

CENTRE FOR CITIES/ NESTA

CITIES AND INNOVATION PROJECT

**WHAT ROLE DO CITIES PLAY IN INNOVATION, AND TO WHAT
EXTENT DO WE NEED CITY-BASED INNOVATION POLICIES AND
APPROACHES?**

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CONTENTS

EXECUTIVE SUMMARY

- 1 INTRODUCTION
- 2 CITIES: THE UK'S BUILDING BLOCKS
- 3 INNOVATION IS SPIKY
- 4 CITIES AND INNOVATION: URBAN HUBS AND LOCAL LINKS
- 5 WHAT ARE THE COMPONENTS OF AN URBAN INNOVATION SYSTEM?
- 6 WHAT IS THE ROLE OF GOVERNMENT?
- 7 RESEARCH QUESTIONS

EXECUTIVE SUMMARY

The UK is one of the most urbanised countries in the world where 74.8% of the population live in urban areas. Cities and city-regions contain the majority of the population and most of the country's economic activity. In recent years, many UK cities have been performing well after years of stagnation, but many others are still lagging behind (Sections 2.1-2.2). **Cities and their hinterlands – ‘city-regions’ – are the building blocks of the UK's economy, especially of the knowledge-based economy.** For example, in England, most knowledge workers live in cities, most patent applications originate from cities, and most knowledge-intensive businesses are located in cities (Sections 3.1-3.2).

The attraction of cities hinges on three basic advantages that they offer: proximity, density and variety. Proximity reduces transaction costs, density intensifies learning, and variety increases possibilities. This ‘basic urban offer’ makes markets work better, and helps firms become more productive. It also helps explain why innovation is concentrated in urban areas and why cities continue to be in ‘demand’ (Section 4.1).

There are two broad explanations for how urban places support innovation. They are complements, and both have something to offer. ‘Urban hubs’ approaches emphasise what cities offer – urban critical mass, assets and markets. Urban firms can use the ‘pick and mix’ economy of big cities and links to bigger external markets. By contrast, ‘local links’ perspectives focus on how firms behave with each other, and with public institutions such as Universities (Sections 4.2-4.4).

Hubs and links are at the heart of bigger urban innovation ‘systems’. These are made up of five main **components: Assets** such as location, infrastructure, finance, property and the skills base; **institutions** such as business / industry associations, government, HEIs and professional associations; **firms, networks** and **markets**. (Sections 5.1-5.6).

Innovation policy for cities should look to broaden out, and to let go. Policymakers are becoming more interested in cities' economic role, and in city-level innovation strategies. The Science Cities programme, for example, reflects policy interest in using cities as innovation engines. However, national innovation policy is seen by some as overly narrow and centralist. Policy would be better if it were broader. Similarly, given the differences in local economic conditions and performance across the country, cities and regions arguably need greater freedom to develop bespoke innovation strategies. However, cities and regions would also need the capacity to deliver. Any policies that give cities and regions greater freedom of powers should also have an adequate focus on building capacity amongst institutions and policy makers to design and implement effective innovation strategies (Sections 6.1-6.6).

We need to know more about how cities support innovation, and how they can help improve national innovation performance. How do different cities support innovation across different sectors? What can innovation contribute to different cities' growth and development? And how can policy help cities to support innovation most effectively? The next stages of this project will look deeper into a number of cities, and try to find answers. (Sections 7.1-7.4).

1. INTRODUCTION

1.1 About this paper

Cities and their hinterlands are the UK's economic bedrock. Innovation is one of the most important drivers of long term economic growth, and it is concentrated in and around cities. But we need to know more about how cities support innovation, and how innovative activity helps cities to regenerate and thrive.

Innovation has a strong urban dimension, but it is uneven across cities. The available indicators show that some places – such as Cambridge and Reading – are punching well above their weight on innovation, whilst others – such as Stoke and Grimsby - are struggling.¹

These differences matter. Innovation drives productivity improvements, stimulates investment and opens up new markets – feeding a virtuous circle of economic growth and wealth creation.² Public policy needs to support cities that are already innovative and help them perform better, but it also needs to understand and address the barriers to innovation in cities that are not reaching their potential.

This paper is part of a 12-month project on cities and innovation. Overall, it aims to provide a narrative about cities and innovation in the UK. It maps visible innovation across the country. It sets out what is known about how cities support innovation, and gives a critique of current urban innovation policies. Finally, it identifies areas for further work, and lays out a roadmap for the rest of the project.

1.2 Definitions and data

There are many ways of looking at cities. This project focuses on the 'economic city' – that is, the urban economy. Urban economies often stretch well beyond administrative boundaries, into the wider 'city-region'. For example, Manchester's economy extends far beyond the city council's borders to include Bury, Oldham, Stockport and others.

Cities are part of wider urban systems, and urban economies are part of larger economic networks. We can see cities as islands in an archipelago of connected urban centres.³ Similarly, we can look at urban economies as hubs in a larger 'space of flows', networks of people, information, money, goods and services.⁴

Cities are the core of their regions, and plugged into national and international economies. To take an extreme example, London is the heart of the Greater South East 'mega-city region', but is also a world city, linked to other world cities through networks of producer services firms, international labour markets, air travel corridors and data cables.⁵

The paper aims to discuss the UK context, and UK cities. However, detailed innovation statistics for urban areas outside of England were unavailable. A key dataset for our analysis is the UK Government's State of the Cities Database, which covers the 56 biggest cities in

¹ DCLG (2006): State of the English Cities Report, London: DCLG.

² HMT (2006): Productivity in the UK 6: Progress and new evidence, London: HMT.

³ Veltz P (2004): 'The Rationale for a Resurgence in the Major Cities of Advanced Economies', presentation to LSE Symposium on *The Resurgent City*, London, April.

⁴ Castells M (1996): *The Rise of the Networked Society*, Oxford: Blackwell.

⁵ Hall P and Pain K (2006): *The Polycentric Metropolis*, London: Earthscan; Sassen S (ed) (2002): *Global Networks, Linked Cities*, New York: Routledge.

England (those with populations of 125,000 or more).⁶ This dataset includes a range of innovation indicators; however there are no comparable data sources for Northern Ireland, Scotland or Wales. For this reason, the bulk of the analysis in this paper focuses on English cities. Due to the significant level of urbanisation throughout the UK however, the policy messages derived from data on English urban areas are likely to be relevant for the other UK nations.

Throughout this paper, 'city' or 'urban area' refers to the economic city or city-region, unless otherwise stated. For much of our data, we use Travel to Work Areas (TTWAs)⁷ as our geographic units – largely due to data availability for innovation indicators. TTWAs approximately map to city regions.

⁶ The full datasets are available at www.socd.communities.gov.uk/socd/. Sourced data is tagged 'SOCD'.

⁷ Within the UK, Travel To Work Areas (TTWAs) are often adopted as convenient approximations to 'local labour markets'. TTWAs are based upon the commuting patterns of the 'average worker' using Census of Population data.

2. CITIES: THE UK'S BUILDING BLOCKS

This section looks at the recent performance of English cities.

2.1 Cities are centres of population, learning, knowledge and economy

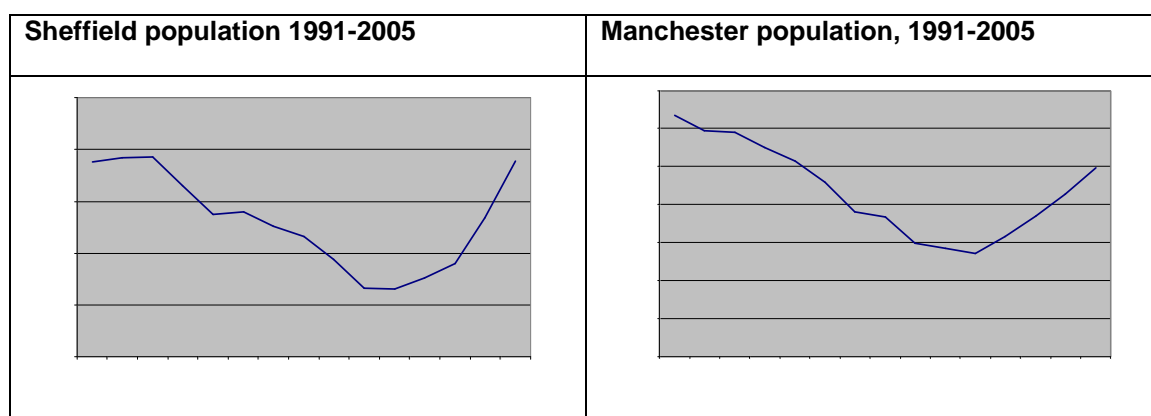
The UK is one of the most highly urbanised countries in the world. Driven by the industrial revolution, the urban population grew from 17 per cent to 77 per cent between 1700 and 1900.⁸ Today, 80.7 per cent of England and Wales's population is classified as urbanised. In Scotland, 78.7 per cent of the population can be considered as urban – living in large and other urban areas or accessible small towns. Northern Ireland is considered slightly less urbanised – at approximately 65 per cent.⁹

The analysis in this report largely focuses on 56 of England's largest towns and cities, utilising the data available from the State of the English Cities Database. From this database, it is calculated that 58 per cent of the population lived in the 56 biggest towns and cities, and 73 per cent lived either in the biggest city-regions: the urban core and its surrounding area. Cities and city-regions contain the majority of the population, and most of the country's economic activity: in 2005, English city-regions contained 77 per cent of the country's employment, and accounted for 79 per cent of employment growth over the previous decade.¹⁰

2.2 Many cities have performed well recently, but some are still lagging behind

After going through a period of sustained decline between the 1950s and 1980s, many English cities are enjoying an economic resurgence. However, there remain lagging cities and significant pockets of deprivation within successful cities. Thus, while there is a need to sustain both improved growth and success in a number of English cities, there is also a need to continue to address decline and stagnation in others, particularly in the North.

Figure 1: Population change in selected core cities, 1991-2005¹¹

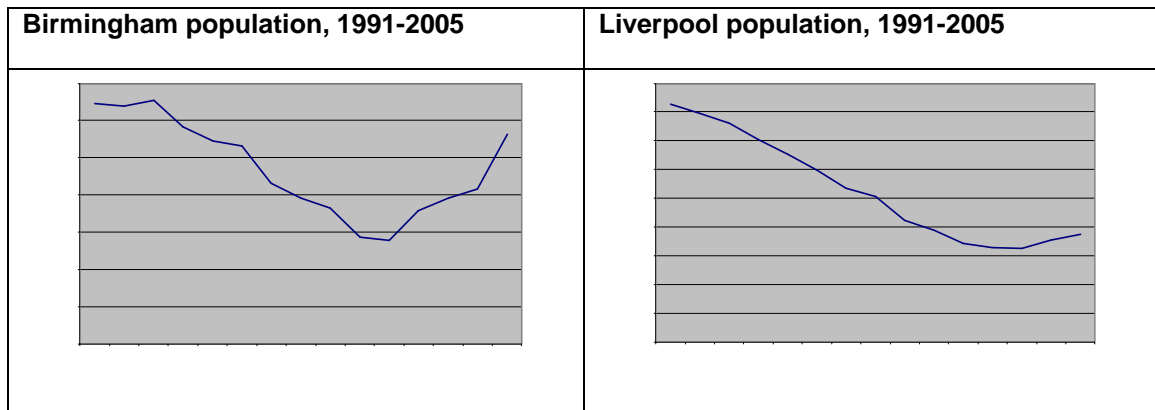


⁸ Allen R (1998): 'Urban development and agrarian change in early modern Europe' Vancouver: University of British Columbia; ONS (2007) Census on-line.

⁹ Definitions of 'rural' and 'urban' differ between nations of the UK. England and Wales have consistent definitions. Northern Ireland and Scotland differ in their definitions. All statistics referring to levels of urbanisation presented here are sourced from official calculations that have used the 2001 Census of Population. Northern Ireland figures are according to NISRA estimates.

¹⁰ SOCD.

¹¹ SOCD.

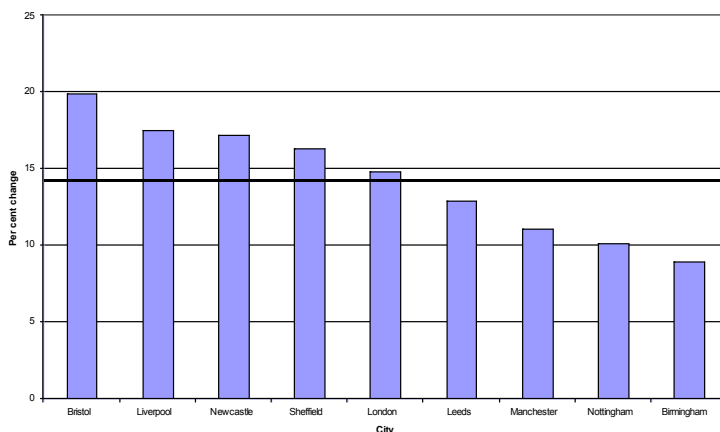


As Figure 1 shows, key cities like Sheffield, Manchester, Birmingham and Liverpool have all reversed population decline between 1991 and 2005. These demographic changes reflect a turnaround in the economic fortunes of a number of English cities over the past 15 years – with population inflows needed to support economic growth and city-centre living becoming more attractive.¹²

Employment growth data reinforces the positive picture for a number of England’s larger cities, whilst also showing that performance has been relatively sluggish in others. As Figure 2 shows, between 1995 and 2005, employment growth in five of England’s largest cities exceeded the national average of 14 per cent, which is represented by the horizontal bar on the chart.

But aggregate figures hide significant variations in growth rates within city-regions. In Manchester, for example, employment growth rates between 1995 and 2005 for the various local authorities comprising the city-region varied between 7 per cent in Bury and 21 per cent in Manchester – suggesting that development challenges may vary between different parts of the city-regional economy.¹³

Figure 2: Percentage employment growth in core cities and London, 1995-2005¹⁴



In recent years, several smaller cities like Reading, Milton Keynes and Aldershot have also performed exceptionally well. As Figure 3 shows, between 1995 and 2005 all of these cities experienced employment growth well above the national average.

