

Research report: May 2011

Sourcing knowledge for innovation

The international dimension



Executive summary

Drawing knowledge from external – especially international – sources has become increasingly important to small and medium-sized firms (SMEs). As these firms cannot generate all they need to know to develop new products and processes within their own companies, they need to look elsewhere for new ideas and expertise. This is what is known as knowledge sourcing.

In a practical sense, knowledge sourcing may involve learning to use new technology and equipment, especially that used by customers or suppliers. It may involve drawing on new scientific research from universities to facilitate innovation. Or, it can mean using expert marketing advice or technical or business development expertise that is not available in-house.

Being able to effectively access knowledge from external sources is increasingly recognised as a key factor in a firm's competitiveness. Therefore, we need a better understanding of how companies source knowledge and how this impacts on their performance. We also need to know which types of knowledge sourcing amount to good practice and best help small firms to learn new things.

The report provides a detailed review of patterns of knowledge sourcing, and the key factors influencing these patterns, particularly from a small business perspective. We present key findings from a survey of 393 UK companies and analyse the results. We also highlight case studies of UK SMEs that work closely with overseas partners and agents to widen their own knowledge.

Our survey found that:

Most firms – approximately two-thirds – access knowledge from overseas sources. Within the UK, despite the recent focus on regional policy, firms are more likely to source knowledge from outside their own region than within it. For the majority of firms, knowledge sourcing networks have become international, with over two-thirds of firms accessing knowledge from overseas sources. These sources are often in developed economies in Europe, the US, and Asia, but increasingly stretch to developing economies such as China and India.

New technology and professional intelligence are the most frequently sourced forms of knowledge. Service sector firms are most interested in getting professional information and intelligence, whereas manufacturing firms tend to source scientific information. Nearly three-quarters of our respondents (72.8 per cent) use intermediary organisations to access knowledge on their behalf.

Knowledge flows two ways: UK firms both export and import knowledge. Over 80 per cent of firms in the survey provide their ideas and expertise to companies outside the UK. Meanwhile, two-thirds (65.1 per cent) of firms import ideas from firms in Europe whilst 55.7 per cent do so from the United States (US) and 28.8 per cent from Asia. Nearly 6 per cent of firms access knowledge from sources located in ten or more countries. The interdependent nature of the relationships with overseas sources should strengthen the development of international knowledge sourcing networks.

International knowledge sourcing is associated with innovation and growth. Over half the respondents (53.7 per cent) bought some of their inputs for innovations from overseas, with 11.4 per cent sourcing over half those inputs abroad. Firms with strong innovation and sales growth are more likely to be engaged in international knowledge sourcing than poor performers. There is a clear link between innovation and strong sales growth, and international knowledge networking. High-performing firms both purchase a larger percentage of inputs for innovation activities from overseas and act as a more frequent source of knowledge for overseas companies. The more active sourcing of knowledge by better-performing firms is manifested by their frequent sourcing of new technology, skills and expertise, and access to a greater range of sources at different locations.

Levels of international knowledge sourcing vary according to the size of firms. The degree to which a firm is engaged in international knowledge sourcing varies significantly by size and industrial sector. Larger firms source knowledge from overseas more frequently and access sources in more countries than their smaller counterparts. Larger firms also use intermediary organisations such as Business Link or universities more frequently than their smaller counterparts when sourcing external knowledge.

Manufacturing firms are more likely to engage internationally than service sector firms. Manufacturing firms with their stronger global production networks and supply chains are more likely to engage in international knowledge sourcing than those in the service sectors. They are also more likely to exchange ideas with overseas firms. Manufacturing firms access knowledge from more countries than firms in service sectors. They also use intermediary organisations more frequently when sourcing knowledge from overseas.

The impact of a firm's location is more limited. There is little difference in the degree of international knowledge sourcing between firms located in the core (London, South East, and East of England) or peripheral regions (rest of the UK). However, firms in peripheral regions use intermediary organisations more often than those in the core regions to assist in the process.

Cost considerations inhibit knowledge sourcing. The cost of sourcing knowledge is seen as the most significant barrier to its wider practice. Firms in peripheral regions consider this a bigger issue than their counterparts in the core regions.

Smaller firms tend to be disadvantaged. The findings suggest that smaller firms and those operating in service sectors may be at a disadvantage, since they are less active in international knowledge sourcing and use intermediary organisations less frequently than their larger counterparts.

Our case studies confirmed the value of networking and external knowledge sourcing. There are ten lessons we draw from those case studies.

1. International knowledge sourcing can generate innovation and sustain competitiveness. Sourcing international knowledge and engaging in a process of continuous innovation enables small firms to stay ahead of the competition.
2. Successful knowledge sourcing requires investment in close and lasting relationships. This delivers benefits to both parties. Regular and sustained communication makes it much easier to source knowledge when it is required.
3. Network investment requires time and money. Allowing time to nurture and maintain relationships is important. Face-to-face contact is often essential to build relationships that are based on trust and understanding.
4. Sourcing knowledge through international networks enhances innovation. Complementary networks enable SMEs to use and provide innovative goods and services. Leading SMEs often use a range of channels to share ideas.
5. Informal networks play a crucial role in accessing international knowledge. Informal contacts are crucial to building links and identifying suitable partners. The best SMEs continually invest time and resources into generating and maintaining relationships with key individuals.
6. International knowledge is vital to tracking and understanding global markets. SMEs seeking to export must

have a good knowledge of international competitors and customers to respond to emerging trends and adapt to changes in the global market.

7. Language and cultural differences can inhibit effective knowledge sourcing. Appropriately responding to underlying cultural and linguistic differences is important for breaking into new markets.
8. Knowledge brokers can facilitate access to international knowledge. Overseas branches and agents can overcome cultural and linguistic barriers, and help small firms effectively break into new markets.
9. Effective knowledge sourcing requires significant levels of absorptive capacity. The pre-existing skills, knowledge and experience of firms helps determine their capability to generate effective international networks.
10. SMEs need to be able to store externally sourced knowledge. Establishing a knowledge repository is increasingly important for smaller firms which often lack the knowledge management systems common in larger firms.

These lessons and observations have led us to make a series of policy recommendations:

1. SMEs should be provided with appropriate support to enable them to access the knowledge they require from home and abroad. Government could map key global communities of practice for the benefit of SMEs.
2. Small firms should be helped to identify and use international agents. With the help of embassies and overseas trade missions, lists of suitable agents, lawyers and financial advisers with knowledge of trade in different countries should be made available to firms. This should complement financial support for UK firms on overseas trade missions.
3. Overseas trade missions to the UK should be better supported. Financial assistance should be given to fund international customers, suppliers, collaborators and associates to undertake visits to the UK. This will help UK firms through the spread of ideas and shared expertise.

