre and meaning of an associative society, and that we need to recover the language and practice of the common good. Our work seeks to strengthen the links between local individuals, organisations and communities that create social capital.

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Author's Note

We have in this paper reviewed the available evidence on the approaches taken worldwide to the issue of growth in the economy, to see if we might learn from those methods and identify gaps in the approach being taken in the UK.

We have had an opportunity to consult with stakeholders and industry participants and look forward to a broader discussion over the coming months.

We believe that the ideas in this paper are complementary to the approach taken by the Technology Strategy Board. However we have not covered the Technology Strategy Board's role in this paper. See here for the basis of the Board's new strategy:

<http://www.innovateuk.org/ourstrategy.ashx>

Foreword

It would appear that there is a certain reluctance on the part of the government to admit that it does have an intervening role in the market. This is not to endorse a statist approach, just that a continuing attachment to notions of 'free markets', when all markets are regulated to a greater or lesser degree by the state, necessitates moving the discussion forward from whether the government should or should not intervene in the market, to accepting it does play a role and asking what is the most enabling part it can play and what form that intervention should take.

Government has a role in making markets, not least by its impact as a buyer. It also plays a role in actively regulating the conduct of players in the market through industry specific regulation and clearly as a result has an impact on the structure of markets. We at ResPublica strongly support the government's payments by results agenda – and we believe that this should also be applied to the issue of technology and that process should not be privileged above outcome. All players in the market need to be involved as a plurality of incentives and rewards always need to be in play. In addition, the continued maintenance of regulations that affect the market and which impede innovation plays a role in reducing the pace and slowing the dynamic of innovation and should be reviewed and changed to support and promote innovation. One of the most consequent factors in promoting innovation is new market entrants, and we fear that the standards proposed risk not facilitating, rewarding and creating the optimal level of market entry.

It is ResPublica's view that the road to growth and economic development is fundamentally reliant on innovation. Therefore the question that needs to be asked is what the government can do to encourage innovation and allow innovation to flourish in the UK. This report does not claim to address this issue across all sectors, but in the realm of technology it does identify questions, issues and barriers, and as a result offers some recommendations. It is the first of our pro-growth reports that we want to commission across all sectors, seeking to ask what Government can do to promote innovation and facilitate industry and commerce in rebalancing the economy and restoring prosperity for all.

Phillip Blond, Director, ResPublica



Introduction

Growth strategy is an issue which has been a subject of worldwide analysis and debate. From our review of the Government's plan for growth, by comparison with the position in other countries, we lack a plan that specifically relates to technology. Given that technology is an enabler, it could be argued that technology is already embedded in each of the growth approaches or plans already outlined by government. However, technology is too important an issue to be submerged by others. The internet and new technology in the information communications and other related technologies have the property of providing a general capability that supports the rebalancing of the economy and one that enables other industries to increase their productivity and efficiency; therefore, a growth review looking specifically at the information communication and technology sector as an integrated or horizontal sector is both timely and necessary.

Aside from the merit of having a horizontal review of ICT, the following questions can be raised with regards to the government's growth plans:^[1]

- What elements of the technology sector are covered by the "Digital and Creative Industries" sector work, and will the focus on creative industries mean that the very significant impact of the ICT sector on industry and its importance in enterprise and government be under-valued?
- Does the "Professional & Business services" review include IT services or are they seen as an enabler for other professional and business services?
- Does Electronics and electronics design sit comfortably within "Manufacturing"?
- Does the focus on verticals properly cover the disruptive effects that technology might have across all verticals?

In the circumstances we believe that a growth plan looking at innovation and at the horizontal impact of technology should be a priority.

Finally, despite apparent reluctance to acknowledge their role, it is evident that government does intervene in the market as a buyer of ICT. It also plays a role in actively regulating the conduct of players on the market through industry specific regulation and has an impact on the structure of markets, for example given its position on availability of capacity in the form of spectrum and in its management of spectrum on mobile markets. Indirectly, the continued maintenance of regulations that affect the market and which impede innovation, play a role in reducing the pace and dynamic of innovation and should be reviewed and changed to support and promote innovation.

1. <http://www.bis.gov.uk/policies/growth/the-plan-for-growth>

Executive Summary

Capturing the Cloud: Technology-Driven Growth and Innovation in the UK

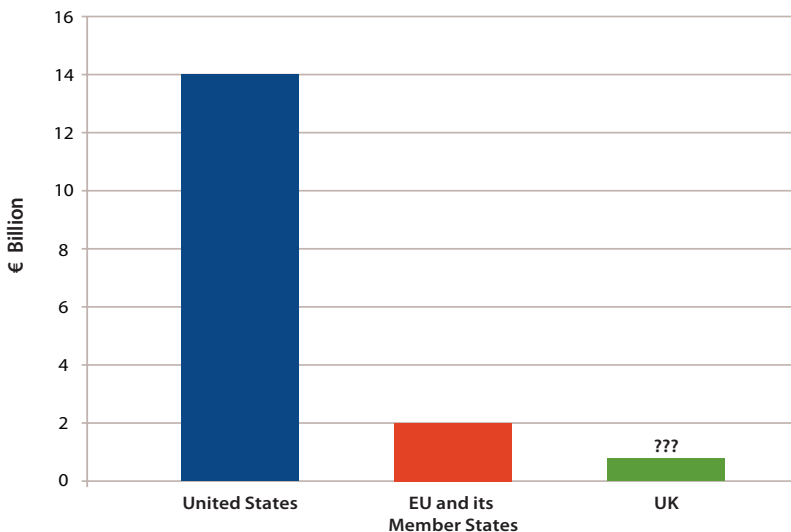
The coalition government is aiming to promote economic growth and creating employment. ResPublica supports the direction of the government's plans and respects the need to conserve funding given the financial crisis.^[2]

Innovation is currently insufficiently supported, yet is regarded as critical to any growth agenda.

This paper suggests that creativity and competitive markets have the dynamic effect of stimulating innovation. The latest wave of technology has opened up new opportunities for boosting growth. Learning from a review of the latest economic evidence and the plans of other countries, we have identified that the government is not doing as much as other countries and could adopt the following 5 proposals which will support both the demand and supply side of the economy without additional funding:

1. The government could boost the economy through intelligent purchasing. The UK is below the EU average in its use of intelligent procurement: see Fig. 1. We are not suggesting that the government spends more money. However, the current budget, spent more wisely, on newer technology will save money. This is because newer technology (such as cloud computing) is cheaper than technology currently in use, and can lead to considerable economic benefits (see Fig 2).

Fig. 1: Use of Procurement to Boost Innovation

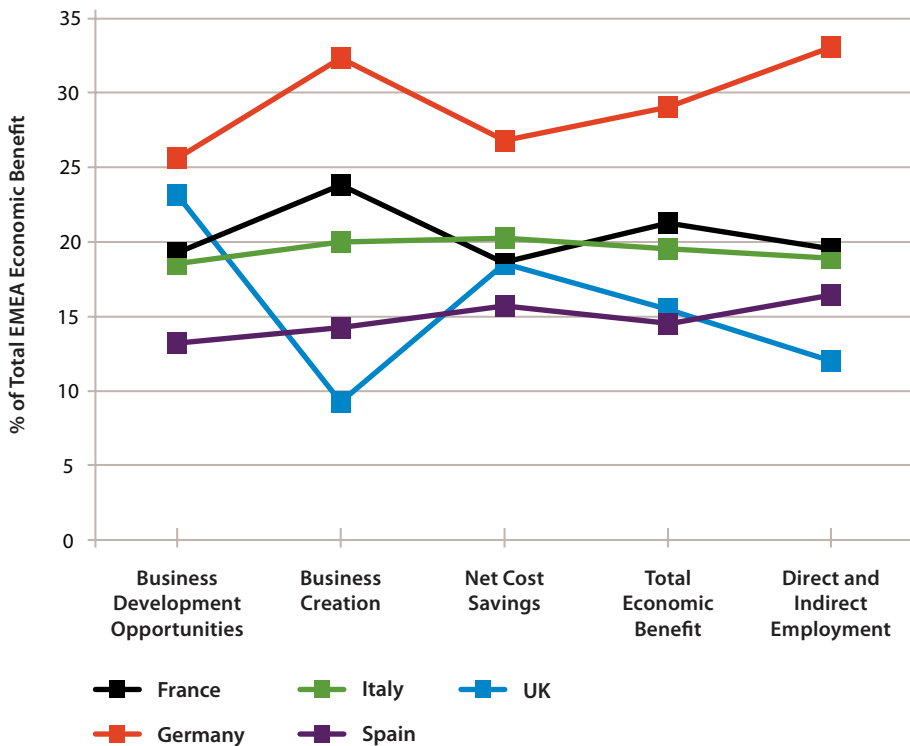


Source: European Commission

2. See HM Government, *Blueprint For Technology*, <http://www.bis.gov.uk/assets/biscore/innovation/docs/b/10-1234-blueprint-for-technology>; David Cameron, *East End tech city speech*, Thursday 4 November 2010 - <http://www.number10.gov.uk/news/speeches-and-transcripts/2010/11/east-end-tech-city-speech-56602>; Government ICT Strategy, March 2011 - http://www.cabinetoffice.gov.uk/sites/default/files/resources/uk-government-government-ict-strategy_0.pdf; UKTI, *Britain Open For Business*, - www.ukti.gov.uk/uktihome/aboutukti/item/148280.html ; and The Hargreaves Report, *Digital Opportunity: A Review of Intellectual Property and Growth* <http://www.ipo.gov.uk/ipreview-finalreport.pdf>

2. The government should be seen to lead by example; through buying new computing solutions on open, standards-based competitive terms. Buying according to the method of production (and the government's bias towards open source and against intellectual property rights) risks picking winners by supporting methods over outcomes. This wastes money. The method of production should be no part of the purchasing specification, the outcome should be specified and the market should be left to propose solutions according to any method that works.

Fig. 2: Economic Benefits of Cloud Computing of Europe's Five Largest Economies (EMEA) Between 2010 - 2015



Source: CEBR Study - *The Cloud Dividend: Part One*

3. Innovation should become the centrepiece and central goal of regulatory policy for the digital economy. The most important industry specific regulation affecting the technology, media and telecoms businesses is communications regulation. Communications regulation affects the structure of the market and, in particular, affects the dynamic of competition throughout the digital ecosystem over time. We believe that the current model has served its purpose but is increasingly outdated. In the light of the shift to cloud computing, and the increased importance of services based competition, we suggest a debate on whether the current theoretical model of competition, whether described as effective, workable, or contestable, will be sufficient to support innovation in terms of quality and service throughout the dynamic modern digital ecosystem.

We make a proposal for change to the theoretical model of competition underlying the regulatory and competition law regime, proposing the adoption of an 'innovation model' over the current 'commodity utility' or 'perfect competition' model. Other laws should be reviewed for their ability to support innovation and competition.

Fig. 3: Government Commitments to Next-Generation National Broadband Networks

Country	Date Announced	Total Investment US \$ in Millions	Investment Per Capita US \$
New Zealand	2009	840	205
Australia	2009	3,300 ¹	159
Singapore	2008	710	154
Portugal	2009	1,060	100
Greece	2008	1,030	92
Malaysia	2008	720	27
Ireland	2009	110	25
US	2009	7,200	24
South Korea	2009	890	18
Germany	2009	200	2

¹ Based on an initial commitment of A\$4.7 billion required investment, considering the plan to keep a 51% stake in the announced National Broadband Network Company, the Australian government's investment could go up to A\$21.9 billion.

Source: Regular Web sites; press releases; Booz & Company analysis

4. As can be seen from the absence of the UK in Figure 3 above, the UK is in danger of slipping behind in both broadband and fibre deployments. Innovation in the broader economy depends on general purpose technologies and improvements in the UK's underlying broadband and fibre infrastructure. The communications and computer technologies are, like a giant circuit board, interdependent. At the top level, massive increases have recently taken place in data processing capability, and processing can now take place either on customer premises or at a distance in remote data centres provided to customers as cloud computing services. Mobile devices are also increasingly sophisticated and volumes of data traffic are exploding. Increasing use of cloud computing lowers costs and increases agility but is increasingly dependent on the capacity and quality of the underlying telecommunications links. Improvements are needed to upgrade

the UK's lower capacity copper network to higher capacity fibre. This would support the digital economy with benefits for the whole of industry and the government's policy of 'rebalancing' the economy. While the private sector should make the running, there is a wider public interest in ensuring that it happens. **We propose greater government leadership in the form of a project plan and timetable for broadband and fibre investments is needed to increase visibility of the availability of fibre and to make sure that fibre roll-out becomes a reality.**

The UK invents a lot but commercialises badly and the pace of innovation, and commercialisation needs to be improved. Innovation takes place both through research and development and also through collaboration between players at all levels in the supply chain. Knowledge and information can be improved through increased communication. Innovation hubs and clusters, bringing together smaller and medium sized players with major industry participants that make up the global supply chains and digital ecosystems can be convened and sponsored by government to the benefit of society more generally. On its own, the Tech City initiative is not going to solve the UK's growth issues. Tech City is only part of the answer and we propose that government should use its power to convene and promote cross sector exchange of knowledge and build on existing clusters in Cambridge and elsewhere.

5. Engagement with people and smaller firms at local level is lacking. Innovation will best be implemented through engagement with players at a local level, and the government has a unique convening power which can increase understanding, increase knowledge and information and improve trans-sector and cross-industry awareness of opportunities. This can be expected to support investment, in and with, smaller and medium sized firms. Smaller firms make a disproportionate difference to innovation³ and employment and we propose that government should engage with smaller firms about their role in an innovation economy.

Conclusion

We consider that more can be done without undermining the approach taken to date, and much can be achieved without a change of direction. Outlined in this paper we review the available economic evidence, the approaches being taken by other governments worldwide and, learning from those initiatives, we suggest proposals in line with the government's established approach.

3. NESTA, 2009, *The Vital 6%: How high-growth innovative businesses generate prosperity and jobs*, London: National Endowment for Sciences, Technology and the Arts - <http://www.nesta.org.uk/library/documents/Vital-six-per-cent- Nov2010-v3.pdf>

Part One: Economic Context

We recognise, in looking at the factors that affect the development of the digital economy, that governments worldwide are grappling with similar issues. We also recognise that increasing skills, access to finance, the tax system, balance of payments and a wide variety of other factors will play their part in creating a growth oriented economy. In this paper we review those elements of industry specific regulation that particularly affect the digital economy, and the prospects for targeted action that will support information communication and technology products and services.