¹² Nathan M and Urwin C (2006): City People: city centre living in the UK, London: Centre for Cities.

¹³ NOMIS (2007) Annual Business Inquiry.

¹⁴ SOCD / NOMIS (2007) Rescaled AES.

But the story isn't positive everywhere. Significant disparities remain in the English economy, and many urban areas – particularly smaller cities in the North – are struggling. As Figure 3 shows, Blackpool, Stoke and Burnley have all performed relatively poorly when compared to the national average, with Burnley seeing a fall in total employment over the period.

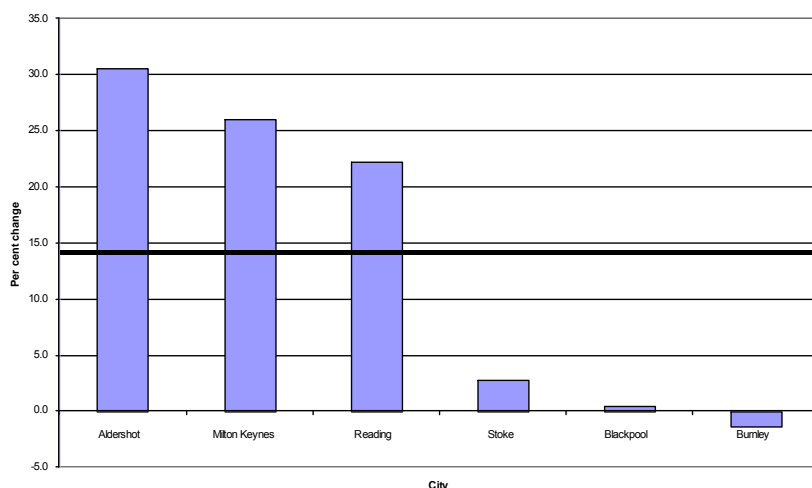
The experience of Scotland's major cities has been positive in recent years. Edinburgh and Glasgow have been leading in terms of growth in employment between 1998 and 2002, with growth rates ahead of the Scottish average. The only English Core Cities with greater percentage growth in total number of employees are Manchester and Newcastle. Aberdeen, Edinburgh and Glasgow also have high levels of GVA per capita.¹⁵ The national authorities in Wales and Northern Ireland have not undertaken comparable studies on the economic performance of their cities. However, other studies¹⁶ suggest that Cardiff has been performing very well in terms of GVA levels, and also continues to perform strongly in developing knowledge-based employment, only surpassed by Bristol, Edinburgh and Manchester.

There is a lack of comparable city performance data for Northern Ireland's Cities. However, regional data indicates that Northern Ireland's GVA per head, at 80.2 per cent of the UK average compares closely with two other UK regions – Wales (79.1 per cent) and the North East of England (79.9 per cent).

¹⁵ Hutchins, M and Parkinson, M (2005): *Competitive Scottish Cities? Placing Scotland's Cities in the UK and European Context*, Edinburgh: Scottish Executive Social Research.

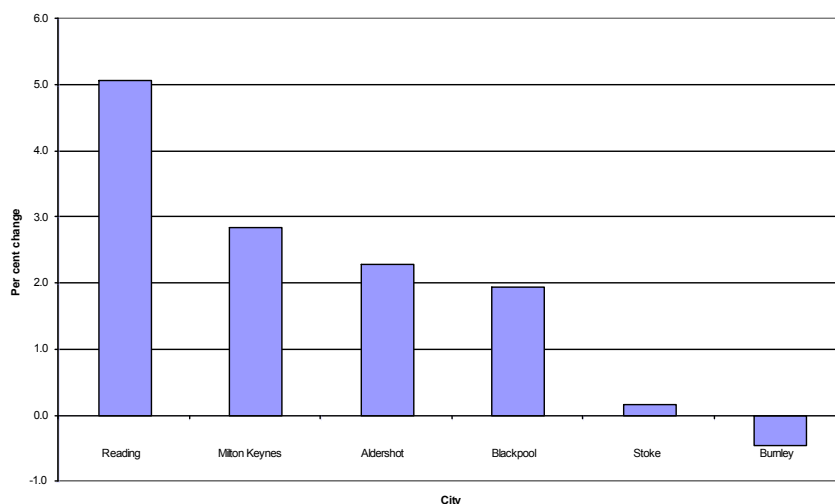
¹⁶ Robert Huggins Associates (2005) *UK Competitiveness Index 2005 – The Changing State of the Nation 1997-2005*.

Figure 3: Per cent employment growth in selected smaller cities, 1995-2005¹⁷



Cities have had different degrees of success in developing ‘knowledge-based’ economies. Figure 4 shows the growth in knowledge-based employment in selected city-regions between 1995 and 2005. It shows that high performing economies such as Reading have experienced considerably greater success in restructuring their economies than, for example, Burnley and Stoke.

Figure 4: Per cent change in knowledge-based industries employment as proportion of total, 1995-2005¹⁸



Some of these results need further explanation. For example, Blackpool’s strong growth in knowledge-based employment is surprising. However, as Table 1 shows, Blackpool is coming from a much weaker position on knowledge-based employment than Reading, Milton Keynes and Aldershot – with only 25 per cent of employment engaged in these activities.

¹⁷ SOCD / NOMIS (2007) rescaled AES.
¹⁸ SOCD.

Table 1: Share of knowledge-based employment in total, 2005¹⁹

City-region	Share of knowledge-based employment in total (%)
Reading	45
Milton Keynes	40
Aldershot	39
Blackpool	25
Burnley	23
Stoke	19
England	26

Overall, most English cities have improved their economic, demographic and social performance during the past decade. Some are still in transition. And as the preceding discussion and evidence presented suggests, some of the highest-performing cities are building on a legacy of economic strength. This underlines the challenge facing other urban areas. Similarly, available evidence suggests that the major cities in Northern Ireland, Scotland and Wales have experienced economic recovery and growth.

The next section looks deeper into urban economies, focusing on patterns of innovation.

¹⁹ State of the Cities Database.

3. INNOVATION IS SPIKY

This section looks at the distribution of innovative activity across cities and city-regions.

3.1 Innovation is concentrated in cities

Evidence suggests that the UK's biggest cities account for the lion's share of innovative activity. Data for England's 56 largest urban areas shows that, between 1999 and 2001, they accounted for 67 per cent of patent applications. 43 per cent of these applications came from just ten urban areas.²⁰ Although the evidence on patents in cities is unavailable in Northern Ireland, Scotland and Wales – it is likely that patterns are similar to England – that innovation activity has an urban focus.

However, patent applications are not a perfect measure of innovation: they are poor at capturing process innovations and they are biased towards manufacturing industries.²¹ So we also need to look at broader measures of innovative activity.

Using the number of knowledge workers present in an area as a proxy for innovation is one way of getting around this problem. Table 2 shows the proportion of firms identifying themselves as 'innovation active' broken down by sector – indicating that engineering-based manufacturing, other manufacturing and knowledge intensive services are considerably more active in innovation than other sectors of the English economy.

Table 2: Per cent innovation active firms by sector, 2002-2004²²

Sectors	Proportion of firms identifying themselves as active in innovation activities (%)
All sectors	54
Primary sectors	53
Engineering-based manufacturing	72
Other manufacturing	68
Construction	42
Retail and distribution	46
Knowledge intensive services	66
Other services	42

Statistics for 2005 showed that employment in these sectors was highly concentrated in England's city-regions. For example, 81 per cent of knowledge intensive services employment was located in city-regions in 2005 – suggesting that most innovation activity in this sector was also concentrated in city-regions.

More widely, employment statistics also show that whilst 77 per cent of England's total employment was concentrated in city-regions in 2005, 90 per cent of knowledge workers – an aggregate including engineering-based manufacturing, manufacturing, knowledge intensive services and creative industries workers – worked in these areas. This suggests that highly innovative, knowledge-based activities have a greater than average tendency to cluster in city-regions.

Data on innovation for Northern Ireland, Scotland and Wales is unavailable for cities and urban areas. European innovation scoreboard indicators²³ give a general indication of their performance relative to the rest of the UK and Europe. The rankings (out of 208) were as

²⁰ SOCD.

²¹ NESTA (2006): The Innovation Gap: why policy needs to reflect the reality of innovation in the UK, London: NESTA.

²² 4th Community Innovation Survey.

²³ 2006 European Regional Innovation Scoreboard.

follows: Northern Ireland (113), Scotland (89) and Wales (80). The highest ranking UK region/nation was the South East of England (12). The lowest ranking English region was the North East (78). Generally, the innovation benchmarking data shows that Northern Ireland, Scotland and Wales have comparable innovation profiles to the Northern English regions.

Community Innovation Survey results are available for UK regions, which give a helpful context for the areas of the UK where urban data on innovation is unavailable. In Northern Ireland, rates of enterprises being 'innovation active' were 56 per cent in the three year period 2002-2004, similar to the equivalent UK figure of 57 per cent. The proportion of firms in Northern Ireland engaged in innovation activity had increased from 46 per cent in 1998-2000 to 63.²⁴

In Scotland, the extent of both product and process innovation is in line with the UK. However, the proportion of those introducing novel innovation is higher amongst Scottish innovators; and significantly higher for product innovators. Scotland has the highest proportion of novel innovators among its product innovators of all UK regions and, outside London, the highest proportion among its process innovators. Almost one in five employees in Scotland work in enterprises that have introduced a product that is new to the market, compared with less than one in six in the UK as a whole.²⁵ In Wales, the share of enterprises undertaking product and process innovations is in line with the UK average and comparable to rates in the North East of England, Eastern England, and the West Midlands.

3.2 Innovation is uneven across cities

The available evidence suggests that innovation is concentrated in and around cities, but not all cities are the same. There are large variations in the rates of innovation between urban areas. For example, Cambridge registered 81 patent applications per 10,000 adults between 1999 and 2001, whereas Blackpool registered just two. Table 3 presents the top five highest and lowest innovation performers – based on patents per 10,000 inhabitants.

Table 3: Top and bottom five innovation performers on patents per 10,000 in England's largest 56 urban areas

Top and bottom five innovation performers on patents per 10,000 in 2001	
Top 5 performers	Bottom 5 performers
Cambridge (80.8 per cent)	Doncaster (3.1 per cent)
Oxford (50.1 per cent)	Luton (2.9 per cent)
Birkenhead (35.0 per cent)	Sunderland (2.3 per cent)
Swindon (34.4 per cent)	Blackpool (1.6 per cent)
Reading (30.7 per cent)	Grimsby (1.6 per cent)
England average = 13.7 per 10,000	

Source: SOCD. Note that rankings are based on absolute (not rounded) values.

There is also variation in alternative measures of innovation activity between English cities.²⁶ Tables 4 and 5 show the top and bottom five product and process innovating cities in England – illustrating widely differing performances between urban areas. These statistics should only be used as a rough guide to the level of innovation in city-regions because sample sizes varied significantly between city-regions. City-regions with sample sizes of 25 businesses or less have been excluded from the analysis.

²⁴ Department of Enterprise, Trade and Investment (2006) The Northern Ireland Economic Bulletin 2006.

²⁵ Michie J, Oughton C, and Frenz M (2006): The Community Innovation Survey: An Analysis for Scotland, Edinburgh: The Scottish Executive.

²⁶ Survey data is based on the third Community Innovation Survey (CIS): CIS data should only be used as a rough guide at the city level because sample sizes can be very small for individual cities. For example, Blackpool's sample size was only 20.

Table 4: Per cent of firms introducing process innovations, 1998-2000, in England's largest 56 urban areas

Percentage of firms introducing process innovations, 1998-2000	
Top 5 performers	Bottom 5 performers
Northampton (31.3 per cent)	Liverpool (11.7 per cent)
Coventry (29.7 per cent)	Southend (11.0 per cent)
Crawley (29.0 per cent)	Gloucester (10.7 per cent)
Oxford (27.1 per cent)	Grimsby (10.3 per cent)
Chatham (26.0 per cent)	Wakefield (6.1 per cent)
England average = 17.9 per cent	

Source: DCLG (2006), Community Innovation Survey. Notes: areas with sample sizes below 25 firms were excluded from the analysis; rankings are based on absolute (not rounded) values.

Table 5: Per cent of firms introducing product innovations, 1998-2000, in England's largest 56 urban areas

Percentage of firms introducing product innovations, 1998-2000	
Top 5 performers	Bottom 5 performers
Cambridge (39.7 per cent)	Wigan (13.2 per cent)
Aldershot (37.5 per cent)	Wakefield (12.2 per cent)
Coventry (35.1 per cent)	Grimsby (10.3 per cent)
Derby (31.8 per cent)	Stoke (8.3 per cent)
Bradford (30.0 per cent)	Doncaster (6.1 per cent)
England average = 22 per cent	

Source: DCLG (2006), Community Innovation Survey. Notes: areas with sample sizes below 25 firms were excluded from the analysis; rankings are based on absolute (not rounded) values.

Many of these statistics confirm what we might have expected. City regions like Cambridge, Oxford and Reading are known to be high performing economies and their strong innovation profiles help explain that performance. Other cities – like Stoke and Grimsby – are known to be low performing economies and their weaker innovation scores are not surprising.

Cambridge's strong innovation performance is partly due to its world class university and strong university/business linkages – though many other factors have played a role (see Box 1 below). Birkenhead's performance begins to make sense when we factor in the large scale presence of car manufacturing, oil refineries and other light industrial activities. In Reading, strong concentrations of high-technology businesses – particularly in the information and communications technology sector – are likely to have driven up the city-region's innovation profile.

This section demonstrates links between cities, innovation and economic growth. The next section explores these connections further.

