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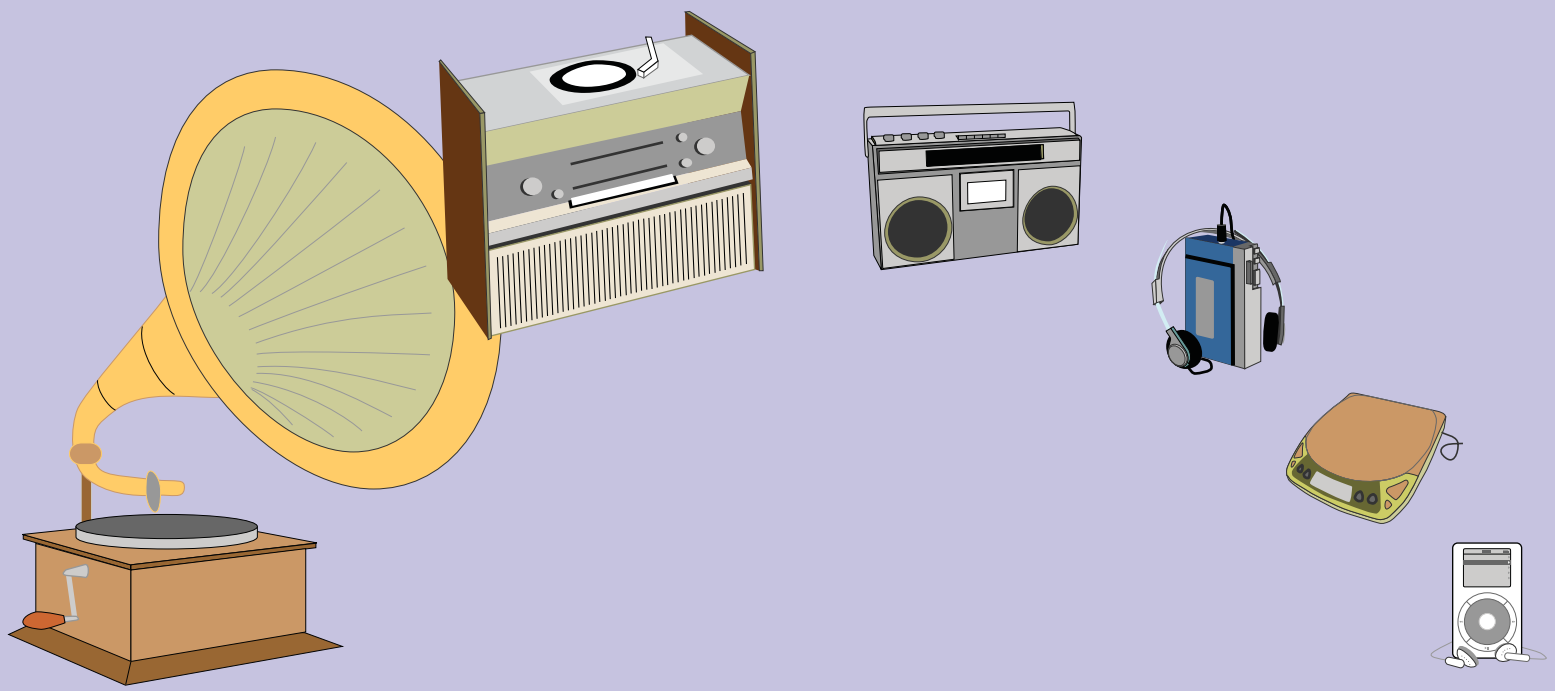
Supporting London's innovators

By **Nick Ennis** and **Slawek Kozdras**



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Contents

Executive Summary

Innovation boosts efficiency and productivity and contributes to economic growth. Innovation is a tricky word to pin down, meaning many things to many people. For the purpose of this paper, innovation is defined relatively broadly as the exploitation of new ideas, but to give the word more meaning, we focus primarily on radical innovations that transform the user experience, as Apple's iTunes and iPod revolutionised the way people consume music.

Research shows that innovations, especially service innovations, are often invisible, highly customised and contextual, relying heavily on organisational change, training and other intangibles. All of this makes them difficult to analyse and reproduce and near to impossible to measure. Economic literature dating back more than five decades has focused on the role of competition in producing innovations. But in policy circles, innovation has long been synonymous with scientific research and development, perhaps because it is identifiable and measureable, unlike innovations.

One of the key findings of the last decade's research into innovation is recognition of the wider innovative ecosystem that nurtures and facilitates innovation. The social and economic context in which firms operate can encourage or hinder innovation. Lessons from history make it clear that innovators respond to wider conditions and incentives to be entrepreneurial. The wider conditions approach calls for policy to get the conditions right for innovators to thrive rather than ones that try to pump-prime innovation through investment in research and development.

London's key strengths are its business environment and its ability to connect people and spread ideas and knowledge. London provides a stable, robust and extremely competitive business environment where entrepreneurs face fewer barriers than in other UK regions. But London struggles to a degree with a risk-averse culture, physical infrastructure deficiencies, particularly with respect to ICT provision and the availability of small, cheap office space, and a skills gap between its school-leavers and the needs of employers.

Research has demonstrated that innovation is too random a process to imagine government might promote it directly, so a shift in focus to the wider conditions is a good one. Innovation relies heavily on individual raw talent and motives and cities naturally provide better conditions for innovators, having open networks, free flowing of ideas, and access to labour, financing, markets, and specialised suppliers. It is no coincidence that these are also the benefits of agglomeration (the density of population and economic activity) that are the reason behind London's outsize contribution to the national economy.

The wider conditions go to the very core of basic government institutions: freedom, property rights, and infrastructure, which means government should be able to make improvements. And they also touch on a number of policy areas: planning, education, tax, transport, regulation, etc. There is not, as has been imagined, a specific "innovation" policy. Instead, the effect of each and every policy on the ability of people to innovate should be considered.

Introduction

Innovation boosts efficiency and productivity and contributes to economic growth. The urbanist Jane Jacobs was one of the first to argue that without innovation, cities stagnate and decline.[1] Cities are reliant on trade – whether domestic or international – and sell their products and services elsewhere. Innovative products give them an edge, but over time producers in other cities learn how to make these things themselves or might find substitutes. Take, for example, the sale of salt from Venice (which lost out to new sources elsewhere) and London's early dominance of the wool trade (which was replaced by new materials, like cotton). This means that cities (and the people who live in them) must always innovate (or copy) if they are to maintain their position.

Defining innovation is difficult, as this paper will show, and measuring it even more so. But how policymakers can encourage innovation is the more important question. Efforts have previously concentrated on stimulating research, building links between research outfits and businesses, and encouraging business start up. But this has not been found to accomplish much, at least on the measures used to judge performance, and this is because, one could argue, innovation, particularly in the service sector, has been long misunderstood.

This paper updates our understanding of how innovations emerge and recognises the contribution of the wider environment to innovators' success (or failure). It assesses London's performance in providing the right environment for innovators and identifies areas in which London needs to make improvements in order to provide innovators a more supportive environment.

Defining and measuring innovation

Innovation is a tricky word to pin down, meaning many things to many people. For the purpose of this paper, innovation is defined relatively broadly as the exploitation of new ideas, but to give the word more meaning, we focus primarily on radical innovations that transform the user experience, rather than the much more prolific smaller innovations that aim simply to improve an existing product. To differentiate between the two, consider the consumption of music before and after the iPod.

Apple's iTunes and iPod quickly revolutionised the way people consume music when they were released in 2001. Before iTunes, people bought music on CDs from shops, usually as a whole album. Record labels orchestrated a slow roll out of songs through radio and entertainment venues to build up demand for a later album release. iTunes knocked this strategy off its feet by allowing consumers to buy individual songs and to easily browse hundreds of thousands of songs in its library. The iPod, released a few months later and five years after the first commercial MP3 player, complemented this new distribution system with a stylish, user-friendly music player. Together, the two allowed consumers to seamlessly buy the digital media they wanted and listen to their music collection on-the-go in whatever order they want, something the old CD-based system didn't allow.

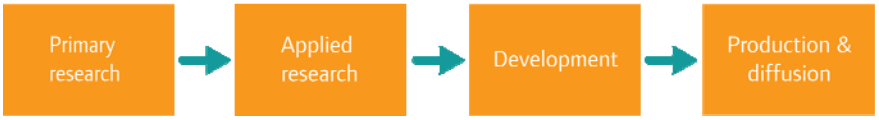
[1] Jacobs, Jane. *The Economy of Cities*. 1970

Apple's iTunes and iPod is an example of what has been coined "creative destruction," the process through which new replaces old, which is seen as an important contributor to urban growth. The economist Joseph Schumpeter popularised this term in the 1940s and it has regained prominence in recent years as policymakers look to innovation to stimulate their economies. Schumpeter believed that innovative entrepreneurs drove long-term economic growth while at the same time destroying the collective value of established interests from the previous paradigm. Innovation allows people to behave in a new way, to reform working practices, and to demand new things, which can all be summed up as change.

Research shows that innovations, especially service innovations, are often invisible, highly customised and contextual, relying heavily on organisational change, training and other intangibles. All of this makes them difficult to analyse and reproduce and near to impossible to measure. Economic literature dating back more than five decades has focused on the role of competition in producing innovations.[2] But in policy circles, innovation has long been synonymous with scientific research and development, perhaps because it is identifiable and measureable, unlike innovations.

Innovation has been measured through scientific research and development and all things associated with it: patents, journal articles, spending, and the number of highly-educated scientists. This is in line with a linear model that assumes innovations emerge mainly through formal research and development. In response, policy currently aims to facilitate this sort of activity, through tax credits on R&D spending and by promoting links between research universities and businesses to try to bridge the gap between ideas and innovations. The Government also does much to support people starting new businesses. But while these indicators are definable and measurable, they are not innovations, nor necessarily the source of innovations.

Figure 1. The linear system of innovation



This rather simple idea misses a whole range of innovations that emerged from outside the lab and affected policymaking in a rather bad way by making it too narrowly focussed. The linear model ignores many innovations in services, as well as process-driven changes in manufacturing. We need look only in the recent past to find examples: Ford's assembly line revolutionized manufacturing at the start of the twentieth century by changing business methods. In financial services, equity financing and stock markets solidified their role in corporate enterprise while consumer debt and mortgages became widespread in the second half of the twentieth century. Only a few decades later, consumer products, including food, began to be packaged and marketed as specific products rather than sold wholesale as a generic product. This went alongside the rise of self-service supermarkets and department

[2] See, for example: Schumpeter, Joseph. Capitalism, Socialism and Democracy, 1942; Demsetz, Harold. "*Toward a Theory of Property Rights*," American Economic Review, No. 57, 1967, pp 347. ¡Nelson, Richard. "The Economics of Invention: A Survey of the Literature," *The Journal of Business*, V. 32, No. 2, April 1959, pp. 101-127.

stores, which changed the face of retailing from the 1930s, not to mention the development of diversified goods. There are countless other examples of innovations that did not originate in scientific laboratories or follow the linear model of innovation.

The linear model also contrasts with the innovation process that can be seen in past centuries, where many firms and individuals are seen to contribute (in competition and sometimes in cooperation) to technological progress through trial and error, arguably the real source of innovation. This can be illustrated by examining Detroit in the late 19th century, where dozens of firms worked to advance technology, improve business methods and introduce new products and processes into the economy, all of which resulted in the modern automobile. In moving from ship building (Detroit's first large-scale industry) to motor cars, firms in Detroit combined advances in technology, working practices, and sales and distribution strategy, all important aspects of innovation that don't take place in a science laboratory.

The first automobile was not made in Detroit, nor was Detroit the only city where early versions of it were produced. In fact, there were a number of cities that competed head-to-head with Detroit in the early years of this technology, but it was Detroit that became the centre of the world's car industry by the middle of the 20th century (though in the long-term Detroit's automakers did not keep up with more innovative competitors in Asia and have recently struggled to survive). If the linear system of innovation is correct, there is no reason why Detroit was more successful than these other cities at commercialising the automobile. But it was, and that it was demonstrates that something else was at work in Detroit during that period, which is an important point to consider in devising policy.

New approaches to innovation

Economists and social researchers have been questioning what causes innovation for many decades. Researchers struggled for some time with the concept of innovation because they viewed it through the scientific paradigm that was adopted by governments and so struggled to make sense of innovations that occurred outside scientific environments, particularly in the service sector. Innovations in finance, in customer service, and even in air transport were often characterised as merely adaptations of new products instead.