4. A register of global university expertise should be compiled. There should be a shift away from assuming that local universities are the fount of all knowledge. An online directory of expertise within UK and overseas universities should be made available to small firms, with encouragement to develop links with the most appropriate academic teams.
5. Better support should be made available to help SMEs engage with emerging economies including China and India. The four emerging BRIC economies – Brazil, Russia, India and China – are increasingly leading the way in new ideas, products and processes. UK small firms need support to engage with them, if they are not to be left behind in the new global economy.
6. Firms need advice on effective network management. While there is already significant management and leadership support, it doesn't sufficiently address the art of managing knowledge networks. This new discipline should be supported by government.¹
7. Government must continue to fund existing network support. With tighter public finances, there may be a temptation to cut back on support for organisations such as the Technology Strategy Board (TSB) and research councils which facilitate SME engagement in these activities. This would be a false economy. Such work is vital for UK competitiveness and trade.
8. Government should widen its regional focus. Knowledge sourcing and networking occur in a regional, national and global context. SMEs should be encouraged to source the most relevant knowledge wherever it is located.

1. The Intellectual Assets Centre in Scotland (www.ia-centre.org.uk) is a good example of a publicly supported organisation engaged in providing these skills to SMEs.

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Our aim is to transform the UK's capacity for innovation. We invest in early-stage companies, inform innovation policy and encourage a culture that helps innovation to flourish.

Part I: Introduction

2. Mahroum, S., Huggins, R., Clayton, N., Pain, K. and Taylor, P. (2008) 'Innovation by Adoption: Measuring and Mapping Absorptive Capacity in UK Nations and Regions.' London: NESTA; Faber, J. and Heslen, B. (2004) Innovation capabilities of European nations: cross-national analyses of patents and sales of product innovations. 'Research Policy.' 33(2), pp.193-207; Teigland, R. and Wasko, M.M. (2003) Integrating knowledge through information trading: examining the relationship between boundary spanning communication and individual performance. 'Decision Science.' 34(2), pp.261-286.
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6. Palazzo, G. (2005) Postnational constellations of innovativeness: a cosmopolitan approach. 'Technology Analysis & Strategic Management.' 17(1), pp.55-72; Davenport, S. (2005) Exploring the role of proximity in SME knowledge-acquisition. 'Research Policy.' 34, pp.683-701.
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10. Athreye, S. (2004) Agglomeration and growth: a study of the Cambridge hi-tech cluster. In Bresnahan, T. and Gambardella, A. (Eds) 'Building High-Tech Clusters Silicon Valley and Beyond.' Cambridge/New York: Cambridge University Press; Garnsey, E. and Heffernan, P. (2005) High-technology clustering through spin-out and attraction: The Cambridge Case. 'Regional Studies.' 39, pp.1127-1144.
11. This report represents a synthesis of more detailed reporting and standalone reports covering the literature review and the company survey, and the case studies presented in the document are available for download from the NESTA website.

Drawing knowledge from external sources has become increasingly important to small and medium-sized firms (SMEs), as they cannot generate internally all the ideas and research necessary for new product and process development.² All other things being equal, firms prefer to get ideas from local sources, though SMEs are often more sensitive to the proximity than larger corporations.³

Although people can communicate over the phone, email or Internet, firms often prefer face-to-face meetings as a way to get to know each other and build trust. And trust is often an important ingredient for successful knowledge sharing. But many, particularly those based on innovation-driven growth, are turning to overseas sources as their primary source of new ideas.⁴ If applicable knowledge is available locally, firms will attempt to source and acquire it; if not, they will look elsewhere.⁵

But those that look abroad may be in a stronger position. There is a growing recognition that those with the more distant relationships are often equally, if not better, able to transfer complex knowledge, provided that a high performing network structure is in place.⁶ The constraining effect of distance on knowledge flow and transfer is gradually diminishing.⁷ And the knowledge learnt from abroad is often superior to that available locally, resulting in greater innovation. In any case, simply being in the same locality is often of little benefit for diffusing knowledge without strong networks.⁸ In general, there is increasing evidence of the heightened role being played by international knowledge sourcing networks.⁹ In the high-tech setting of Cambridge, for example, firms and academics report global networks to be of greater

significance than local networks to their operations.¹⁰

This report reviews patterns of knowledge sourcing in more detail, together with the key factors influencing these patterns, particularly from an SME perspective.¹¹ The report presents empirical data and analysis, both quantitative and qualitative, to examine the nature of knowledge sourcing activities across firms in the UK.

The report is structured as follows:

- Chapter 2 analyses some of the substantive literature relevant to knowledge sourcing and SMEs, and the role of proximity and the nature of knowledge as an asset that may be sourced through networks or markets.
- Chapter 3 presents the results of a survey of UK firms. It analyses the knowledge sourcing activity undertaken by the respondents – including types of knowledge sourced, frequency of the use of various sources of knowledge, location of international sources of knowledge, and reciprocity of international knowledge sourcing networks.
- Chapter 4 presents a series of case studies of global-facing UK SMEs. The case studies highlight good practices in sourcing knowledge from overseas, as well as highlighting the diversity and variety of sourcing practices.
- Chapter 5 assesses the public policy framework associated with international knowledge sourcing and outlines policy recommendations.
- Chapter 6 summarises our key conclusions.

Part 2: Knowledge sourcing, proximity, and SMEs

12. Rutten, R. and Boekema, F. (2007) 'The Learning Region: Foundations, State of the Art, Future.' Cheltenham: Edward Elgar.
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This chapter summarises some of the substantive literature relevant to knowledge sourcing and SMEs. It analyses the role of proximity and the nature of knowledge as an asset that may be sourced through networks or markets. The links between knowledge sourcing, networks and innovation are reviewed. Finally, there is a discussion of local and international knowledge sourcing patterns, particularly the international links being developed across clusters.

2.1 Knowledge sourcing and proximity

Knowledge sourcing and the networks through which this knowledge flows are seen as crucial to economic success and competitiveness.¹² In particular, proximity to key knowledge sources is regarded as a key reason for the greater competitiveness of some of the most successful cities and regions in the world. The development of leading advanced regional economies is considered to involve the percolation of knowledge through a highly networked regional business culture rich in 'untraded interdependencies'.¹³ Networks within these leading regional economies are able to mobilise and fully develop people's skills and ideas, particularly in SMEs, through external networks providing good feedback. This ensures continued high levels of innovation.¹⁴

The important role of external knowledge sources has led to innovation being conceived as a systemic process resulting from both formal and informal networking with universities, research labs and other firms.¹⁵ A systems perspective enables us to embrace this range of influences on innovation,

describing and evaluating knowledge sourcing activities holistically. This discourse largely relies on empirical work from the most competitive regions and firms in the world in terms of economic growth rates and workforce qualifications and the number of large, international firms based in 'new' or 'high technology' sectors.¹⁶ This appears to disadvantage small firms, and those in less-favoured locations, suggesting wide variations among businesses in their innovation behaviours and strategies, including knowledge sourcing.