Knowledge gaps

- What explains the uneven spatial distribution of innovation?
- What are the specific characteristics and determinants of innovation-rich cities?
- Is there a typical urban innovation system or model?

4. CITIES AND INNOVATION: URBAN HUBS AND LOCAL LINKS

This section looks at the links between cities, innovation and urban economic growth. Cities help innovation happen, and in turn, innovation should help cities to grow.

4.1 Why cities still matter

For decades, commentators argued that the development of better transport and modern communications technologies would remove the need for cities. In their view, progress would make distance – and thus place – increasingly irrelevant.²⁷ This was wrong. In fact, cities are now more important than ever. Levels of urbanisation are increasing all over the world.²⁸

Essentially, cities make it easier to do things – meeting people, sharing information, making deals, selling things. Cities offer three overlapping benefits for people and firms – proximity, density and variety.²⁹ For firms, the scale and choice of economic activity creates thick labour markets, enables access to a range of suppliers, and helps knowledge diffuse.³⁰ A large, highly skilled workforce allows firms to adapt quickly to new challenges and opportunities. Proximity to suppliers and users means that firms can more easily find and use specialist inputs that improve their performance.

For residents and visitors, cities offer ‘agglomerations of consumption’ – that is, easy access to lots of different goods and services within a fairly small area.³¹ Many cities are sites of the growing ‘play economy’ – retail, tourism and leisure. For younger people, urban lifestyles are increasingly popular.³² Big urban labour markets can help residents build careers.³³

Critically, the concentration of people allows for frequent face-to-face contact. Knowledge-based activities – such as business services – depend on building trust, maintaining relationships and exchanging complex information. These interactions are still best done in person.³⁴ Cities enable ‘face time’ something that is at a premium in the knowledge economy.³⁵

Urban areas also operate as transport and communications hubs. These proximity benefits allow firms easier access to their customers and suppliers outside the city and vice versa. In a globalising economy, for example, access to an international airport has become more important – as it enables rapid access to international partners, collaborators and clients.³⁶

This basic ‘urban offer’ makes markets work better, and also enables innovation. This helps explain why innovative activities cluster in urban areas.

²⁷ Cairncross F (1997): *The death of distance: how the communications revolution will change our lives*, US: Texere Publishing; Gray J (1998) ‘False dawn: the delusions of global capitalism’.

²⁸ United Nations (2004): *World urbanization prospects: the 2003 revision*, New York: United Nations.

²⁹ Glaeser E (2000): ‘Demand for Density: The Functions of the City in the 21st Century’, *Brookings Review*, Summer.

³⁰ Marshall A (1920): ‘Principles of Economics’, New York: MacMillan; Jacobs J (1961): ‘The death and life of great American cities’, New York: Random House.

³¹ Storper M and Manville M (2006): ‘Behaviour, Preferences and Cities’, *Urban Studies*, 43:8, pp 1275-1300.

³² Nathan M and Urwin C (2006): *City People: City centre living in the UK*, London: Centre for Cities; Chatterton P, Byrnes B, Hollands R and Reed C (2003): *Changing Our ‘Toon’: Youth, Nightlife and Urban Change in Newcastle*, Newcastle: University of Newcastle.

³³ Venables A (2006): ‘Shifts in Economic Geography and their Causes’, CEP Discussion Paper 767, London: LSE.

³⁴ Sassen S (2006): ‘Four Dynamics Shaping the Ongoing Utility of Spatial Agglomeration’, presentation to Cambridge Econometrics Conference, Greater Cities in a Smaller World, Cambridge, July.

³⁵ Storper M and Venables A (2003): ‘Buzz: face-to-face contact and the urban economy’, London: LSE, Centre for Economic Performance; Iammarino, S. & McCann, P. (2005) ‘The structure and evolution of industrial clusters: transactions technology and knowledge spillovers’, SPRU Electronic working paper series, No. 138.

³⁶ Simmie J, Sennet J & Wood P (2002) ‘Innovation and clustering in the London metropolitan region’ in Begg I (ed) *Urban Competitiveness: policies for dynamic cities*, Bristol: The Policy Press; Sassen, S (2001): *The Global City – 2nd edition*, Princeton: Princeton University Press.

4.2 Urban hubs and local links: how cities support innovation

Urban proximity and density seem to matter for local innovation. US evidence on patent citations has shown that new patents are more likely to cite existing patents within the same state and local area (with particularly strong evidence to suggest that spillovers are localised).³⁷ Further US research found that innovation activity was highly geographically clustered, and that knowledge spillovers are a more important determinant of the clustering of innovation than the geographic concentration of production and supply chains.³⁸ Many recent studies find evidence of some kind of positive spillover effects for R&D and innovation within regions.³⁹

There is a vast theoretical literature exploring innovation in cities, and the different ways in which urban places support innovative activity. Traditional urban theory and economic geography help explain why economic activity concentrates in urban places, and how cities shape firms' productivity. Over the past two decades, 'new economic geography' and innovation systems approaches have taken a closer look at clusters and knowledge spillovers. From a different starting point, many technologists have been exploring the resilience of cities in the face of computerisation.⁴⁰

We have drawn together these explanations into two broader perspectives on urban innovation: 'urban hubs' and 'local links'.

These models of innovation are overlapping, and should be seen as complements. Each stresses different aspects of an urban economy: urban hubs approaches focus on urban assets, markets and business networks; local links perspectives emphasise the role of institutions, knowledge networks and public-private collaboration. So each of the approaches has different implications for policy. Decision-makers need to identify the relative role of hubs and links in explaining innovative activity in given cities and sectors.

Urban hubs models explain how cities' critical mass helps firms to innovate

'Urban hubs' models are based on the concept of 'urbanisation economies': the basic urban offer of proximity, density and variety. The argument is that the scale and choice of urban economies helps firms innovate. Businesses can select the optimal mix of suppliers and workers. They can sell to large local markets, and have access to larger markets, and international flows of money, ideas, people and goods.⁴¹ This 'pick and mix economy' of

³⁷ Jaffe A, Trajtenberg M, and Henderson R (1993): Geographic localization of knowledge spillovers as evidenced by patent citations, *Quarterly Journal of Economics*, 108: 577-598.

³⁸ Audretsch and Feldman (1996): op. cit.

³⁹ For example, see Feldman, M (1999): The new economics of innovation, spillovers and agglomeration: a review of empirical studies, *Economic Innovation and New Technology*, 8: 5-25; Harhoff, D (1999): Firm formation and regional spillovers - evidence from Germany, *Economics of Innovation & New Technology*, 8: 27-55; Sternberg, R (1999): Innovative linkages and proximity: empirical results from recent surveys of small and medium-sized firms in German regions, *Regional Studies*, 33(6): 529-540; Bode, E (1999): Localised knowledge spillovers and regional employment growth: evidence from Germany, Working Paper No. 938 Keil Institute of World Economics, Kiel; Lissoni, F (2001): Knowledge codification and the geography of innovation: the case of Brescia mechanical cluster, *Research Policy*, 30(9): 1479-1500; Co, C (2004): Evolution of the Geography of Innovation: Evidence from Patent Data, *Growth and Change*, 33(4):393-423; Acs, Z, Fitzroy, F and Smith, I (1999): High Technology Employment, Wages and University R&D Spillovers: Evidence from US Cities, *Economic Innovation and New Technology*, 8: 57-78; and Kelley, M and Helper, S (1999): Firm size and capabilities, regional agglomeration and the adoption of new technology, *Economic Innovation and Technical Change*, 8: 79-103.

⁴⁰ For example, see Olson G and Olson J (2003) Mitigating the effects of distance on collaborative intellectual work, *Economics of Innovation and New Technology*, 12: 27-42; Teasley S and Wolinsky S (2003) Scientific collaborations at a distance, *Science*, 292(5525): 2254-2255; and Olson G and Olson J (2000): Distance Matters, *Human Computer Interaction*, 15: 139-178.

⁴¹ Liu X and Buck T (2007): 'Innovation performance and channels for international technology spillovers: Evidence from Chinese high-tech industries', *Research Policy* 36:3, pp 355-366; Saxenian A-L (2007): *the New Argonauts: Regional advantage in a global economy*, Cambridge, Mass: Harvard University Press; Simmie J

major cities like London helps explain the concentration of innovative firms in and around the capital.⁴²

As Jane Jacobs, the American-born Canadian urbanist, has argued, a city's economic diversity can also lead to cross-pollination between different sectors and specialisms.⁴³ Cities facilitate knowledge spillovers across the urban economy, as businesses learn from others, workers move between companies and new paradigms form. For example, New York's vibrant art and music scenes help cross-pollinate the city's fashion, advertising and design worlds. In this way, innovation helps build a city's long term economic base.

In policy terms, urban hubs models stress the importance of 'urban basics' – assets such as skills, infrastructure and public services, and using transport policy to improve effective market size. Urban hubs models also highlight the role of good governance – and in some cases, quality of life.

Local links models emphasise how firms and institutions network and collaborate to drive innovation

In contrast, '**local links**' models are based on the concept of 'localisation economies' – the specialised connections and networks that cities help firms to form. Essentially, proximity allows firms to establish business and knowledge networks within a given sector, or between businesses and public institutions. Cities allow a complex and deep division of markets and labour, and thus the formation of specialist firms and pools of skilled labour. Proximity encourages knowledge spillovers and helps organisations collaborate – for example, on new ideas, shared standards, skill requirements, or buying raw materials. Over time, distinct 'industrial districts' may form where innovation is 'in the air'.⁴⁴

Michael Porter and others have used these ideas to develop the concept of clusters. Concentrations of small, networked firms in sectors like ICT and advanced manufacturing seem to lie behind many regions' economic success.⁴⁵ Firms develop local supply networks, compete to offer new products, and share the same labour pools. Higher education and research institutions emerge and adapt to provide skills and R&D for industrial clusters. Government organisations serve industries with the infrastructure that they need to develop and grow.

These institutions form part of a web of market and knowledge relationships. The three main components are usually local government, the HE sector and business – sometimes referred to as the 'triple helix' that drives the wider innovation system.⁴⁶

Local links models tend to stress the role of networks and institutions, and the importance of activist local government, public-private partnerships and 'change agents'.

(2004): 'Innovation Clusters and Competitive Cities in Europe', in M Parkinson and M Boddy (eds): *City Matters*, Bristol: Policy Press.

⁴² Simmie J (2004): *op. cit.*

⁴³ Jacobs J (1969): *The Economy of Cities*, New York: Vintage.

⁴⁴ Marshall A (1920): *op. cit.*

⁴⁵ Piore M and Sabel C (1984): *The Second Industrial Divide: Possibilities for Prosperity*, New York: Basic Books; Porter M (1990): *The Competitive Advantage of Nations*, London: Palgrave Macmillan.

⁴⁶ Cooke P (2001): 'Regional Innovation Systems, Clusters and the Knowledge Economy', *Industrial and Corporate Change*, 10:4, pp 945-974; Etzkowitz H and Leydesdorff L (2000): *The dynamics of innovation: from National Systems and "Mode 2" to a Triple Helix of university-industry-government relations*, *Research Policy*, 29: 109-123.

4.3 What drives urban economic growth?

Patterns of urban economic development are path-dependent.⁴⁷ For instance, there is a basic positive relationship between agglomeration economies and city size.⁴⁸ The urban offer helps firms improve their productivity, and – other things being equal – this should improve their market position. Over time, this should amplify initial differences between places.⁴⁹ But diseconomies of scale – such as overcrowding, pollution and high land costs – tend to have the opposite effect, dispersing economic activity out of cities. How urban economies evolve is – in part – a product of how these opposing forces interact and feed back on each other.

Similarly, new ideas and institutions emerge, and are diffused within and across cities at different rates. Successful innovation systems develop through ‘institutional thickness’ – the capacity of public and private bodies to frame and deliver change.⁵⁰ In urban hubs models, this is city government’s capacity to maintain the urban asset base and deliver services. In local links models, institutional thickness refers to the connections, relationships and norms linking key public and private actors (see Box 1 below).

How urban actors innovate can shape future economic performance.⁵¹ Similar cities can respond to the same change in different ways. For example, a number of big cities were affected by de-industrialisation during the 1970s and 1980s. Thirty years later, there are now wide variations between the performance of London; Manchester and Leeds; and Liverpool and Newcastle.

Box 1: Institutional thickness - the Cambridge story

Cambridge demonstrates how urban innovation can create positive feedback, further strengthening the local economy and the innovation system itself.

Entrepreneurs are at the heart of the Cambridge story. Current and former academics develop spinout companies to house their ideas, with some serial entrepreneurs developing a number of businesses.⁵² The Cambridge Network and Cambridge-MIT Institute promote networking and ideas sharing. The city’s Science Park provides business space (Microsoft is a tenant). The St John’s Innovation Centre is a dedicated incubator, providing workspace and services to new firms.

The system is largely self-organising. EEDA, the Regional Development Agency, provides the basics – land assembly, business support and area marketing. The city economy sits across two District Councils and a County Council: the Greater Cambridge Partnership, set up in 1998, aims to provide more strategic support.

Cambridge’s economic successes are changing the shape of the innovation system. Over time, specialist support firms have grown up, and specialist labour markets have developed.

⁴⁷ Martin R and Sunley P (2006): ‘Path dependence and regional economic evolution’, *Journal of Economic Geography* 2006 6:4, pp 395-437.

⁴⁸ Rosenthal, S. and Strange, W. (2003). Evidence on the Nature and Sources of Agglomeration Economies. In Henderson, J. and Thisse, J-F. (Eds) *Handbook of Urban and Regional Economics*. London: North-Holland.

⁴⁹ Venables A (2007): op. cit.

⁵⁰ Amin, A. & Thrift, N. (1994): ‘Globalisation, institutional ‘thickness’ and the local economy’, in *Urban Management*. Healey, P., Cameron, S., Davoudi, S., Graham, S. & Madani-Pour, A. Belhaven.