1.1 Economic context: the need for confidence, the opportunity for inspirational leadership and the importance of the digital economy for dynamic growth

The British economy has been severely affected by the financial crisis and is now, slowly, emerging from recession. Over the past few years, people going to work on a daily basis have been faced with a barrage of relentlessly negative media. The numbers are now looking more promising, but behind the numbers there has been a narrative, with its many visions of financial ruin and catastrophic near-misses, all of which have increased uncertainty. In such times people become cautious and fearful and there is a need to generate and support confidence and a role for inspirational leadership in building that confidence, not just in financial markets, but in the minds of ordinary people and within firms of all shapes and sizes.^[4]

The corrosive effect on general levels of confidence needs to be countered. This has created an opportunity for government to show leadership and build confidence, in both words and actions that will encourage people to take risk, increase productivity, efficiency, and to be creative; supporting innovation and employment.

To date symbols of change and growth have eluded the government. The digital economy can provide a basis for changing that position, and the government can embrace modernity and the dynamism of innovation and technological change can be harnessed by the government. Providing a focal point on the future.

In generating growth, the options available are limited. The promotion of trade and investment is underway and the government's trade and investment initiative " Britain Open for Business"^[5] is to be welcomed. Tax incentives have been provided for entrepreneurs, but the lack of availability of finance needs to be addressed.^[6] In common with many other governments we are investing in key skills in science, technology, engineering and mathematics (the so called STEM skills) and again these need to be a priority.^[7]

4. Keynes, The General Theory of Employment, Interest and Money

5. *Ibid* n.1

6. HM Treasury Budget, March 2011 - http://cdn.hm-treasury.gov.uk/2011budget_complete.pdf

7. BIS, BIS Research Paper 30, *STEM graduates in non-STEM jobs*, March 2011 - <http://www.bis.gov.uk/assets/biscore/further-education-skills/docs/s/11-771-stem-graduates-in-non-stem-jobs.pdf>; CBI, *Ready to Grow: business priorities for education and skills*, Education and skills survey 2010 - <http://cbi.org.uk/pdf/20100501-cbi-education-and-skills-survey-2010.pdf>; *Unleashing Aspiration: The Final Report of the Panel on Fair Access to the Professions* - <http://www.bis.gov.uk/assets/biscore/corporate/migratedd/publications/p/panel-fair-access-to-professions-final-report-21july09.pdf>

Demand side generation can also be encouraged, and we identify a role for government in being an intelligent purchaser. We suggest that government should be an adopter of new and more cost effective and efficient ways of working and a user of newer technology which lowers costs and increases productivity. We consider that care is needed and intelligent purchasing requires the use of an open, standards-based, competitive model.

Government has an impact on demand in the UK because it is such a big player. UK public sector ICT spending forecast to 2015-16 shows the sector is in the midst of a marginal decline, and should be reversed to provide growth over the next 4 years. The headline figures are for the total spend, estimated at £17.99bn for 2010-11, to slip to £17.75bn in the next financial year, followed by another mild decline in 2012-13; but that by 2015-16 it will rise to £18.27bn, showing an overall increase of 1.5 per cent (source Kable). However these figures do not indicate the dramatic technological changes and significant cost reductions that would be possible if newer technology were adopted earlier.

The aim of government as purchaser should be to purchase on open, non discriminatory and technologically neutral basis, and in line with the principle of a level playing field for all suppliers to government. This approach delivers value for money in all government purchasing. We consider that the approach taken in this area has to date been inadequate and the delaying of decisions to purchase the latest technology is a false economy, driving costs up rather than down.

Also, in catching the latest wave of technological change the opportunity exists for government to both reduce its costs, increase its productivity, and project confidence and trust in the digital economy. The signal that this would send that the UK is serious about supporting a dynamic, digital economy would be significant. Where government exhorts others to innovate and embrace new technology but does not do so itself, it undermines its credibility and is counterproductive, particularly at this time.

Factors that affect supply side of the economy, including the way in which the economy is regulated, can make a substantial difference to the speed and dynamism of market development. Indeed, the government has contemplated, in its commissioning of the Hargreaves review of intellectual property rights, that changes to the legal and regulatory system can promote growth and affect investment. We identify an additional way in which the model which underpins regulation can be modernized in line with the most recent technological changes further below.

In a recent CEBR study the position of the UK and other European countries has been starkly summarised:^[8]

“Now, for the first time, Europe is competing with economies that currently pay themselves (on an hourly basis) about a tenth of what we pay ourselves. Even after differential inflation and likely exchange rate adjustments, it is likely that, in 10 years time, the cost ratio is still going to be around five to one. But, if we intend to pay ourselves five times as much as the Chinese or Indians, we are going to have to work extremely smartly to be competitive.”

8. CEBR study on cloud computing: *THE CLOUD DIVIDEND: Part one – The economic benefits of cloud computing to business and the wider EMEA economy. (France, Germany, Italy, Spain and the UK)* - <http://uk.emc.com/collateral/microsites/2010/cloud-dividend/cloud-dividend-report.pdf>

We will have to use all the available technological advances in order to achieve this. Obviously, cloud computing is only one of many ways in which we in Europe can improve our efficiency, but our study shows that it is especially important. The study shows that cloud computing could improve the efficiency of an average employee by an average of 2.1%, while also reducing the amount of investment tied up in underutilised IT capacity”.

The latest economic evidence demonstrates the importance of the digital economy for productivity, and the importance of Britain in the digital economy. The digital economy and “Tech City”^[9] initiative is a centrepiece of the government’s existing programme and adopting the approach in principle and applying it more generally will be more effective in underpinning the growth in the economy more generally. It can also serve as a highlight in the gloom of the narrative and something that has been missing from the coalition agenda. It could be a highlight that shows all the central importance of innovation in generating growth, and the importance of small and medium sized businesses in achieving that goal.

1.2 Technological context

Relentless sweeping change is characteristic of technology markets. Currently we are in the middle of a major shift to cloud computing and increasingly intelligent mobile devices. In the 2009 study by IDC the shift to cloud computing was noted as taking place in the middle of the recession and calculated as contributing US \$800 billion in net new business revenues in 52 countries by 2013.^[10] A recent CEBR study across only 5 countries: UK, Germany, France, Italy and Spain, places the potential benefits of widespread adoption of cloud computing at over €763 billion of cumulative economic benefits between 2010 and 2015. The same study calculated the direct and indirect job creation at 289,000 by 2015.^[11]

Gartner inc put the size of the market at US \$150 bn and other studies have placed it at a higher level.^[12] The latest Cloud Industry Forum^[13] and recent McKinsey studies^[14] indicate that the adoption of cloud computing is accelerating rapidly in the UK, and there is an opportunity for the UK to build an advantage when compared with other countries.

The effect on cost savings and job creation could be very significant and prompted Commissioner Reding to describe cloud computing as: **“the medicine needed for our credit squeezed economy”**^[15]

This is not simply about a cloud service substituting for an existing desktop program. Major benefits in productivity will be achieved if the ways of working that are facilitated by cloud computing are adopted. The Cloud Industry Forum study 2011 shows that while cloud computing solutions are

9. David Cameron, *East End tech city speech*, Thursday 4 November 2010, *ibid* n. 1

10. IDC Study, *Aid to Recovery, the Economic Impact of IT Software and the Microsoft Ecosystem on the Global Economy* - <http://www.intertec.org/Policy%20Papers/IDC.pdf>

11. *Ibid* n. 7

12. Gartner, *Forecast: Sizing the Cloud; Understanding the Opportunities in Cloud Services* - <http://www.gartner.com/DisplayDocument?id=914826>

13. Cloud Industry Forum, *Cloud UK, Paper One: Adoption and Trends 2011* - <http://www.cloudindustryforum.org/downloads/whitepapers/cif-white-paper-1-2011-cloud-uk-adoption-and-trends.pdf>

14. McKinsey & Company, *Internet Matters: The Net’s sweeping impact on growth, jobs and prosperity* - http://www.eg8forum.com/fr/documents/actualites/McKinsey_and_Company-internet_matters.pdf

15. Viviane Reding EU Commissioner for Telecoms and Media Digital Europe – Europe’s Fast Track to Economic Recovery The Ludwig Erhard Lecture 2009 Lisbon Council, Brussels, 9 July 2009 - <http://europa.eu/rapid/pressReleasesAction.do?reference=SPEECH/09/336&format=HTML&aged=0&language=EN&guiLanguage=en>

much cheaper than traditional computing deployments, they are increasingly being adopted because of the increased agility that they provide to firms.^[16] Agility means the capability provided by a flexible computing and communications architecture on the ability of a firm to work in new ways and adopt new and innovative working practices. Simple changes to working practices, such as working from home, which can be facilitated through remote working technology that can be accessed from anywhere, can make considerable productivity improvements. The UK is already a leading adopter of remote working practices and the property of cloud computing services, which are inherently off-premises and accessible from anywhere, lend themselves to new ways of working and more opportunity for adopting new working practices.

Cloud computing has many established impacts on productivity.^[17] A common starting point for review of a firm's technology requirements is a review of the services that a firm needs to deliver to its customers, and that is often taken as the basis for the technology that is then specified. Such an approach, starting with the review of business process, is commonly adopted in the private sector and is seen to be increasing the agility and responsiveness of firms in meeting their customers' needs. It increases efficiency and allows for simpler or more cost effective working practices than in the past.

Continuing to do the same things as in the past, with increasingly out of date technology, cannot be a sound footing for productivity gains in government. When the productivity issue is laid alongside the case for the direct budget savings that can also be made from swifter adoption of cloud computing solutions, the argument for early government adoption of cloud services becomes compelling. It is estimated that many instances of cloud computing based solutions saved government between 20 and 50% of the cost of traditional computing deployments and in some cases more than 50%.^[18]

There has been a market boom in mobile devices and in the mobile market in general. This trend is set to continue. As the recent Cisco report shows average smart-phone usage doubled in 2010. The Cisco study suggests that worldwide mobile data traffic will increase 26-fold between 2010 and 2015, and there will be nearly one mobile device per capita by 2015. This will mean there will be over 7.1 billion mobile-connected devices, including machine-to-machine modules in 2015 — approximately equal to the world's population in 2015 (7.2 billion).^[19]

It is understood by government that mobile is increasingly the access method of choice for much of the population.^[20]

16. *Ibid* n.12

17. The Open Computing Alliance, *Removing barriers to tomorrows' ICT - Comments on the Commission's Public Consultation on 'Post-i2010: priorities for a new strategy for European information society (2010-2015)'* - <http://www.opencomputingalliance.org/oca-reports/open-access-interoperability/>; CEBR study on cloud computing: *THE CLOUD DIVIDEND: Part one – The economic benefits of cloud computing to business and the wider EMEA economy. (France, Germany, Italy, Spain and the UK)*, *ibid* n.12

18. US House of Representatives Review, "*Cloud Computing: Benefits and Risks of Moving Federal IT into the Cloud*" - http://democrats.oversight.house.gov/index.php?option=com_content&task=view&id=5012&Itemid=2&layout=default&view=article&date=2011-04-01, and http://democrats.oversight.house.gov/images/stories/Hearings/Committee_on_Oversight/2010/070110_Cloud_Computing/Chairman_Towns_Opening_Statement_-_Cloud_Computing.pdf.

Submissions in response to the House of Representatives Review by:

(i) Google - http://democrats.oversight.house.gov/images/stories/Hearings/Committee_on_Oversight/2010/070110_Cloud_Computing/Cloud_Testimony_-_FINAL.pdf;

(ii) Microsoft - <http://judiciary.house.gov/hearings/pdf/Hintze100923.pdf>;

(iii) Amazon - <http://judiciary.house.gov/hearings/pdf/Misener100923.pdf>.

19. Cisco Visual Networking Index: Global Mobile Data Traffic Forecast Update, 2010-2015 - http://www.cisco.com/en/US/solutions/collateral/ns341/ns525/ns537/ns705/ns827/white_paper_c11-520862.pdf

20. Government ICT Strategy, March 2011 - http://www.cabinetoffice.gov.uk/sites/default/files/resources/uk-government-government-ict-strategy_0.pdf

“Innovations in online commercial services have set high standards for an increasingly mobile population. Many citizens’ expectations have shifted from traditional face-to-face, telephone or paper channels to more responsive 24/7 online personalised services and delivery through mobile devices.”

However, government currently appears to be missing out on the benefits of the technology change that is taking place. Early studies indicated that Government could have adopted cloud computing to advantage some time ago.^[21] Indeed it was government policy to move to a ‘G –Cloud’ through which consolidation of data centres and the use of distributed computing would have allowed the reduction in data centre costs, and property, labour and other costs as well as supporting business process changes and efficiency and productivity benefits.^[22] The approach taken to date has been to freeze contracting and reduce costs on existing contracts. This has led to the perhaps unintended consequence of slowing the speed of adoption of newer better, and cheaper solutions.

Government is itself a major customer and in the UK is a major market and a shaper of markets. It cannot afford to continue to work with expensive, out-dated technology. To delay contracts has the very short term benefit of conserving cash and avoiding being seen to be profligate, but when newer technology supports more efficient ways of working and at less cost there is now a need to move on.