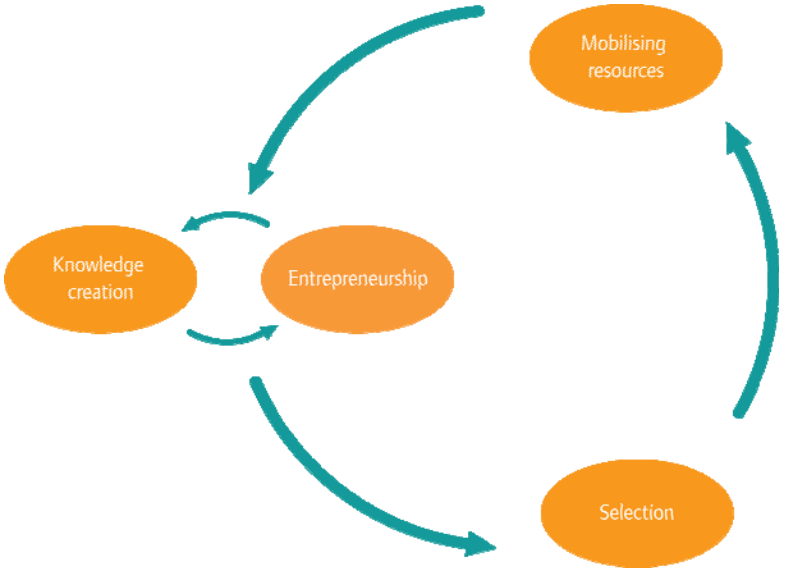
A critical change in thinking came in the 1990s, when the large corporate R&D departments that were at the forefront of progress in the 50s and 60s faded to the background while new businesses and ideas were sprouting up on all sides. New research brought the commercialisation of innovations into the fold, which connected with economic literature's long-standing focus on competition between firms and resulted in a new paradigm: a functional system approach (which arguably existed all along anyway). This model, shown in Figure 2, views the innovation process not as a single path driven by research, but as a dynamic system that transforms knowledge and ideas into new products and services.

The functional system reflects lessons from history and recognises that successfully introducing new ideas to market is as important as generating the ideas themselves and notes that there isn't really a start and end point for innovations. Innovations can start anywhere, for example by finding a new use or for existing products or copying working

methods seen elsewhere. But equally, an innovation can fail at any point. Behind the shift to a functional approach is an acknowledgement that innovation is not a simple formula, but rather more like a complex differential equation where each stage is supported by a wider contextual environment. It represents a rethink about what the drivers of innovation are and who makes innovation happen, putting people (innovators) in the driver's seat.

Figure 2: The functional system approach to innovation

Source: Adapted from NESTA



The functional system requires a rethink of how we measure innovation and how policy deals with it. Previously, innovation was measured largely by inputs (patents, spending on research, etc) that fit in with a research-driven model that we know is not representative of how innovations emerge. These are now no longer seen as good measures of innovation. Work by GLA Economics has previously noted the bias towards input measures in government policy and argued that using these measures misjudged the level of innovative activity at London's businesses.[3]

Recent research, led in the UK by NESTA,[4] has instead suggested a wholly different measure: spending on intangible assets (non-monetary assets that cannot be touched or physically measured, including intellectual property and human capital).[5] A measure of investment in intangible assets attempts to record investment in innovation, and is wide enough in scope to include investment in the newly recognised acts of innovation like organisational change. NESTA is still measuring inputs (not outputs), though at least broadly defined as 'knowledge' rather than narrowly focussed scientific research inputs.

On NESTA's investment measure, the UK performs very well against its world peers, investing 14 per cent of market GVA in 2008 compared to a rather poor performance using business investment in R&D, an old measure of innovation. Using growth accounting methods that

[3] GLA Economics, *Innovation in London*, 2007
[4] NESTA, the National Endowment for Science, Technology and the Arts, is an endowment-funded body set up to make the UK more innovative.
[5] NESTA includes as intangibles: Organisational change, Training and skills, Market research and branding, Traditional R&D, Design, and Software development

attempt to separate out the contribution of specific inputs (usually capital and labour) to economic growth, NESTA found that innovation accounted for two-thirds of productivity growth in the UK between 2000 and 2008, around half of which is direct investment with the other half an increase in total factor productivity. UK firms invest most in training and skills development followed by organisational change, together accounting for nearly 40 per cent of investment in intangible assets. The sectors that invest most heavily in intangible assets in the UK are manufacturing, business services and financial services.

It is not possible to devise a robust regional measure of intangible investment because there is insufficient data to track the purchase of goods and services at a sub-national level, and so we do not know how much firms in London invest in this asset class. Two sectors in London are found to be amongst the largest investors in intangible assets, though: business and financial services. The Community Innovation Survey shows that a similar proportion of firms in London introduce new goods and services each year than firms elsewhere in the UK. Firms in London are much more likely to introduce process innovations (changes in working methods or organisational structure, for example) than firms elsewhere in the UK and to design these changes internally. But firms in London report earning a lower proportion of annual turnover from new or significantly new products.

Figure 3: Proportion of firms reporting introducing innovative products

Source: Community Innovation Survey, 2009

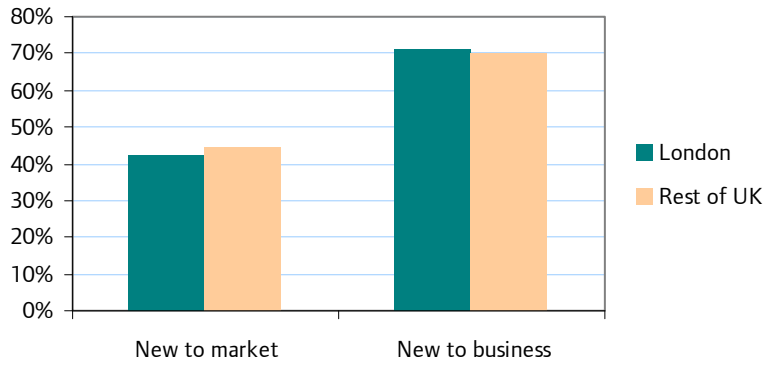


Figure 4: Proportion of innovating firms cooperating with others to develop product innovations

Source: Community Innovation Survey, 2009

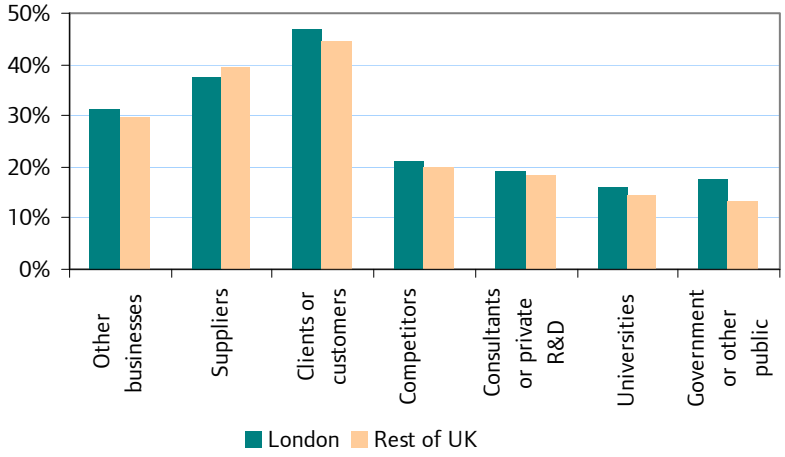


Figure 5: Proportion of firms reporting introducing process innovations

Source: Community Innovation Survey, 2009

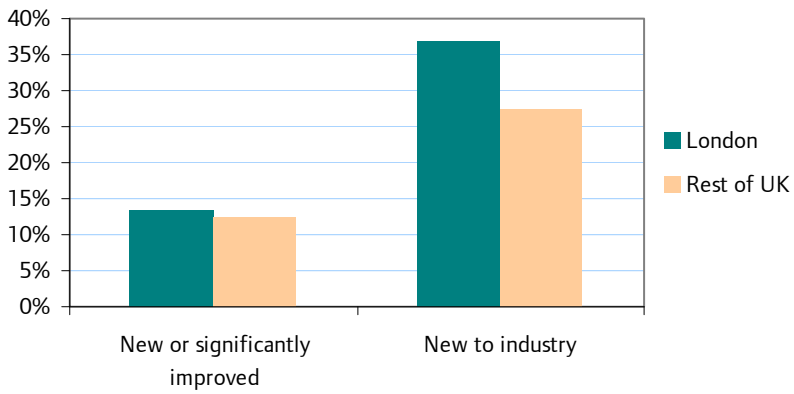
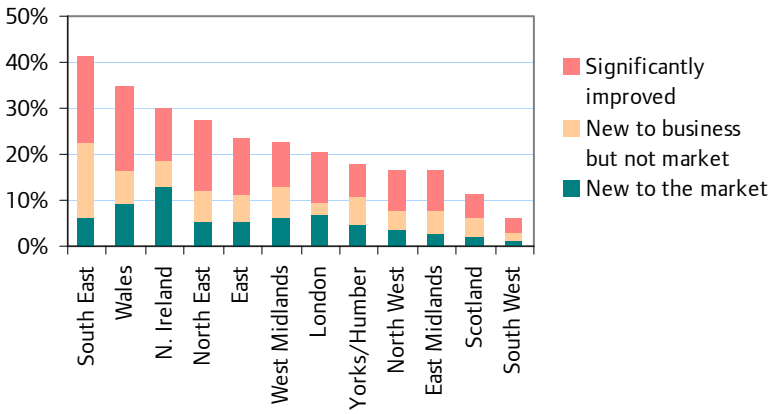


Figure 6: Proportion of turnover received from innovative products

Source: Community Innovation Survey, 2009



Focus on context – creating the environment innovators need

One of the key findings of the last decades' research into innovation, at least with respect to policymaking, is not this new measure of investment in intangible assets or the use of surveys to understand what firms do, but rather a shift in focus to the wider innovative ecosystem that nurtures and facilitates innovation. These wider framework conditions affect the ability of firms to innovate and are largely under the influence of government.

The social and economic context in which firms operate can encourage or hinder innovation.[6] Lessons from history make it clear that innovators respond to wider conditions and incentives to be entrepreneurial. The wider conditions approach calls for policy to get the conditions right for innovators to thrive rather than policy that tries to pump-prime innovation through investment in research and development.

NESTA has led research on innovation in the UK, but similar research has been conducted in other countries, and by the OECD, a think-tank. This research has focussed on fleshing out the contextual factors that allow innovation to happen. These wider framework conditions support the different stages of the functional model and can be broadly grouped into the following categories:

[6] NESTA, The wider conditions for innovation in the UK: How the UK compares to leading innovation nations, November 2009

Research & knowledge exchange
New and shared ideas are the fundamental buildings blocks of innovation. For many decades, research was seen as the primary driver of innovation, but equally important to the innovation process is the exchange of information. Not all innovation comes from new ideas; some are born from the combination of existing ideas and the spread of tacit knowledge helps this happen.

Demand
Consumers must also play their part by demanding innovation. Businesses are more likely to introduce innovative products or services when they can be confident consumers will take up their new offer; firms cannot force innovation upon people.

Business environment & competition
Commercialisation is a necessary step for an innovation to become real. The local business environment plays an important role in encouraging (or discouraging) business activity. Competition drives improvement and experimentation with new ideas, which affects whether innovation is possible.

Entrepreneurship
Entrepreneurship plays a key role in introducing new innovations to society. While the term is generally associated with starting a business, what is meant here is whether people have the ability to identify and take advantage of opportunity, and whether there is an environment where people are able to make use of these skills and to take risks.

Finance & infrastructure
Innovators can't get off the ground if they can't find money or don't have access to the right infrastructure, including affordable office space and ICT services like high-speed Ethernet connections.

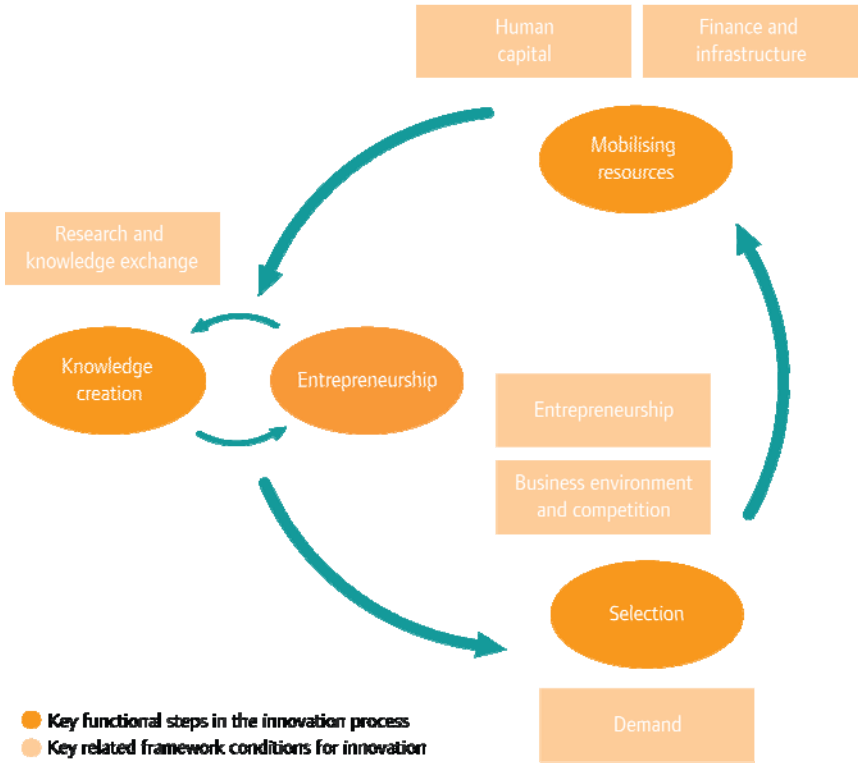
Human capital
People are the drivers of innovation and so need to have the right skills to become innovators (or to be useful to innovators). While much debate on human capital and education focuses on a university education, it is important to realise that human capital is accumulated through training and practical skills as well.

Tracking innovations from start to finish

The wider framework conditions identified above correspond to the different stages of the functional innovation system, as shown in Figure 7, and are a useful way to think about whether a city fosters an innovative environment. Entrepreneurs have been seen as the leaders of innovation since even before Schumpeter's time and thinking of innovators as entrepreneurs helps understand how innovators work to navigate through the functional system shown above. But we must keep in mind that while most innovators are entrepreneurs, in the sense that they identify opportunity and mobilise resources quickly to take advantage of it, not all entrepreneurs are innovators.