Locations may also vary in number and quality of their knowledge sources. A study of business services – advertising, market research, graphic design, product design and management consultancy – in UK regions shows that business services providers in London and the South East have higher productivity and greater export penetration, as well as faster growth and wider markets, than their counterparts in peripheral regions.¹⁷ The more competitive characteristics of business services in London and South East also indicate better service quality. Businesses, especially SMEs, in peripheral regions often have too few good local sources of knowledge.¹⁸

2.2 The nature of knowledge

In order to analyse in more detail the nature of knowledge sourcing practices, it is important to understand what we mean by the term 'knowledge' in this context. Peter Drucker provides us with a useful definition, viewing it as 'information that changes something or somebody, either by becoming grounds for action or by making an individual or

an institution capable of different or more effective action.¹⁹ Knowledge, unlike simple information, is about action and is a function of a particular stance.²⁰

Knowledge is often described as a public good, where use by one actor does not preclude its use by others. However, as Christine Oliver argues, it is no longer possible to think of knowledge as a truly public good that can be easily reproduced and diffused, but at best to regard it as a quasi-public good where reproduction and diffusion cannot be taken for granted.²¹ John Seely Brown and Paul Duguid distinguish between 'sticky' and 'leaky' knowledge, with sticky knowledge being that which is difficult to move, while leaky knowledge is the undesirable flow of knowledge to external sources.²²

The potential problem for firms, therefore, is that knowledge may flow more easily out of them rather than move productively within them. With this risk in mind, the question can be legitimately asked – why would firms engage in knowledge networks that involve other firms – non-market collaborative and co-operative interactions – rather than control their knowledge flows through the marketplace? (Figure 1 illustrates the two possible routes). The truth is that knowledge markets are rare. They are difficult to create due to inherent asymmetry in the existing knowledge base of buyers and sellers. The buyer is often unable to convey specifically to the seller the knowledge they are seeking, and vice-versa. If the seller is able effectively

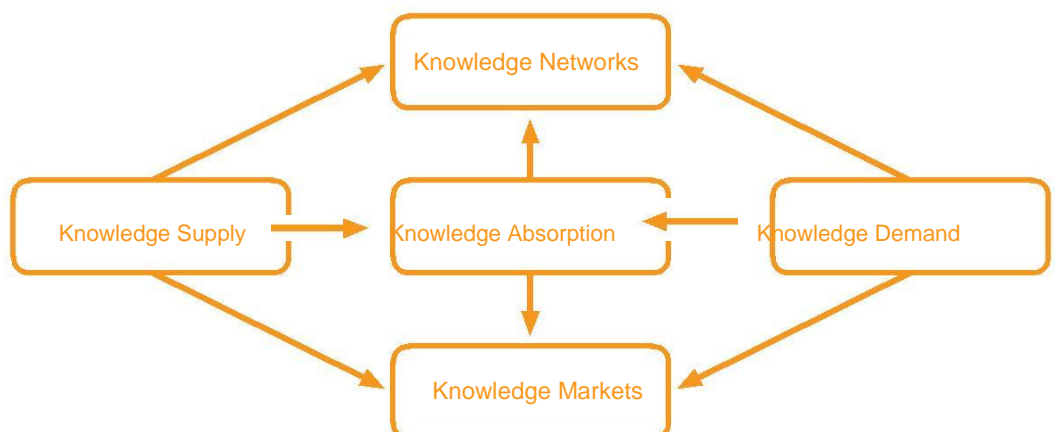
to convey the knowledge they are selling, the buyer will in effect have acquired it for free.²³

In any case, most such markets are actually for information – books, newspapers and other 'fact-supplying' media – rather than knowledge. This means that knowledge must often be sought through other means. While firms may seek to internalise knowledge sources to overcome market failure, networks are now widely accepted as a good way to access knowledge.

The problem in sourcing knowledge highlights its intangible, non-standardised and inseparable nature – like most services, it can't be seen, felt or touched like manufactured goods. Moreover, a producer of services is unable to provide constant performance and quality, because services are difficult to standardise. And, while tangible goods are produced, sold and then consumed, services are sold, then produced and consumed simultaneously.²⁴ These factors mean that users of knowledge-based services often lack the information required (due to the imbalances of information between knowledge-seeker and knowledge-provider) effectively to buy knowledge.

The lack of information is particularly problematic when attempting to assess returns to knowledge.²⁵ The fact that the production and consumption of services can occur simultaneously makes evaluation difficult, reinforcing the problem of forming knowledge markets. A knowledge-provider cannot fully disclose all they know until it is purchased,

Figure 1: Knowledge sourcing across networks and markets



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26. Lechner, C. and Dowling, M. (2003) Firm networks: external relationships as sources for the growth and competitiveness of entrepreneurial firms. 'Entrepreneurship and Regional Development.' 15, pp.1-26.
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because once it is disclosed, the knowledge loses much of its value. The knowledge-seeker gains know-how without purchasing it.

2.3 Small firms

Within a small firm, external networks are increasingly recognised as important ways of creating and sustaining innovation and competitiveness.²⁶ There is growing evidence that network development is related to the growth of small firms, particularly links involving the flow of knowledge.²⁷ To compete successfully with large firms, small firms may need to develop external networks to access resources that they do not possess internally.²⁸ Small firms are particularly reliant on social networks through connections with friends and family.²⁹

Entrepreneurs and small business owners build personal networks where individual ties combine calculative and social aspects.³⁰ This is to be expected, since in small and new firms the network requirements of both the firm and its owner are likely to coincide, and encompass both his or her social and economic needs and objectives.³¹ The different functions and objectives of a network can be defined as its 'compositional quality', reflecting the ability of differing network ties to provide necessary resources.³² In general, new and small firms are more likely to be dependent on the social networks of the owner's relatives and friends.

As firms grow, they come to rely more on strategic networks, as suppliers, customers, collaborators and partners become more important, and less reliant on those social networks.³³ With this change, their networks should evolve from pre-existing (or path dependent) social networks into more structured networks based on reputation and access to relevant resources and partners.³⁴

The nature of the networks will also depend on the size and age of its partners. Many small firms are often "forced to share their initial technology base with other and more powerful firms".³⁵ This can lead to 'knowledge theft' given that small firms are less likely to have secured patents, copyrights or licensing agreements to protect their ideas.³⁶ However, these small firms may improve their performance if their credibility grows from having prominent strategic allies.³⁷

In other words, small firms use these networks to develop their reputation as a means of overcoming imperfections in the markets for knowledge.³⁸ There is evidence that newer knowledge-based firms need both to interact intensely and to share information if they are to acquire knowledge.³⁹ The configuration of networks in a firm's early stages will influence company performance, which will be enhanced by developing networks that provide access to diverse information and capabilities with minimum costs of redundancy, conflict and complexity.⁴⁰

Within mainstream strategic management literature, studies on strategic alliances often highlight the contractual networks developed by multinational corporations to improve their access to resources and knowledge.⁴¹ The regulation underlying these relationships often contrasts with more informal, flexible and mobile small firm networks.⁴² The lower survival rates of small firms also means that relative network stability is gained through participation in networks with multiple members, rather than the two-way networks and bilateral alliances that constitute many large firm networks.⁴³ As the cost of searching and maintaining network partners may be proportionately higher for small firms, networks will tend to account for a greater proportion of their total investment.⁴⁴

The external orientation of a firm's management can affect knowledge sourcing. For instance, small shops or manufacturing firms are often reluctant to engage in network building or the use of external knowledge sources. Holding responsibilities for many areas, managers of such small businesses often feel they lack the time to build effective knowledge networks. Whilst large firms may have special departments to manage knowledge sourcing and innovation, small firms often lack these resources.