1.3 Worldwide and UK Regulatory context

The digital economy in the EU is perhaps most specifically affected by communications laws and regulations under the European framework and the laws that affect privacy and data protection.^[23] These industries are heavily reliant on intellectual property right protection to secure investments and that has been reviewed most recently in the Hargreaves Review of intellectual property, which followed the Gower review. We support the conclusions of the Hargreaves review. In particular we consider that evolutionary changes to intellectual property rights are to be adopted and that intellectual property rights are vital to investment.^[24]

21. Liam Maxwell, It’s Ours – Why we, not government, must own our data - http://www.cps.org.uk/cps_catalog/it's%20ours.pdf. Martin Read, Operational Efficiency Programme: Final Report, HM Treasury 2009 - http://www.bis.gov.uk/assets/biscore/shex/files/oeop_final_report_210409_pu728.pdf

22. Government ICT Strategy, March 2011, *ibid* n. 19

23. Directive 2009/140/EC of the European Parliament and of the Council of 25 November 2009 amending Directives 2002/21/EC on a common regulatory framework for electronic communications networks and services, 2002/19/EC on access to, and interconnection of, electronic communications networks and associated facilities, and 2002/20/EC on the authorisation of electronic communications networks and services - <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:337:0037:0069:EN:PDF>

Directive 2009/136/EC of the European Parliament and of the Council of 25 November 2009 amending Directive 2002/22/EC on universal service and users’ rights relating to electronic communications networks and services, Directive 2002/58/EC concerning the processing of personal data and the protection of privacy in the electronic communications sector and Regulation (EC) No 2006/2004 on cooperation between national authorities responsible for the enforcement of consumer protection laws (Text with EEA relevance) - <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:337:0011:0036:EN:PDF>

24. See for example, the number of submissions and the types of companies who thought it was absolutely necessary that they respond to the call for submissions in relation to the Hargreaves Report, highlighting the importance of IPR for investment in the UK. This, for example, included the likes of:

- (i) BBC - <http://www.ipo.gov.uk/ipreview-c4e-sub-bbc.pdf>;
- (ii) C4 - <http://www.ipo.gov.uk/ipreview-c4e-sub-channel4.pdf>;
- (iii) CBI - <http://www.ipo.gov.uk/ipreview-c4e-sub-cbi.pdf>;
- (iv) eBay - <http://www.ipo.gov.uk/ipreview-c4e-sub-ebay.pdf>;
- (v) IBM - <http://www.ipo.gov.uk/ipreview-c4e-sub-ibm.pdf>;
- (vi) Microsoft - <http://www.ipo.gov.uk/ipreview-c4e-sub-microsoft.pdf>;
- (vii) Nokia - <http://www.ipo.gov.uk/ipreview-c4e-sub-microsoft.pdf>;
- (viii) Premier League - <http://www.ipo.gov.uk/ipreview-c4e-sub-microsoft.pdf>;
- (ix) Sky - <http://www.ipo.gov.uk/ipreview-c4e-sub-bsb.pdf>;
- (x) Talk Talk - <http://www.ipo.gov.uk/ipreview-c4e-sub-talktalk.pdf>

The EU's i2010 project and Digital Europe programme recognizes the central importance of the sector for productivity growth and employment.^[25] The EU Council^[26] has recently recognized that the following are the key issues affecting European countries by contrast with major trading partners:

- poor availability of finance,
- costly patenting,
- lack of legal and tax level-playing field,
- outdated regulations and procedures,
- slow standard setting,
- weaknesses in public education and innovation systems,
- failure to use public procurement strategically,
- a fragmentation of efforts.

The EU discussion encourages the UK to look carefully at smart fiscal consolidation (supporting R&D as well as cutting costs), improved framework conditions, including increased enforcement of intellectual property rights and the faster setting, and use, of EU standards, as well as best practices in using public procurement. The review of IPR and other actions that has now been done leave the remaining questions that need to be addressed in the UK as those that relate to:

- strategic procurement,
- outdated regulation, and
- how to increase innovation, whether through research and development or otherwise.

In the US, President Obama has, earlier in 2011, personally led and endorsed a Strategy for American Innovation.^[27] The principle components include the recognition:

- that innovation is the mechanism that drives growth,
- that the market is the engine of American innovation, and
- that government has a role as an innovation facilitator.

While the specific initiatives of that strategy have to be set in an American context, the underlying economic evidence and logic of the approach is reflected in this paper.

The World Bank,^[28] ITU/UNESCO^[29] and OECD^[30] and many other studies compare the actions being taken by governments worldwide to facilitate growth. There are common themes and it is recognized that the UK is well placed among nations in its approach to the digital economy, however, there are indications that the current British approach is less ambitious than the position in other countries, and that this could lead to comparative disadvantage over time.

25. European Commission, *A Digital Agenda for Europe* - <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2010:0245:FIN:EN:PDF>; i2010: Europe's Digital Competitiveness Report – Main achievements of the i2010 strategy 2005-2009 - http://ec.europa.eu/information_society/eeurope/i2010/docs/annual_report/2009/digital_competitiveness.pdf; Europe's Digital Competitiveness Report 2010 - http://ec.europa.eu/information_society/digital-agenda/documents/edcr.pdf

26. President Barosso's presentation to the European Council of 4 February 2011, *Innovation Priorities for Europe* - http://ec.europa.eu/europe2020/pdf/innovation_en.pdf

27. US White House, *A Strategy for American Innovation – Securing Our Economic Growth and Prosperity*, February 2011 - <http://www.whitehouse.gov/sites/default/files/uploads/InnovationStrategy.pdf>

28. OECD/World Bank joint publication, *Innovation and Growth: Chasing a Moving Frontier*, Edited by Carlos A. Primo Braga, Pier Carlo Padoan, Vandana Chandra, Deniz Eröcal. Published by, OECD Publishing

29. ITU/Unesco Report, *Broadband: A Platform for Progress*, June 2011 - <http://www.broadbandcommission.org/report2/full-report.pdf>

30. *Ibid* n.27; OECD, *Broadband Growth and Policies in OECD Countries* - <http://www.oecd.org/dataoecd/32/57/40629067.pdf>

In this regard we note the following statement from the US' Strategy for American Innovation as an area where the US appears to have taken the lead. It relates in particular to the alignment of all national regulation to the innovation agenda and to ensuring that regulation supports competition and innovation rather than impeding it. Specific attention is drawn to the central importance of standards and the role of government in spurring innovation and the adoption of new products:

Government can also accelerate innovation by setting rules in specific sectors, notably by updating or eliminating outdated regulations. To that end, President Obama signed an Executive Order in January 2011 calling for a government-wide review of regulations to update or revise them to, among other purposes, ensure that they facilitate—rather than impede—competition and innovation in addressing valid public policy goals. Effective management of public resources, such as the electromagnetic spectrum, unleashes innovation by opening markets and reducing uncertainty over usage rights and engineering design.

In appropriate contexts, public leadership can help set standards for technology platforms, such as emerging smart grid or health IT technologies, providing confidence to the marketplace to develop and adopt new generations of products. Standard setting, which the government can enable through its role as convener and support through research and development, often involves facilitating coordination within the private sector to create a larger market, thus enhancing the demand for innovative products.

Export initiatives further increase the market scale for U.S. businesses. Increased scale is an attraction to business innovation, while tiny, balkanized markets are not.^[31]

The US approach leaves us asking the question ; are we doing enough to promote innovation in our system of regulation? We recognise that UKTI's plan, 'Britain Open for Business',^[32] is potentially highly supportive of the export agenda and mirrors the US approach for exports, but much more could be done domestically. We also recognise that there are on-going consultations and expect that this paper will be considered in the DCMS consultation,^[33] and the European consultations that are taking place on cloud computing,^[34] privacy and data protection,^[35] and the recent EU review of public procurement.

31. *Ibid* n.26

32. UKTI, *Britain Open For Business*, *ibid* n.1

33. DCMS review into the UK Communications Sector - http://www.culture.gov.uk/what_we_do/telecommunications_and_online/8109.aspx, and <http://www.culture.gov.uk/crquestionnaire/>

34. European Commission's Public Consultation on Cloud Computing - <http://ec.europa.eu/yourvoice/ipm/forms/dispatch?form=cloudcomputing&lang=en>

35. See for example, the currently ongoing Information Commissioner's Office consultation, *Promoting Openness by Public Bodies and Data Privacy for Individuals* - http://www.ico.gov.uk/about_us/consultations/~/_media/documents/library/Corporate/Research_and_reports/ico_information_rights_strategy_consultation_pdf.ashx

Part Two: Economic Position

The importance of the Digital Economy for productivity growth and employment

In this section we reference the many reports that have identified the importance of the ICT sector in driving GDP growth and in increasing productivity. The existing studies are overwhelming, with the latest ITU/Unesco report for June 2011 referencing around 100 research reports and case studies on the economic effects of providing broadband, access to the internet and the use of ICT in general.^[36]

These studies demonstrate the positive link between GDP growth and ICT and positive returns from investment in infrastructure and fibre roll out and broadband. In Brazil, one study indicates that broadband added up to 1.4% of the employment growth rate, and in China, for every 10% increase in broadband penetration, there is reported to be an additional 2.55 increase in GDP growth.

These studies also show a pattern that is consistent, ICT is a general purpose technology that underpins growth in the economy generally. The Hargreaves review also referenced the NESTA study of 2009^[37] and Greenhalgh and Rogers^[38] studies in the following terms:

“It is widely accepted that the most important driver of long term economic growth is improved productivity. Over the last decade the majority of productivity growth and job creation has come from innovation, primarily by small and young firms. These innovative firms grow twice as fast, both in employment and sales as firms that fail to innovate...”

“1.17 Digital technology is probably the most important and transformative technology of our time. Because digital is fundamentally an information and communication technology (ICT), intellectual property rights lie at its heart. Not only has ICT adoption and use been among the strongest drivers of growth but it has pushed content and communications technologies into new uses ...”^[39]

We consider that supporting smaller and medium sized companies is central to the digital agenda, but it should not be forgotten that major businesses have a significant role to play, both in terms of innovation and in the way that they operate as channels to market for new and smaller businesses. In addition, for many venture capital backed firms, the exit route through which their innovation becomes embedded in a commercial system is through acquisition or merger with other enterprises.

In looking at the impact of the internet on the economy, the latest McKinsey research finds that the internet now accounts for a significant share of global GDP and plays an increasingly important role in economic growth. In May 2011 McKinsey reported that the Internet accounts for 3.4 percent on average of overall GDP for 13 leading countries worldwide.^[40]

36. See for example, figures 1.1 and 1.2 in the ITU/Unesco Report, *Broadband: A Platform for Progress*, which highlights how broadband subscriptions have grown worldwide in recent years, *ibid* n. 28

37. *Ibid* n.2

38. Greenhalgh C and Rogers M, 2010, *Competition, Intellectual Property and Innovation*, Report for the Review of IP and Growth - <http://www.ipo.gov.uk/ipreview-doc-h.pdf>

39. The Hargreaves Report, *Digital Opportunity: A Review of Intellectual Property and Growth*, *ibid* n.1

40. *Ibid* n.13

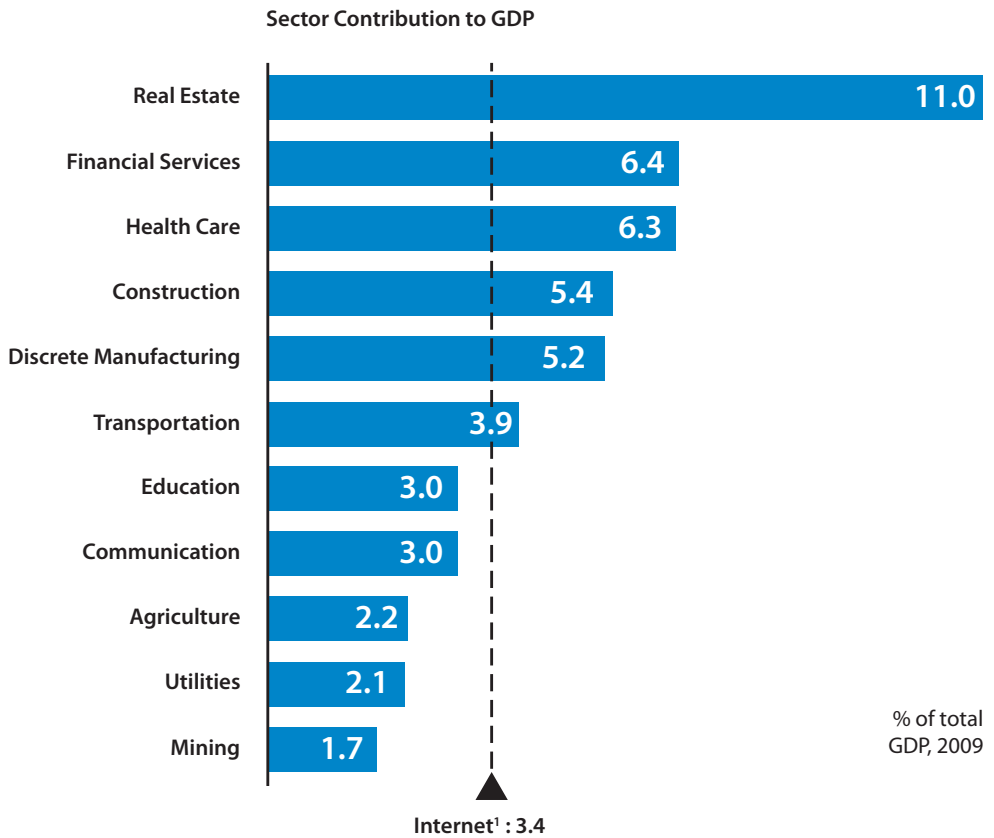
This report also notes that UK internet usage is different from, and is higher than, the average. In this context, specific actions could make increased differences. The report indicates that the Internet accounted for 10 percent of GDP over the 15-year period from 1995 to 2009, and its influence is expanding. Over the last five years of that period, its contribution to GDP growth doubled, to 21 percent. The Internet contributed 7 percent of growth from 1995 to 2009 and 11 percent from 2004 to 2009. The UK and Sweden appear to be early adopter economies in the EU and ahead of the game. This is no cause for complacency. It is also noted that in the global Net's growing ecosystem of suppliers, US companies play leading roles in key sectors, and China and India rank among the fast-growing players in the Internet's global supply chain.

One key feature McKinsey identifies is that most of the economic value the Internet creates falls outside of the technology sector: companies in more traditional industries capture 75 percent of the benefits. It is thus critical for all the sectors of the economy, and for the government's established project to rebalance the economy, for the digital economy to be understood as a material factor in helping to achieve those goals.

The diagrams taken from the McKinsey^[41] report below show quite emphatically the significant and fundamental role the Internet plays in the development of the economy.