Figure 7: The functional system approach to innovation with wider framework conditions noted

Source: Adapted from NESTA



The innovative process is fraught with risk and more often than not ends in failure. Innovations arise from ideas, knowledge, and observation – the Knowledge Exchange and Entrepreneurship stages – and they are put into action by individuals who are normally motivated by the desire to strike it rich or, occasionally, to change the world (profit seeking, in economists' jargon). Very often small firms are at the forefront of innovation, particularly in this stage of the innovation process, because they can be dynamic and nimble, having limited internal bureaucracy and few vested interests that affect decision-making. They can also be enthusiastic, though inexperienced, and are flexible enough to chase opportunities, often at lower expected returns.

In the Selection stage, an innovation must go through many iterations of design, as ideas are formulated and products tested. Flexibility and spontaneity is still required to keep the process going; an innovator must change course quickly if necessary. Here the wider environment comes into play significantly, providing demand for these new products and entrepreneurs willing to take risk on still-unproven ideas. If the business environment is not conducive to growth, the innovation is likely to fail (or be bought up by a firm located in a more favourable environment) in this stage.

If an idea is seen to be feasible in terms of product development, it will be market tested and commercialized – the Mobilising Resources stage. In this stage, market knowledge becomes much more important, as does access to human capital, financing and other infrastructure. The competencies of successful large firms begin to deliver greater benefits in this stage because many will have gained important knowledge and significant resources through successful trading over time in wide geographical and product markets. This information can reduce risk in their decision-making process and is pivotal in making an innovation a full commercial success.

Most innovations are not developed by only one firm, and small, innovative firms will not necessarily grow into large firms. Instead the two firm types are complementary and both play a part in introducing ideas and inventions to the wider economy, with firms of varying sizes playing to their strengths.[7] Small firms' strengths are flexibility and closeness to customers. This allows some to be strong in innovation aimed at applying basic technologies to new uses, developing inventions, and in implementing and introducing innovation in small, niche markets. Large firms' advantage is in scale and so they can be relatively strong in more fundamental research and at efficient production and distribution.

Does London provide innovators the right environment

London's performance in providing the right environment for innovators to succeed is explored in detail below. We have adapted these measures from research by NESTA and the OECD and have identified as many relevant sub-national indicators as possible.[8] We identify missing indicators when necessary. Each theme is measured by a number of indicators, but to reduce the importance of any single indicator, London's performance is judged only across the full theme.

Research and knowledge exchange

New and shared ideas are the fundamental buildings blocks of innovation. For many decades, research has been seen as the primary driver of innovation, and so a number of indicators have already been identified to record the amount of research being conducted. Here we use measures of research outputs – patents and trademarks – to determine how well London does at producing new ideas. Of course plenty of research isn't formal research, including research into product markets and competitors, but this is an important aspect of innovation for which we do not have a measure.

On the measures available, the picture is mixed for London. Spending by businesses on formal research and development is low in London, at only 0.3 per cent of regional GVA. London is home to around 25 per cent of UK patent applicants, though only 10 per cent of inventors (the inventor is not always the entity that applies for the patent). Twenty-seven per cent of trademarks are filed by London-based entities, but the North East files more trademarks per employee.

[7] See the discussion in Nooteboom, Bart. "Innovation and diffusion in small firms: theory and evidence," *Small Business Economics*, v. 6, 1994, pp 327-347.

[8] Indicators are adapted from NESTA, *Measuring wider framework conditions for successful innovation: A system's review of UK and international innovation data*, 2011 and *OECD Measuring innovation: A new perspective*, 2010

Figure 8: Business enterprise spending on research and development as a proportion of regional GVA, 2009

Source: Office for National Statistics

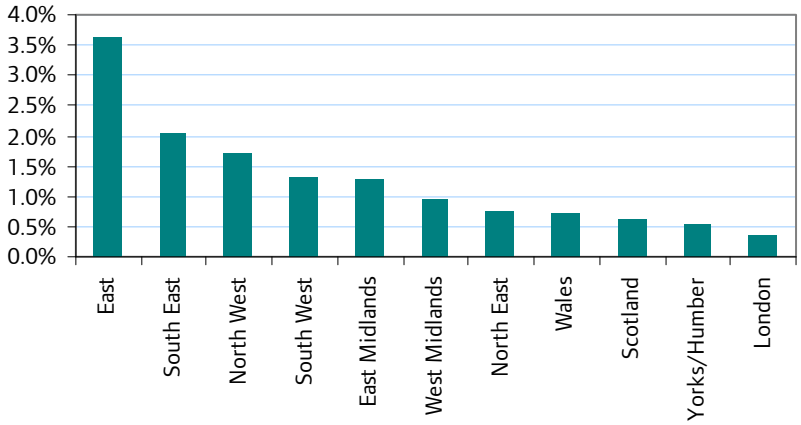


Figure 9: Patents filed at the European Patent Office per capita

Source: OECD REGPat database

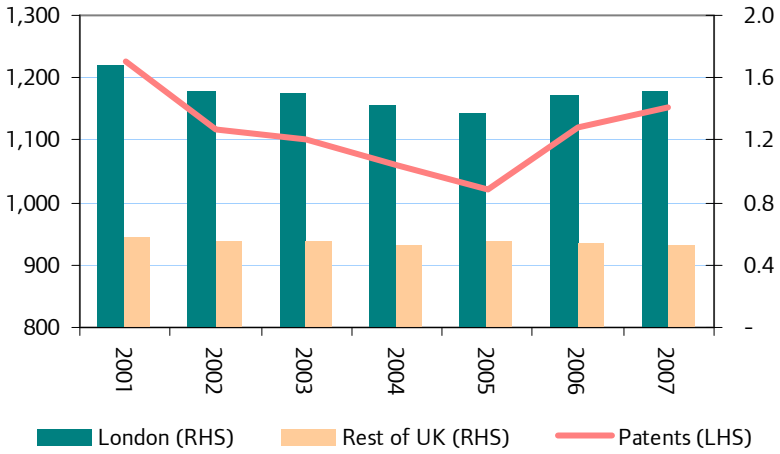


Figure 10: Number of patents filed at the European Patent Office by inventor and applicant location

Source: OECD REGPat database

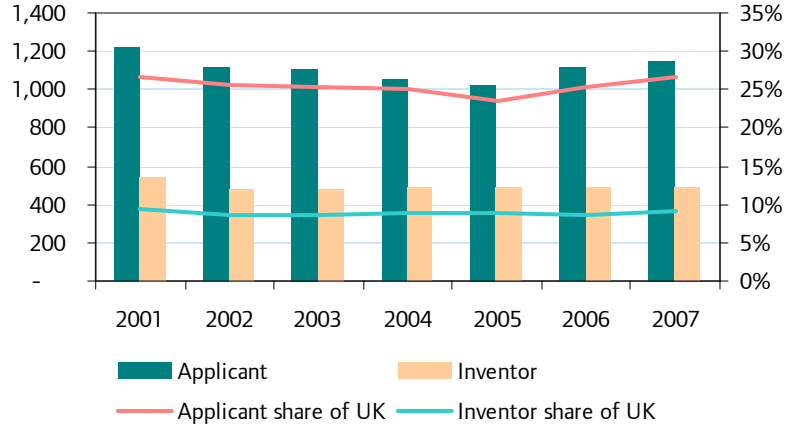
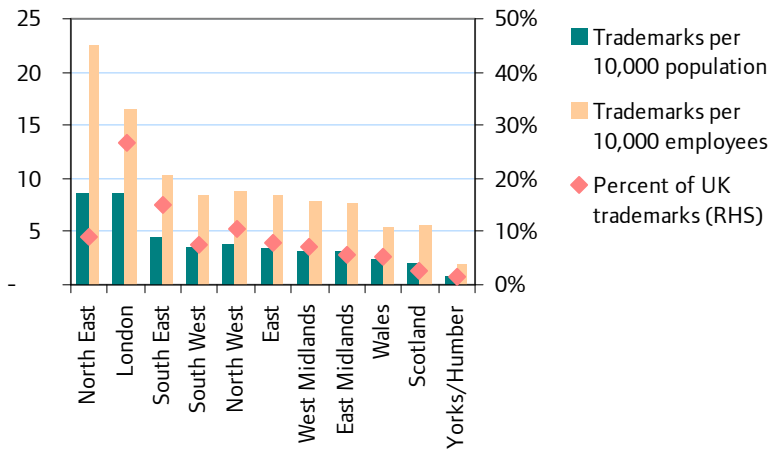


Figure 11: Trademarks filed at UK Intellectual Property Office per capita and per employee, 2009

Source: IPO Facts and Figures, 2009-10



Equally important to the innovation process is the exchange of information. Not all innovation comes from new ideas; some are in fact born from the combination of existing ideas and the spread of tacit knowledge helps this happen. Take, for example, the Dyson vacuum cleaner: the suction technology used was adapted from the extraction system used to clean up dust in saw mills. This product did not arise from research; it has its source in observation and knowledge exchange and it is this that we want to monitor. Knowledge exchange is also important for the diffusion of innovations across industries and geographies. Think of the movement of just-in-time manufacturing from Toyota to other manufacturers and retailers.[9]

Ideas flow through society over networks of people, whether personal or professional. People and their contacts are central to knowledge exchange.[10] Companies sometimes seek advice from consultancies or use new hires to improve information exchange, and so staff turnover plays an important role in knowledge diffusion. Business membership organisations help to build standards within industries and to spread knowledge across individual sectors, and some even specialise in bringing together people from all sectors, which supports knowledge exchange and so potentially aids innovators.

To measure the exchange of knowledge, we use two variables: job mobility amongst adults and employment in business membership organisations. On these measures London does well compared to other UK regions. A higher proportion of employees in London have changed job in the UK in the last year than in other regions. This is important to spread ideas, tacit knowledge and working methods between firms. London has a considerably larger number of people working in business membership organisations, though this is probably because many have national headquarters in London. But the margin is considerable against other regions, and so no doubt companies in London have more chances to engage in both structured and unstructured interaction with others in their field.

[9] Just-in-time is a business strategy that seeks to minimise inventory and associated costs by ensuring that supplies arrive only when they are needed.

[10] Ter Wal, Anne L J and Boschma, Ron. "Co-evolution of firms, industries and networks in space," *Regional Studies*, V. 45, No. 7, 2011, pp 919-934.

Figure 12: Job mobility amongst employed 25-to-64-year-olds, 2009

Source: LFS Eurostat

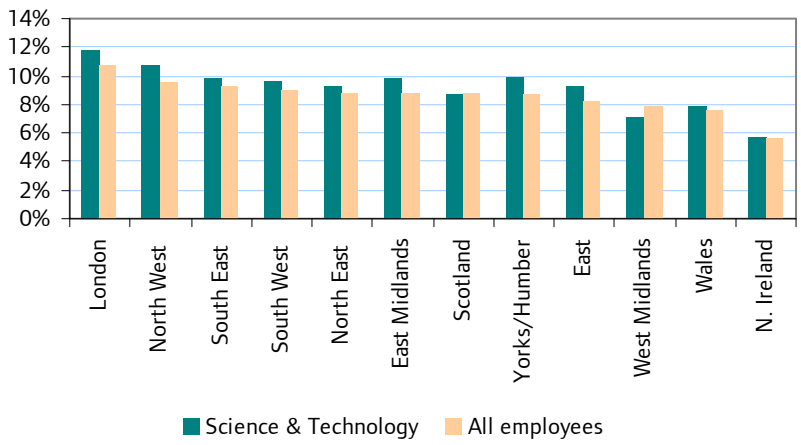
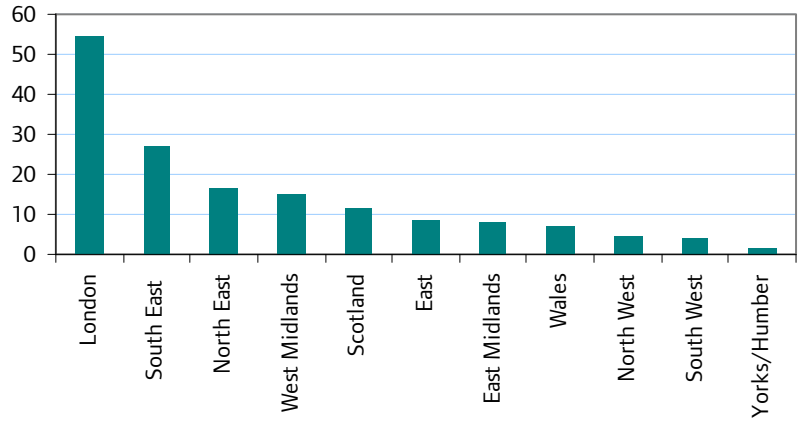


Figure 13: Employment in business membership organisations (thousands), 2009

Source: Business Register and Employment Survey



<u>London's performance</u>

London performs relatively poorly on research but very well on knowledge exchange compared to other UK regions. London has not traditionally been seen as a leader in research and development, as is evident in the business spending on R&D. But this is mostly because of its industrial mix, and in any case London businesses are probably engaged in market research, which is an important part of the innovation process, rather than scientific research. What remains to be discovered is the degree to which people in London develop new ideas, and there is certainly no measure of this.