Small business owners consider the independence and freedom from control by others central to their entrepreneurship. Because of this, they may be reluctant to do anything that might lead them to depend on others or even be seen as needing support. They avoid networking activities beyond the minimum demanded by their business needs.⁴⁵

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48. Ireland, R.D., Hitt, M.A. and Vaidyanath, D. (2002) Alliance management as a source of competitive advantage. 'Journal of Management.' 28, pp.413-446.

2.4 Innovation and knowledge sourcing

Innovation is a complex process which may require knowledge to flow between firms and other actors.⁴⁶ Increasingly, this process is viewed as a systemic undertaking – firms no longer innovate in isolation but through a complex set of interactions with others.⁴⁷ Therefore, external knowledge networks are potentially an important aspect of the innovation process, enabling firms to procure knowledge that they do not or cannot generate internally. These networks often involve strategic alliances between firms through formal collaboration and joint ventures, or other 'contracted' relationships resulting in frequent, repeated interaction. Firms gain competitive advantage from these alliances by accessing the resources of their partners. This makes a firm's potential competitive advantage dependent on its partners' resources.⁴⁸

Alliances can either be 'open' channels or more proprietary 'closed' conduits.⁴⁹ Those based on open channels and weak connections may offer members returns through spillovers – beneficial side effects – not available in closed alliances. As a proxy for innovation alliances, Community Innovation Survey (CIS) data suggest that around 10 per cent of UK enterprises cooperate on innovation with other firms or institutions, with cooperation highest in the South East, Eastern and South West. The UK as a whole is ranked 11th most active nation for innovation cooperation across the 30 nations benchmarked by the European Innovation Scoreboard, with the most active nations being Denmark, Sweden and Finland.⁵⁰

In general, whilst firms with low levels of absorptive capacity tend to network locally, those with a greater ability to assimilate and apply new knowledge are often more connected to global networks.⁵¹ This is perhaps to be expected, but it does illustrate the importance of a firm's internal capacity to assimilate knowledge in its ability to develop external networks. It also helps explain why SMEs with relatively low knowledge absorption capacities tend to rely on local networks. In general, only those firms and organisations located in an area rich in relevant knowledge sources can take competitive advantage from their location. In uncompetitive regions, the propensity of firms to engage in knowledge sourcing networks is often related to the characteristics of individual entrepreneurs, which will be shaped by the regional social and business culture.⁵² Older industrial regions may suffer from lock-in or path dependency

– inertia among firms preventing changes in traditional practices from occurring.⁵³

The inability of firms to change and adapt may stop them seeking and absorbing external new knowledge and could lock them into an existing low growth regime preventing the development of new knowledge networks.⁵⁴ By necessity, leading firms in regions with few internally generated new ideas must develop links beyond their region.⁵⁵

More generally the development of innovation clusters is shifting firms to a business model based on wider connectivity and consolidation. Knowledge is increasingly flowing beyond clusters and regions, resulting in greater global knowledge connectivity. It is these new patterns of connected clusters and broadened knowledge networks that both the firms and policymakers are increasingly attempting to foster, although the push from both the corporate and the government sectors varies.⁵⁶ In particular, some of the world's most visible knowledge clusters operate networks that are more open than others, as they seek new knowledge and the means more efficiently to exploit their existing knowledge base.⁵⁷ In Silicon Valley, California, firms utilise the benefits of proximity to build and manage global-scale production networks.⁵⁸ In the UK, national and international networks are just as significant as their local counterparts for fostering innovation.⁵⁹

2.5 Conclusion

The world's most advanced local and regional economies no longer rely on local knowledge. Instead, there are positioned within global knowledge networks, connecting clusters and their actors.⁶⁰ Furthermore, national innovation systems are becoming 'leakier' over time, causing firms to locate R&D facilities to places where new knowledge is being created.⁶¹ There is an increasing recognition that knowledge clusters face problems if there is little diversification in the type of knowledge being created and commercialised.⁶² The requirements for specialised technological research, supply and servicing mean that knowledge industries are tied to a specific knowledge base, limiting the number of global locations within which such development has so far occurred.

This complex local and global environment has led to two broad schools of thought regarding geographical proximity and knowledge

49. Owen-Smith, J. and Powell, W.W. (2004) Knowledge networks as channels and conduits: The effects of spillovers in the Boston biotechnology community. 'Organization Science.' 15, pp.5-21.
50. MERIT (2007) 'European Innovation Scoreboard 2007: Comparative Analysis of Innovation Performance.' Maastricht: MERIT.
51. Drejer, I. and Lund Vinding, A. (2007) Searching Near and Far: Determinants of Innovative Firms Propensity to Collaborate across Geographical Distance. 'Industry and Innovation.' 14(3), pp.259-275.
52. Watts, H.D., Wood, A.M. and Wardle, P. (2006) Owner-Managers, Clusters and Local Embeddedness: Small Firms in the Sheffield (UK) Metal-Working Cluster. 'Entrepreneurship and Regional Development.' 18(3), pp.185-205.
53. Martin, R. and Sunley, P. (2006) Path Dependence and Regional Economic Evolution. 'Journal of Economic Geography.' 6(4), pp.395-437.
54. Asheim, B. and Isaksen, A. (2003) SMEs and the regional dimension of innovation. In Asheim, B., Isaksen, A., Nauwelaers, C. and Tödtling, F. (Eds) 'Regional innovation policy for small-medium enterprises.' London: Edward Elgar.
55. Mahroum, S., Huggins, R., Clayton, N., Pain, K. and Taylor, P. (2008) 'Innovation by Adoption: Measuring and Mapping Absorptive Capacity in UK Nations and Regions.' London: NESTA.
56. Huggins, R. (2008) The Evolution of Knowledge Clusters: Progress and Policy. 'Economic Development Quarterly.' Vol. 22, No. 4, pp.277-289.
57. Britton, J.N.H. (2004) High technology localization and extra-regional networks. 'Entrepreneurship and Regional Development.' 16(5), pp.369-90.
58. Sturgeon, T.J. (2003) What really goes on in Silicon Valley? Spatial clustering and dispersal in modular production networks. 'Journal of Economic Geography.' 3(2), pp.199-225.
59. Simmie, J. (2004) Innovation and clustering in the globalised international economy. 'Urban Studies.' 41(5/6), pp.1095-112.
60. Wolfe, D.A. and Gertler, M.S. (2004) Clusters from the inside and out: local dynamics and global linkages. 'Urban Studies.' 41(5/6), pp.1071-93.
61. Carlsson, B. (2006) Internationalization of innovation systems: a survey of the literature. 'Research Policy.' 35(1), pp.56-67, quote from p.65.

sourcing. The first argues that proximity is an important way to generate collaborative innovation. The second suggests that global connectivity is a more important stimulant of technological advancement. These two positions introduce an unnecessary divide between global and local forces; in reality, both forces operate in an overlapping manner. Successful global connectivity often follows localised interaction: the knowledge gained while crossing hallways and streets initially catalyses intellectual exchange and knowledge transfer that may later spread across oceans and continents.⁶³ Leading knowledge clusters are adapting their approaches to network building by seeking greater global connectivity or critical mass through consolidation with those nearby.⁶⁴

The cross-border sourcing of knowledge is also meshing previously independent national innovation systems into open, more interconnected international innovation systems.⁶⁵ This does not diminish the importance of localised network building as clusters are started. However, as the evolutionary process from genesis to renewal or demise becomes progressively shorter, new clusters need simultaneously to position themselves in global networks.