41. *Ibid n.13*

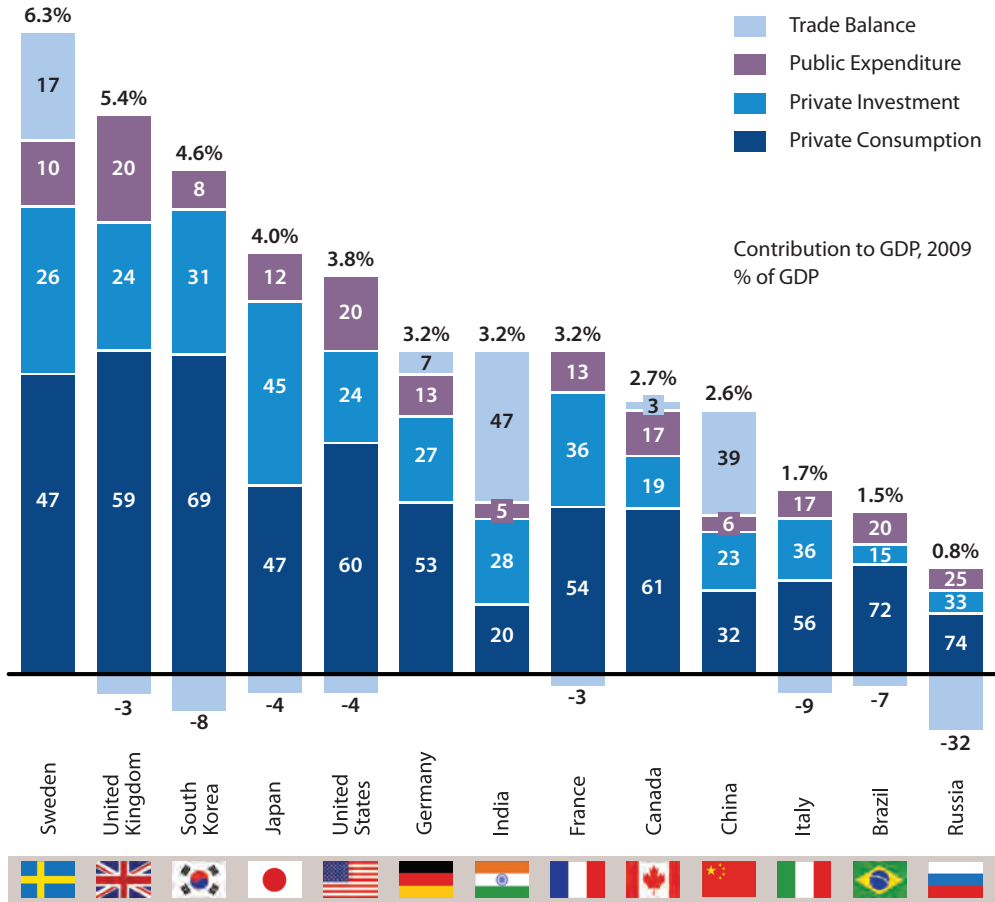
Fig. 4: If Internet were a sector, it would have a greater weight in GDP than agricultural or utilities



¹ Internet share includes parts of other sectors (e.g. communication)

Source: Organisation for Economic Cooperation and Development; McKinsey Analysis

Fig. 5: Internet contributed directly to between 0.8% and 6.3% of GDP, depending on the country

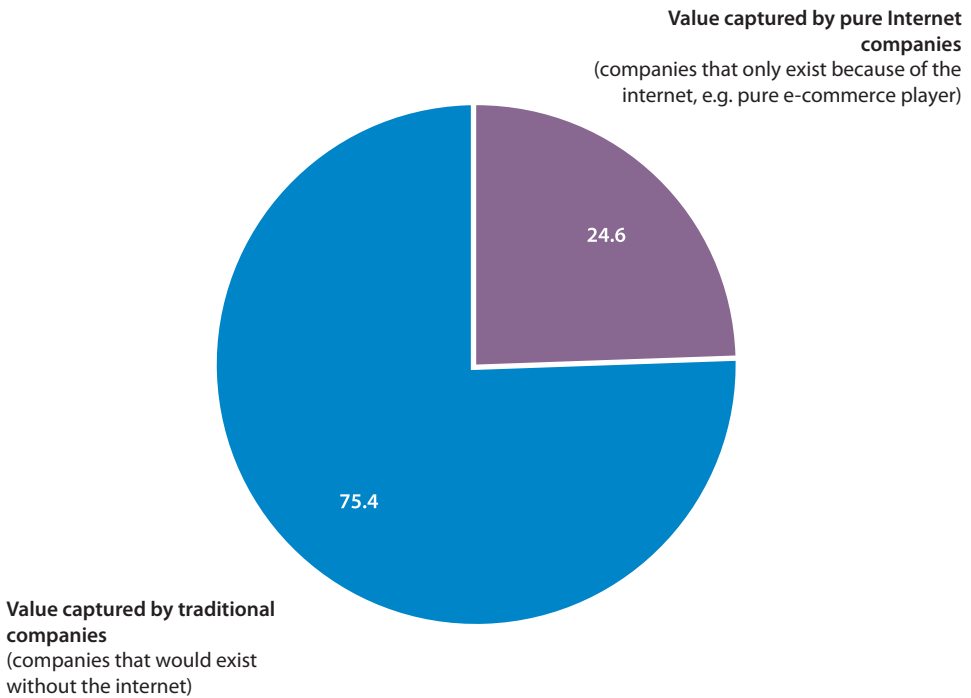


Source: McKinsey Analysis

Fig.6: Traditional industries capture 75% of the value of the Internet

Share of Internet profitability gain between companies

100% = Total Internet value for all companies



Source: McKinsey SME Survey

The Internet is also a catalyst for generating jobs. Among 4,800 small and midsize enterprises surveyed, it created 2.6 of them for each lost to technology-related efficiencies.

It is well known that the long-term benefits of infrastructure investment are immense. This was most recently noted by Lawrence Summers, then head of the President's National Economic Council, explained in 2010.^[42]

Further evidence and support for the underlying importance of the ICT sector for the economy can be found in the materials listed in the bibliography, and in particular the following:

- WTO and ETRO studies showing the link between technology, growth and jobs.^[43]
- CEBR study on cloud computing.^[44]
- EU Digital Agenda and Single Market Act: the established and agreed framework for growth for the EU.^[45]
- Cloud computing and the promise for GDP.^[46]
- February 2011 CIF study showing cloud computing take up and the opportunity for Cloud Computing to lower costs and increase operational agility.^[47]

42. L. Summers, *Technological Opportunities, Job Creation, and Economic Growth*, Remarks at the New America Foundation on the President's Spectrum Initiative -

<http://www.whitehouse.gov/administration/eop/nec/speeches/technological-opportunities-job-creation-economic-growth>

43. Federico Etro, *The Economic Impact of Cloud Computing on Business Creation, Employment and Output in Europe – An application of the Endogenous Market Structures Approach to a GPT innovation* - <http://www.intertic.org/Policy%20Papers/RBE.pdf>

44. *Ibid* n.7

45. *Ibid* n.24

46. *Ibid* n.16

47. *Ibid* n.12

Part Three: Government Proposals

Review of the coalition approach: directionally correct and a need to refine the specifics

The standard bearer for the coalition's approach to the sector is the Prime Minister, David Cameron's 'Tech City' speech, in the winter of 2010.^[48] This has been followed by the Cabinet Office's Technology Strategy of March 2011.^[49]

The Tech city speech famously questioned whether the IPR system in the UK impeded the development of entrepreneurs, and the subsequent review found the opposite to be the case. However, the underlying rationale behind the question, whether regulation impedes growth, raises a point that has not been fully answered. Government plays a role in the economy through laws that can enable or restrict growth, and while IPR is a careful balance and the need for change limited, other legislation needs to be reviewed for its impact on competition and innovation.

Much of the Government's ICT strategy is to be welcomed.^[50] In its overall management structure, with clear deliverables and identified priorities for cost control the priorities are clearly set out and, in managing the large organisation which is government, the project plan is clear. Two areas in particular need further refinement:

Firstly, in paragraph 12 it is stated that:

"Government will ensure that technology requirements are considered earlier in the policy-making process. This approach will be supported by the application of lean and agile methodologies that will reduce waste, be more responsive to changing requirements and reduce the risk of project failure."

How this is to be done needs to be much clearer, with publication of the potential description of products and services being offered by government departments and the programme being subject to constant upgrading through benchmarking and input from market players. The purchasing system is dependent on the definition of requirements and they need to meet internal service definitions reflecting the supply of government services to the end customer/voter. This is often the weakest link in the process. The way of upgrading government services to meet the 'market' needs to be changed. This needs to be more dynamic, reflecting the speed of technological change. Customer/voter demand-led definition of requirements needs to be refined and work its way through to contract specifications and purchasing more quickly. The process also needs to include market feedback and non-linear feedback loops and the market needs to be involved in helping government departments to understand what possibilities exist that will meet the requirements over time. The conundrum of lack of information about what is possible and specifying out of date technology may be solved if government contracts included a requirements specification schedule through which upgrades and alternatives have to constantly be offered by suppliers.

48. David Cameron, *East End tech city speech*, Thursday 4 November 2010, *ibid* n.1

49. *Ibid* n.19

50. See Government ICT strategy, Cabinet Office March 2011, *ibid* n.19

Secondly, extreme care needs to be taken when government is purchasing, to ensure that it does not abuse its market power as a monopolistic purchaser. The ICT strategy states:

*“Government sourcing of ICT has often failed to deliver economies of scale and the most cost-effective use of taxpayers’ money. The Government will therefore aim to become a single and effective ICT customer **which will leverage its considerable buying power** to drive down the operating cost of its ICT.”*

This is potentially evidence of an intent to abuse market power and a breach of competition law. Obtaining the benefits of economies of scale and objectively purchasing on better terms is to be applauded in the public interest, but **“leveraging its considerable buyer power”** may be a form of abuse which would undermine effective competition and distort a competitive market between suppliers. It is also likely to be incompatible with the express wish of government to support purchasing from smaller and medium sized enterprises and could drive them out of business. The impact on innovation is unlikely to be positive.

As can readily be appreciated, it would be something of a poisoned chalice for SMEs to become major suppliers to government on ruinous terms, reflecting the short term interests of government in reducing costs and creating situations of supplier dependency. A balanced approach toward purchasing on benchmarked terms supporting effective competition and innovation would be preferable. Government should be aware of the impact that it has on the market and work together with competition and regulatory agencies such as Ofcom and the Office of Fair Trading to understand in more detail the market it affects and to appreciate when and how it can avoid stifling competition and better encourage innovation in its purchasing practices.

The Government should be aware that standards are important in technology and it should purchase on the basis of open, non discriminatory standards. Its approach should be to use open standards and in using international and other standards in line with its international obligations under the WTO and EU procurement rules. (Recent Cabinet office guidance should be altered to reflect this approach). In particular, we note that the government states in its ICT strategy that it:

“will continue to work with the European Union to ensure that its ICT meets legal obligations and, where applicable, aligns its frameworks and strategies with those commonly agreed at a European level to improve the way Member States work across borders. The Government will work with countries across the world to learn from, share and reuse the best solutions and standards”.

The approach proposed in the Cabinet Office PPN appears to be at odds with the government’s strategy and the strategy with its emphasis on open competitive purchasing, is to be preferred to the PPN.

Part Four: Practical Suggestions

4.1 Central government actions

4.1.1 *The role of central government as purchaser driving the adoption of new technology: cloud computing and mobile commerce*

In the sections above we have identified the political, economic, technological and regulatory context that suggests that now is the time for an enhanced role for government to lead in the adoption of new technology. As discussed, innovation should be placed at the centre of the government's strategy for growth and the government should be seen to lead by example and through intelligent, open, standards-based competitive purchasing. Consistent with international thinking this is likely to achieve both cost savings, productivity gains and to stimulate the economy.

4.1.2 *The role of regulation in creating a more innovative economy*

It is well understood that regulation affects the conditions for investment in the economy. The current EU package of communications regulation,^[51] has itself served to deregulate markets and increase investment, opening markets to competition across the EU, while regulating market failure and monopoly.

In particular, the regulation of access to underlying communications infrastructure is based on an obligation on incumbent telecoms players to provide their services on open non discriminatory and cost based terms. These obligations are the basis on which the entire digital ecosystem depends. Downstream operators, such as interconnecting telecommunications companies, and internet service providers, use the underlying monopoly access facilities and provide their services over the top of these communications networks. The entire system can be thought of as a giant digital circuit board, with processing taking place on computers at people's desks, in data centres, or in vast warehouses called cloud computing centres, all connected together by the communications system.

The underlying communications facilities are provided on terms and prices that are supplied and regulated in the public interest. Both competition law and sector specific regulation operate on the basis of requiring the supply of facilities against a theoretical model of competition that expects that prices will tend to converge towards average costs over the long run. This 'long run average incremental cost' (LRAIC) or average total cost (ATC) approach assumes a model of competition. This assumption is of a type of competition that would exist in a competitive market, typically composed of similar goods and where there are a large number of buyers driving demand and a large number of suppliers of similar goods from which to choose.

The objective of regulation and competition law^[52] in this area has been to mirror the conditions of competition that arise in a competitive market and has imposed on monopoly the outcomes that would be expected in competitive markets. The effect has been that incumbent operators are

51. *Ibid* n.22

52. Case C-52/09, *Konkurrensverket v TeliaSonera Sverige AB*, Judgment of the European Court of Justice of 17 February 2011

required to supply at lower prices than they would otherwise have been able to charge. The system benefits all in this regard. It means that players in downstream markets, such as internet companies and broadband suppliers, get access to communications facilities on cost-related prices. However, while price competition can be assumed to increase efficiency, the competition for quality of service improvements has been more limited.

There is a debate at the present time about whether the current 'utility' or 'commodity competition' approach is adequate or sufficient to provide access suppliers with sufficient returns and whether the congestion driven by internet growth is causing problems for traffic management. Also there are concerns that the system is not providing a level of return sufficient for incumbent operators to make the capital investments needed to build next generation access and fibre networks. To help resolve the impasse, change to the underlying theoretical model, to a model of innovative competition in services markets and away from a model of a type of competition that typically applies in commodity or utility markets, is something that could be adopted as a matter of policy.