In terms of exchanging ideas, London does quite well. London has long served as a pivotal place in global trade networks, which makes it uniquely positioned to gain knowledge from all parts of the world. This exchange of knowledge is especially useful for later stages of the innovation process where demand must be assessed and products and services commercialised, and so may, indeed, be more important than the generation of wholly new ideas. The diffusion (and copying) of innovations across sectors and geographies occurs through knowledge exchange, and this is something London is well placed to capitalise on, if it is not already.

Firms can improve the exchange of information by taking part in more business-to-business networking and knowledge-sharing opportunities like conferences, which are sometimes

viewed as a waste of time or money by managers. Businesses can also benefit from knowledge exchange through recruitment; those that fill vacancies only by internal promotion may limit access to new ideas or working methods. And finally, information exchange within the firm is important – those on the front line are often the source of novel ideas and if they are not encouraged to share ideas with management, businesses may miss an opportunity for innovation.

Demand

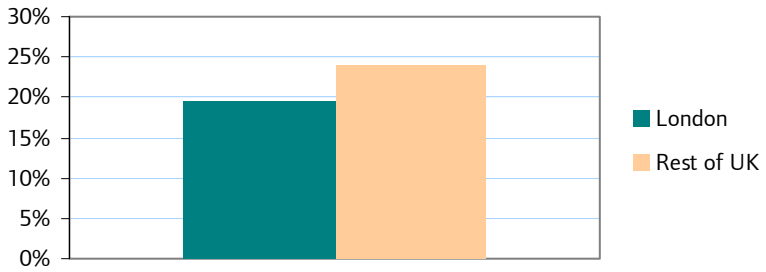
Businesses are more likely to introduce innovative products or services when they can be confident consumers will take up their new offer. Consumers' interest in new and innovative things actually helps them come to market in a virtuous circle. While plenty of innovations originate from latent demand that a clever entrepreneur can discover and exploit, measuring apparent demand is still a useful measure of the favourability of the market toward new products.

The UK ranks about average compared to other developed countries in terms of openness to foreign ideas and attitudes to new technology.[11] It is a generally conservative country, somewhat resistant to change and new ideas, particularly in comparison to the United States and East Asia. London is likely to be a little ahead of the curve compared to other regions in this respect given its more varied population and exposure to the rest of the world through overseas visitors and business activity but there is no data to show this.

Measuring demand for innovation is best done with surveys, and the only one found for London is the Community Innovation Survey, which asks businesses if uncertainty of demand is an inhibitor to innovation. Though nearly 20 per cent of businesses identified this as an obstacle, this is less than the proportion in the rest of the UK.

Figure 14: Proportion of businesses reporting uncertainty of demand as a barrier to innovation, 2009

Source: Community Innovation Survey



To complement this measure, we also try to gauge consumer demand directly, using digital communications take-up as a proxy. London has a high take-up rate for mobile broadband, and 3G mobile use compared to the rest of the UK, but this level is lower than in many other developed countries. Households in London are somewhat less likely to have home broadband connections than in the rest of the country and less than in other Northern European countries. Households in London spend more on communication services than

[11] IMD WCY Executive Opinion Survey, reported in NESTA, *The wider conditions for innovation in the UK: How the UK compares to leading innovation nations*, Nov 2009

households in other regions, but also is a smaller proportion of total spending, suggesting it is not a high spending priority.

Figure 15: Take-up of digital media services, 2009

Source: OfCom Communications Market Report

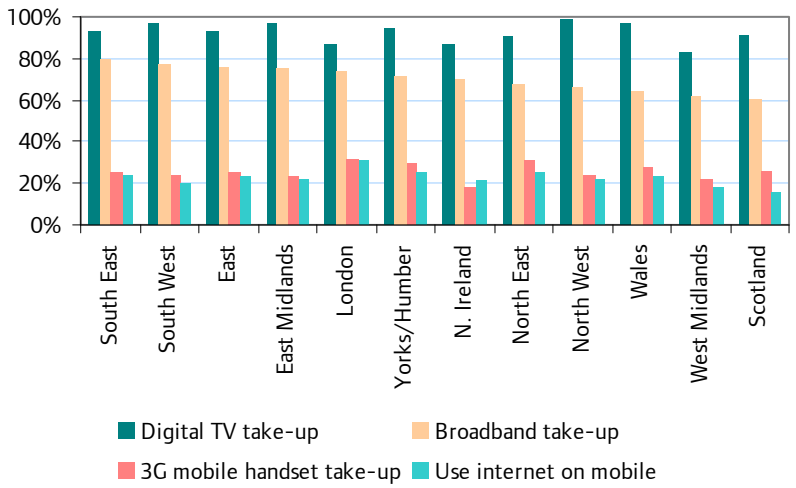
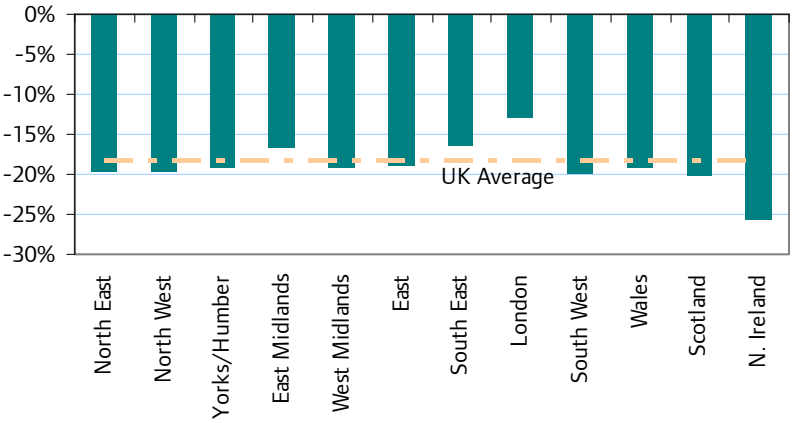


Figure 16: Consumer Confidence Index, 2010

Source: GfK NOP



London's performance

The overall picture of demand for innovation is mixed for London compared to other global cities, even if Londoners demand more innovation than other UK regions. The country lags behind others in terms of openness to different ideas and fast-moving change, though we expect that London performs better in this respect. While information and communication technology take-up in London is relatively good compared to the rest of the UK, it is middle-ranking within Europe, ahead of only the Mediterranean basin and the former Eastern Bloc.

Improving demand for innovation is fairly difficult, as it is inherently tied up in attitudes and culture. London is attractive to many people as a place where old and new combine together well, where cutting-edge meets ancient history. But this is a delicate balance. Demand for innovation is essentially demand for change, and willingness to accept change. Cultural change is a slow process and if the government wants to promote change in attitudes to innovation, it must consider how it responds to and deals with change itself. So, politicians might consider how they balance celebration of Britain's rich heritage with optimism of

future possibilities, which may vary markedly from the past. This thinking extends to every area of policy, from planning applications to school curriculum.

Business environment and competition

Commercialisation is a necessary step for an innovation to become real. The local business environment plays an important role in encouraging (or discouraging) business activity and competition drives improvement and experimentation with new ideas and affects whether innovation is possible.

For a business environment to foster innovation, it must first promote private enterprise, including the pursuit of profits. The regulatory structure and tax system has a significant role to play here; if regulation is too strict or taxes too high business activity will be dampened. There is no known tipping point at which this happens, so governments aim generally to limit both.

Businesses rely on a sound legal system, strong protection of individual and personal property rights, and a well-functioning government free from corruption that doesn't play favourites. The UK is generally regarded as one of the most stable and well-functioning nations in the world, and so provides a sound place in which to conduct business. The UK's regulatory system is not as strict as in many other European countries and its corporation tax rate is highly competitive. But the income earned from working is, at high levels, taxed somewhat more here than in other developed countries now that the top income tax rate is 50p (though whether this actually discourages innovators is disputed).[12]

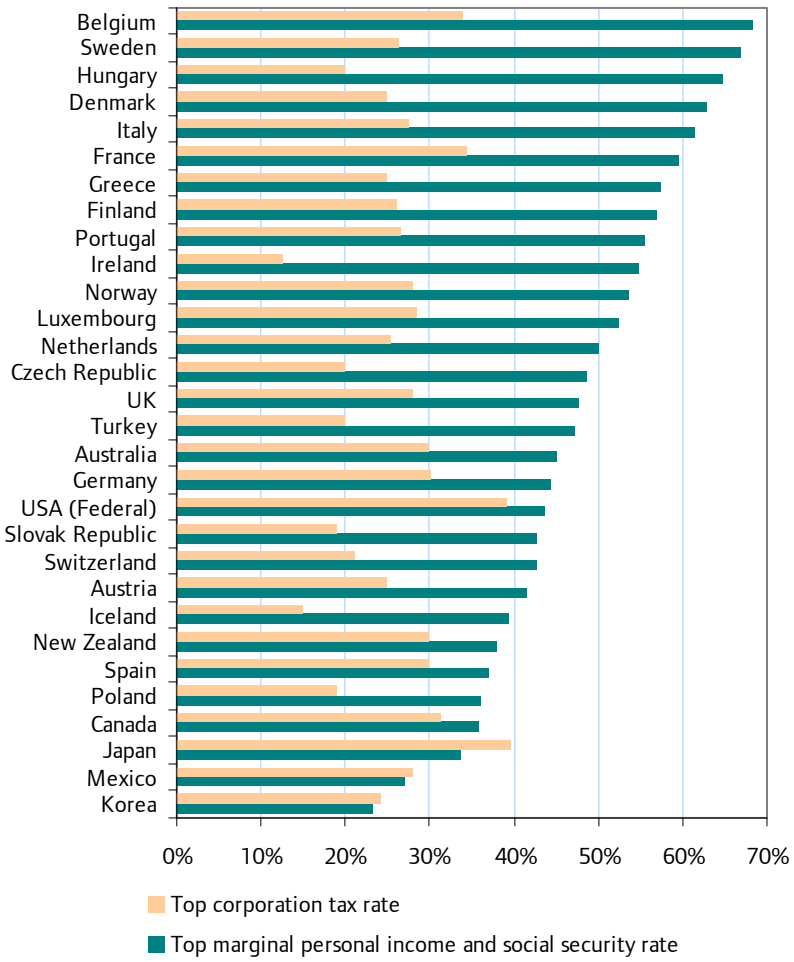
The regulatory environment in London is much the same as in the rest of the UK due to the strong role central government plays in governance in Britain. However, local government does hold power over local licensing and planning decisions, which can affect the ability of people to engage in businesses activity, though there isn't a robust indicator with which to make comparisons between regions.

[12] While the UK's new top personal income tax rate is amongst the highest in Europe, comparisons with other countries are often incomplete due to taxes levied by lower tiers of government and other employment taxes like National Insurance contributions or exemptions.

Figure 17: Marginal personal and social security tax rate on labour income and highest corporation tax rate*, 2010

Source: OECD

** Note that the UK has since lowered the top corporation tax to 26% and raised the top personal income rate by 10 percentage points*



While there are standard measures showing tax rates and the regulatory burden, the overall atmosphere is harder to pin down. To identify a business environment that promotes innovation, we focus on the state of competition in the market because competition drives results and forces businesses to continually improve.

London's local and international markets are highly competitive, with some of the most productive firms in the world located here. The number of businesses per resident is higher in London than in other regions, and a slightly higher proportion of businesses in London are small or medium businesses compared to other UK regions. Small and medium businesses are important to the innovative mix because their nimbleness allows them to introduce innovations to market more quickly and to take greater risks than large companies that typically focus on product improvement.

The net business start-up rate is similar in London compared to the rest of the UK, but the overall level of churn (the rate of starts and closures) is much higher, indicating that in London there are both more start-ups and more failures each year and that the market is probably more efficient in London at closing down failing companies.