Part 3: A survey of the knowledge sourcing activities of UK companies

62. Glaeser, E.L., Kallal, H.D., Scheinkman, J.A. and Shleifer, A. (1992) Growth in cities. 'Journal of Political Economy,' 100(6), pp.1126-52.
63. Huggins, R. (2008) The Evolution of Knowledge Clusters: Progress and Policy. 'Economic Development Quarterly,' Vol. 22, No. 4, pp.277-289.
64. Le Bas, C. and Sierra, C. (2002) Location versus home country advantages. In R&D activities: some further results on multinationals' locational strategies. 'Research Policy,' 31(4), pp.589-609.
65. The full set of survey results and methodology are presented in the standalone report.
66. Respondents were asked to indicate the frequency with which they accessed a particular type of knowledge by choosing a point in a scale that ranges from 0 (never) to 10 (very often).
67. Bathelt, H., Malmberg, A. and Maskell, P. (2004) Clusters and knowledge: local buzz, global pipelines and the process of knowledge creation. 'Progress in Human Geography,' 28, pp.31-56.
68. Asheim, B. and Gertler, M. (2005) The Geography of Innovation: Regional Innovation Systems. In Fagerberg, J., Mowery, D.C. and Nelson, R.R. (Eds) 'The Oxford Handbook of Innovation.' Oxford: Oxford University Press, pp.291-317.
69. The respondent firms are divided into three groups by their sectors: manufacturing; services; and others. Respondent firms falling into the third category – mainly construction and a few in agribusiness – are a relatively small group accounting for only 3.8 per cent of the whole respondents.
70. Core regions cover: Eastern England; London, and the South East (i.e. regions GVA per capita above the UK average). Peripheral regions cover: the East Midlands; the North East; the North West; Northern Ireland; Scotland; the South East; Wales; the West Midlands; and Yorkshire and the Humber (i.e. regions with GVA per capita below the UK average).
71. Huggins, R. and Izushi, H. (2007) 'Competing for Knowledge: Creating, Connecting, and Growing.' London: Routledge.

This chapter presents and analyses some of the key findings from a survey of 393 companies in the UK, focusing on their knowledge sourcing activities.⁶⁶ This is followed by an analytical account of knowledge sourcing activity undertaken by the respondents – types of knowledge sourced, frequency of the use of various sources of knowledge, location of international sources of knowledge, and reciprocity of international knowledge sourcing networks. We also provide a further indicator of international sourcing – inputs purchased from overseas for innovation activity. The chapter then analyses the significance of strategic sources of knowledge; frequency of actor change in knowledge sourcing networks; inhibitors of knowledge sourcing; and the use of intermediary organisations, as means of shedding light upon whether the geographical location of respondent firms exerts an impact upon their knowledge sourcing practices, particularly international knowledge sourcing practices.

3.1 What types of knowledge do companies most frequently source?

Figure 2 shows the frequency with which knowledge is sourced from external sources by type of knowledge.⁶⁷ New technology is the most often sourced category, followed by access to professional information and intelligence. Access to scientific information and to research and development are among the least sourced categories.

Knowledge takes many different forms. One of the most familiar typologies suggests that it is either explicit or tacit. In general, explicit knowledge refers to information that can be

easily communicated between people through language, text, blueprints, operating manuals, codes or guidelines, whereas tacit knowledge – such as skills, competence, and talents – are more difficult directly to communicate to someone else in a verbal or other symbolic form. Codified knowledge is usually considered to be relatively less sensitive to space than tacit knowledge.⁶⁸ Its ready communication formats, supported by lower transport costs and improved communications, make it accessible from afar: someone can easily order a manual or download a programme. These transport and communication changes have not only increased access to codified knowledge, they have made it less important as a source of competitive advantage. Tacit knowledge, on the other hand, is considered not to travel well, making proximity to the source more important.⁶⁹

There are significant differences in the frequency with which firms can source scientific information and professional information and intelligence – explicit knowledge – across economic sectors.⁷⁰ Whereas manufacturing firms look for scientific information most frequently, service firms are most likely to seek professional information and intelligence (Figure 3). Similarly, firms in the peripheral regions are more likely than those in core regions to seek market or competitor intelligence more frequently, whereas those in the core regions are more likely to source scientific information.⁷¹ The peripheral region firms source knowledge at conferences, trade fairs and exhibitions in their own region more often than firms in the core regions. But the former also source knowledge from universities, commercial labs or private R&D institutes elsewhere in the UK less frequently than their