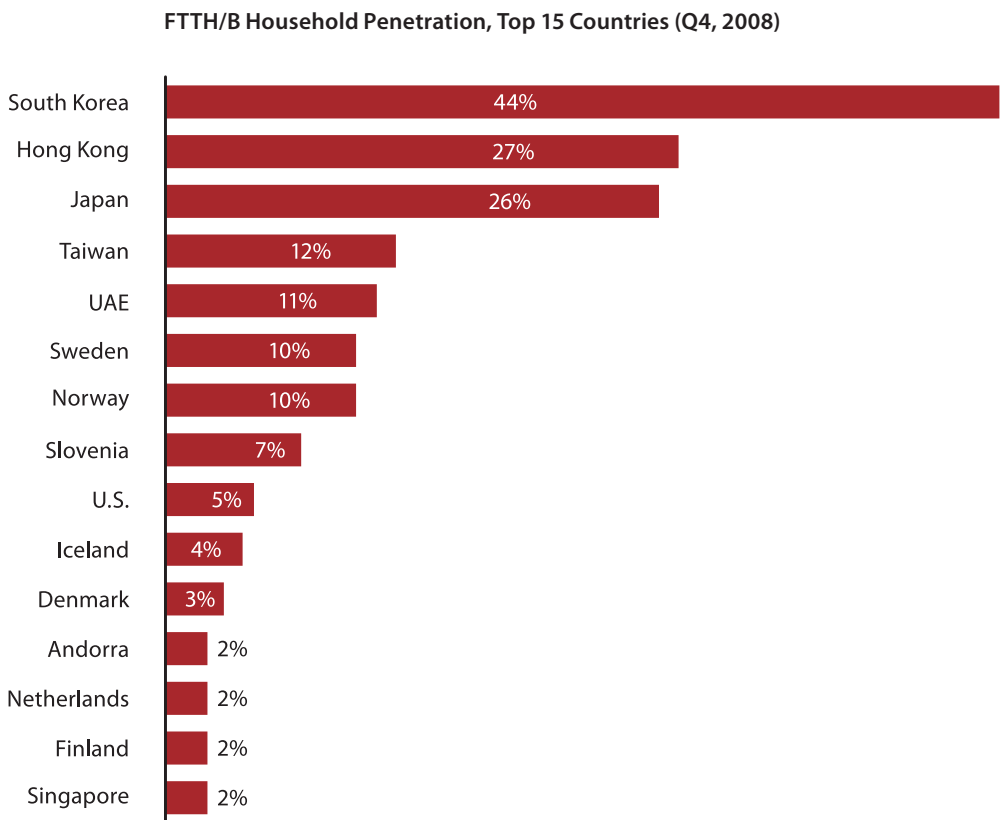
One consequence of the current theory is that the terms and conditions of supply of regulated facilities are intended to limit risk, as would occur in a typical commodity-utility environment. The world of communications and computing that this model originally supported, of commodity voice and data traffic, has rapidly changed. Now, with increasing innovation, and risk, being taken by propositions and products offered to customers at the retail level innovation is taking place in the market and in collaboration with the customer. There is a greater need for both risk to be passed through the supply chain and borne by access suppliers, and for innovation in access products, which would support cloud computing and other new services and support increased mobile device usage at the retail level. Regulated access currently restricts this from taking place. It may even be the case that current regulation, with its outdated utility-commodity model of competition, is impeding the development of services such as cloud computing and services in other digital markets by limiting the risk and quality competition that should be occurring throughout the ecosystem, and acting in a way that restricts the development of the market as a whole. **We therefore propose that the regulatory regime could be altered with a duty to promote innovation being a goal of regulatory policy.**

We have identified the opportunity for an change of approach in communication regulation, moving from a commodity-utility model to a more innovation led model of competition. We are not proposing that the regulation of prices should be abandoned. Operationally, this proposal would need to be combined with increased forecasting by downstream operators and broadband suppliers of the types of quality of service required by such things as cloud computing services and increased forecasting of the types and volumes of traffic that would be generated. Forecasting information would need to be passed on to regulated access suppliers. Benchmarking, and regulation of access through comparisons with baskets of innovative retail products and services would provide a basis for objective regulation of the system and a way to safeguard the public interest. With longer term forecasting and greater commitment from downstream players, such an approach would increase innovation throughout the supply chain and provide a workable basis for co-investment going forward.

4.2 General Purpose Technologies and the effect of ICT on the broader economy; the importance of Broadband and Fibre for the economy generally. The UK position in international comparisons: are we slipping?^[53]

The graph below provides an indication of worldwide investment in the next generation networks. The UK is nowhere to be found.

Fig. 7: Few Countries Have Extensive Networks of Fiber to the Home or Business

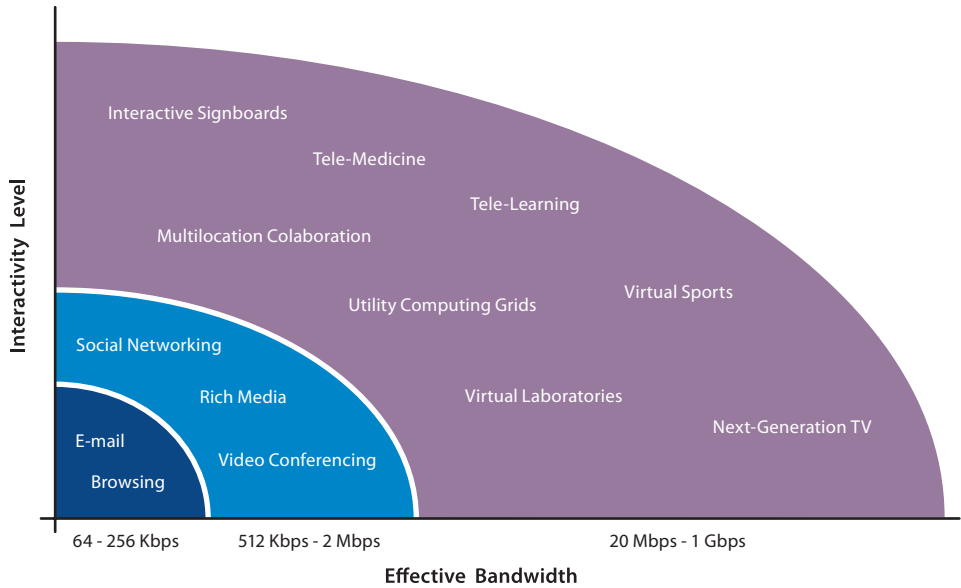


Source: FTTH Council; Booz & Company Analysis

53. See ITU/Unesco Report, *Broadband: A Platform for Progress*, June 2011 *ibid* n.28

Fiber provides higher capacity links and infrastructure that enables a wide variety of products and services to be developed. It provides a facility which increases innovation. The potential for the development of new services is indicated below.

Fig. 8: Pushing Beyond Broadband’s Current Capacity



Narrowband	First-Generation Broadband	Next-Generation Broadband	Access Type
PSTN, 2G	DSL, 3G	FTTx, LTE	Typical Technology
\$20 - \$50	\$100 - \$150	\$300 - \$2,500	Typical Capital Expenditure/Subsidy per Subscriber (in US\$)

Source: Booz & Company Analysis

When considering innovation that is facilitated by fiber and broadband, it is not just the innovation that has been traditionally supported by Government through R&D programmes that needs to be considered. There is much established thinking that suggests research and development needs to be publically funded as a basis on which commercialisation of new products and services then emerges. EU and US thinking has accepted, since the 1960s, that competitive markets don't deliver as much benefit to society as funded R&D.^[54]

54. See for example, US Whitehouse, *A Strategy for American Innovation – Securing Our Economic Growth and Prosperity*, February 2011, *ibid* n.26

In early 2011 the US White House, “A Strategy for American Innovation – Securing Our Economic Growth and Prosperity” noted that:

“one central “market failure” is in the field of basic scientific research. Basic research typically does not have direct commercial payoffs. Yet breakthroughs in basic research underpin downstream, commercial ideas, which can bring enormous economic benefits. For example, engineering builds on Newton’s laws of motion, the biotechnology industry builds on Watson and Crick’s discovery of the structure of DNA, and the dot.com industry builds on government and university development of the Internet. Because basic science has little if any immediate commercial return, its costs are typically not easily undertaken by private investors, thus leaving government funding as a critical source of support.”

As noted in the TNO report: ^[55]

“The concept of market failures has been applied to technology and knowledge productions markets (innovation markets) and has become mainstream in R&D and innovation policy (Nelson, 1959; Arrow, 1962; Hauknes en Nordgren, 1999; Oxera, 2005). Standard market failures have been adapted and disaggregated to be relevant for innovation markets, Martin and Scott (2000):

“The level of investment in research and developments is likely to be too low, from a social points of view, whether market structure is nearly atomistic, a highly concentrated oligopoly, or something in between. Limited appropriability, financial market failure, external benefits to the production of knowledge, and other factors suggest that strict reliance on a market system will result in underinvestment in innovation, relative to the socially desirable level. This creates a prima facie case in favour of public intervention to promote innovation activity.”

However, R&D is not the only source of innovation and demand side innovation may be more important than previously understood, particularly for services innovation. The Hargreaves Report highlights the idea of how collaboration should play a fundamental and important role in R&D: *services are no longer produced in the R&D laboratories and factories where they are tested, tailored and tinkered with until they are made into their optimum product.* As noted in the Hargreaves report, services are now developed using a “market facing” approach, whereby the services retrieve their information from databases provided by others - people and organisations – who share their experiences of innovation with others: ^[56]

“The nature of services innovation implies that answers to technical problems will not lie exclusively within research institutions or companies with proprietary R&D cultures and the means to manage and protect IP. Instead, they will emerge through integration of ideas from a wide range of organisations.”

Major and existing businesses and governments as buyers play a role in developing new and innovative services and in adapting new propositions to meet the complex needs of major customers. Systems integrators and services suppliers have an expanded role to fulfil the market’s demand for tailored products and services. In many ways this customisation allows customers to become increasingly specialised and to reform or change their working processes in ways that work better for them. This type of services innovation is important to the overall innovation

55. TNO Report, *The policy mix for ICT innovation in the Netherlands: in search for new instruments, policy coherence and impact.*

56. Hargreaves Report, *Digital Opportunity: A Review of Intellectual Property and Growth*, *ibid* n.1

process and is a type of innovation 'at the coalface', or in dialogue with the customer at the different levels in the ecosystem, adding value to customers and often adding increased value at lower costs. Sometimes it is provided through mass customisation either through the technology providing customers with the ability to themselves adapt technology to their specific environment, or through an additional player providing a service of buying to meet that particular requirement, or integrating and adapting newer technology to work with the existing or older platforms.

4.3 Innovation takes place both through research and development and also through collaboration between players at all levels in the supply chain

As noted in the detailed study conducted by TNO for the Dutch government, the sources of innovation are not limited and the issues that cause market failure, and impede innovation are reviewed:^[57]

"Martin and Scott (2000) provide a list of innovation market failures that are linked to a menu of policy suggestions. Furthermore, their suggestions take into account specific types of innovation (e.g. incremental innovation, difficult to protect by patents), sector characteristics (e.g. sectors that apply innovative inputs) and firm size (e.g. SME's).

Oxera (2005) has explored innovation market failures in a study for the (new) European Framework for state-aid for R&D and innovation (EC, 2006b). The study builds on Martin and Scott (2000) and other articles. Three types of market failures that are listed by Oxera (2005)" indicate areas where government may play a role:

1. **Technologies or knowledge spillovers:** *the process of undertaking innovation, or the end result of the innovation process (e.g. a product), often generates wider benefits (positive externalities). Left to the market, projects that, from a private perspective, are unprofitable, but would generate large social benefits, may not be taken forwards.*
2. **Public goods appropriability:** *knowledge and ideas are often non-excludable: it can be difficult to exclude others from using the innovation and to make them pay individually for the benefit they receive. Again, firms may give up projects as a result.*
3. **Imperfect and asymmetric information:** *this affects, in particular, financial markets. Due to information problems, SMEs engaged in high-tech innovative projects with good prospects may find it difficult to obtain funding.*

Oxera (2005) also lists coordination or network failures. This is inspired by the systems of innovation literature (that is mentioned by Oxera). Oxera does not present a separate list of system failures. The explanation of coordination or network failures refers to system failures (see below), appropriability (e.g. expensive R&D projects with large consortia, to spread costs and risks but with the need to coordinate intellectual property) and imperfect and asymmetric information (e.g. the information that SMEs and large firms have about trends, subsidies and partners)."

Both the Obama administration in the USA and the Dutch government have reviewed their laws and regulations for the impact upon, and support for, innovation. This would be a worthwhile approach in the UK. Further comparison with successful policy approaches is provided in Annex 1, which summarises the approach taken in Denmark, Sweden and Korea.^[58]

57. See *ibid* n.54

58. See *ibid* n.54

Innovation hubs and clusters, bringing together smaller and medium sized players with major industry participants that make up the global supply chains and digital ecosystems is clearly an area where government may play a useful role. Greater cross sector engagement can be facilitated and broader use can be made of government's convening power to bring diverse players, investors and others together to the benefit of society more generally.

4.4 Innovation will best be implemented through engagement with players at a local level, the government has a unique convening power which can increase understanding

Through the ability to convene, government can increase information and information flows and increase knowledge and particularly improve trans-sector and cross-industry awareness of opportunities and support investment. This is of considerable importance for smaller and medium sized firms who have limited resources to develop trans sector education and awareness.

Local government actions: ResPublica, localisation and digital inclusion

Looking from the point of view of the local community/local government, the strategies for developing local engagement fall into 4 groups, listed in the order in which the locality usually chooses to try them:

#1 Convene – sometimes, the government can persuade another entity - private, non-profit, or another government department to provide the service.

#2 Support – once an infrastructure project has been established the local government may use "loaned executives" and other people from the major businesses in the private sector to help run one of the other three strategies.

#3 Anchor – Government acting as 'Anchor Tenant' local governments or government bodies such as foundation hospitals or public services such as fire services or police stations can install the latest fibre or latest cloud computing or mobile service and act as the keystone in local development: see North Yorkshire where 10 year lease stimulated local fibre roll out. The government can effectively act as an anchor tenant for new technology for a local area.