Figure 18: Number of businesses per 10,000 residents, 2009

Source: BIS Enterprise Directorate Analytical Unit

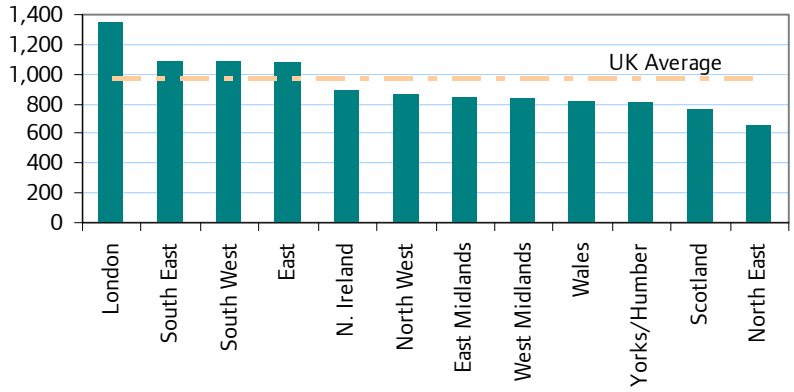


Figure 19: Number of small and medium businesses per 10,000 residents, 2009

Source: BIS Enterprise Directorate Analytical Unit

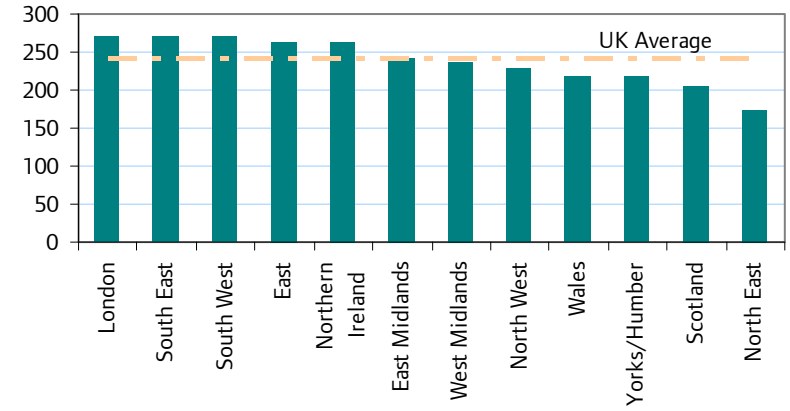


Figure 20: Net business start-up rate, 2004-2009

Source: ONS Business Demography

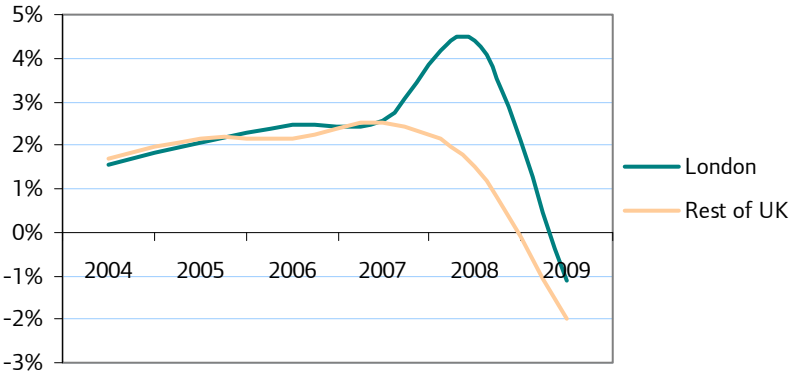
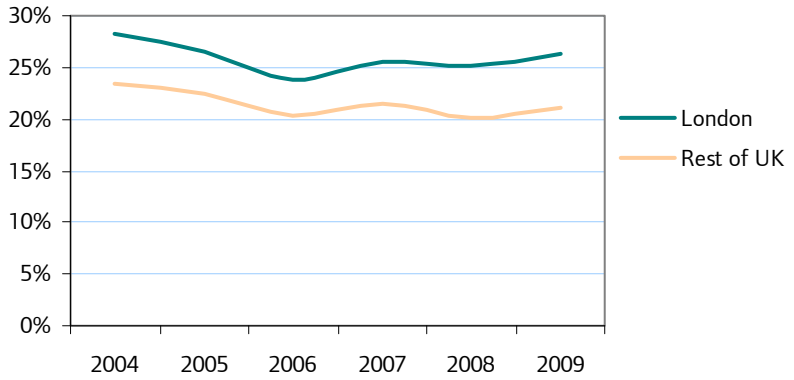


Figure 21: Business churn rate, 2004-2009

Source: ONS Business Demography



London's performance

London has a stable and strong business environment. It consistently ranks at or near the top of many international surveys as a desirable place for global companies to locate. Regulation is not too onerous, and for the most part tax rates are not unduly high, though the top income tax rate is now amongst the highest in Europe, even as corporation tax falls.

Businesses in London face more competition than those in other regions, which contributes to both the high business start-up rate and the higher business closure rate. The constant churn of businesses means new ideas and experimental products are more likely to be introduced in London than in other parts of the country.

Early research into innovation was tied up in competition theory and the competitive environment is thought to be the most significant driver of innovation. Policy should aim to foster competition in all sectors, particularly those that are themselves platforms – financial services, telecoms, etc – and to enable firms in London to compete on the global stage. Industry-specific policy or blanket small business policy is unlikely to benefit innovators directly and is more likely to benefit incumbents.

Entrepreneurship

Entrepreneurship plays a key role in introducing new innovations to society. While the term is generally associated with starting a business, the ability to identify and take advantage of opportunity can be used in both new and existing companies. What we want to measure, in terms of assessing the conditions in London to foster innovation, is whether people have those skills, and whether there is an environment in London that allows people to make use of them.

Attitudes towards entrepreneurial behaviour are important in gauging the willingness of people to pursue new ideas. The UK does not rank well amongst developed countries in perceptions of entrepreneurship. The proportion of people who think there are good opportunities for new businesses but say they are too afraid of failure to start a business has remained fairly high over the last decade, at 36 per cent in 2010.[13] Unfortunately there isn't a regional split in this survey data, though the business start-up rate suggests Londoners are less likely to be put off than people in other regions.

To measure how well the London economy promotes entrepreneurship we rely on measures of business start-up rates and the bureaucratic requirements to start a business. New businesses, whether built from scratch or as spin-offs, often introduce new ideas to markets, while many established businesses focus on improving their existing product range. It is certainly true that not all new businesses will survive and that most will not be innovative, but the rate at which new businesses are established reflects the degree to which people are able to identify opportunity and are prepared to take on risk to pursue it.

[13] GEM Global Report 2010, Global Entrepreneurship Monitor

Figure 22: Attitudes to entrepreneurship across the world, 2010

Source: Hunter Centre for Entrepreneurship

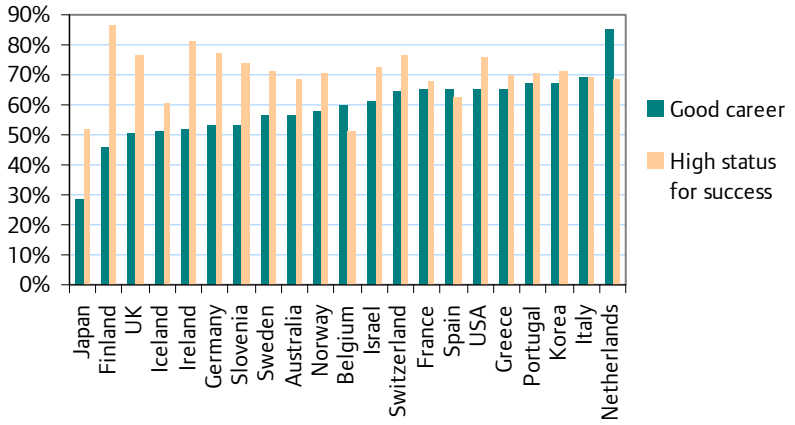


Figure 23: Business start-up rate, 2004-2009

Source: ONS Business Demography

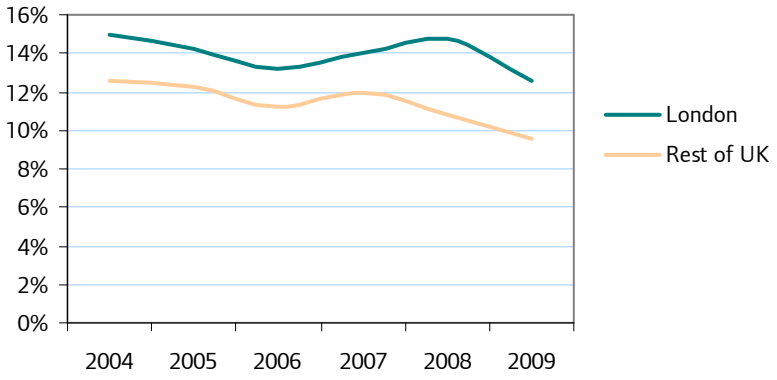
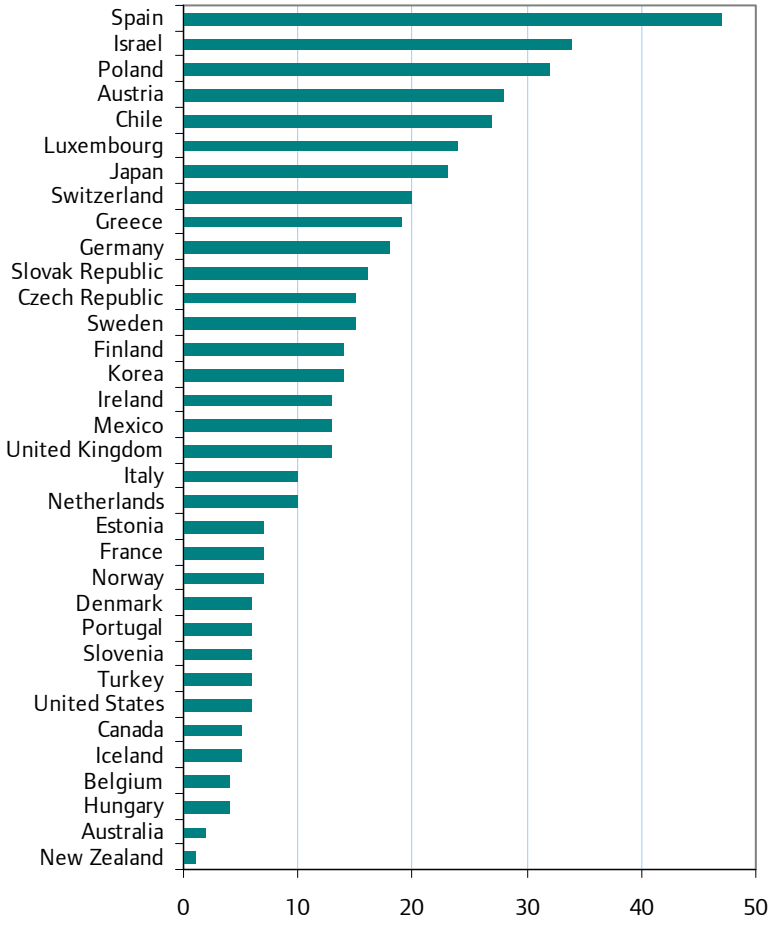


Figure 24: Days needed to start a business, 2010

Source: OECD



Identifying opportunity is one thing and having the courage to start a business is another. The business aspect of innovation can often be difficult for innovators, and basic training in how to start a business would prove useful to any budding innovator. The proportion of people who receive such training sheds light on how well prepared a person might be to start a new business if the opportunity arose. We also consider the proportion of self-employed people who were born overseas, because they are thought to introduce new ideas, and research has found that immigrants are as likely to start a business in their new country as they were in their old country, regardless of the entrepreneurial spirit in the new country.[14]

Figure 25: Proportion of self-employed people born outside UK, 2009

Source: Annual Population Survey

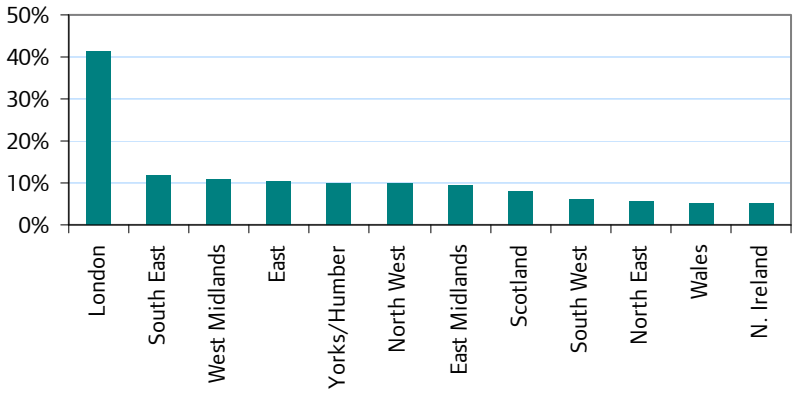
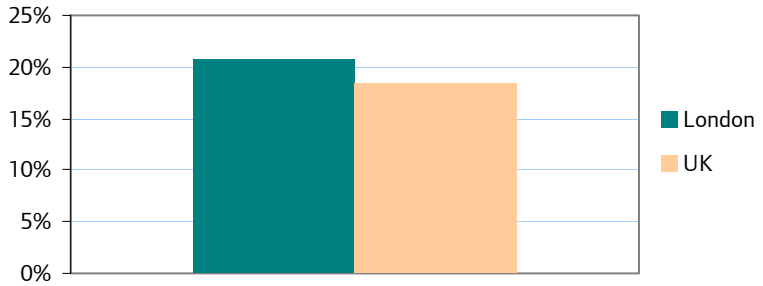


Figure 26: Percentage of the population 18 to 64 years old who received any type of training in starting a business, during or after school, 2008

Source: Hunter Centre for Entrepreneurship



London's performance

London has been shown to provide a good business environment, and on the face of things appears to encourage entrepreneurship. While it is easy to start a business in the UK and many more people do start them in London than in other parts of the UK, there remain challenges to overcome. Perceptions toward entrepreneurs could be improved and a growing number of people are likely to be too afraid of failure to try, an ominous trend for the future.

Like demand for innovation, entrepreneurship is heavily influenced by culture and perceptions of risk taking, evidenced in the fact that immigrants are as likely to become an entrepreneur in their host country as people living in their home country. Entrepreneurship requires a significant amount of risk taking, and so attitudes to risk are important. But risk aversion is pervasive, meaning that overall policy attitudes to risk, whether at a childrens' playground or at work, should be considered and put into balance. Like demand for innovation, government can influence attitudes through the way in which it acknowledges

[14] OECD, *Open for Business: Migrant Entrepreneurship in OECD Countries*, 2010

entrepreneurs and celebrates their success (or failures). For example, Singapore awards an annual prize to the entrepreneur who fails most fantastically.

Finance and infrastructure

Businesses can't get off the ground if they can't find money or don't have access to the right infrastructure, including suitable and affordable office space, ICT services like high-speed Ethernet connections, and a suitably skilled labour pool.