Figure 2: Frequency of knowledge sourcing by types of knowledge

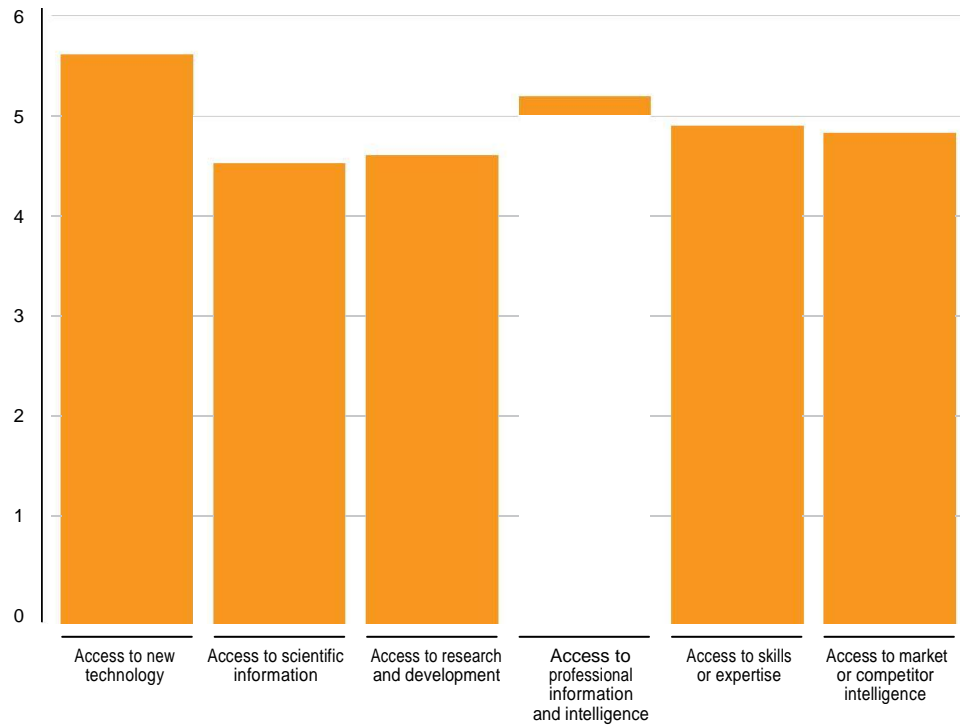


Figure 3: Sector and the frequency of knowledge sourcing by types of knowledge

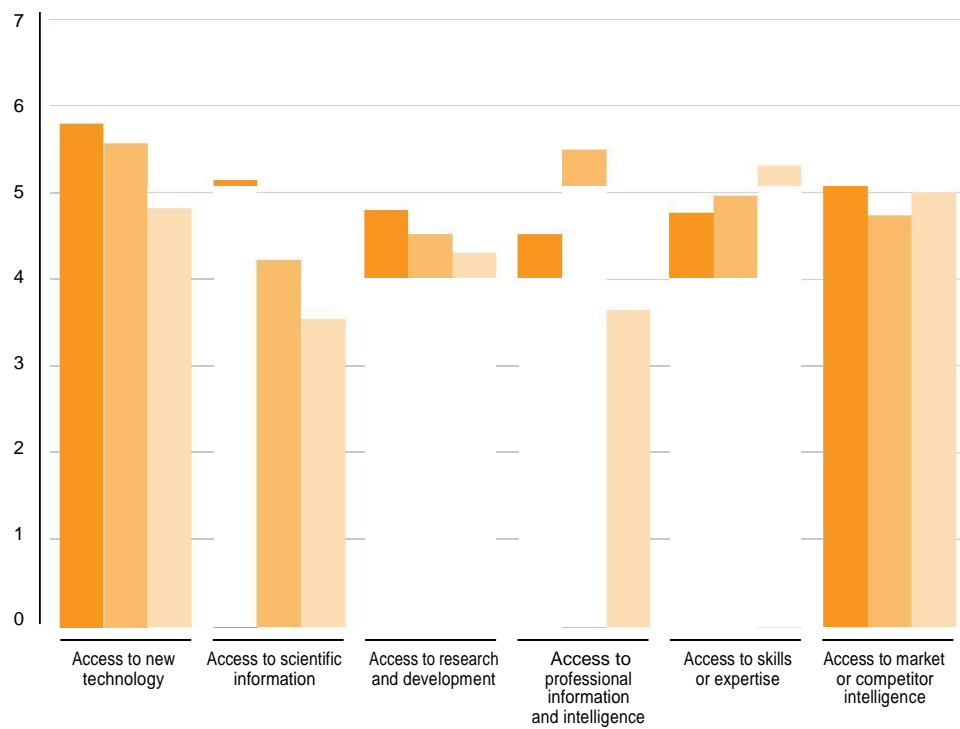
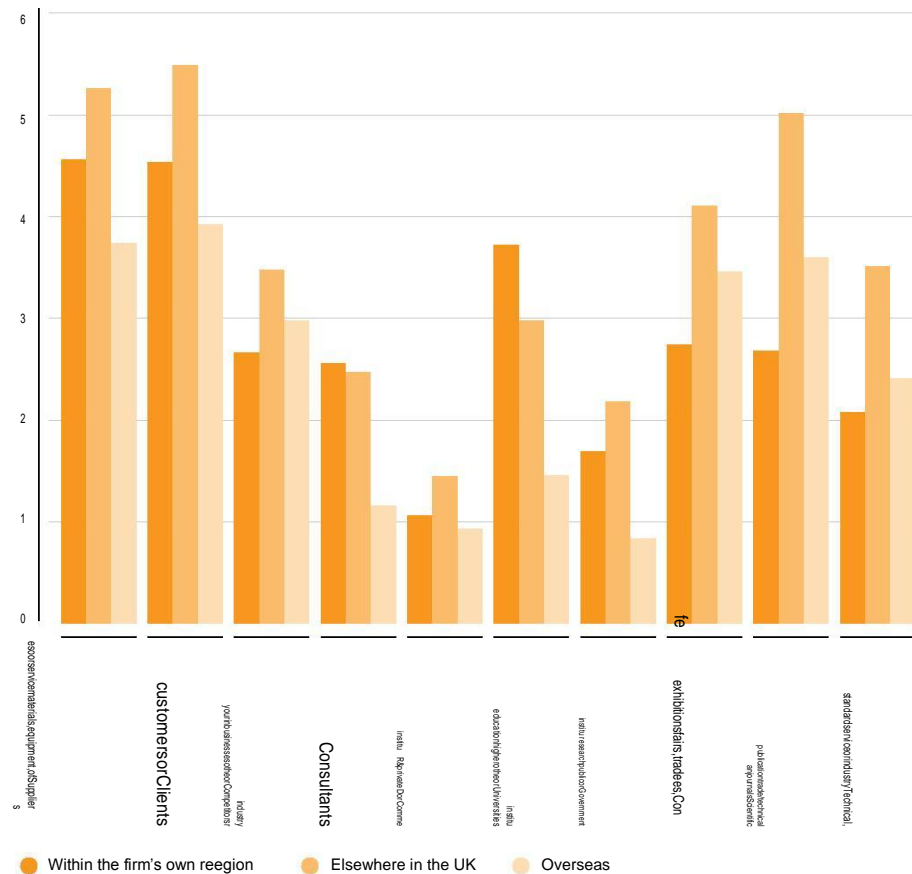


Figure 4: Frequency of knowledge sourcing by types of external sources and their locations



core region counterparts. This may explain their less frequent sourcing of scientific information.

Figure 4 shows the frequency of knowledge sourcing by types of external sources and their locations. The locations of external sources are grouped into three categories: 'within the respondent firm's own region', 'elsewhere in the UK', and 'overseas'. Sources from 'elsewhere in the UK' are most frequently accessed for all types of knowledge provider, apart from consultants. This is at odds with the recent government emphasis on regional clusters for learning and competitiveness. Indeed, overseas sources are also more frequently accessed than regional sources for scientific journals and trade/technical publications; conferences, trade fairs, exhibitions; competitors or other businesses in the same industry; and technical, industry or service standards. Universities or other higher education institutions are the only sources frequently accessed in firms' home regions.

There are some notable differences between manufacturing and service firms. Service providers source knowledge from sources

within their own region more frequently than manufacturing firms, including from competitors, consultants, government or public research institutes, conferences, trade fairs and exhibitions. Manufacturing firms are more active knowledge seekers overseas and are more likely than service sector firms to engage with suppliers of equipment, materials, services or software, clients or customers, or to attend overseas conferences, trade fairs and exhibitions.