#4 Build – the "public FTTH" projects are examples of this strategy. These have been adopted on a nationwide basis from public funding in Australia and New Zealand and in other European countries municipalities and local investments are taking place. Even in this space, many alternatives exist. The purest form would be the city, using city employees, finances the construction and operation out of general revenues, and does most of the work itself, just as it does with city-owned roads, water, sewer, rubbish, etc.

Given restrictions in the UK on raising capital from bond markets, local government effectively co-invests with private parties either through the letting of long term contracts as part of a joint venture with the private sector, or through letting long term contracts for the private provision of public services (the option of allowing local government access to the different forms of finance and different appetites for risk and return at different levels in the financial system is something that perhaps ought to be revisited).

In the US, with its more relaxed approach towards the raising of local government finance, sometimes the city finances, via a separate fund, from revenue bonds (that is, the bonds are paid out of network user fees and the general credit of the city is not involved). Commercial models may vary with cities contracting out up to 100% of the construction and up to 100% of the operation, so that they act as intelligent commissioner in the public interest while leaving management to private sector bodies.

Especially in cities under state government restrictions, operation of communications network may be wholesale only, with solo, several, or unlimited firms allowed to offer services over the network. The city of Stockholm is a well known example where fibre and duct has been built by the city and there are then separate communications and internet companies which run services over the public infrastructure for the benefit of all.^[59] The city has built over 1 million miles of fibre and there are 90 operators and service providers providing services.

The general principle that emerges from the existence of these strategies and their variants is that "one size does not fit all." The ResPublica approach to involvement of the local community is to have the government provide the information about the strategy available but to have the local community take ownership and consider many different strategies and choose/design one for each specific community.

59. See www.stokab.se

Engagement of Communities

Successful projects have community involvement throughout planning, construction, and operation. Any given strategy works better when key stakeholders of various sorts (large entities, small entities, groups of individual end-users) are involved in choosing/designing the strategy and in their mutual commitment to carrying it out.

This paper is intended to provide a platform for discussion, and there should be a linkage between these Technology, Growth and Employment proposals and a wider 'Growth' agenda and the identification of other initiatives and factors that affect growth, which will follow in further ResPublica studies.

Annex 1

Extract in TNO Report – 34702

The Policy Mix For ICT Innovation In The Netherlands Inspiration From Denmark, Sweden And South Korea

1. Introduction

As was mentioned above, policy makers in the Netherlands mainly look for inspiration in Scandinavian countries and non-European countries. We have selected policy programmes and instruments in Denmark, Sweden and South Korea that are different from the Netherlands in their design, or that do not exist in the Netherlands. We also mention whether the policy mix in these countries differs clearly in focus than the mix of the Netherlands.

2. Denmark

The Danish innovation policy mix shows many similarities with the policy mix in the Netherlands regarding type of instruments, objectives etc. However, Danish innovation policy also addresses new innovation areas, such as user driven innovation and innovation in services. High priority is given to education, innovation with ICT and ICT use by citizens (like in the Netherlands). Policy is innovative in specific areas such as eGovernment (OECD, 2004), for example by enforcing the use of specific applications such as digital signatures.

Tax credit scheme

In 2002, the Danish government introduced a 150% tax deduction for the research investments of private enterprises. It differs from the Dutch tax credit scheme WBSO as it covers not only labour costs but includes different kinds of research expenditures. The investments must be in research projects undertaken by public research institutes. The objective is to increase private incentives to cooperate with public research institutes. This scheme will be phased out due to a reorganisation in funding for collaboration between research and industry (Technopolis, 2006).

Highly qualified staff in enterprises

The *innovation pilot initiative* promotes the employment of highly qualified staff in small and medium-sized enterprises. For a specified period of time, a highly educated person is employed by a SME with a salary subsidy to implement a development project in a smaller enterprise (DASTI, 2007). The *industrial PhD initiative* involves PhD training where the student is employed in a company with a salary subsidy and divides its time equally between the university and the company. The initiative aims to promote R&D in Danish industry. The *PhD innovation initiative* supports PhD students in areas where the private sector is an important procurer (DASTI, 2007). The *mentor scheme* will be a new initiative that will aim to build SME competencies in innovation management. The scheme could consist of experienced and industry managers being loaned to SMEs (DASTI, 2007).

Programme on Creativity and Innovation

The Danish Council for Strategic Research has initiated the programme in to support research in non-technological innovation. The programme has earmarked DKK 69 million (€ 9,2 million) for the themes Creativity, Innovation, New modes of production and the Experience Economy (KINO),

DKK 26 million (ca € 3,5 million), and User Driven Innovation, DKK 43 million (€ 5,8 million) in 2008 (Danish Council for Strategic Research, 2008). The objective is to strengthen development and growth in creative and service enterprises, by creating strategic research centres and supporting smaller research projects (Technopolis, 2006).

ICT Foresight

In 2006, three technological foresights were conducted in the field of ICT (ICT in food and agriculture, wireless and mobile telecommunications, and Cognition and Robots). The foresights aim to set priorities in research, innovation, and education systems and within Danish businesses and the public sector. Following the foresight projects, six projects on ICT in the food sector have been launched (IT and Telecommunication Policy Report, 2006 and 2007).

Open pool

A demand-orientated open pool that can meet new ideas and requirements as they arise shall be set up. This pool supports networks and collaboration projects that cannot be accommodated by existing initiatives (DASTI, 2007).

3. Sweden

Innovation policy in Sweden currently focuses on transforming the Swedish innovation system from its large dependence on a few multinationals to more and diverse actors, especially universities, start-ups and SMEs (ETEPS, 2007). Recent innovation policy initiatives emphasize the commercialisation of research results of universities and improving the interaction between science, industry and the public sector (ETEPS, 2007; Technopolis, 2006). ICT policy sets out two dimensions: achieve good use of ICT, and using ICT to achieve societal challenges (ETEPS, 2007). Priority is given to eEducation and eHealth policy initiatives. Another issue is access to and deployment of broadband networks, especially in rural areas.

University and SME cooperation

This programme focuses on new forms on cooperation between SMEs and universities (Technopolis, 2006). In the first step seven universities were selected for participation. They are to implement and try out new forms of cooperation that can generate knowledge about the importance of entrepreneurship to universities and how it could be stimulated. In the next step, six other universities are to implement the results from these first experiences.

Key Actors Programme

The long term goal is to develop competence, methods, processes and structures to enhance the professionalism of key actors in the Swedish innovation system. Innovation management is a key topic. The programme must increase the *amount and efficiency of cooperation* between research, industry and other actors as well as valorisation of knowledge (knowledge transfer and commercialisation). One part is targeted exclusively at universities.

SMINT

Funds for small and medium-sized companies for feasibility studies relating to international technological collaboration. SMEs have the opportunity to participate in various EU programmes. Usually, at least four or five participants from several countries participate in the projects, although the formal requirement is three countries.

4. South Korea

The innovation policy mix in Korea has an emphasis on government planning and enforcement of (research) projects by the central government.^[60] In the Vision 2025, Korea's long term Science and Technology policy, changes are presented towards a more private sector-driven innovation policy. Furthermore, the main investment strategy in Korea has been on 'quantitative expansion' and attempts are made to allocate R&D funds more effectively.^[61] The emphasis in ICT policy in Korea is shifting towards effective use of ICT (such as enhancing ICT skills, increasing use of ICT in the public sector, eGovernment) (OECD, 2003). In 2006, the U-Korea Master Plan was launched. The aim is to become the first ubiquitous society (U-society), based on a ubiquitous infrastructure.^[62] It anticipates the development towards digital convergence. The focus is on the development and diffusion of new technologies (IPv6, wireless communication, IPTV) and new services and business models.

Total information management providers (TIMPS)

TIMPS targets SMEs with high possibilities of early returns on ICT investment. The instrument assesses the level of ICT adoption, and provides funds for consulting, system development and maintenance for SMEs e-transformation. SMEs repay 30% of the government support, only if the implementation is successful (OECD, 2003).

Creating the e-work environment

The e-Korea vision 2006 recognises the changing needs for organisation and management skills under the title of 'Creating the e-work environment'. To enhance organisational change the government is revising laws and regulations. The government aims to actively promote telework so that people can work without restrictions in space and time. It is planned to amend laws for labour contracts, wages and working hours to protect the rights and interests of teleworkers (OECD, 2003).

Professional IT consultant programme

This programme is designed to develop IT consultant skills in IT and brick-and-mortar firms. System integrators, IT and consulting firms design curricula for employees of 'normal firms.' These employees develop the skills to lead or assist their firms in the adoption and use eBusiness. The programme is currently carried out with government support, but the lead will be taken over by the private sector.

60. Ministry of Science and Technology (2000). Vision 2025: Korea's Long Term Plan for Science and Technology.

61. As of 1997, the investment level ranked 6th globally and third in the world in proportion to GDP.

62. Ministry of Information and Communication Technology, MIC (2006) U-Korea Master Plan 2006-2010.

Annex 2

Extract from an OECD 2010 Report on International Approaches to Innovation and Government Policy Approaches to the Technology Sector

Government ICT Policies:

Top ICT policy developments for the economic recovery

ICT Policy Area	Number of Countries
ICT skills and employment	15
Broadband	15
R&D programmes	11
Venture finance	11
Enabling environmental impacts of ICTs	11

In times of crisis, there is focus on ICT policies that contribute to innovation and growth: Broadband and innovation promotion, employment creation and skills development, ICTs for the environment. As economies grow digital, security of information systems and networks is higher on the agenda than ever.

Longer-term ICT policies take account of the ubiquity of ICTs

Longer-term ICT policy priorities are also influenced by the economic crisis, with some differences in the overall promotion of ICT innovation across the economy. The number of governments giving high priority to security of information systems and networks has increased since 2008 in response to the ubiquity of ICTs in OECD economies, high uptake rates among individuals and organisations, and the potential risks of greater reliance on information systems.

ICT policies are now mainstream economic policies

ICT policies have changed considerably in the last ten years. They are now mainstream policies underpinning growth and jobs, increasing productivity, enhancing the delivery of public and private services, and achieving broad socio-economic objectives in the areas of health care and education, climate change, energy efficiency, employment and social development. As ICT applications and services have become ubiquitous, they have become essential for ensuring sustainability throughout the economy. This makes policy evaluation more crucial than ever to ensure that policy design and implementation are efficient and effective.

Top ten longer term ICT policy priorities, 2010; ICT policy area

1. Security of information systems and networks
2. Broadband
3. R&D programmes
4. Government on line, government as model users
5. Innovation networks and clusters
6. ICT skills and employment
7. Digital content
8. Consumer protection
9. Technology diffusion to businesses
10. Technology diffusion to individuals and households

Research and Development ('R&D')

From the materials available from the department for Business Innovation and Skills, (BIS), R&D spending by companies in the UK1000 in 2008 was dominated by five sectors: pharmaceuticals and biotechnology; aerospace and defence; software and computer services; banks; and automobiles and parts. Together these sectors accounted for 59% of R&D (see Figure 9), similar to the previous year's results. The emergence of the banking sector as one of the big five in R&D spending was a significant change to the 2007 Scoreboard.

A concern is that the spending on R&D will have been cut as a reaction to the recession. As commented in the EU's Innovation policy tracker based on information from Eurostat and IMF sources listed below:

"At the heart of this recession is the collapse of the financial services industry...[.] These finance and business service industries were central to the UK's relative prosperity, fuelling economic growth and providing hundreds of thousands of jobs. From 2000 to 2007, financial services added 15% to annual GDP growth."

"The knock-on effects of the global financial crisis are also hitting Britain's non-financial businesses hard, where reduced business lending and lower spending is forcing industries from car manufacturers to shoemakers to seek government help. In previous economic downturns, the immediate response of many corporate managers has been to trim costs, particularly R&D and innovation investment. If firms are forced to make cuts in R&D and innovation activities in the current economic climate, then they do risk losing out to competitors who will make the breakthroughs and disruptive innovations that may form major business opportunities of the future."

The European commission commented that, in the light of the UK's 2007 Implementation Report and the Commission's assessment of progress made in implementing key structural reforms and based on the Integrated Guidelines for Growth and Jobs, the UK made significant progress in implementing its National Reform Programme (NRP) over 2005-07. The UK also showed good progress in fulfilling the commitments agreed by the 2006 Spring European Council in the four priority action areas (investing in knowledge and innovation; improving the business environment; increasing employment opportunities for the most disadvantaged; and defining an energy policy for Europe).

To sustain success in the UK, macroeconomic and financial policies must remain attuned to the changing global environment. The OECD publication *Science, Technology and Industry Outlook (2010)* reviews various measures of innovation performance at the national level, highlighting

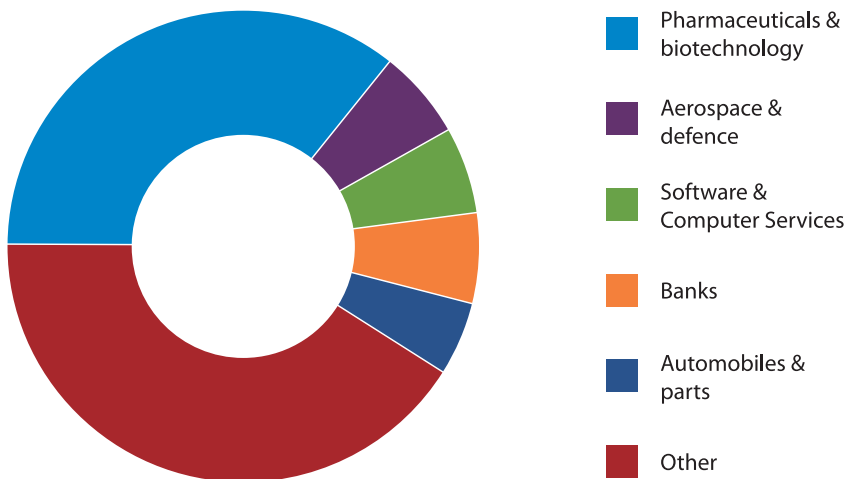
their strengths and weaknesses. This publication confirms that the UK is characterised by a strong science base and strong innovation capacity in the services sector, but business R&D spending relative to GDP is below the OECD average.