London is one of the world's leading financial centres, so one might assume that businesses here would have no problem securing financing. But that is certainly not the case, though local information is difficult to obtain. The UK leads Europe in terms of venture capital investment, but small companies in the UK have long found it difficult to secure financing.[15]

Figure 27: Number of companies receiving venture capital funding and average investment, 2009

Source: The British Private Equity and Venture Capital Association

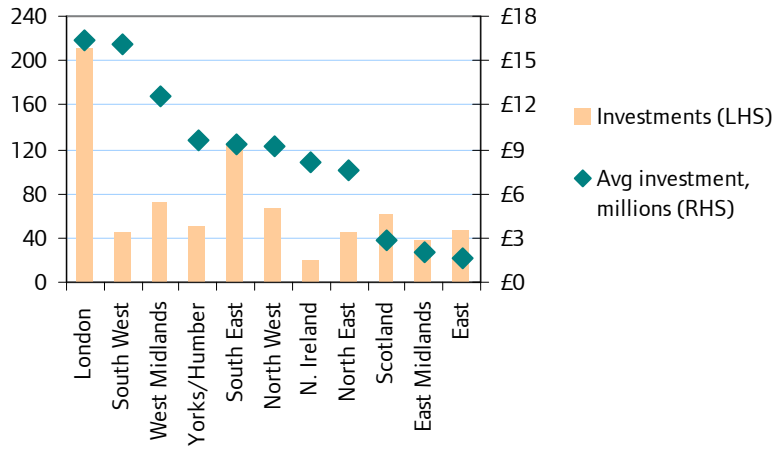
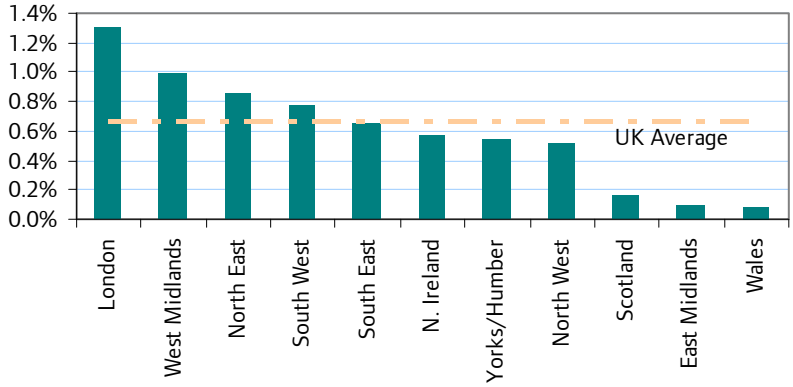


Figure 28: Venture capital as a proportion of GVA, 2009

Source: The British Private Equity and Venture Capital Association



In today's market, internet service is critical for future success, as more and more of the economy shifts to the digital realm. The UK lags its European competitors in terms of broadband speed, though it leads in access and price. This anomaly means that while many British consumers have access to very cheap internet, they will be cruising along at speeds perhaps only 25 per cent as fast as their competitors in other countries.[16]

[15] Bank of England, *Financing of technology-based small firms*, Feb 2001
[16] OECD Broadband Portal

Businesses report being unhappy with internet provision in the UK, and amongst the survey sample those in London are even more unhappy than the UK average, even though provision is generally better here than elsewhere. This reflects the higher level of intensity of use.

Figure 29: Proportion of households with broadband service, 2009

Source: Ofcom Communication Market Report

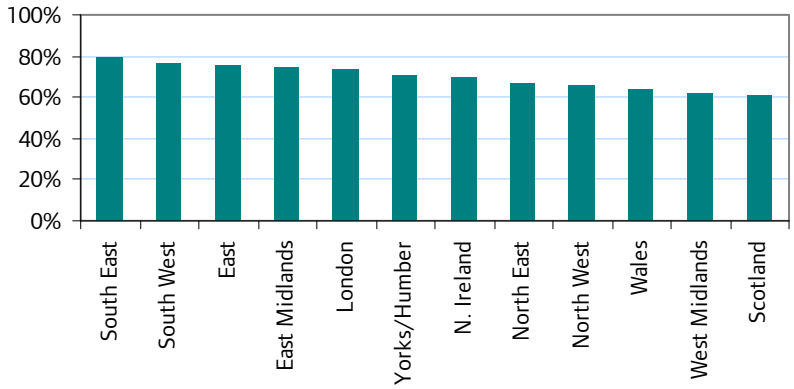


Figure 30: Business satisfaction with ICT infrastructure, 2010

Source: Ofcom Business Customer Experience Research

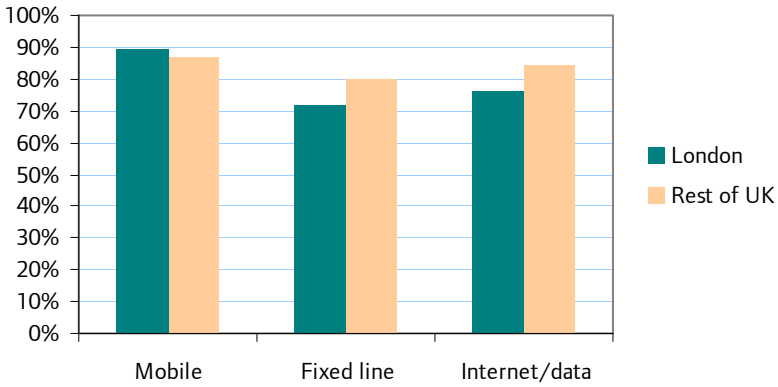


Figure 31: Average advertised broadband speed, thousands Kb per second, 2010

Source: OECD Broadband Portal

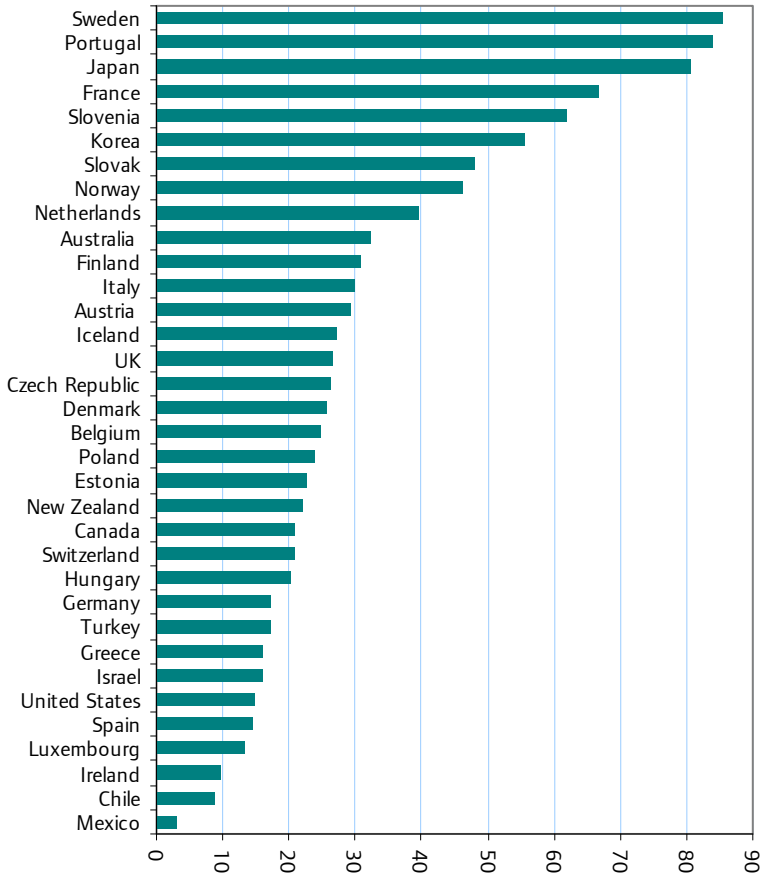
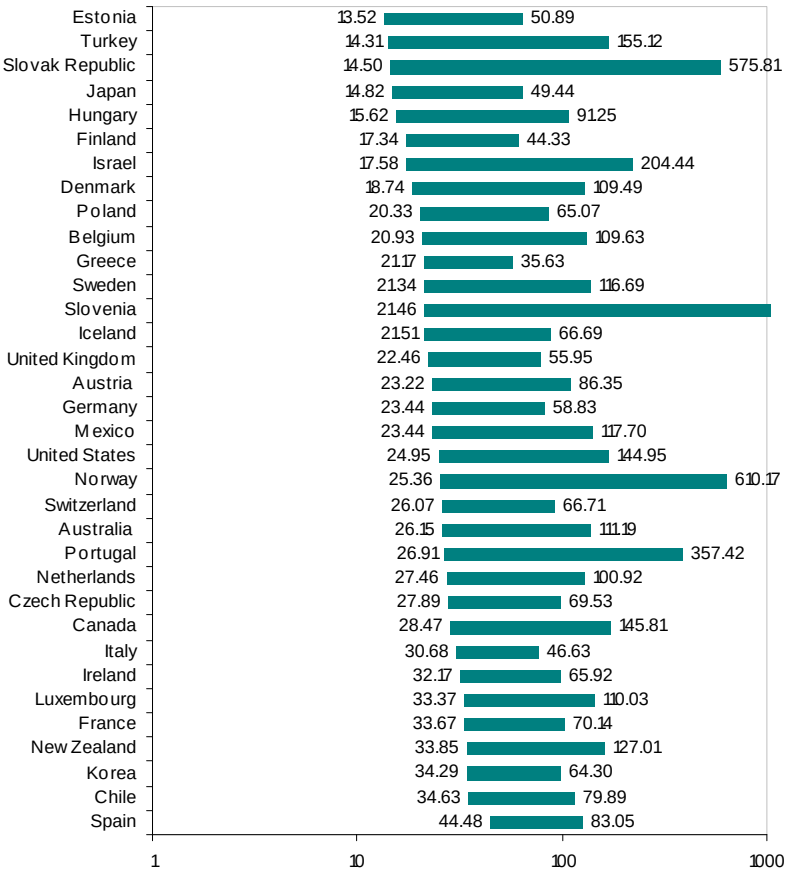


Figure 32: Broadband price per Mb per second of advertised speed, 2010 (logarithmic scale in US Dollars and purchasing power parity)

Source: OECD Broadband Portal



An often overlooked aspect of infrastructure is the availability of office space. London is an important global centre and attracts highly productive businesses from around the world, which combines with a fairly restrictive planning process to push up rental prices. Office rents in London are amongst the highest in the world, yet we still plan for 'managed growth', and rents here and in other UK cities are kept artificially high by planning constraints.[17]

Of course new businesses or those that are not yet profitable would not occupy the most expensive offices in the city, but there is anecdotal evidence of a shortage of cheap office space in London, which makes it difficult for new businesses to grow and succeed. Equally important are minimum leasing periods; landlords demand long leases to reduce their risk profile and satisfy lenders, which presents a challenge to new businesses. The recent emergence of a hub of new, small technology-focussed businesses and incubators in Shoreditch demonstrates this problem, and shows that many firms must look to areas suffering from planning blight[18] to find cheap and flexible space.

London's performance

London doesn't provide the best platform to support innovators, in terms of finance, working space and telecommunications infrastructure, and neither does the UK. On finance, small firms have struggled for at least two decades to achieve equity financing, particularly when they attempt to grow. This is a problem for potential early-stage investors as well as firms, and is often overcome by large firms buying up small firms, though this is not necessarily a bad thing. Businesses in London must also make do with slow internet (though it is at least cheap) and they pay high rents for office space compared to business in other cities, especially when business rates are taken into account.

Infrastructure is one of the basic functions of government and is often provided in a monopoly environment. It is also important because it facilitates other economic activity: with slow internet connections firms can't engage in video conferencing, employees struggle with home working, and computer services can't move into the cloud (remote servers). These are all things that improve productivity, and so it is possible to justify direct government intervention into this market because of the many externalities it brings. But a competitive market might do just as well. The Economist Intelligence Unit ranked Britain's plans for a next generation broadband network 12th (of 40), noting that the public sector contribution is very high for the expected speed and coverage. The government must demonstrate competence in this field by understanding the technology, its benefits and the most cost-effective way to deliver a network if it is to find the best solution and so far it appears behind the curve.

Office (and housing) costs are a perennial problem in London. While the market will efficiently allocate the available space amongst occupiers in favour of those that provide the most value, the absolute price level still matters to firms. Planning constraints have been shown to be a significant contributor to office rents, allowing landlords to earn significant

[17] Cushman and Wakefield, *Office Rents Across the World*, 2011, and Cheshire and Hilber, "Office Space Supply Restrictions in Britain: The Political Economy of Market Revenge," 2007

[18] The term planning blight is used to refer to the general decline of a neighbourhood where significant physical change is expected but takes a long time to get through the planning system. The increase in uncertainty this causes results in landowners deferring maintenance and investment until the planning decision is made.

profits. Occupancy taxes are also highest in London compared to other large, global cities, making office space very expensive to firms engaging in unproven, innovative activity.

Human capital

People are the drivers of innovation and our measures of human capital focus on accumulated knowledge, skills and abilities that people contribute to the business environment. While much debate on human capital and education focuses on a university education, it is important to realise that human capital is accumulated through training and practical skills as well, even if many of the indicators available focus on formal education.

Students in the UK tend to perform at or below the average of OECD countries and this is an area where improvement is needed. London's students achieve similar exam results at GCSE and somewhat better A-level (or equivalent) results compared to students in the rest of the UK. But when using the global, standardised PISA score London performs poorly, especially in science, compared to the rest of the UK and by extension much worse than pupils in other developed countries.