⁵¹ Simmie J (2005): ‘The Competitive Economic Performance of English Cities’, *SOCR Summary Paper*, London: ODPM.

⁵² Garnsey E and Heffernan P (2005): ‘High-Tech Clustering through Spin-Out and Attraction: The Cambridge Case’, *Regional Studies*, 39:8 pp 1127-1144.

Very large players are now moving in. In effect, the urban innovation ecosystem is changing to a 'planetary system'.⁵³

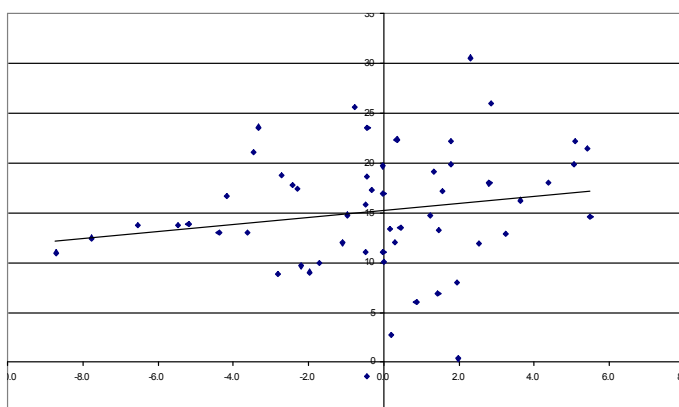
So there are clear overlaps between patterns of urban economic growth and spatial patterns of innovation. But the complexities of the relationships – and limits to available data – mean that establishing a direct statistical link between the two is difficult.

Analysis of descriptive statistics using patent figures (which are generally very limited indicators of innovative activities), for example, shows no clear relationship. Other broader measures of innovation using available statistics and indicators for travel-to-work areas also do not show a clear link between innovation and growth. Figure 9 shows how the rate of total employment growth relates to growth in knowledge workers in English cities between 1995 and 2005. There is no strong relationship. Cities such as Milton Keynes have demonstrated high employment growth and high knowledge worker growth, but other cities such as Doncaster have experienced high employment growth in non-knowledge worker jobs.

Figure 10 presents a comparison in knowledge worker share of total employment with average gross weekly pay. As one would expect, there is a positive correlation between the two as knowledge intensive jobs tend to be higher paid. However, this is likely to be more revealing than comparing employment growth – as it is probably a better proxy for wealth creation and economic output than employment growth is.

Overall – there are limits from comparing descriptive statistics for urban areas in determining causal factors for growth. More robust methods usually incorporate multivariate and econometric analysis, but this is outwith the scope of this paper and study.

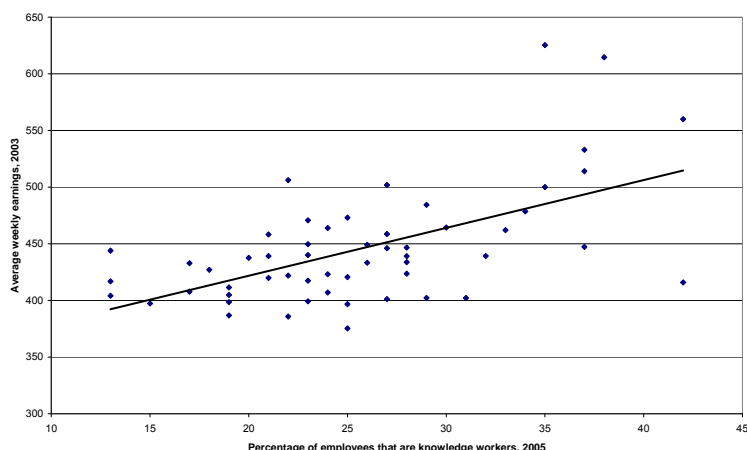
Figure 9: Per cent change in knowledge workers, 1995-2005 vs. employment growth, 1995-2005 for England's 56 urban TTWAs⁵⁴



⁵³ Ektovitz H (2005): 'Innovation and Technology Transfer in Cities', Presentation to Science Cities workshop, York, September.

⁵⁴ SOCD.

Figure 10: Knowledge workers share of total employment in 2005 vs average gross weekly pay in 2003 for England’s 56 urban TTWAs⁵⁵



4.4 Hubs and links models can help us map innovation in different cities

Innovative activity in cities varies widely – across sectors, and by cities’ size, location and history. Nevertheless, hubs and links approaches can help begin to categorise urban innovation. Table 6 below presents a sample typology based on the economic performance of English cities. This could be expanded – for example – by looking at each city’s policy architecture and governance capacity.

Table 6: Classifying the innovation performance of English cities.

Hubs	Links	Example
Strong	Strong	London World city with a huge domestic economy, and clusters in e.g. creative industries and financial services. Size of city, reaches out and is integral to international markets. Specialisation of sectors and subsectors.
Strong	Weak	Birmingham, Manchester, Coventry, Reading/Thames Valley Major conurbations, some with an industrial heritage, in transition to a post-industrial ‘knowledge economy’.
Weak	Strong	Cambridge, Dundee Small cities / urban systems driven by science and services. Strong growth in innovation related industries and services, often linked to research strengths of higher education and research institutions.

Note: examples are for illustration only.

We will explore and develop these ideas further in the rest of our research, drawing on a number of detailed city case studies.

Knowledge gaps

- What is the relative importance of the various features of hubs and links models and processes?
- What factors, processes or mechanisms are more likely to result in innovation than others?

⁵⁵ SOCD.

- What urban assets are essential prerequisites for innovation? Of these, how do key public services and 'urban basics' support innovation?

5. WHAT ARE THE COMPONENTS OF AN URBAN INNOVATION SYSTEM?

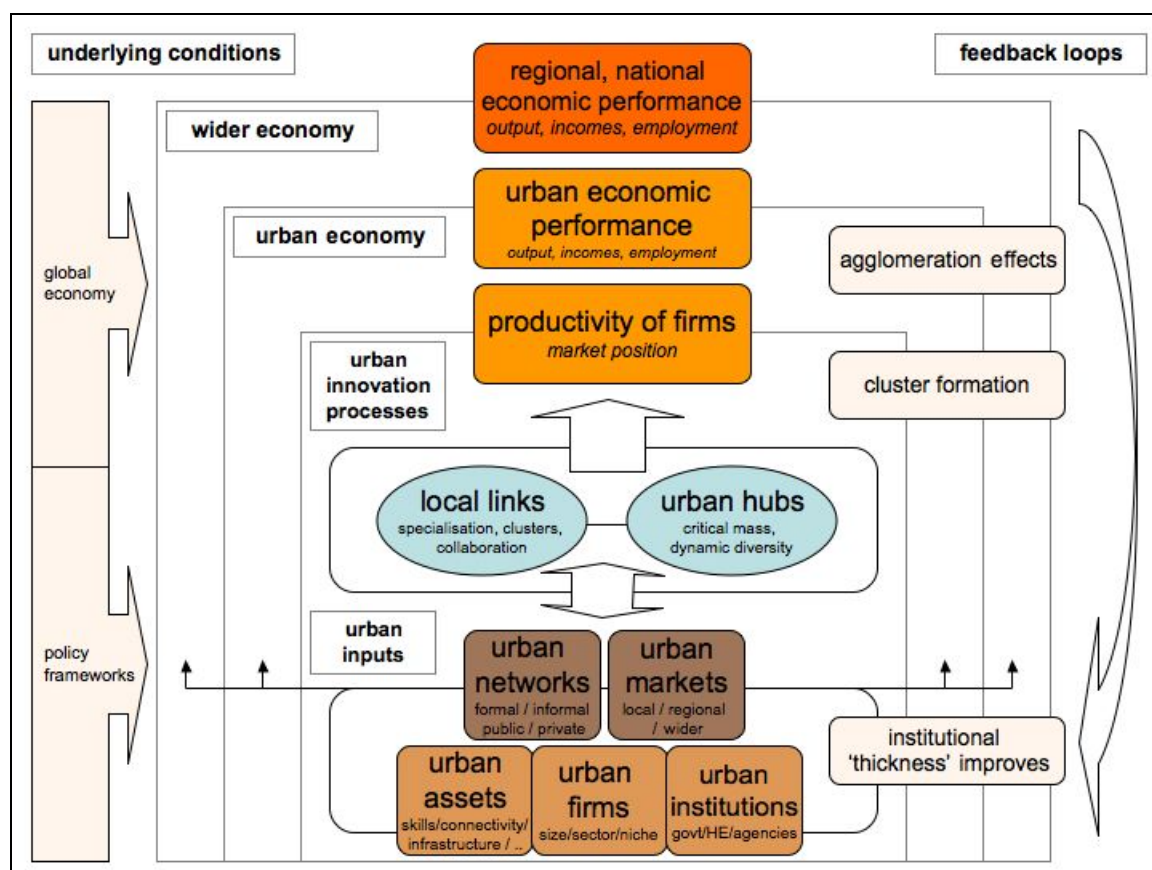
This section explores urban innovation systems in detail, setting the ideas previously mentioned against the existing evidence.

5.1 Hubs and links are at the heart of bigger urban innovation ‘systems’

To understand urban innovation, it helps to take a systematic approach. One possible urban innovation framework is set out in Figure 11 below. This framework sets out the main ‘inputs’ of the urban innovation system, in its wider economic and policy context; how these elements relate to the most important urban innovation processes; the outcomes of innovative activity on firms, urban and wider economies; and the feedback effects which help increase urban economic growth, and strengthen the innovation system itself.

In particular, the framework identifies the main **components** of urban innovation systems innovation – **assets** such as location, infrastructure, finance, property and the skills base; **institutions** such as business / industry associations, government, HEIs and professional associations, as well as **firms**, the main users of new ideas. Other critical components are knowledge and business relationships – **networks** between these institutions and the private sector, and **markets** – both in cities and further afield, where the demand ‘pull’ for innovation occurs.

Figure 11: A sample framework for understanding urban innovation



As outlined in the previous section, urban hubs and local links approaches emphasise different components of urban innovation systems. Hubs perspectives highlight urban assets, markets and business relationships; links models concentrate on institutions, knowledge networks and public-private interactions.

This framework is a starting point. It is designed to illustrate the links between cities, innovation and urban economic growth. It does not measure the relative importance of different components and processes. Nor does it specify the full list of components, and their relationship to each other.

The rest of this section seeks to describe the components and dynamics of the framework in more detail, drawing on existing evidence. It concentrates on the main components of the innovation system: assets, institutions, firms, networks and markets.

5.2 Urban assets underpin innovation systems

A city’s urban asset base underpins economic and innovative activity, and shapes firms’ location and expansion decisions. Surveys suggest the main factors affecting business location are the availability of qualified staff, communications, low property and other costs, access to markets and good transport links.⁵⁶

Table 7: A typology of urban assets

Location and history	Connectivity – physical, electronic
Market access	Built environment
Skills	Public services
Property and land	‘Quality of life’

The different elements of the urban asset base overlap, and affect each other. The urban **skills** base seems to be the most important location factor – for both innovative firms and businesses in general. The availability of highly skilled workers is a major factor for the location and retention of innovative firms in a given city.⁵⁷

Knowledge workers are highly concentrated in cities and their hinterlands. In 2005, 90 per cent of knowledge workers were located in England’s city-regions – with 34 per cent in London, 13 per cent in the eight Core Cities and a further 13 per cent in eight highly knowledge-intensive economies including Aldershot, Cambridge, Derby, Milton Keynes and Reading.⁵⁸

Figure 12 shows the strong relationship between the skills base of a city and the rate of innovation of its firms. It shows that for England’s 56 largest urban areas, an increase in the presence of knowledge workers is associated with higher rates of patenting. The relationship can work the other way too: innovative firms are likely to require more skilled workers.⁵⁹

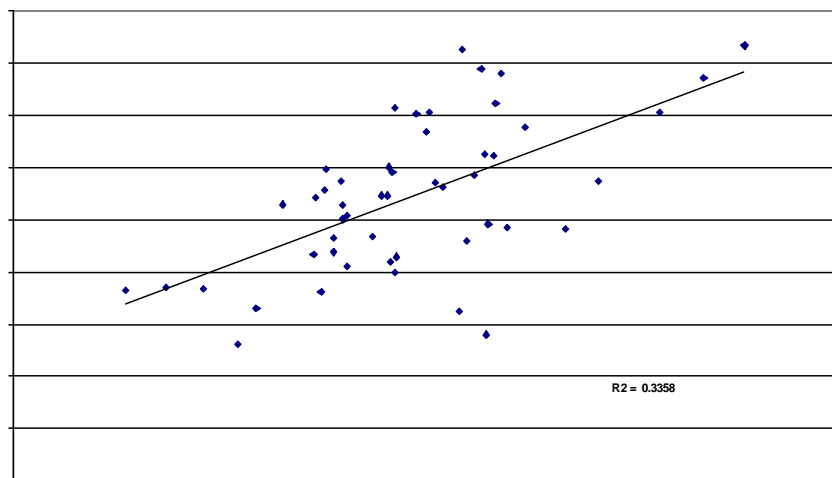
⁵⁶ Cushman Wakefield Healey and Baker (2004): *European Cities Monitor*, London: CWHB.

⁵⁷ Shown in interviews conducted with 160 innovative firms in 5 European cities as reported in Simmie J, Sennett, J, Wood P and Hart D (2002): *Innovation in Europe: A Tale of Networks, Knowledge and Trade in Five Cities*, *Regional Studies*, Vol. 36.1, pp. 47-64.

⁵⁸ Data and definition of knowledge workers are employees working in Knowledge Intensive Business Services as described in the State of the English Cities database at <http://www.socd.communities.gov.uk/socd>.

⁵⁹ Simpson E, McGregor A and Botham R (2004): *International Approaches to Enterprise Strategies*, The Scottish Executive.