The Commission notes:

At the most general level, UK innovation policy has been driven by a commitment to increase productivity to levels comparable with the UK's leading competitor nations, and thereby achieve high and sustainable levels of growth and employment. Based on a strengthened economy, the Government's primary role is to ensure that the UK has, on the one hand, a strong science base, provided with trained personnel, funds and infrastructure and, on the other, a competitive and forward thinking business sector, with good access to trained personnel and the outputs of the science base, able to operate in the absence of a constrictive regulatory environment. These goals thus set the framework for the Government's innovation policies.

The fixed line telecommunications sector saw a decline of 11% in its R&D investment, and therefore dropped out of the BIS scorecard for R&D. As in previous Scoreboards, the pharmaceuticals and biotechnology sector was by far the largest investor, accounting for 36% of the UK1000 total. It invested six times as much as the next biggest sector. The dominance of pharmaceuticals and biotechnology has eroded only slightly as firms in other sectors have increased their investment in R&D at a faster rate.

Fig. 9: Distribution of UK1000 R&D expenditure (2008, %)



Globally, five sectors dominated expenditure by the world's leading R&D investors. Three of the sectors were also among the five largest spending sectors in the UK – pharmaceuticals and biotechnology, software and computer services and automobiles and parts. Technology hardware and equipment and electronic and electrical equipment made the next two.

Annex 3

Extract from a Forthcoming ResPublica Report on Competition and Innovation written by Phillip Blond Innovation and Competition/Regulatory Policy

Nobel Laureate Robert Solow and his colleagues on MIT's Industrial Productivity Commission noted that: "*Undeveloped cooperative relationships between individuals and between organizations stand out in our industry studies as obstacles to technological innovation and the improvement of industrial performance*"^[63]

"Innovation is the search for, and discovery, development, improvement, adoption, and commercialization of new processes, new products, and new organisational structures and procedures. It involves uncertainty, risk taking, probing and reprobating, experimenting, and testing. It is an activity in which 'dry holes' and 'blind alleys' are the rule, not the exception."
(Jorde and Teece, 1990).^[64]

Whether competition contributes to more or less innovation remains a contested debate in economics. Therefore, in a competition or regulatory policy regime based on economics, the relationship between competition and innovation is open to question. Schumpeter described capitalism as developing through gales of "*creative destruction*," whereby new technologies supplant the old and consequently only temporary monopolies will exist.^[65] He argued that large firms and monopolists were more innovative than firms in competitive markets.^[66] The rationale is:

- Large firms rather than small ones can source funding for large R&D projects.
- It may be easier to explain to the suppliers of financial capital why R&D projects have promise (overcoming agency problems and information asymmetries) when some of the sources of financing are from within the organisation.
- Firms with a strong pre-existing market position, including monopolists, may be more willing to pursue R&D in order to gain first mover advantage; especially if they have the knowledge that rivals lack their installed base and reputation to successfully market products that emulate their new ideas or indeed if the threat from rivals who may have developed improved production processes is low. Further, there will be more of an incentive to engage in R&D activity the more that the financial returns from an innovation go to the firm that first develops the idea.

Kenneth Arrow, a Nobel Prize Winner (1972) held an opposing view in that a monopolistic or an oligopolistic market would innovate less than competitive firms because they have more to lose. Arrow observed that a monopolist bears a cost when innovating that an innovating competitor does not, as it gives up the opportunity to continue to earn monopoly profits without innovating.^[67]

63. Dertouzos, M. L., Lester, R. K. and Solow, R. M. 1989. *Made in America: Regaining the Productive Edge*. Cambridge, MA: MIT Press. (pg. 7).

64. Jorde, T. M. And Teece, D. J. 1990. *Innovation and Cooperation: Implications for Competition and Antitrust*. *Journal of Economic Perspectives* – Vol. 4, No. 3, Summer 1990, pg. 75-96.

65. Schumpeter, 1942, *supra* note 6.

66. Schumpeter, 1942, *supra* note 6.

67. Arrow, K. J. 1962. *Economic Welfare and the Allocation of Resources for Invention*. In Nelson, R. (ed.). *The Rate and Direction of Economic Activities: Economic and Social Factors*. Princeton, NJ: Princeton University press.

In consequence, the incremental gains from innovation to the monopolist may be less than those of a firm in a competitive setting that would expect to earn similar post-innovation profits. A monopolist could incur large costs to make a dramatic improvement – whether by lowering cost, improving quality or creating a new product – and take over the market, only to find further market gains not attainable due to its monopolisation of the market already. A competitor would, with the same innovation by contrast, gain a larger return on their investment in innovation because it would expect to take a large percentage of the business previously conducted by rival firms. This limitation on the incentive of the monopolist to innovate is often termed the “Arrow effect” or the “replacement effect” (so-called because it arises to the extent the monopolist replaces itself rather than developing new business). It will occur in particular where the new product or process can be expected to fully displace the old, and when the monopolist does not fear that some other firm (perhaps an entrant) will soon implement a similar new idea.

Oligopolies are a source of innovation, when there are numerous large firms competing together in the same market. This is in part due to the tendency to decrease the risk of R&D investment in two different ways: (1) coordinating their behaviour – they form a strategic alliance or joint venture with technical cooperation or licensing so as to reduce the risk of being outperformed by rivals as well as reducing their cost of investment; and (2) strategic innovation imitation such that any increases to R&D investment by one firm are likely to be followed by the other firms.^[68]

The relationship between competition, innovation and competition and regulatory policy is a complex one. Clearly innovation is key to future economic growth and prosperity and therefore a crucial determinate and legitimate policy goal for the formation of competition and sector specific regulatory policy. Whilst innovation cannot be said to be the only goal of competition policy, by any reasonable account it should stand alongside other valid criteria for policy formation be that economic efficiency or indeed social value. So what is the relationship between innovation and competition? And how should we re-arrange the latter to encourage the former?

Academics working in the area have increasingly found heterogeneous effects with competition both inhibiting and augmenting innovation. This phenomenon is related to various effects: the distance of the firms from the technological frontier, the relative parity of the competing firms and the economic sector being analysed. But before we address this issue in detail it is worth outlining the traditional view of the debate in order to then underscore its current complexity.

Perhaps the most classical view in economic theory regarding the interplay between innovation and competition is that advanced by Joseph Schumpeter (1883 -1950). For Schumpeter the transformative dynamics of capitalism are generated by the ‘innovator entrepreneur’ who fundamentally differs from an ordinary industry manager whose role is only to operate the given conditions and functions efficiently. Whilst the manager’s income derives and depends on a stable economic equilibrium – the innovator entrepreneur derives his or her income from discontinuity: radical breaks in the equilibrium that result from innovations that can deliver either a given product at less cost or a new market or some other such transformation. This then becomes a monopoly rent on the innovation that benefits the innovator. In time imitator entrepreneurs will copy the move and diffuse its benefits around the economy. Thus a temporary monopoly benefits the entrepreneur whilst a permanent advantage accrues to society. In this way individual and communal advantages are balanced – when the economy is innovated society as a whole benefits

68. Glader, M. 2006. *Supra*, note 20: Baumol, W. J. 2002. *The Free-Market Innovation Machine: Analysing the Growth Miracle of Capitalism*. Princeton University Press: Princeton, USA.

as goods are both increased in range and often reduced in costs while the rewards of such go to the innovator on a temporary basis. This process of creative destruction means that monopoly rent albeit of a temporary nature benefits society through rewarding the entrepreneur – this in turn provokes and underpins what Schumpeter calls two stages of economic development: ‘competitive capitalism’ and ‘trustified capitalism’. In the former earlier phase, competition is driven by lots of small firms whose inefficient or un-innovative members are progressively eliminated through bankruptcy and collapse.

The success of the innovator firms leads to a gradual increase not in the number of firms but in their respective size as under trustified capitalism innovation becomes a group concern of managers and employees rather than the individual concern of a single entrepreneur. But crucially the motivation for innovation is the same: a seeking of monopoly rent. Innovation is therefore tied to the pursuit of monopoly advantage and R&D investment is dedicated to ensuring that this period of monopoly rent is as long as possible. And the bigger the firm the more long-term resources and capital can be devoted to innovation and its development – thus monopoly advances and secures innovation rather than undermining it. Moreover since Schumpeter assumes monopoly advantage is temporary this structure of innovation he argues underpins the business cycle as innovation gradually clusters and breaks through equilibrium, producing various cycles that help direct capitalism’s inner dynamic.

Leaving aside any further delineations of Schumpeter’s approach and in simplistic summation, one can argue that concentrated markets provide an ideal innovative environment. Monopoly advantage gives innovative advantage not least because firms can more readily perform R&D activities because they face less market uncertainty and so know that their innovations are more likely to prosper since fewer competitors allow them a maximal extension of monopolistic rent and a minimized chance of imitation. Plus of course one of the major barriers to innovative investment is finance. Individual and smaller players in general have less access to capital than larger and more successful companies. Since banks only lend money where there are profits to enable loans to be repaid – and since profits come from monopoly advantage, it is only the existence of monopoly and profit that allows innovation to proceed.^[69] Building on Schumpeter’s classic work on *Business Cycles* (1939)^[70] and *Capitalism, Socialism and Democracy* (1942)^[71] the immediate postwar period was heavily influenced by this ‘monopolistic’ view of the relationship between competition and innovation.

However, during the subsequent decades this Schumpeterian assumption was increasingly challenged both theoretically and empirically. For example, in a famous article, first published by the Rand Corporation in 1959 and then recast in 1962, Kenneth J. Arrow argued that the incentive to innovate or invent (and we accept there is a difference) is less in a monopolistic economy than in a competitive one. Largely because in an uncompetitive market the risk of innovating is higher (it costs more and often fails to deliver) than the lesser risk of merely collecting current profits, or to put it another way pre-innovation rents are higher than post innovation income.^[72] Therefore because of uncertainty and because one cannot insure against innovation failure (since then

69. What is interesting is that this debate still defines the field see for instance the following paper – where once again market concentration and innovation indices are held to support Schumpeter and not Arrow. The Value of Innovation: The Interaction of Competition, R&D and IP. Greenhalgh, Christine and Rogers, Mark (2006) *The Value of Innovation: The Interaction of Competition, R&D and IP*. Research Policy, 35. ISSN 0048-7333

70. Joseph Alois Schumpeter. 1939. *Business Cycles: A theoretical, historical, and statistical analysis of the capitalist process*, 2 vols. Martino Pub, 2005.

71. Joseph Alois Schumpeter. 1942. *Capitalism, Socialism and Democracy*. New York: Harper Brothers.

72. Arrow, K., 1962. Economic welfare and the allocation of resources for invention. In: Nelson, R. (Ed.), *The Rate and Direction of Inventive Activity*.

Princeton University Press, Princeton

there would be no incentive to innovate) and because the private sector has no way of effectively securing the innovation since imitators will always be able to erode patent control through mimicry – it is better in an uncompetitive situation to remain where one is – collecting rent from an uncompetitive market. Arrow identifies this phenomenon as a ‘replacement effect’ where innovation simply replaces one profitable investment with another.^[73] Moreover the monopolist may actually receive a lower net return from introducing a new innovation that displaces its previous settled activity. In part because the opportunity cost of innovation adds to the actual cost arising when the incumbent’s capital stock is locked into a particular mode of production or technology, it might be more expensive to retool than to continue in the same manner. In effect Arrow is demonstrating the economic interest in not innovating in an uncompetitive market and he argues that competition can promote innovation by reducing the value of failing to invest in research and development.

After Arrow, numerous studies were published partially confirming elements of his thesis that monopoly and market concentration tends to conspire against innovation. Nickell (1996) studied the effect of market structure on TFP (Total Factor Productivity) an accepted academic measure of the impact of innovation, by using U.K. firm level data from 1972 to 1986, he demonstrated that market competition helped to promote the productivity growth of firms.^[74] Blundell, Griffith, and Van Reenen (1999) used count data on innovation and patent data instead of TFP growth as the dependent variable.^[75] Their estimation results showed that market share has a positive impact on firms’ innovative activities, although the concentration ratio has a negative impact so a bigger market share in a more competitive environment can still help stimulate innovation. Results like these proliferated in the 1990s supporting the contention that market competition and a lessening of firm concentration stimulates rather than retards innovative activity and they used a variety of empirical data to counter the theoretical prediction of the Schumpeterians.

These results were even mirrored by those who support Schumpeter’s theoretical hypothesis for instance in transition economies (those for example moving from state planning to liberalisation). Further, Aghion and others, found in 2002 that existing monopolies inhibit innovation while new competitors drive it.^[76] Policies to encourage product market competition were found to assist both old firms before transition and new firms who would be spurred to innovate because of the increased profits. In effect bringing competition into a previously uncompetitive market means the rewards from leading on innovation are high enough to secure its active pursuit by new entrants rather than established incumbents.

These empirical studies led to further theoretical refinement of the anti-Schumpeterian position for instance Geroski (1990) outlined how monopoly and the persistence and presence of entry barriers may lead to inefficiencies in innovation.^[77] In a parallel point to Arrow in the 1960’s Geroski argues that the lack of competitive forces allows monopolies who have large current market

73. Others argue against the value of replacement value, in 1982 Gilbert and Newbury suggested that pre-emption can be a stronger incentive to innovate than the inertia of replacement value – one can forestall competition through pre-emptive innovation. See R. J. Gilbert and D. M. Newbury. 1982. ‘Pre-emptive Patenting and the Persistence of Monopoly’, *American Economic Review*, 72, 514-26.

74. S. Nickell. 1996. Competition and Corporate Performance, *Journal of Political Economy* 104(4), 724-746.

75. R. Blundell, Griffith, J. van Reenen. 1999, Market Share, Market Value and Innovation in a Panel of British Manufacturing Firms, *Review of Economic Studies* 66(3): 529-554.

76. P. Aghion, W. Carlin and M. Schaffer. 2002. “Competition, Innovation and Growth in Transition: Exploring the Interactions between Policies”. *William Davidson Working Paper*, No.151.

77. P. Geroski. 1990. Innovation, Technological Opportunity, and Market Structure, *Oxford Economic Papers*, 42(3), 586-602.

share and high profits to relax in an already comfortable rent producing situation. Whereas in a competitive market, with more firms are searching for innovations, the probability of realising innovative potential is higher.