Figure 33: Proportion of pupils achieving 5 A*-C on GCSE and two or more passes on A-Level or equivalent, 2009

Source: Department for Education

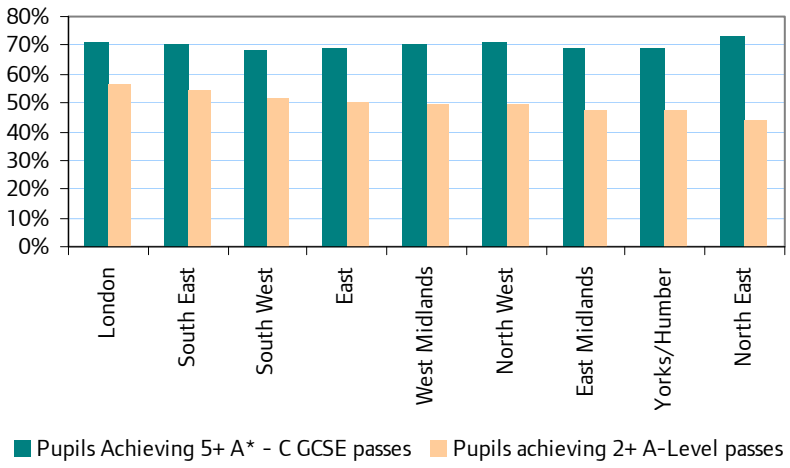
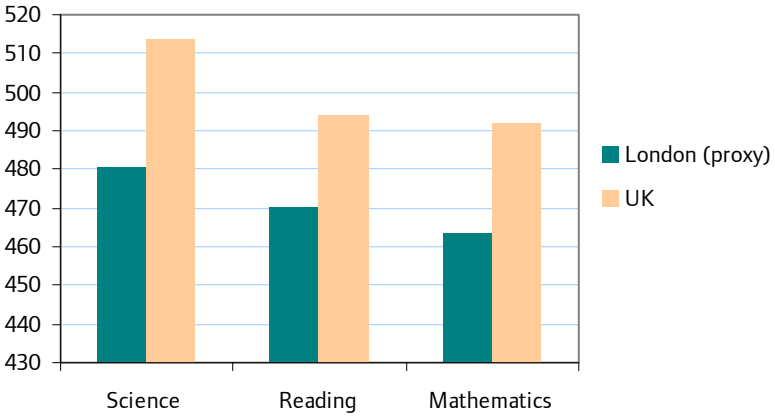


Figure 34: Mean PISA Score in Science, Reading and Mathematics, using "Large City" as a proxy for London, 2009

Source: OECD



Looking at the adult population, the UK again ranks in the middle of the pack on many measures, but London ranks higher than most other UK regions, suggesting that London's adult population is well qualified. London's workforce is the most qualified of UK regions, but the ratio of residents with degrees to employees with degrees is much lower in London than in other UK regions, suggesting that London needs to import highly qualified employees from other regions or countries.

The measures that follow must be read with caution, given their heavy slant toward formal education and that no good measures of 'skills' exist, particularly for tacit knowledge gained on the job.

Figure 35: Unemployment rate for those with and without Level 4 qualifications, 2009

Source: Annual Population Survey

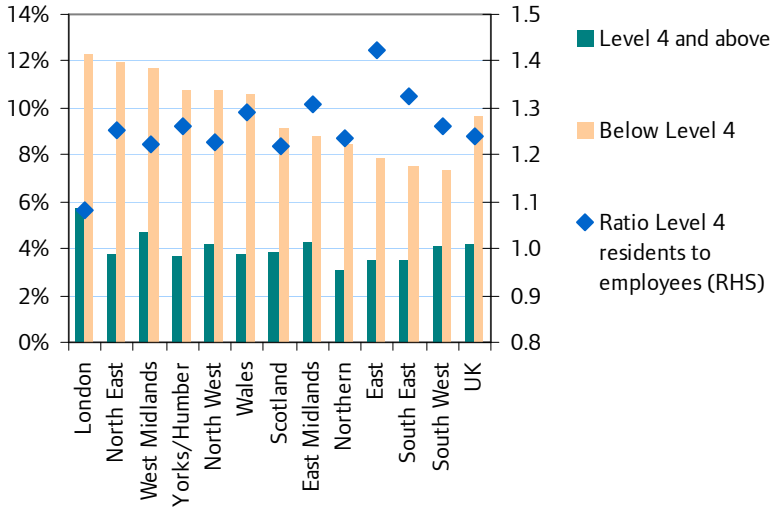


Figure 36: Human resources in science and technology as a percentage of labour force and economically active population, 2009

Source: Eurostat

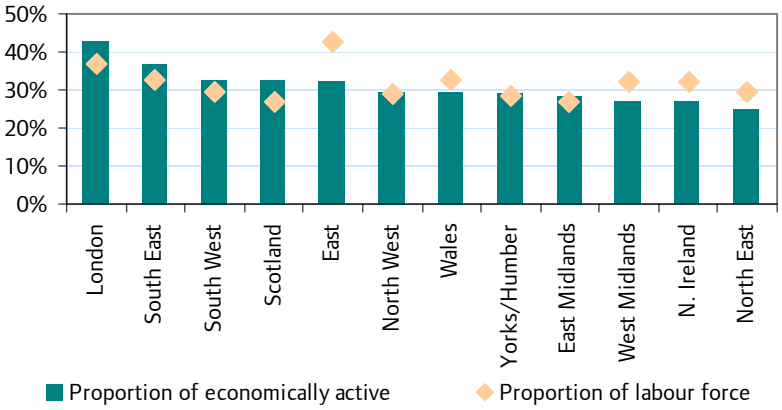


Figure 37: Percentage of residents with university degrees, 25-to-64 year olds, 2009

Source: Annual Population Survey

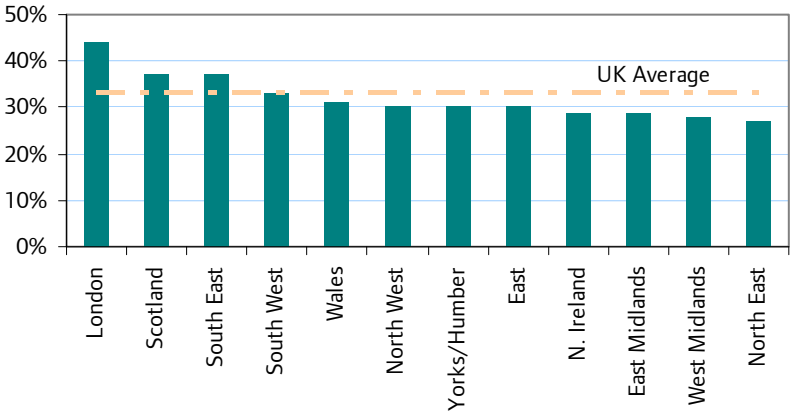


Figure 38: Qualification levels of working-age residents, 2009

Source: Annual Population Survey

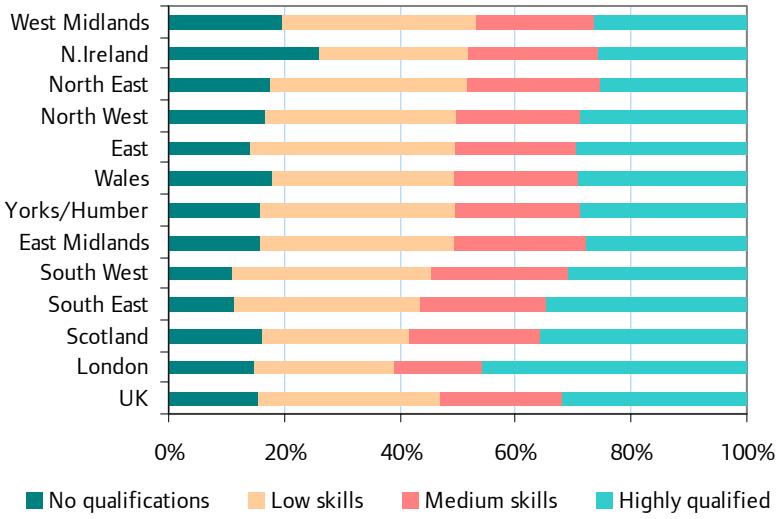


Figure 39: Employees in knowledge-intensive business services, 2009

Source: European Cluster Observatory

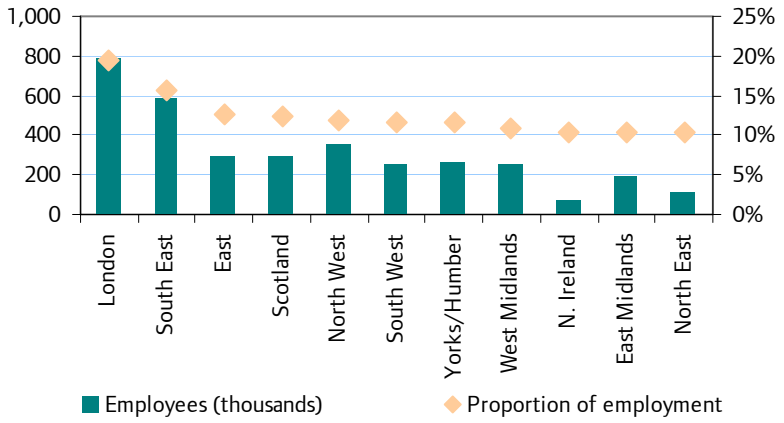
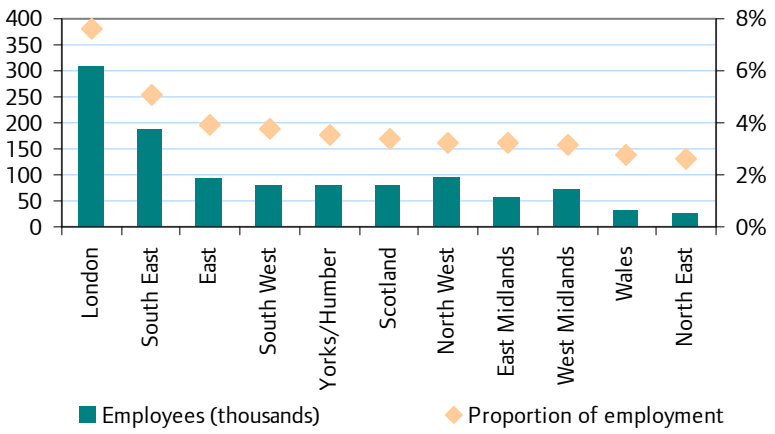


Figure 40: Employees in creative industries, 2009

Source: European Cluster Observatory



On the more practical side, we consider the ability to use a computer, internet use, life-long learning and training at work. The UK ranks poorly compared to other countries in terms of ICT skills and while fewer Londoners report never having used a computer and more say they use the internet at least once per week, we don't have a very good measure of computer skills (which are not the same as ability to use).[19]

Figure 41: Proportion of population that has never used a computer and proportion that uses the internet at least once per week, 2009

Source: Eurostat

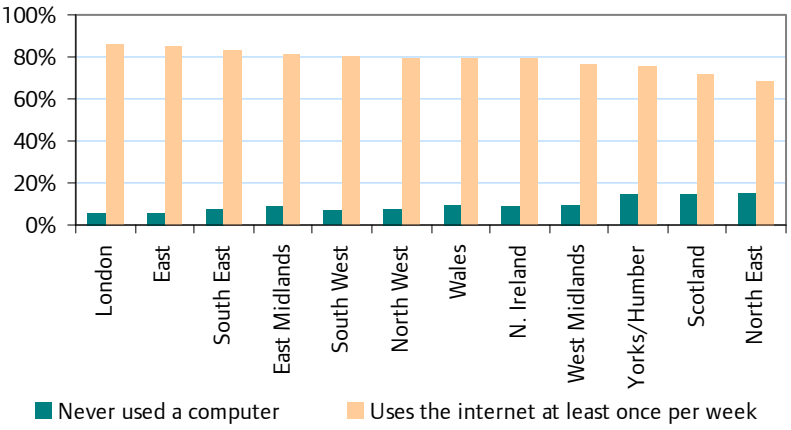
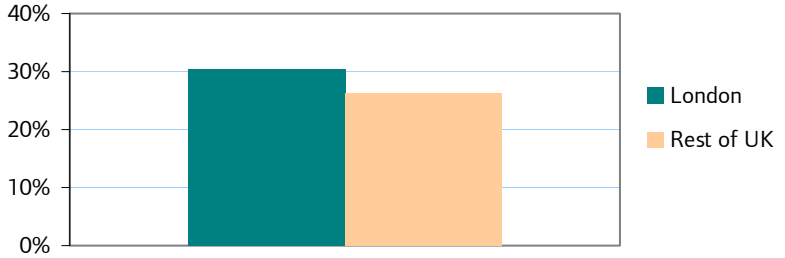


Figure 42: Proportion of firms reporting training staff for innovative activities, 2009

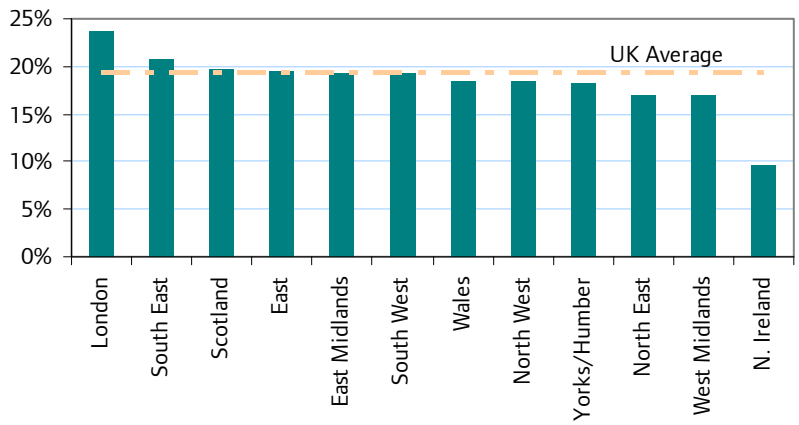
Source: Community Innovation Survey



[19] IMD WCY Executive Opinion Survey, reported in NESTA, *The wider conditions for innovation in the UK: How the UK compares to leading innovation nations*, Nov 2009

Figure 43: Participation in life long learning, 2010

Source: Eurostat



London's performance

London's workforce is the most formally qualified in the country, with nearly 50 per cent of those in work holding a degree. London's schools now perform in line with the national average, an improvement on recent years, but unfortunately this does not stack up well in international comparisons or against the demands of London's labour market. A lower proportion of people ages 15-19 are in education in the UK than in other OECD and EU-15 countries, and the difference for those aged 20-29 is even greater, suggesting this is a long-term problem.