Figure 12: Knowledge workers and innovation in England's 56 urban travel-to-work-areas



Source: DCLG, 2006; Community Innovation Survey.

The **built environment** and **transport** infrastructure help firms configure production and distribution. Hub airports and rail links increase cities' effective reach and improve firms' innovation potential.⁶⁰ Conversely, project leaders in London's innovative firms use face to face contact extensively, with 20 per cent meeting executives from other firms at least once a week.⁶¹

Intuitively, '**quality of life**' factors such as amenities and cultural diversity should help underpin urban growth and innovation. But there is little hard evidence on their exact role. Most recently, Richard Florida has argued that cultural diversity and amenities attracts a 'Creative Class', which in turn attracts high-tech companies.⁶² It follows that the most diverse cities best support innovative businesses and people. However, these ideas are controversial and it is not clear they work well on this side of the Atlantic.⁶³

More broadly, **public services** (in theory) help urban life run smoothly and help attract and keep businesses and residents in the city. We consider the role of local government and other urban institutions below.

5.3 Urban institutions help shape, nurture and maintain innovation

Urban institutions help to maintain the asset base, and more importantly, often take an active role in shaping – and supplying – innovation. Here, we look at city government, regeneration agencies, the HE sector – and individual 'change agents' or social entrepreneurs within and around public institutions.

⁶⁰ Graham D (2005): *Wider Economic Benefits of Transport Improvements: Link between city size and productivity*, London: DfT; Rice P and Venables A (2004): 'Spatial Determinants of Productivity: Analysis for the Regions of Great Britain', unpublished paper, London: LSE.

⁶¹ Simmie (2004): *op. cit.*

⁶² Florida R (2002): *The Rise of the Creative Class*, New York: Basic Books.

⁶³ Nathan M (2005): 'The Wrong Stuff', *Centre for Cities Discussion Paper 1*, London: Centre for Cities at ippr.

Table 8: A typology of urban institutions and key actors.

Government: national, regional, local	Regeneration agencies
Education system: schools, universities	City leaders
Public research	'Change agents' / star scientists

National **government** sets the rules and frameworks around urban and national economies: through regulation, information, tax and subsidies, and direct provision of goods and services.

Government can also take a role in shaping the innovation supply side, most notably through the **education system** – from school to university, and through **public research**. Indirectly, government shapes innovation outcomes by targeting spend on a few centres of excellence – defence spending around Silicon Valley and Boston's Route 128 Corridor, or life sciences spending on the 'Golden Triangle' of London, Oxford and Cambridge universities. Some researchers argue that this kind of mainstream spending – with a strong spatial dimension – has far more impact on innovative activity than dedicated 'innovation' programmes.⁶⁴

The autonomy of local government also seems to help shape innovation, although the evidence base is less than perfect. It is certainly the case that many of the Continent's most innovative urban areas have greater political and, financial autonomy – and more experience of devolved working – than English cities.⁶⁵

According to one recent study, devolved powers seem to help lagging regions catch the leaders – by allowing city government to design bespoke policy frameworks to promote innovation-led growth.⁶⁶ The scale of urban government is also important. City-regions are a more effective level for delivering economic policy, because they are a better match for the reality of an urban economic system.⁶⁷

Universities can play multiple roles in urban innovation. Most obviously, universities help build the urban asset base through a supply of skilled graduates: this is largely an urban phenomenon, with cities accounting for 81 per cent of higher education students.

There is also some evidence that private sector R&D labs tend to converge around research centres in urban universities: one study found clear evidence of co-location in pharmaceutical and mechanical engineering sectors.⁶⁸ This suggests that universities can become a centre of knowledge spillovers, along the lines of local links models. But co-location may arise for other reasons – not least firms' desire to recruit good graduates, or the distribution of public subsidies for new business parks. It is important to know more about universities' direct and indirect roles in supporting innovation in cities.

Within institutions, **change agents** can help build or push innovation forward (see Box 2). Strong **city leaders** can make links between public, private and third sector institutions. Within universities, '**star**' **scientists** responsible for major breakthroughs can also impact a city's innovation trajectory, and act as attractors of other talent themselves.⁶⁹ Evidence from

⁶⁴ Harding A and Robson B (2006): *A Framework for City-Regions*, London: ODPM; Massey D (2004): *For Space*, London: SAGE.

⁶⁵ CURDS / NESTA Seminar on Innovation and Regional Leadership, London May 2007.

⁶⁶ Canaletta, C, Arzoz, P and Garate, M (2004): *Regional Economic Disparities and Decentralisation*, *Urban Studies*, 41(1): 71-94.

⁶⁷ Marshall A and Finch D (2006): *City Leadership: Giving city-regions the power to grow*, London: Centre for Cities at ippr.

⁶⁸ Abramovsky L, Harrison R and Simpson H (2006): 'University Research and the Location of Business R&D', London, Institute for Fiscal Studies, Frenz and Oughton (2004): op.cit.

⁶⁹ Mahroum S (2000): 'Global Magnets: Science and Technology Disciplines and Departments in the United Kingdom', *Minerva* 37:4, pp 379-390.

the US biotech industry suggests stars are geographically concentrated, and may help knowledge spillovers in their surrounding cities – although they cannot anchor a new industry in place.⁷⁰ Much of this is anecdotal, and more knowledge is needed about the role of these ‘change agents’ in cities across the UK.

Box 2: Innovation change agents - Fred Terman & Silicon Valley

Stanford University has been central to Silicon Valley’s development since the mid 20th century. Fred Terman, Provost at Stanford between 1955 and 1965, is widely credited as a key figure in the Valley’s early development.

Terman fostered networks, established infrastructure and promoted talent, based around the University’s electrical engineering department. In 1953, he established the Honors Cooperative Program, which allowed researchers in local technology companies to undertake postgraduate evening classes. He was instrumental in establishing the Stanford Industrial Park – which leased university land to high technology companies. The park is now home to more than 50 research centres, cementing links between the university and the private sector.

Terman tutored several of Silicon Valley’s most successful entrepreneurs during their studies at Stanford and continued to assist them after they had left.⁷¹ He deliberately recruited star researchers – including the Nobel Prize winning scientist William Shockley – and helped them in establishing spin-out companies. These included former students William Hewlett and David Packard – who Terman supported when starting Hewlett Packard.

Dedicated **regeneration agencies** can also help catalyse local innovation. Agencies like Urban Regeneration Companies (URCs) play an important role in urban economic development, and improving the physical asset base. Some regeneration agencies are also involved in brokering networks between researchers and the private sector.⁷² We look more at urban networks below.

5.4 Firms are at the heart of urban innovation

The most important actors in urban innovation are firms and entrepreneurs: they are at the interface between the supply of innovation and the demand for new ideas. To understand urban innovation, therefore, it is important to understand urban business behaviour.⁷³ Firms are at the centre of urban innovation systems – applying and adapting ideas, and generating their own. Similarly, businesses make use of the urban asset base, shape and are influenced by public institutions and policy frameworks. Business strategies, supply chains and market footprint all shape innovation in cities.

Table 9: A typology of urban firms.

Size (small / medium / large)	Position (B2B / B2C)
Sector (manufacturing / hightech / services)	Maturity (startup / growing / mature)

⁷⁰ Feldman (1999): op. cit.

⁷¹ Gillmor C (2004): ‘Fred Terman at Stanford: Building a Discipline, a University, and Silicon Valley’, Stanford: Stanford University Press.

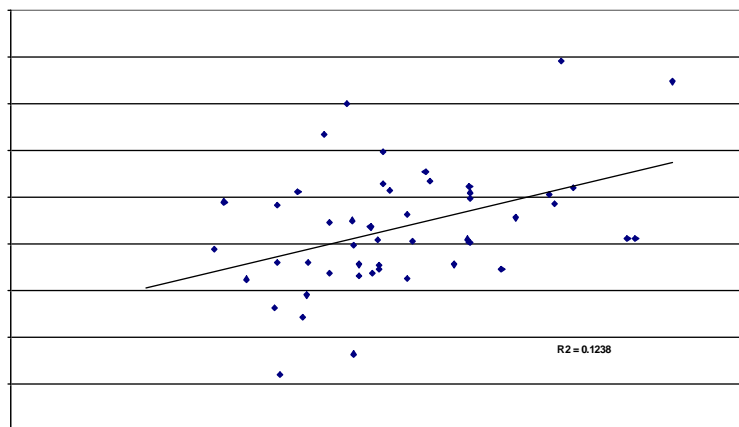
⁷² Frenz and Oughton (2004): op. cit.

⁷³ Martin R and Sunley P (2003): ‘Deconstructing Clusters: Chaotic Concept or Policy Panacea?’, Journal of Economic Geography, 3, pp 5-35.

Firms of different sizes play important, complementary roles in urban innovation.⁷⁴ **Smaller firms** are more likely to produce radical innovation, and help introduce new ideas to the world.⁷⁵ The power of startups in new media and Web 2.0 are two recent examples.

Startups and entrepreneurs tend to be concentrated in cities and their hinterlands. England's biggest cities contain one million VAT registered enterprises (out of a total of 1.6 million in England) – and there is a relationship between the density of business stock and innovation (figures 13 and 14). These results suggest that small businesses and new firms benefit from the scale, choice and networks that cities possess. More knowledge is required about how smaller, newer firms make use of different parts of the urban offer.

Figure 13 enterprise and product innovation in English cities



Source: DCLG, 2006; Community Innovation Survey

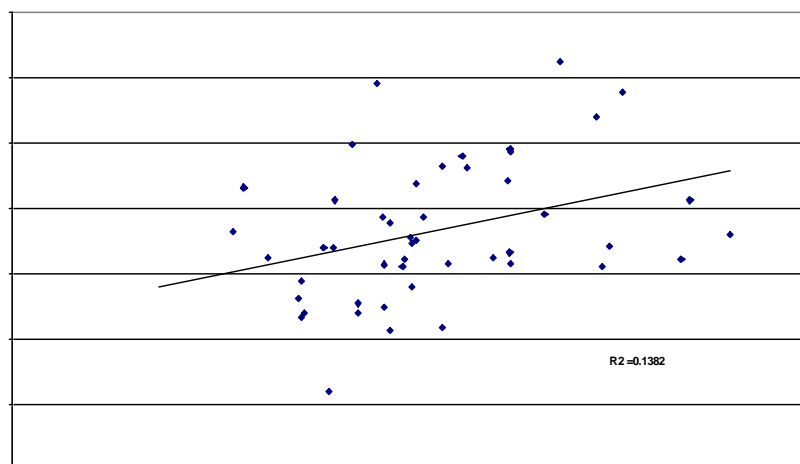
In contrast to smaller businesses, **larger firms** tend to spend more on R&D, as they have the means and money to do so.⁷⁶ There is tentative evidence that ‘anchor firms’ can help clusters take root and develop, for example in the US biotech industry.⁷⁷ These can be multinationals seeking to invest around existing research centres – such as the Wellcome Trust Biocentre in Dundee, which operates as part of Dundee University.

⁷⁴ Frenz and Oughton (2004): op. cit.

⁷⁵ Schumpeter J (1975): *Capitalism, Socialism and Democracy*, New York: Harper.

⁷⁶ Griffith R, Huergo E, Mairesse J and Peters B (2006): ‘Innovation and Productivity Across Four European Countries’, *Oxford Review of Economic Policy*, 22;4, pp 483-498.

⁷⁷ Feldman (1999): op. cit.

Figure 14: Enterprise and process innovation in English cities

Source: DCLG, 2006; Community Innovation Survey

Most of the literature on innovative firms has focused on **science and technology** sectors, such as bioscience, ICT and advanced manufacturing (e.g. electronics, defence and precision engineering). These sectors have a very visible innovation profile, with high levels of R&D spending and patenting.

Firms in the **service sector** spend less on visible innovation – such as R&D, or patent registration – but often innovate by co-ordinating supply chain management (for example, large supermarkets) or through new technology (for example, call centres and internet banking).⁷⁸ Innovation outside science and technology is also critical for cities (see Box 3). Much of this is ‘hidden innovation’ – which includes innovation that occurs but is excluded from measurement; is without scientific or technological basis; is a novel combination of existing technologies and processes; or is locally developed and small scale, occurring ‘under the radar’ of traditional indicators and organisations.⁷⁹

Box 3: The local links and urban hubs in New York’s fashion industry

New York’s fashion industry consists of hundreds of highly specialised fashion and media enterprises supported by a diverse range of more generalist firms and complementary industries.⁸⁰ It is a hugely innovative sector, which barely registers on traditional measures of innovation.

The Garment District – the historical heart of the city’s fashion industry – has, over time, developed a specialised supplier base and labour markets. Downstream, the city has a large and sophisticated local consumer base that can support cutting-edge fashion products and design ideas. New York is also a major centre for the world’s fashion media industry, and the head office location for many major US department stores and purchasing departments. This benefits local enterprises by providing a global platform for their work and by maintaining New York as a focus of world fashion industry networks.

⁷⁸ Miles I (2001): ‘Services Innovation: A Reconfiguration of Innovation Studies’, PREST Discussion Paper, Manchester: University of Manchester.

⁷⁹ NESTA (2006): The Innovation Gap: Why innovation policy needs to reflect the reality of innovation in the UK, London: NESTA.

⁸⁰ Webber C & Athey G (2007) ‘The route to growth: transport, density and productivity’, London: Centre for Cities.

Local innovations are frequent. For example, new design boutiques, catering to more sophisticated tastes, have been formed as spin-out ventures from the mainstream market. These spin-out ventures are now influencing the wider market.⁸¹

More broadly, ideas flow from the music, media and art sectors into the fashion sector and vice versa. New York’s ‘Fashion Week’, for instance, is as much about music, design, art, advertising and nightlife as about clothes.