For small firms in particular, markets served by manufacturing firms are often more global than service firms. This encourages manufacturing firms to stay in touch with overseas clients and to attend conferences or trade fairs. Similarly, their more active knowledge sourcing from overseas suppliers of equipment, materials, services or software probably indicates more global networks of upstream supply chains. As for domestic sources outside the respondent's own region, manufacturing firms source knowledge more frequently from suppliers of equipment and universities, whereas service firms source knowledge more frequently from competitors or other businesses in the respondent's own industry.

Figure 5: Continental blocs listed as main locations for international knowledge sourcing

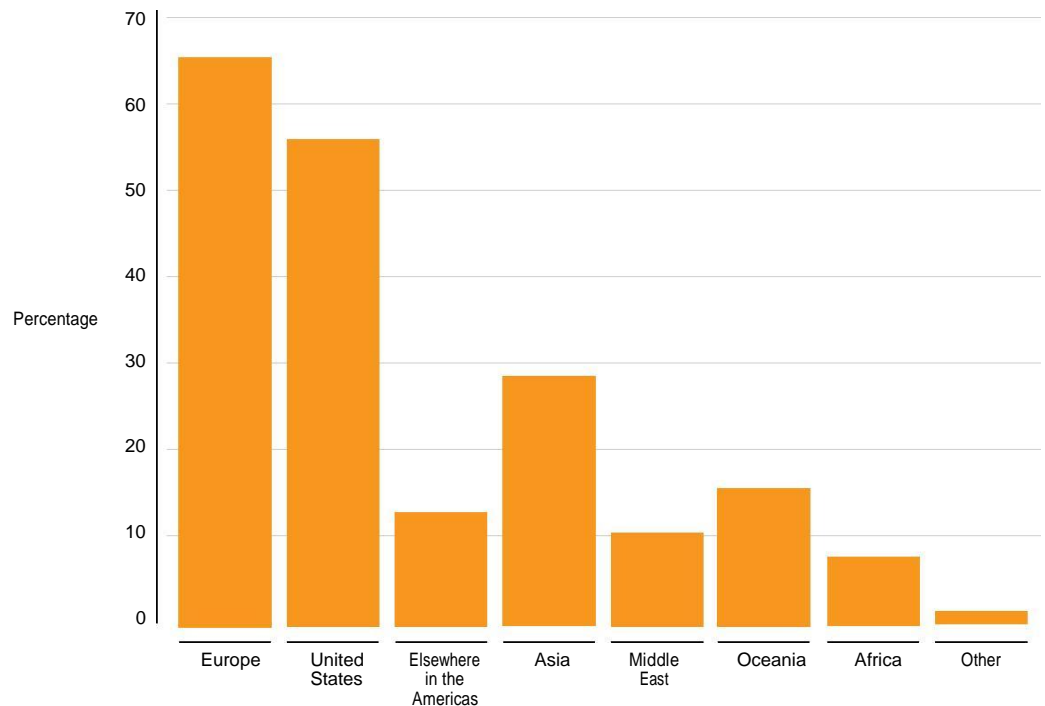


Figure 5 shows the key continental blocs that constitute the main international knowledge sources. Europe is most important – nearly two-thirds (65.1 per cent) of firms list countries in Europe, followed by the United States (US) (55.7 per cent) and Asia (28.8 per cent). Overall, manufacturing firms access more countries than other firms.

As part of the process of global network building in advanced economies, new knowledge centres and clusters are quickly developing in Asian cities and regions including Bangalore, Hyderabad and Mumbai in India, and Beijing, Guangzhou, Hangzhou, Nanjing and Shanghai in China.⁷² Much of Asian development, especially that in China and India, has been attributed to the shift of traditional manufacturing and low value added service sector activities from the western world. Less attention has been paid to the emergence of these nations and their regions as knowledge-intensive locations or to the patterns of knowledge-based growth that are emerging.

Figure 6 shows the percentages of those respondent firms naming the four fast-growing development economies known as the BRICs as a main location for international knowledge sourcing. Of the four, China ranks first, chosen

by 13.2 per cent of respondents, with only 6.4 per cent citing India. On the whole, however, the main locations are in developed economies particularly older European Union members and the US.

3.2 Strategic partnerships

Strategic alliances between firms are often used to source knowledge and ideas. These can take the form of formalised collaboration and joint ventures, or other 'contracted' relationships resulting in frequent and repeated interaction. Firms gain competitive advantage from alliances by accessing the resources of their alliance partners. This means that a firm's potential competitive advantage is dependent on what resources its partners are able to share.⁷³

Respondents were asked how often they accessed knowledge from strategic and non-strategic partners (Figure 7).⁷⁴ Strategic partners came out on top. The mean average for strategic partners is 6.2 (where 10 is the maximum) and the mean average for non-strategic partners is 4.9. The greater frequency of contact with strategic partners is likely to lead closer relationships with them,

72. Ireland, R.D., Hitt, M.A. and Vaidyanath, D. (2002) Alliance management as a source of competitive advantage. 'Journal of Management.' 28, pp.413-446.

73. 'Strategic partners' are defined as 'knowledge sources which the company strategically seeks to maintain and develop' and 'non-strategic partners' are 'knowledge sources which the company does not strategically seek to maintain and develop'. The respondents were asked to indicate the frequency of knowledge sourcing by choosing a point in a 1-10 scale where 0 is 'never' and 10 is 'very often'.

74. Cowan, R., Jonard, N. and Zimmerman, J.-B. (2004) 'Networks as emergent structures from bilateral collaboration.' Maastricht: Maastricht Economic Research Institute on Innovation and Technology.

Figure 6: Four fast-growing development economies as main locations for international knowledge sourcing