There is a very strong focus on academic learning both in the education system and in the way performance is measured. This has complicated efforts here to measure skills and built-up knowledge, which are probably more important to innovation than formal knowledge gained in education. Indeed, employer groups report much difficulty both in London and the rest of the UK in finding staff with practice skills like problem solving and customer service.

Summary of London's performance

London performs fairly well in providing a supportive environment to innovators and it provides the best environment of the UK regions, though in international comparisons the UK generally ranks in the middle of the pack. The table below summarises London's performance relative to the UK regions on the wider conditions that we have discussed above and the UK's performance relative to other countries.

Table 1: London's performance in providing support to innovators

	London compared to UK regions	UK compared to other countries
Research and knowledge exchange	+	=
Demand	=	−
Business environment and competition	+	+
Entrepreneurship	+	=
Finance and infrastructure	=	−
Human capital	+	−

London's strengths

London's key strengths are its business environment and its ability to connect people and spread ideas and knowledge.

Business environment and competition

London provides a stable, robust and extremely competitive business environment where entrepreneurs face fewer barriers than in other UK regions. Regulation is not too onerous, and for the most part tax rates are not unduly high. London's long history of openness, strong institutions and position at the centre of trade is a huge competitive advantage. London should seek to maintain its position as a leading place to do business and to maintain its competitive business environment.

Knowledge exchange

Ideas spread quickly through London's highly educated workforce, whether because of job mobility, formal business-to-business agreements or 'through the air' as they say in London's dense agglomeration of businesses, which helps London's businesses keep up-to-date with the latest advancements in knowledge and technology – even if London isn't a leader in research – and so when something big hits the market businesses in London can be in the game from the start.

London's position as an important node in global trade networks makes it a great place to exchange ideas. Policy has in the past focussed on generating new ideas without recognising that the greatest value of ideas comes from their diffusion across businesses and geographies. This exchange of knowledge is especially useful for later stages of the innovation process, and so could even be more important than the generation of new ideas themselves. While London might not be the world's leading laboratory, it is a place that takes advantage of diffused knowledge and innovation. The greatest commercial gains accrue from diffusion rather than invention, so this is not necessarily a bad thing.

London's weaknesses

London struggles with a relatively risk-averse culture, physical infrastructure deficiencies and a skills gap between its school-leavers and the needs of employers. These weaknesses affect the early stages of innovation when firms try to convert ideas into useful products and, for small firms, in later stages when successful innovators want to ramp up scale and compete in larger markets.

Demand and Entrepreneurship

Though London performs better than the UK on these measures, the UK doesn't perform that well on these measures compared to other countries. Londoners do not demand innovation as much as their peers in other countries, and because people are relatively risk averse they shy away from starting new businesses and trying new things. Entrepreneurship isn't viewed as favourably as more dependable, well-paid City jobs. Risk aversion affects even those who are bold enough to go ahead with a risky idea when they attempt to secure financing from risk-averse banks, venture capitalists and wealthy benefactors who could serve as business angels. Firms in the UK that do succeed and then want to grow have long

struggled to bridge what is known as the 'equity gap' when they seek financing, and instead often end up being bought up by large firms.

Finance and infrastructure

London's physical infrastructure can be a challenge to firms of any size, but new and growing ones struggle especially with office space, which can be very expensive. New firms cannot enter into the long lease periods landlords in London prefer and obviously cannot compete on price and so struggle to find suitable office space, especially space with access to a high speed broadband network. It shouldn't come as a surprise that many small firms end up locating in areas where significant uncertainty in the planning system causes landlords to accept short tenancies. The provision of internet technology in London is still playing catch-up on the latest technology and it is miles behind the best networks in other cities, particularly East Asia, Scandinavia and some cities in the US.

Human capital

Despite its workforce being the most qualified in the UK, London must continue to improve its education system. In recent years the performance of the state education system has improved, with children in London achieving similar GCSE and A-level results to children in other UK regions. But the UK is not a global leader. London's businesses have the greatest demand for highly qualified labour, particularly those with practical skills like problem solving and customer service. Historically this gap has been filled by both domestic and international migration leaving a rump of the local population shut out of the labour market.

Taking a new approach to policy

Since our last paper on innovation, our knowledge of innovation and how it works has improved significantly. The process through which innovations are introduced to society is much better demonstrated by the functional model, which connects well with the economic literature demonstrating the role of competition in driving innovation and the wider environmental factors that affect innovators' ability to succeed.

While innovation was previously measured mostly by research inputs, we now have a new, more inclusive input measure of investment in intangible assets (knowledge) that is better, though it is still not perfect. Research has demonstrated that innovation is too random a process to imagine that government might promote it directly, so a shift in focus to the wider framework conditions would be a good one. Innovation relies very heavily on individual raw talent and motives and cities will naturally provide better conditions for innovators, having open networks, free flowing ideas, and access to labour, financing, markets, and specialised suppliers. It is no coincidence that these are also the benefits of agglomeration (the density of population and economic activity) that are the reason behind London's significant contribution to the national economy.

Many of the wider framework conditions have to do with culture, particularly knowledge exchange, entrepreneurship and demand for innovation. For example, the willingness of firms to hire people from outside their industry affects the exchange of knowledge across sectors, and filling vacancies only by internal promotion may limit access to new ideas or working methods. Firms that don't encourage front-line staff to share ideas with management may

miss opportunities for innovation. Meanwhile the fear of failure stops entrepreneurs from taking action.

Culture changes only very slowly and government can affect change by the example it sets for others and the degree to which it is seen to celebrate or reward one type of activity over another (note that a subsidy is not a reward). If the government wants to promote change in attitudes to innovation, it should consider how it responds to and deals with change itself. Politicians might consider how they balance celebration of Britain's rich heritage with its view of the future, which will vary much from the past. This thinking extends to every area of policy, from planning applications to school curriculum.

Early research into innovation was based in competition theory, which is thought to be the most significant driver of innovation. Entrepreneurship relies on an individual's ability to spot an opportunity and a motivation to successfully take advantage of it. The animal spirits that motivate an entrepreneur are important – it is not easy to be one! Policy has supported new business start-ups with limited success. We must recognise that while many innovations emerge from small businesses, not all small businesses innovate. Policy should aim to foster competition in all sectors, encourage people to take well-informed risks, and to enable firms in London to compete on the global stage by fostering robust competition at home.

The wider conditions go to the very core of basic government institutions: freedom, property rights, and infrastructure, which means government should be able to make improvements. And they also touch on a number of policy areas: planning, education, tax, transport, regulation, etc. There is not, as has been imagined, a specific "innovation" policy. Instead, the effect of each and every policy on the ability of people to innovate should be considered.

Data sources

Innovating firms	
Proportion of firms reporting introducing innovative products	Community Innovation Survey
Proportion of innovating firms cooperating with others to develop product innovations	Community Innovation Survey
Proportion of firms reporting introducing process innovations	Community Innovation Survey
Proportion of turnover received from innovative products	Community Innovation Survey
Research and knowledge exchange	
Business enterprise spending on research and development as a proportion of regional GVA	Office for National Statistics
Patents filed at the European Patent Office per capita	OECD REGPat database
Number of patents filed at the European Patent Office by inventor and applicant location	OECD REGPat database
Trademarks filed at UK Intellectual Property Office per capita and per employee	IPO Facts and Figures, 2009-2010
Job mobility amongst employed 25-to-64-year-olds	LFS Eurostat
Employment in business membership organisations	Business Register and Employment Survey
Demand	
Proportion of businesses reporting uncertainty of demand as a barrier to innovation	Community Innovation Survey
Take-up of digital media services	OfCom Communications Market Report
Consumer Confidence Index	GfK NOP
Business environment and competition	
Marginal personal and social security tax rate on labour income and highest corporation tax rate	OECD
Number of businesses per 10,000 residents	BIS Enterprise Directorate Analytical Unit
Number of small and medium businesses per 10,000 residents	BIS Enterprise Directorate Analytical Unit
Net business start-up rate	ONS Business Demography
Business churn rate	ONS Business Demography
Entrepreneurship	
Attitudes to entrepreneurship across the world	Hunter Centre for Entrepreneurship
Business start-up rate	ONS Business Demography
Days needed to start a business	OECD

Proportion of self-employed people born outside UK	Annual Population Survey
Percentage of the population 18 to 64 years old who received any type of training in starting a business, during or after school	Hunter Centre for Entrepreneurship
Finance and infrastructure	
Number of companies receiving venture capital funding and average investment	The British Private Equity and Venture Capital Association
Venture capital as a proportion of GVA	The British Private Equity and Venture Capital Association
Proportion of households with broadband service	OfCom Communications Market Report
Business satisfaction with ICT infrastructure	Ofcom Business Customer Experience Research
Average advertised broadband speed	OECD Broadband Portal
Broadband price per Mb per second of advertised speed	OECD Broadband Portal
Human capital	
Proportion of pupils achieving 5 A*-C on GCSE and two or more passes on A-Level or equivalent	Department for Education
Mean PISA Score in Science, Reading and Mathematics, using "Large City" as a proxy for London	OECD
Unemployment rate for those with and without Level 4 qualifications	Annual Population Survey
Human resources in science and technology as a percentage of labour force and economically active population	Eurostat
Percentage of residents with university degrees, 25-to-64 year olds	Eurostat
Qualification levels of working-age residents	Annual Population Survey
Employees in knowledge-intensive business services	European Cluster Observatory
Employees in creative industries	European Cluster Observatory
Proportion of population that has never used a computer and proportion that uses the internet at least once per week	Eurostat
Proportion of firms reporting training staff for innovative activities	Community Innovation Survey
Participation in life long learning	Eurostat

Other formats and languages

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Chinese

如果需要您母語版本的此文件，
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Vietnamese

Nếu bạn muốn có văn bản tài liệu
này bằng ngôn ngữ của mình, hãy
liên hệ theo số điện thoại hoặc địa
chỉ dưới đây.

Greek

Αν θέλετε να αποκτήσετε αντίγραφο του παρόντος εγγράφου στη δική σας γλώσσα, παρακαλείστε να επικοινωνήσετε τηλεφωνικά στον αριθμό αυτό ή ταχυδρομικά στην παρακάτω διεύθυνση.

Turkish

Bu belgenin kendi dilinizde
hazırlanmış bir nüshasını
edinmek için, lütfen aşağıdaki
telefon numarasını arayınız
veya adrese başvurunuz.

Punjabi

ਜੇ ਤੁਹਾਨੂੰ ਇਸ ਦਸਤਾਵੇਜ਼ ਦੀ ਕਾਪੀ ਤੁਹਾਡੀ ਆਪਣੀ ਭਾਸ਼ਾ ਵਿਚ ਚਾਹੀਦੀ ਹੈ, ਤਾਂ ਹੇਠ ਲਿਖੇ ਨੰਬਰ 'ਤੇ ਫ਼ੋਨ ਕਰੋ ਜਾਂ ਹੇਠ ਲਿਖੇ ਪਤੇ 'ਤੇ ਰਾਬਤਾ ਕਰੋ:

Hindi

यदि आप इस दस्तावेज की प्रति अपनी
भाषा में चाहते हैं, तो कृपया निम्नलिखित
नंबर पर फोन करें अथवा नीचे दिये गये
पते पर संपर्क करें

Bengali

আপনি যদি আপনার ভাষায় এই দলিলের প্রতিলিপি
(কপি) চান, তা হলে নীচের ফোন্ নম্বরে
বা ঠিকানায় অনুগ্রহ করে যোগাযোগ করুন।

Urdu

اگر آپ اِس دستاویز کی نقل اپنی زبان میں
چاھتے ھیں، تو براہ کرم نیچے دئے گئے نمبر
پر فون کریں یا دیئے گئے پتے پر رابطہ کریں

Arabic

إذا أردت نسخة من هذه الوثيقة بلغتك، يرجى
الاتصال برقم الهاتف أو مراسلة العنوان
أدناه

Gujarati

જો તમને આ દસ્તાવેજની નકલ તમારી ભાષામાં
જોઈતી હોય તો, કૃપા કરી આપેલ નંબર ઉપર
ફોન કરો અથવા નીચેના સરનામે સંપર્ક સાધો.

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