5.5 Urban networks facilitate the flow of ideas

Networks facilitate the flow of ideas, skills, knowledge and deals. They underpin the supply of, and demand for innovation. Cities support their own deep, dense networks, and enable firms to access wider networks and flows in the regional, national and international economy.

Table 10: A typology of urban networks

Local / national / international	Public / Private / Cross-sector
Formal / informal	Self-organising / mediated

Much of the evidence base looks at different types of networks. There is good evidence that formal and informal **local networks** matter, especially for high-tech sectors.⁸² The collaboration between high-tech firms and public research institutions is linked to new patents and product innovation.⁸³ The Lambert Review suggests **university-business collaboration** is fairly common, with over 1/3 of firms collaborating with a local HE institution.⁸⁴ But other evidence suggests the overall level of firm-university co-operation across the UK is very low.⁸⁵ It is important to understand more about which types of firms engage with urban universities, and which sectors could benefit from further engagement.

The networked policy ideal is for the state to foster **public-private networks** that lead to innovation. Finland consistently shows very high levels of business engagement with government programmes and the HE sector – even higher than other Nordic countries.⁸⁶ Finnish cities – such as Tampere – exhibit strong networks between public sector actors, and between the public sector and business (see Box 4).

Box 4: Networked cities - innovation in Finland

Within three generations, Finland has moved from a poor, largely agrarian country to one of the world’s leading high-tech economies. Finland’s cities are the country’s economic building blocks, and key sites of its innovation system.⁸⁷ Local initiatives and networks are an important part of the policy mix. City leaders have set up regional councils to collaborate

⁸¹ Rantisi M (2002): ‘The Local Innovation System as a Source of ‘Variety’: Openness and Adaptability in New York City’s Garment District’, *Regional Studies*, vol. 36.

⁸² Orlando M & Versa M (2005): Do only big cities innovate? Technological maturity and the location of innovation, Kansas: Federal Reserve Bank of Kansas City.

⁸³ Frenz and Oughton (2004): op. cit.

⁸⁴ Lambert R (2003): Lambert Review of Business-University Collaboration: Final report, London: HM Treasury.

⁸⁵ Frenz M, Michie J and Oughton C (2005): Innovation and Cooperation: The role of absorptive capacity, Birkbeck Working Paper Series, London: Birkbeck College.

⁸⁶ Eurostat Community Innovation Survey, 2007.

⁸⁷ Castells M and Himmanen P (2002): The Information Society and the Welfare State: The Finnish model, Oxford: OUP.

across boundaries – planning together and sharing resources. Regional Councils are also used to draw down EU funding. City leaders were given increased autonomy in 1995, and have had over a decade to develop local initiatives of their own.

City leaders have helped Tampere – Finland's second city – evolve from a city of textiles and heavy industry towards a post-industrial economy based on advanced engineering and ICT.⁸⁸ Universities – set up from the 1950s – helped create a cluster of engineering firms and skilled workers, and a science park – built in the 80s – fostered a number of knowledge and business networks.

During the 1990s – facing a major recession – local politicians, officials and academics drew these strands together, forging a distinct urban innovation strategy for the city, based around public-private collaboration. Tampere has since developed a number of local innovation programmes.

For example, the eTampere strategy (2001-2005) was used to help kick-start the city's post-industrial economy. The idea was to improve economic growth and innovation in two ways: on the supply side, by subsidising investment and strengthening networks, and on the demand side by creating a new public market for online public services.

Network-building programmes take time to develop, and it is too early to evaluate the full impacts of the eTampere programme. However, over the past few years, employment in the ICT sector rose in the city while falling across the rest of Finland.⁸⁹

Local links models argue that **business to business networking** and collaboration helps knowledge transfer. Cities make it easier to establish and maintain these connections, which are often largely **self-organising**. Evidence suggests that firm cooperation can in some cases lead to higher levels of innovation.⁹⁰ Cities with clusters of related businesses – in this case, knowledge-intensive sectors – also tend to drive up innovative activity.⁹¹ However, not all networks are successful, and not all businesses use networks successfully.

The indeterminate nature of these results has increasingly led researchers to look at what flows through networks, and the critical difference between **business and knowledge relationships**. For example, 'business networks', such as supplier relationships, may be a conduit for innovation – supermarkets use supply chains to innovate in logistics, for instance. But 'knowledge networks' in particular are very important for innovation – for example, ideas-sharing or strategic collaboration. In many cases, these knowledge networks have been found to be uneven (with many firms not included) and selective (with some 'leaders' in the sector opting out, and forging strategic links with businesses well outside the urban area).⁹² Collective learning is often not the dominant behaviour, even in high-tech clusters.⁹³

The exceptions are SMEs and micro-businesses pursuing radical product innovation – which tend to collaborate and learn more collectively. We need to know more about the strength and nature of connections between urban firms, and the shape of knowledge networks in different parts of the urban economy.

⁸⁸ Soturauta M (2007): 'Tampere's Innovation Journey', presentation to CURDS / NESTA seminar, London, May.

⁸⁹ eTampere (2006): eTampere Programme 2001-2005: Summary, www.tampere.fi

⁹⁰ Roper S and Love J (2001): 'Location and Network Effects on Innovation Success: Evidence for UK, German and Irish Manufacturing Plants', *Research Policy*, 30, pp 643-661; Feldman: op. cit.

⁹¹ Audretsch and Feldman (1999): op. cit.

⁹² Giuliani E (2007): 'The Selective Nature of Knowledge Networks in Clusters: Evidence from the Wine Industry', *Journal of Economic Geography*, 7, pp 139-168.

⁹³ Capello R (2007): 'Spatial Transfer of Knowledge in High Technology Milieux: Learning Versus Collective Learning Processes', *Regional Studies*, 33:4, pp 353-365.

5.6 Markets drive and sustain commercially successful innovation

Markets help reflect the demand for innovation and new ideas. For innovation to thrive, new ideas need lead markets – demanding consumers who provide an early customer base. Lead markets need to be fairly large, to support the costs of innovation; they need supporting physical and economic infrastructure, and they need public and/or private consumers with a taste for new thinking.⁹⁴

Table 11: A typology of urban markets.

Scope: local / regional / national / global	Type: capital / labour / goods and services
Orientation: supplier / consumer	Regulatory framework: light / heavy
Final demand: public / private sector	

Cities can help. First, cities can support their own **local markets**. For example, the dotcom / new media sector is heavily concentrated in a few districts of major cities – inner London and Manhattan, in particular.⁹⁵ Internet businesses draw in finance and know-how from financiers and researchers, then sell to nearby media, publishing and advertising firms.⁹⁶

Big cities exhibit a kind of **urban Long Tail** – they are big and diverse enough to support a range of specialist providers, niche scenes and subcultures.⁹⁷ For example, artists and musicians tend to concentrate in bigger cities – to socialise and collaborate with each other, but also to exploit the urban consumer base and specialist infrastructure of galleries, venues, dealers and media.⁹⁸ We need to know more about what kinds and sizes of cities can support their own local markets, and in which sectors.

Second, as national governments lower trade barriers, urban connectivity helps firms to access **global markets**: flows of capital, product and labour. This is why advanced producer service firms increasingly use major cities as hubs for global business networks.⁹⁹ Cities provide the infrastructure to support high-end knowledge working – and provide a base for firms to reach markets across the globe. Open innovation models, common in the IT industry, allow firms to create a market for innovation that can stretch well beyond city boundaries.¹⁰⁰ Similarly, big cities are sites of **international migration** – often highly-skilled people with new ideas and links to markets ‘back home’ (see Box 5). Decision-makers need to understand these international markets and flows better, and how they shape urban innovation.

Box 5: Brain circulation – Silicon Valley’s globalising economy

Silicon Valley is one of the world’s best-known urban innovation systems: a cluster of settlements around San Francisco and the surrounding Bay Area, centred on the city of San Jose and the university towns of Berkeley and Stanford. The area’s success factors are well-known: a large urban core; a huge University ideas base; infusions of Federal defence

⁹⁴ Georghiou L (2007): Demanding Innovation: Lead markets, public procurement and innovation, NESTA Provocation 2, February, London: NESTA.

⁹⁵ Graham D (2004): op. cit.

⁹⁶ Castells M (2001): The Internet Galaxy: Reflections on the internet, business and society, Oxford: Blackwell.

⁹⁷ Anderson C (2004): ‘The Long Tail’, Wired, October.

⁹⁸ Markusen A (2005): ‘Urban Development and the Politics of a Creative Class: Evidence from the Study of Artists’, paper presented to RSA Conference on *Regional Growth Agendas*, Aalborg.

⁹⁹ Taylor P, Walker D and Beaverstock J (2002): ‘Firms and Their Global Service Networks’, in S Sassen (ed): *Global Networks, Linked Cities*, London: Routledge.

¹⁰⁰ Chesbrough H (2003): *Open Innovation: The new imperative for creating and profiting from technology*, Cambridge, Mass: Harvard Business School Press.

spending, shaping demand for innovative ideas; highly competitive firm relationships, with a massive turnover of companies and ideas, and an 'outsider culture'.¹⁰¹

The paradox of Silicon Valley is that the area has continued to thrive – despite becoming progressively more crowded, congested and expensive. In part, this reflects the gravitational pull of a big urban centre, and the positive feedback loops from earlier success.¹⁰² But it also reflects the area's increasingly open economy.

International migration is a key factor in the Valley's long term sustainability. Over half of Silicon Valley's scientists and engineers were born abroad, mostly in South and East Asia.¹⁰³ These migrant diasporas are highly entrepreneurial – running nearly a third of the Valley's technology businesses in 2000 – and help attract a constant inflow of skilled people. They also forge links 'back home', either returning or setting up parallel businesses. The Valley is the home of an increasingly distributed global production system. This system of 'brain circulation' is win-win: helping Silicon Valley thrive, plugging US businesses into international markets, and helping 'home' countries develop.¹⁰⁴

Third, the **urban public sector** can actively shape and create markets for innovative ideas – in particular, through providing information, setting local standards and through public procurement.¹⁰⁵ London's new climate change strategy is a good example of how city leaders could shape innovation through the demand for new ideas, products and services (see Box 6).

Box 6: Tackling climate change – London's approach

London is leading the way for UK cities in tackling climate change: reducing the city's carbon footprint, and helping create demand for new and emerging low-carbon technologies, tools and services. As such, it is about innovation *and* energy.

The Mayor's strategy makes use of new freedoms won in the UK Government's 2006 review of London government.¹⁰⁶ London's approach is to provide public leadership, to shape markets through regulation and standards, and to incentivise behaviour change through procurement and partnerships with the private sector.¹⁰⁷ There are four key policy areas: public transport, housing, construction, and energy, water and waste.

The centrepiece of the new approach is the GLA's Climate Change Agency, set up in 2005 to drive through behaviour change. Designed as a municipal company, the Agency will work with the private sector to design, finance, build and operate low-carbon energy, water and waste solutions.¹⁰⁸ The Agency will help create a London-wide market for innovative goods and services. The GLA has put a change agent in charge: Allan Jones, who pioneered Woking's low-carbon distributed energy system.

The public sector's demand-side role is relatively unexplored, particularly at city level. It is important to know more about how city government can stimulate urban innovation.

¹⁰¹ Saxenian A-L (1996): *Regional Advantage*, Cambridge, Mass: Harvard University Press.

¹⁰² Venables A (2007): *op. cit.*

¹⁰³ Saxenian A-L (2002): 'Brain Circulation: How high-skill immigration makes everyone better off', *Brookings review* 20:1, pp 28-31.

¹⁰⁴ Saxenian A-L (2006): *op. cit.*

¹⁰⁵ Georghiou L (2007): *op. cit.*

¹⁰⁶ DCLG (2006): *The Greater London Authority: The Government's final proposals for additional powers and responsibilities for the Mayor and Assembly*, July 2006, London: DCLG.

¹⁰⁷ Gavron N (2007): 'Tackling Climate Change in London', speech to Think 07 conference, May.

¹⁰⁸ GLA (2005): 'London's political and business leaders come together to combat climate change', press release, 20 June, www.london.gov.uk

Knowledge gaps

- How do urban-specific factors support innovative activity?
- What is the direct and indirect role of HE in supporting innovations?
- What is the role of 'anchor firms' in shaping innovation in different cities?
- How service-oriented is innovation in urban places?
- What types of knowledge networks are formed in cities? And how unique to cities are those?
- Overall, how well does the model proposed in this paper reflect the reality of urban innovation?