Hoppe and Lee (2000), who studied entry deterrence and innovation in monopolies for durable goods, found that the durability of a good either acts as an entry barrier itself since its very longevity mitigates against profitable market entry since they are simply too few opportunities to stimulate new demand, a situation that creates further opportunities for incumbents to deter entry by limit pricing.^[78] This form of price strategy either prices goods so low so that no new entrant can make a profit for example with a durable good a company may flood the market with old cheaper versions in order to decrease the price that any new entrant may charge or an incumbent company will develop excess production capacity as a potent threat that it could swamp the market and so signal to potential entrants the punitive costs of market entry. Hoppe and Lee tried to ascertain 'what factors determine entry into monopolized industries through innovation?'^[79] The authors concluded 'although the power to deter entry is not equivalent to the lack of incentive to innovate, the power allows the incumbent to cause underinvestment in innovation or make an inefficient innovation decision. It is rather surprising that the inefficiency in innovation may go in the opposite direction as well, namely that the entrant may innovate even though the incumbent has a cost advantage in innovation.'^[80] Thus concluding a double rebuttal of the Schumpeterian assumptions – monopolies in durable goods under innovate in order to deploy limit pricing as a means to deter entry – likewise if there is innovation it takes place as a result of new entrants and more competition – even though the basic economics favours innovation by the incumbent.

A further concern is that even if monopolies do allow plentiful innovation and technological advances, their existence as a monopoly still means that consumer welfare is not maximised. For example many authorities claim that there is a tendency to have less choice, more expensive goods, less innovation under Schumpeterian monopoly than there might have been under a regime that featured greater competition and market dilution. Moreover the greater innovation realised or lower cost achieved by the Schumpeterian model might in the end be taken out as profit rather than as consumer benefit. There is a long standing and extended academic debate on both sides over the question of the social utility benefits of monopoly.^[81] For instance and way of illustrative example in 2008 Reksulak and others argued that despite the fact that some of the benefits of innovation are transferred to consumers when the monopolist expands output and lowers prices, the deadweight welfare loss to consumers increases. The opportunity cost of monopoly expansion is loss of consumer welfare because the progressive monopolist limits output below the competitive level proportionately more after innovating than before.^[82]

To conclude this brief survey, in examining the evidence for the Schumpeterian hypothesis that there is a positive correlation between firm size, market concentration and innovation a paper published by Archibugi *et al* in 1995 summarised the academic state of play so far: '*The various surveys of the literature on this subject have examined hundreds of works to reach the verdict that the*

78. H. C. Hoppe, I. H. Lee. 2000. 'Entry Deterrence in Durable-Goods Monopoly', Discussion Papers in Economics and Econometrics, University of Southampton (January 29th).

79. Hoppe and Lee. 2000. 'Entry Deterrence in Durable-Goods Monopoly', 4.

80. Hoppe and Lee. 2000. 'Entry Deterrence in Durable-Goods Monopoly', 22.

81. A very good recent paper that gives a full literature review of this area and develops a Schumpeterian counter critique is by S. Yao and L. Gan 'Monopoly Innovation and Welfare Effects' in Economics, Nr. 2010-10 February 16, 2010. See <http://www.economics-ejournal.org/economics/discussionpapers/2010-10>.

82. M. Reksulak, W. Shughart II, and R. Tollison. 2008. Innovation and the Opportunity Cost of Monopoly. *Managerial and Decision Economics* 29(8).

results furnished have so far been partial, contrasting, and hence to some degree inconclusive.^[83] Things had not improved ten years later as Bhaskar Sastry pointed out in a 2005 paper for Intertic *'Theory has generally supported Schumpeter's hypotheses. The empirical evidence in favour of Schumpeterian innovation dynamics, on the other hand, is weak.'*^[84]

The Inverted U

How then to square this circle – how to conceptualise and capture the empirical and theoretical evidence that shows competition and market entry spurs innovation while also representing the other perhaps equally compelling theory and convincing evidential basis that monopolies and oligopolies are not antithetical to innovation. In a series of papers in 2002, Philippe Aghion put forward a model that he believed captured both elements of this debate and explained both the theoretical and empirical dimensions of the terrain.^[85] His answer was the inverted U.

Aghion and his co-authors developed a new model which explains both the Schumpeterian hypothesis and the positive effect of market competition on innovation. To capture the phenomenon and hopefully explain both sides of the debate they took as their model firms in the intermediate goods market and assumed can produce different types of products. They categorised the firms into two types. One type of firm reflects a sector in which firms compete neck-and-neck and the technological distance or gap between competing firms is small. In this sector, firms have an incentive to conduct innovation to escape from profit damaging competition and reap the rewards from innovation. On the other hand, other firms that are far from the technology frontier have little incentive to innovate, because the rents or rewards such firms derive from innovation are small – in effect they are never close enough to the technological frontier to make an innovation sufficiently innovative that it repays the investment required. In this case, the Schumpeterian effect works – monopolies are the innovators that Aghion claims, whereas for the first part of the curve in a low competitive environment – new market entrants are the drivers of innovation through the introduction of competitive pressures. In short he argued that the relationship between competition and innovative activity can be described by an inverted U-shaped curve.

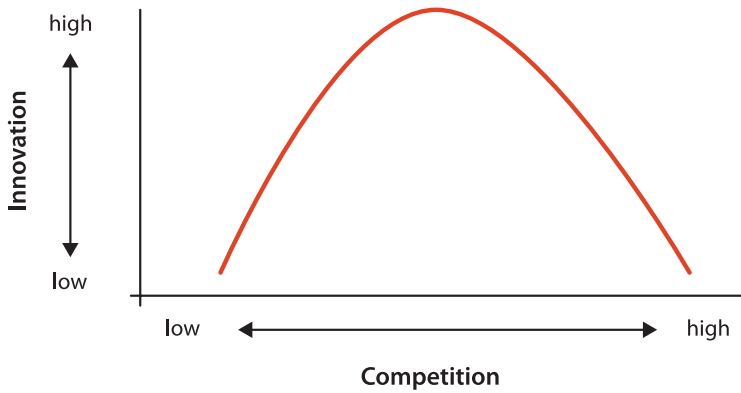
In other words, increased competition increases the incentive to innovate when competition is not intense. However, if competition level is high, increased competition leads to reducing the reward of innovation and it also reduces the incentive to innovate. Thus, the relationship between product market competition, when measured as the price-cost margin (e.g. the Lerner index) or market concentration, depends on the characteristics of different markets, is it a market showing low competition or high – is it made up of neck and neck players or leaders and laggards, the location of each player in respect of the other and the distance from the technological frontier.

This relationship is perhaps best expressed in figure 10 below.

83. D. Archibugi, R Evangelista, R.Simonetti. 1995. 'Concentration, firm size and innovation: evidence from innovation costs *Technovation*', 15(3), 153-163.

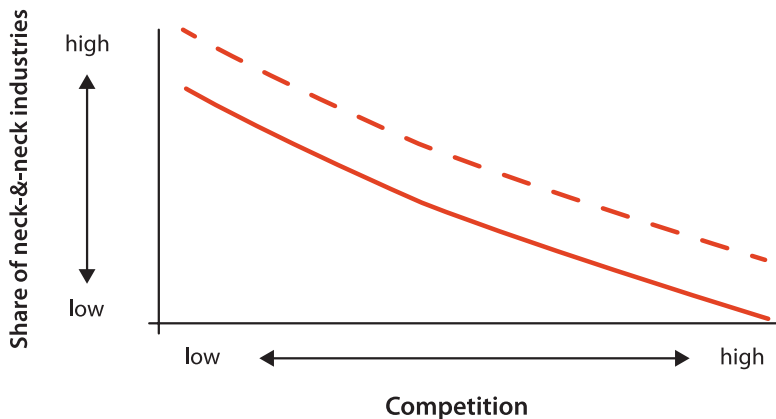
84. Bhaskar Sastry. 2005. 'Market structure and incentives for innovation', 7. Paper for INTERTIC available at <http://www.intertic.org/Policy%20Papers/Sastry.pdf>

85. See Philippe Aghion, Nicholas Bloom, Richard Blundell, Rachel Griffith, and Peter Howitt. 2005. 'Competition and Innovation: An Inverted U Relationship', *The Quarterly Journal of Economics*, 701-728. See also Daron Acemoglu, Philippe Aghion and Fabrizio Zilibotti. 2002. 'Vertical Integration and Distance to Frontier', a paper prepared for the Papers and Proceedings of the European Economic Association 2002. http://www.economics.harvard.edu/faculty/aghion/files/vertical_integration.pdf. See also Philippe Aghion and Rachel Griffith .2005. 'Competition and Growth. Reconciling Theory and Evidence', MIT Press.

Fig. 10: Innovation and Competition Relationship

Here the authors found at low levels of competition the “competition effect” or market dilution effect dominates leading to a positive relationship between competition and innovation. But at high levels of competition the “Schumpeterian effect” takes over leading to a negative effect on innovation. The authors based this model on a panel of 460 firms over 20 years and found a robust inverted U-shape between competition and innovation (measured through patenting).^[86]

In Figure 11 below Aghion et al argued that their model predicted that the higher the percentage of neck and neck industries in a market the more positive the effect of competition but that an increase in competitive pressures will result in a decline in the share of “neck-and-neck” industries no doubt because of the kicking in of the Schumpeterian effect.

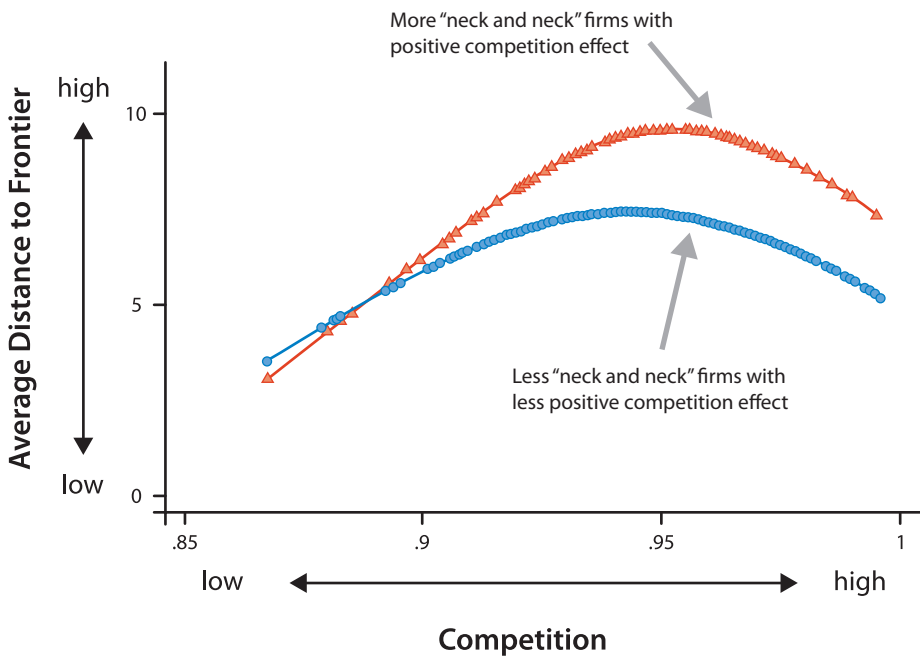
Fig. 11: Innovation and Competition Relationship for neck and neck industries

86. Slides sourced from powerpoint demonstration on competition and innovation Aghion (Harvard & UCL) Nick Bloom (CEP, LSE) Richard Blundell (IFS & UCL) Rachel Griffith (IFS & UCL) Peter Howitt (Brown) “Competition and Innovation Workshop”, 23rd September 2003.

Competition

Similarly figure 12 below measures the distance to the technological frontier and the impact of competition on firms in respect of this distance for neck and neck firms and for a leaders and laggards composition – in effect the higher the level of competition the more it pushes neck and neck firms towards the technological frontier.

Fig. 12: Empirical Results: “Neck-and-Neck” industries also show a steeper inverted U-shape



To conclude it seems that the Schumpeterian curve relies on a prior burst of competition and market entry for without the initial breaking of monopoly it is not clear how innovation could ever advance. Indeed is not the end of one inverted u the beginning of another – if un-managed markets lead to monopoly then the goal of competition agencies is to sharpen the curve and open up markets to new innovators to create neck and neck industries that can approach their own sectors technological frontier – the key task will be to hit the golden point and hold it there – a difficult task for competition and regulatory policy but the right one.

About the Author

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Tim Cowen is a Partner in Sidley Austin, one of the world's leading international law firms. The views expressed are his own. Tim is a member of the board of the International Institute of Communications ('IIC'), EU Business Affairs Council ('Ad Hoc Council'), he is the immediate past Chairman of the Competition Panel at the Confederation of British Industry ('CBI'), and immediate past Chairman of the International Association of Commercial and Contract management ('IACCM'). He was a Visiting Fellow of the British Institute of international and Comparative Law (Biicl 2009) and was awarded the title of 'Distinguished Visiting Fellow' at the European Business School in London in November 2008. He is a Visiting Professor at the City of London Law School, the largest law school in the UK. From qualification as a Barrister in 1986, Tim has worked in private practice and industry; from joining BT in the early 1990s he held a variety of roles including General Counsel for BT's international businesses. In 2009 he founded The Open Computing Alliance ('OCA'), an alliance of companies in the information technology sector dealing with issues of common concern in public contracting, competition and data transfer and interoperability between platforms and systems with particular reference to the shift to 'Cloud Computing'. He stepped down from executive responsibilities in 2011 and has a continuing role as legal advisor to the OCA.



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It would appear that there is a certain reluctance on the part of the government to admit that it does have an intervening role in the market. This is not to endorse a statist approach, just that a continuing attachment to notions of 'free markets', when all markets are regulated to a greater or lesser degree by the state, necessitates moving the discussion forward from whether the government should or should not intervene in the market, to accepting it does play a role and asking what is the most enabling part it can play and what form that intervention should take.

It is ResPublica's view that the road to growth and economic development is fundamentally reliant on innovation. Therefore the question that needs to be asked is what the government can do to encourage innovation and allow innovation to flourish in the UK. This report does not claim to address this issue across all sectors, but in the realm of technology it does identify questions, issues and barriers, and as a result offers some recommendations. It is the first of our pro-growth reports that we want to commission across all sectors, seeking to ask what Government can do to promote innovation and facilitate industry and commerce in rebalancing the economy and restoring prosperity for all.

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