6. WHAT IS THE ROLE OF GOVERNMENT?

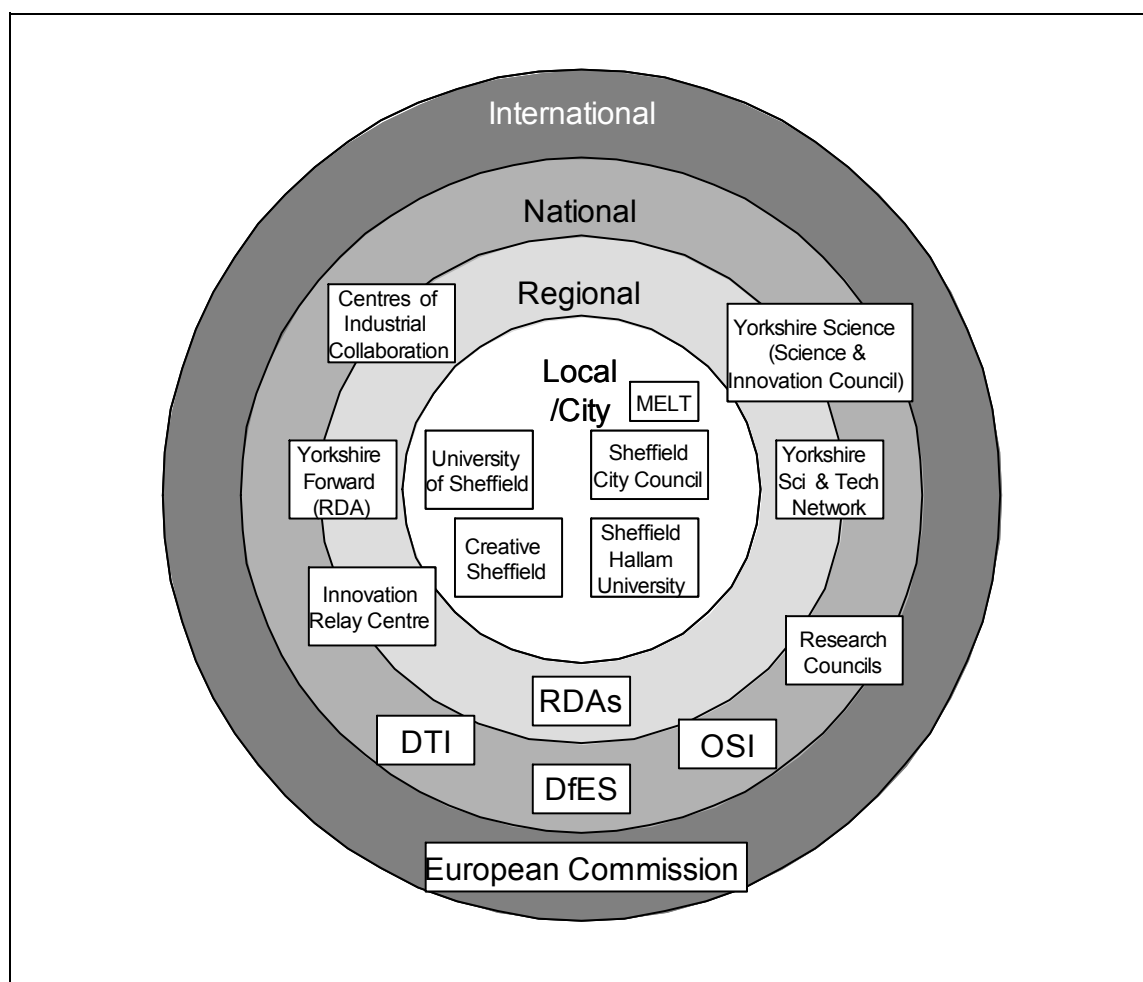
This section looks at innovation policy for cities at European, national, regional and local level. It then maps policy provision against our urban innovation framework.

6.1 A typology of urban innovation policy: institutions, frameworks and funds

There are several layers of policy that shape urban innovation systems: different spatial levels, agencies, strategies, initiatives and funding pots. The Government, the regions and nations, and the European Commission have been very active in providing policies, funding, guidance, and programmes to promote and enable innovation strategies and activities at city level. At the same time, cities have developed their own strategies – drawing down assistance from other institutions, or delivering their own initiatives.

From a city point of view, therefore, the policy architecture is extremely complicated. Figure 15 illustrates the institutional map around the city of Sheffield – just one aspect of the policy system the city leaders need to grapple with.

Figure 15: The institutional context for public innovation policy and action in Sheffield



This section develops a simple typology to describe the policy landscape: institutions, policy frameworks and funding streams.

6.2 National innovation policy is well established, but its focus and effectiveness for cities is questionable

Institutions

Innovation policies in the UK are driven and implemented by a variety of different institutions. At the UK level, the DTI is the lead department for innovation policies. Regional Development Agencies in England take a significant role in regional strategies and delivery. In Northern Ireland, Wales and Scotland, innovation policies, strategies and initiatives are mostly devolved to their national assemblies and executive agencies.

Frameworks

Innovation is one of the Treasury's five drivers of productivity, and is seen as a key driver of long-term economic performance.¹⁰⁹ The UK Government's innovation strategies focus heavily on science and technology – it has run a number of innovation policy reviews including the Baker Report on Publicly Funded Research Establishments (1999),¹¹⁰ the Lambert Review of Business-University Collaboration (2003),¹¹¹ and the Cox Review of Creativity in Business (2005).¹¹² The Sainsbury Review of Science and Innovation is currently looking at future challenges in innovation policy.

In 2004, the UK Government set out its long term innovation strategy, The Science and Innovation Investment Framework 2004-2014.¹¹³ The investment framework is grouped into six key themes (see Box 7).

Box 7: The UK Government's science and technology framework

- research excellence
- responsiveness of publicly funded research to the needs of the economy
- increased business investment and engagement
- a strong supply of scientists, engineers and technologists
- sustainable and financially robust universities and public laboratories
- public confidence in the science base

In 2005, the Government designated six cities in England as 'Science Cities'. These cities include Birmingham, Bristol, Manchester, Newcastle, Nottingham and York. The aim of Science Cities is to develop city-based strategies to exploit centres of world-class scientific research more effectively, by developing complementary policies on knowledge transfer, business support, skills, infrastructure and communication links. This is being delivered in each city through various forms of partnerships between RDAs, local government institutions, local businesses, and the research base.

Funds

Government institutions have been active in designing and delivering early innovation and pre innovation support to individual enterprises and to higher education institutions, more than to cities. These activities include the RDA-delivered Grant for R&D – which provides grants for SMEs to undertake development projects, technical and commercial feasibility studies, and prototyping. Grant for R&D replaced the DTI's SMART, SPUR and SPUR plus schemes which were designed in the 1980s and 1990s.

¹⁰⁹ HMT (2006): op. cit.

¹¹⁰ Baker J (1999): Creating knowledge creating wealth: realising the economic potential of public sector research establishments London: HMT.

¹¹¹ Lambert R (2003): Lambert Review of Business-University Collaboration London: HMT.

¹¹² Cox G (2005): Cox Review of Creativity in Business: building on the UK's strengths London: HMT.

¹¹³ HMT (2004): Science & Innovation Investment Framework 2004-2014 London: HMT.

Other key innovation funding streams include Knowledge Transfer Partnerships, which provide financial support to collaborative business-research projects, e.g. placements; R&D tax credits, and a number of venture capital funds, including the nine RDA-administered Regional Venture Capital Funds, and European Venture Capital Funds.

6.3 The European Commission actively promotes innovation and has provided the funds and frameworks for many innovation projects in cities and regions

Institutions

The European Commission has made funding and support programmes available for a variety of initiatives targeted at a variety of scales, including locally- and city-based programmes. These programmes often have established executive teams to distribute funds, and establish and manage pan-European networks.

These include The Innovation Relay Centre (IRC) network – 68 consortia providing expert support for transnational technology transfer to SMEs in 30 European countries; and the network of Innovating Regions in Europe (IRE), formerly RIS/RITTS (Regional Innovation and Technology Transfer Strategies) projects, which supports regional administrations in developing and assessing their innovation systems and programmes. In addition, the structural funds programmes such as the European Regional Development Fund and European Social Fund have sizeable funding allocations that are expected to be spent on innovation and related activities.

Frameworks

The Lisbon Strategy stressed the need for knowledge-based growth, and placed emphasis on promoting innovation. Lisbon reflects 15 years' previous EU programmes to promote innovation at nation-state level and below. The first European programme for promoting innovation was Sprint (the Specific PRogramme for INnovation and Technology transfer). Launched in 1983, Sprint supported the development of a European environment conducive to innovation, based on co-ordination and co-operation among existing agencies. The VALUE and VALUE II programmes (1989-1994), meanwhile, focused on promoting the dissemination and exploitation of the results of Community-funded research.

These programmes were integrated under the Fourth Framework Programme. Framework Programmes encompass the broad funding regime for the EC's specific innovation initiatives, including research and enterprise based approaches. There have been successive Framework Programmes, and we are now into the Seventh Framework Programme which makes over €50 billion available for research and development and innovation in universities and businesses from 2007 to 2013.

As well as providing funds for bids for tailored programmes for regions, localities, businesses and academic institutions, within the Framework Programmes there are a number of other European-wide initiatives which have predominantly been delivered at the regional level. Examples include the Co-operative research (CRAFT) projects, which enable SMEs to undertake joint research by contracting research to an outside research supplier.

Funds

The European Commission's approach to innovation has involved funding a number of regional and city-level projects and programmes. The European Regional Development Fund has focused on developing innovation amongst firms, especially SMEs; developing innovation skills in regions; and creating a culture of innovation within SMEs. These funds are available for local and regional partners to bid for designing and implementing their own innovation programmes and initiatives. In the next section we outline examples of specific regional and city based innovation initiatives that have been funded by European Commission funds.

6.4 Many cities have their own innovation strategies, or make them part of their overarching economic strategies

Institutions

The main institutions shaping urban innovation policy in England are not cities, but RDAs, the European Commission and Whitehall. RDAs deliver many of the UK Government's innovation policies. Innovation is a component of each RDA's Regional Economic Strategy (RES), and seven of the nine RDAs have devised Regional Innovation Strategies (RIS). Local governments work within these frameworks, although many are developing their own local initiatives – working with RDAs, the Commission and local universities. However, some cities do have dedicated innovation strategies, or make innovation a substantive part of their overarching economic development strategies.

Outside of England, economic development and innovation policy and delivery are largely a devolved responsibility. There is a range of development agencies and executive responsibilities for innovation which differ markedly and have a longer track record than regional arrangements in England. Within Scotland, the Scottish Executive is largely responsible for innovation and economic development policy and priorities, with the two arm's length executive agencies of Scottish Enterprise and Highlands and Islands Enterprise being responsible for action planning and delivery. Within Wales, the Welsh Assembly Government's Department of Enterprise, Innovation and Networks takes charge of economic development and innovation policy and delivery. In Northern Ireland, The Department of Enterprise Trade and Investment leads on innovation policy and affairs.

For cities, local authorities have statutory duties relating to economic development. Throughout the UK, local authorities have a duty to promote the economic well being of their local community. These duties are enacted by legislation such as the 1989 Local Government and Housing Act and the 1994 Local Government (Scotland) Act. More recently in England, Local Area Agreements represent strategic priorities and targets for a range of local authority services and responsibilities – which include economic development and enterprise. Many city-based local authorities develop economic development strategies as part of their statutory duties, and some have developed separate innovation strategies. Local authorities also plan and spend money on economic development activities, and collaborate with other organisations. They also seek funding from sources such as European Regional Development Fund programmes for initiatives and projects. Having a well developed and high quality economic development strategy helps to make the case for external funding bids where appropriate.

Some city local authorities engage in collaborative economic development strategies and activities – such as in the case of Greater Manchester, which currently deliver enterprise support and inward investment promotion functions via a collaborative arrangement between the ten unitary authorities which make up Greater Manchester.

Frameworks

Urban innovation strategies evolved around 20 years ago, with the emergence of city-level economic development and regeneration frameworks. In their early days, city-based innovation initiatives were focused on science and technology, and often involved the creation of science parks, such the West of Scotland Science Park in Glasgow which was completed in 1983. Aiming to provide a location for the development of businesses focussing on emerging and future technologies, it involved the Scottish Development Agency, Glasgow City Council and the University of Glasgow.

Further afield, in Austin Texas, the Institute for Innovation, Creativity and Capital was established within the University of Texas in 1977, which did much work to create a vision of Austin as a high tech innovation driven city.¹¹⁴

Across the UK, a few cities have their own dedicated innovation strategies – for example, Nottingham’s Innovation Strategic Framework;¹¹⁵ the London Innovation Strategy and Action Plan;¹¹⁶ and Edinburgh’s Science Triangle.¹¹⁷

Innovation also is a significant element of current city economic development strategies – for example, in Swansea’s Economic Regeneration Strategy, ‘Swansea 2020’.¹¹⁸ Another example is in Glasgow’s Ten-Year Economic Development Strategy - A Step Change for Glasgow, with the priority of moving up the value chain by achieving higher productivity through innovation, skills and creativity.¹¹⁹ A final example is Birmingham’s economic strategy ‘Developing Birmingham An Economic Strategy for The City 2005 – 2015’ which states that innovation and creativity are fundamental to the growing knowledge economy and to allowing businesses to survive and grow in the city.¹²⁰

As mentioned, the six Science Cities – Manchester, Newcastle, York, Bristol, Nottingham and Birmingham – are developing new, more joined-up approaches to building science and innovation capacity and its economic exploitation.

Funds

English local authorities’ budget for innovation policy is limited. So the bulk of funding for local strategies has come from drawing down regional, national and European funding. Between 2002/3 and 2005/6, the RDAs spent £2 billion to assist 120,000 businesses under their funding allocation for business development and competitiveness. This includes activities relating to innovation in enterprise, and includes the support of 3,900 businesses to engage in new collaborations with the research institutions.¹²¹ The RDAs also pledged over £360 million specifically for funding for promoting science and innovation in 2005-06, including £100m for the Science Cities.¹²²

In the current round of European Structural Funding from 2007 to 2013, the UK as a whole will receive €9.4 billion, with €5.3 billion being allocated for the Competitiveness and Employment Objective (which includes funds for innovation projects). And innovation has been given higher priority and recognition in this round of funding – reflecting the focus of the 2007-2013 structural funds on achieving Lisbon Agenda aims, and explicitly recognising that innovation is one of the main vehicles for building competitiveness.

Whilst managed on a regional basis, these funds are available for local projects – including city-based ones, and have been used extensively (see Box 8).

Box 8: Examples of EU-funded urban innovation programmes across the UK

Glasgow’s Targeting Innovation Ltd offers dedicated enterprise support and advisory service for innovative enterprises. It receives Objective 2 funding from the European Regional Development Fund. It was established in 2003, from the amalgamation of two other previously Objective 2 funded initiatives – Targeting Technology Ltd, and Services to

¹¹⁴ Botham R (1999) Developing an IT Cluster: What Can Scotland Learn From Austin, Texas? Scottish Affairs, no. 29, pp 58-72.

¹¹⁵ <http://www.nde.org.uk/press.asp?page=123&cat=58>

¹¹⁶ <http://www.lida.gov.uk/server/show/nav.001005006005>

¹¹⁷ <http://www.scottish-enterprise.com/edinburghsciencetriangle>

¹¹⁸ <http://www.swansea.gov.uk/index.cfm?articleid=6328>

¹¹⁹ <http://www.glasgoweconomicfacts.com/default-2.asp.htm>

¹²⁰ <http://www.birminghameconomy.org.uk/strategy.htm>

¹²¹ All Figures Sourced from DTI Annual Reports on RDAs, <http://www.dti.gov.uk>

¹²² *RDA Round Up*, Issue No. 4, July 2005.

Software – which were both established in 1993 to provide support to technology based enterprises.

Sheffield’s Melt initiative is a three year, digital content development programme which was launched in 2005. Melt gives annual research and development (R&D) awards of up to £50,000 to leading artistic, media and technical talent to explore the creative and economic possibilities of innovative content for new and emerging media platforms. It is part-funded by the South Yorkshire Objective 1 European Regional Development Fund Programme.

Nottingham Development Enterprise is an enterprise support programme that runs several programmes that are part-funded by the European Regional Development Fund – including its OnCourse Innovation Leadership Programme.

London has operated several European-funded innovation initiatives, the biggest being the Jumpstart programme (2004-2006), which provided contributions to project costs for collaborative projects between SMEs, HEIs and RTOs; grants to help minority businesses improve access and uptake of innovation; and funding to strengthen and enhance new and existing networks to promote London as a centre for innovation and strengthen engagement of businesses in innovation.

6.5 How well does innovation policy support urban innovation systems?

We now map innovation policies against the reality of innovation in cities, focusing on the key components of the urban innovation system: assets, institutions, firms, networks and markets. Table 12 summarises our findings.

Table 12: Mapping urban innovation systems against urban innovation policy

Component	Policy coverage
Assets	Partial <i>Focus on built environment – site assembly, premises and facilities Direct provision of scientific research, and some skills-based initiatives Other ‘urban basics’ are not seen as innovation-relevant Quality of life policies are poorly understood, developed</i>
Institutions	Widespread <i>Many local government-led initiatives Some university-led initiatives, generally network-based Questions about effectiveness</i>
Firms	Partial <i>Business support focuses on STEM sector, other sectors largely ignored Entrepreneurship policies are generic, not focused on innovative firms</i>
Networks	Widespread <i>Extensive use by all levels of government Questions about effectiveness, appropriate scale</i>
Markets	Minimal <i>A few recent initiatives Almost no policies explore the role of public procurement</i>

	<i>Overall, under-developed</i>
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Urban assets

Urban assets are partly covered by innovation policies. There is a long history of site and infrastructure based initiatives and activities, with Trinity College at Cambridge University establishing the UK's first Science Park in 1970. Local and regional organisations and government institutions have been instrumental in funding and developing science, innovation and/or technology parks. In many cases, these developments contain small workspace units with on-site advisory services – known as 'incubators'. They also often include shared research facilities and shared services, and are sometimes located on site with, or in close proximity to a higher education institution such as Aston Science Park in Birmingham.

There are also some skills-based initiatives which aim both to develop skills required by enterprise for innovation, and to expose businesses to new skills needed for R&D and innovation. These include the placement of students into small enterprises to undertake R&D projects, on schemes such as the Business Bridge scheme in the North West of England. There are also many initiatives to ensure that local skills are developed and retained for innovation. The South East England Development Agency established a STEM (science, technology, engineering and mathematics) resource centre in partnership with the University of Southampton to improve science education, outreach and coordination.

What about the rest of the 'urban basics'? These are not widely seen as part of the urban innovation system, and are dealt with as other elements of economic development. City assets such as quality of life, transport and cultural diversity seem to be important for innovation, but their specific role in innovation policy is little explored and developed. In the provision of skills, the public sector is a major player, but there is limited autonomy across the UK for skills planning at the city or city-region level. Higher level skills provision tends to be coordinated at the national levels through the Higher Education Funding Councils for England, Northern Ireland, Wales and Scotland. At the UK level, the Sector Skills Development agency and Sector Skills Councils plan for skills needs in sectors and industries. There is some provision of locally based training initiatives for innovators – such as business and management skills for those with academic or research backgrounds. But beyond technical scientific and engineering skills, there seems to be little formal policy development.

Urban institutions

A number of urban institutions are active in innovation policy, and EU strategies seek to engage local actors. But given the complexity of urban innovation systems (see section 5), it is unclear how effective these strategies are on the ground.

Local authority led initiatives are widespread, particularly in large cities (see above). Higher education based initiatives also figure strongly at the local level. These initiatives largely deliver services and initiatives to commercialise research, to encourage business-university links, spin out research ideas into commercial enterprise, and placement of students to undertake research projects for companies. Some initiatives have been started independently by the institutions themselves, such as the Cambridge-MIT Institute. Other initiatives in England have been funded by UK Government programmes – such as the Higher Education Innovation Fund for programmes and activities that relate to encouraging collaboration between companies and higher education institutions.

Examples of HEIF projects include Knowledge East – an initiative set up by East London's eight higher education institutions; and i10 – a collaborative project between the Higher Education Institutions in the East of England. HEIF projects have been developed at many geographical scales in England – at regional, subregional and city-based levels.

Urban firms

Science and technology firms – particularly start-ups – are well-covered by urban innovation policy frameworks. Innovative firms in other sectors, whether at the early mature stage, generally are less well supported.

Enterprise-based initiatives have been an important strand in local and regional innovation initiatives – largely focusing on business advice and the provision of finance where there are gaps in the market. Examples of dedicated advice and support for innovation and technology-based enterprises include Glasgow's Targeting Innovation Ltd, and the East of England's Gateway2Innovate programme – which both offer dedicated enterprise support and advisory service for innovative enterprises. Finance programmes have included loans (such as the University of Strathclyde's Innovation Fund), VC funds (such as the Advantage Growth Fund in the West Midlands), angel networks (such as LINC Scotland), financial planning advice, and advice and support on raising finance (such as London's Finance Readiness Programme). England's Regional Development Agencies also deliver innovation advice and services to enterprises – such as SEEDA's Innovation Advisory Service, and Yorkshire Forward's Centres of Industrial Collaboration.

Support tends to be for existing enterprises, or for early stage enterprises that are engaged in research and development work. Whilst enterprise initiatives and activities are well developed generally in England or the rest of the UK, and are both developed and implemented at the regional and local levels, entrepreneurship is not often associated with innovation. This is an important gap for cities – as new enterprises often bring new products, processes and ways of doing things to the market; and companies that spin out from larger ones are usually driven by people with entrepreneurial potential linked to an idea or an innovation.

Urban networks

As we have seen, networks are a key focus of urban innovation policies, at all levels. Network development and forging linkages between businesses, and between businesses and Higher Education Institutions has been a key strand in local and regional innovation policies and activities. Private and professional associations are also significant in this regard – including formal organisations such as the CBI and Institute of Directors, and also other professional associations, city based networks, societies and alumni. Entrepreneurial networks such as the First Tuesday groups, based in cities, have also emerged in recent years, which are privately run and encourage investors, innovators and service providers to network and collaborate in technology-based business ventures.

The Department for Trade and Industry, and the European Commission have promoted and funded several networking initiatives over the past 20 years through programmes such as the series of Framework programmes and EUREKA; and specific initiatives such as Innovation Relay Centres. Current examples of local and regional initiatives include Knowledge Networks in the South East of England, 'Innovation Promotes' in Yorkshire; and 'Business Champions' in the East Midlands. A more recent regional initiative has been the tasking of England's RDAs with establishing Science and Industry Councils to promote collaboration between Higher Education and Research Institutes and industry interests.

Again, given the organic nature of innovation systems in and around cities, it is not clear how effective all network-building initiatives are in practice.

Urban markets

A more recent range of initiatives have attempted to establish market intermediaries that help research institutes and innovating enterprises reach a wider market, and also help enterprises reach research institutes and other sources of innovation for commercial use and exploitation. These types of initiatives are at their early stage of development in England. In Scotland, Intermediary Technology Institutes have been developed to act as centres or 'hubs' for identifying, commissioning and supporting the diffusion of market focused pre-

competitive technology. However, such initiatives are at the early stages, and have not yet been evaluated to prove their worth.

Demand side initiatives such as using public sector procurement opportunities to enable innovation are relatively undeveloped in England. The SBRI initiative was established by the Small Business Service to help SMEs gain greater access to publicly funded Research and Development (R&D) contracts. It does this by providing an alert service about government procurement opportunities and providing links to the procuring organisations web sites. Such approaches are based on the US Small Business Innovation Research (SBIR) programme which provides over 4000 research and development contracts and awards, worth over \$2 billion every year to small US companies, including start-ups and university spin-outs.

Overall, market-based initiatives have been under-developed, especially those that aim to stimulate the demand for innovation, or to develop market transactions and diffusion of innovation. This is an important missing dimension to innovation policy at all levels – as one of the key elements of the definition of ‘innovation’ is the successful commercial application of an idea, process, product or new way to organise business.

6.6 Towards a broader, more devolved approach to innovation in cities

From the analysis hitherto it is possible to say that urban innovation is influenced primarily by top-down policy making processes but that increasingly they are being influenced by bottom-up initiatives too. In addition to the question of who makes policy – there are important questions concerning the content of policies themselves. In this regard, our analysis raises four key points for urban innovation policies:

- First, the overall approach to innovation appears to be narrow, and largely focused on science and technology (although a small number of other sector-based strategies have been undertaken). However, the UK economy and cities, in particular, are dominated by services.
- Second, there is a heavy emphasis on the supply side of innovation policy – in particular, on institutions that supply science and technology knowledge. Little consideration is given to the role of markets and entrepreneurship in cities, and related policy responses such as creating demand-niches through public procurement. For example, cities have special demands for innovation to manage housing, health, noise, transport, and crime.
- Third, policy is largely driven from the national UK and devolved parliaments and executives, with some further designation of strategic and delivery responsibilities to Regional Development Agencies. Currently cities have little autonomy in terms of deciding on the content and priorities of policy relating to such tasks as infrastructure, education, economic development and innovation. Examples from around the world such as Barcelona, Tampere, Toronto, and various German cities demonstrate that big cities may benefit from increased autonomy to raise and spend money and create their own strategies and action plans. Increased local autonomy, however, will require developing strong local leadership and executive capacities in potentially wholly new areas of responsibility and expertise for UK cities.
- Finally, it is not always clear how integrated national and central Government policies and priorities are with those of cities and city-regions. In particular, there is a question of how much the various agendas are functionally coherent. The existence of a multi-layered governance structure where the majority of power is held by central government raises some serious questions about whether a single national policy is effective for all local conditions, priorities and agendas. It also leads to the problem of artificially realigning local agendas to those of the central fundholders.

Knowledge gaps

- How city governments can best stimulate urban innovation
- The potential role beyond science and technology based innovation policy
- The potential of government policies and actions to influence the creation of 'local links' and networks which enable innovation
- Whether local government autonomy can stimulate or enable innovation
- The effectiveness of local vs. central innovation policies and programmes

7. RESEARCH QUESTIONS

7.1 Cities enable innovation, innovation helps cities to grow

The UK is largely and increasingly an urban country, with cities as the building blocks of the economy. Many cities have stabilised or prospered in the past ten years, but some cities have not, and even with successful cities, problems remain such as significant pockets of deprivation. Innovation activity also varies between UK cities, and is quite low in some.

The available evidence suggests that cities shape innovation outcomes, and that cities can positively support innovation – for example, through local knowledge spillovers, urban infrastructure and access to markets. Cities are also the focus for most of the nation's skills, knowledge, research institutions, enterprises, migrants and markets – all which nurture, support and drive innovation.

Innovation is one of the main drivers of long term economic growth. So it is not surprising that national policymakers are starting to turn their attention to how urban places can support innovation. City leaders are also increasingly interested in the potential for innovation-led urban growth.

7.2 Is there a typical urban innovation system?

Based on traditional indicators, most innovation tends to occur in and around cities – so to make good innovation policies and initiatives, we need to have a clear understanding of the system and processes of innovation taking place at city level. We also need to know what kinds of policy levers are most relevant for urban economies.

Whilst there is a lot of high quality research on spatial aspects of innovation and on the nature and dynamics of the urban economy, there have been few attempts to bring everything together. There are very few studies of UK or English regions or localities, that attempt to map innovation systems – unlike the extensive studies of other countries' regions and urban areas.

How well does this reflect the reality of urban innovation? We need to map a number of urban innovation systems across the UK, to better understand the relative roles and strengths of the system components.

Generating a generic map of innovation systems at the urban-city level will help in identifying and recognising variations in local conditions and contexts and the development of appropriate policy based upon these conditions.

7.3 Innovation policy for cities: what works?

This paper has revealed a number of knowledge gaps related to innovation in cities that we will seek to explore in more detail in the next stage of this project. In particular the next phase of the project will aim at answering a number of questions derived from these knowledge gaps. These questions are of two types: Questions relating to understanding innovation dynamics in cities; and questions relating to understanding innovation policy in cities. The first set of questions are:

- How do urban-specific factors – such as proximity, density, and variety – enhance innovation performance in cities?
- How do different types of businesses rely on 'urban offerings'?

- How do the different components of urban institutional settings (e.g. HEI, city governments, and local business networks) influence innovation?
- How do 'urban basics' – such as skills, markets, infrastructure, and public services – support innovative activity?

The second set of questions seek to address our knowledge gaps in the area of innovation policy at the city level. The paper has pointed out that innovation policy in the UK tends to be dominated by UK Government, Devolved Administrations and Regional Development Agencies, and thus a number of questions were raised in this context:

- To what degree do current policy priorities at various levels of government enhance the factors that support innovation in cities? And what could be improved?
- What is holding cities back from delivering more effective solutions to their innovation challenges and opportunities?
- Does further integration or disintegration between various levels of governance foster innovation in cities?