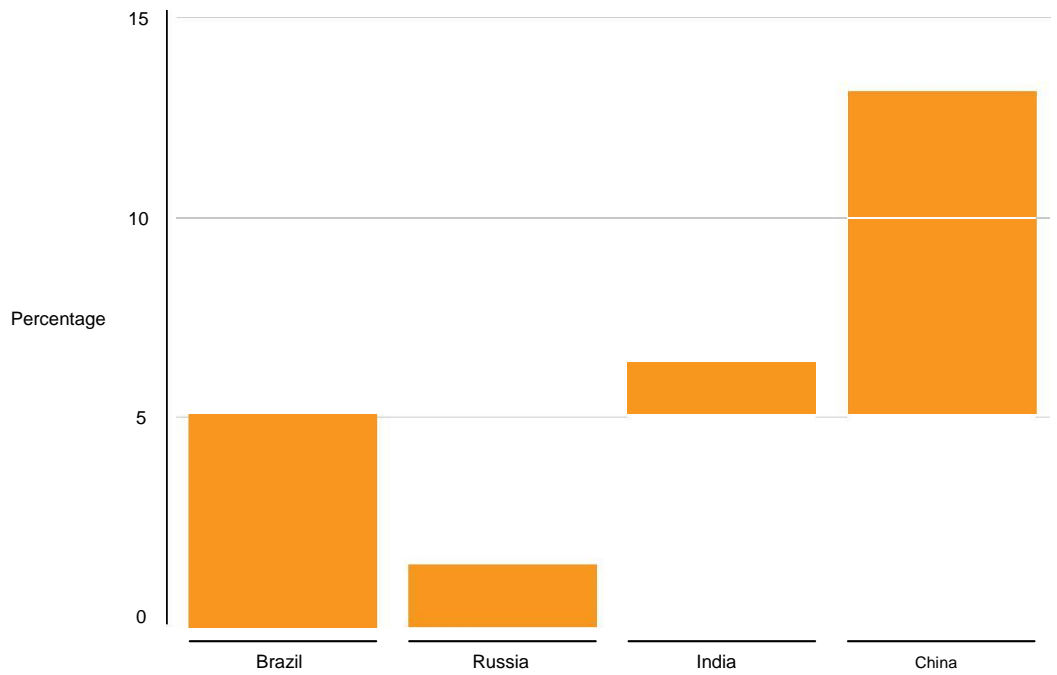


Figure 7: Frequency of access with strategic partners and non-strategic partners

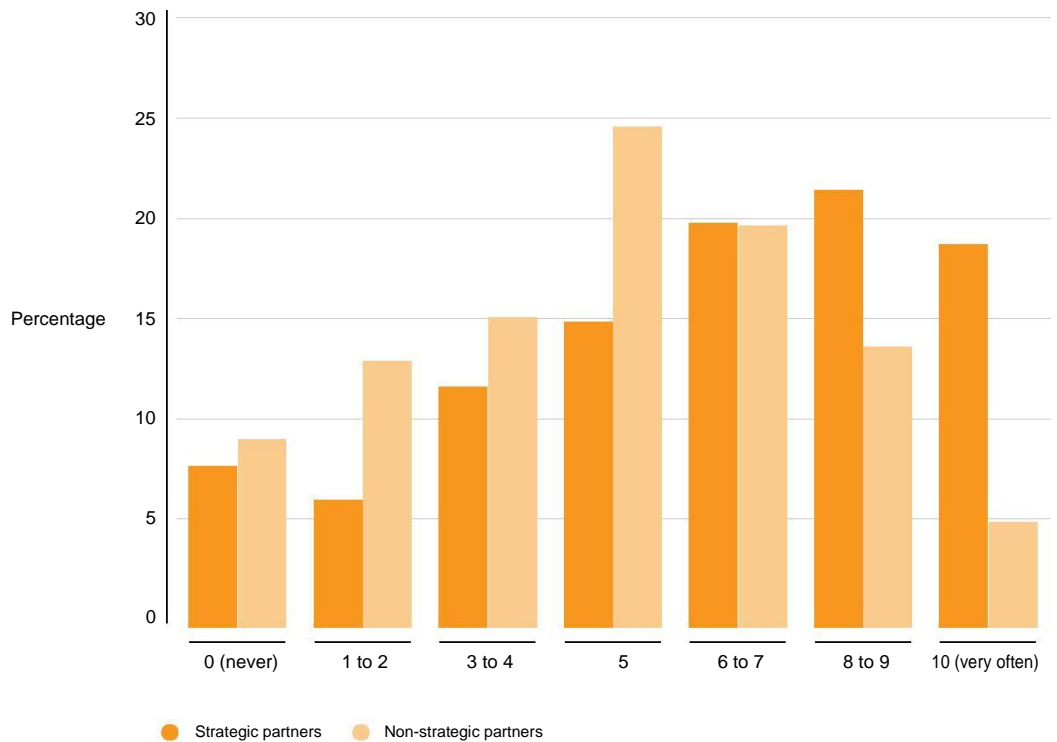
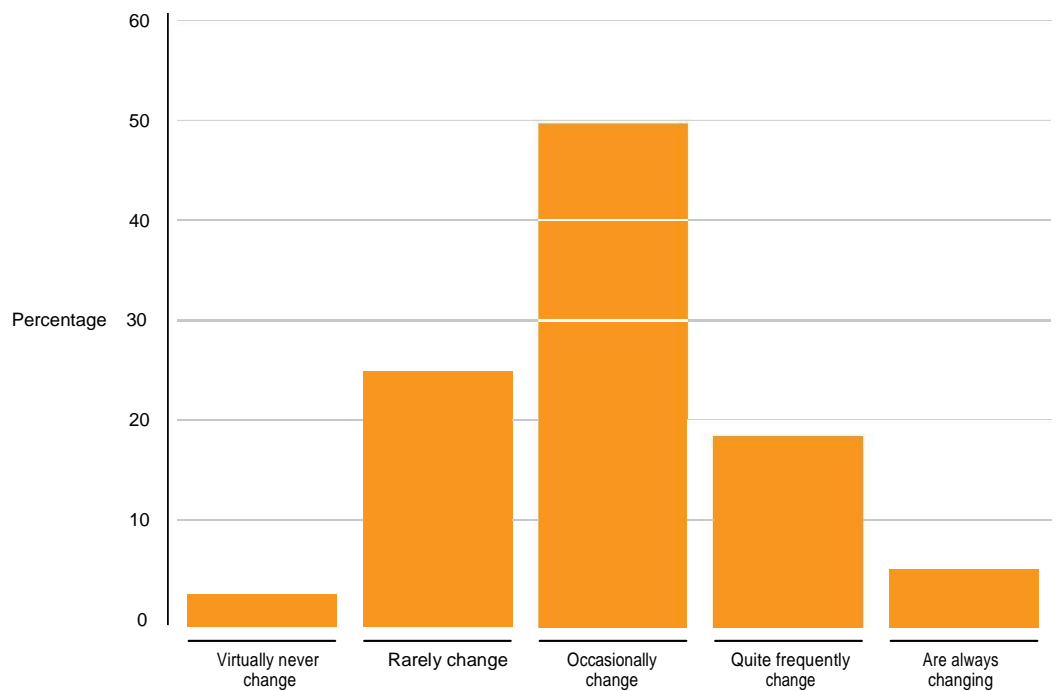


Figure 8: Frequency of change in the organisations from which knowledge is sourced



75. Arthur, B. (1989) Competing technologies and lock-in by historical events: the dynamics of allocation under increasing returns. 'Economic Journal.' 99, pp.116-131.

76. Again, they chose a point on a 1-10 scale where 0 is 'never' and 10 is 'very often'.

77. The frequency of use is expressed by a point in a 0-10 scale where 0 is 'never' and 10 is 'very often'.

78. The mean average scores are 3.2, 2.9, and 2.2 for access to knowledge in the respondent's region, elsewhere in the UK, and overseas respectively. The differences between the three areas are statistically significant.

79. Mahroum, S., Huggins, R., Clayton, N., Pain, K. and Taylor, P. (2008) 'Innovation by Adoption: Measuring and Mapping Absorptive Capacity in UK Nations and Regions.' London: NESTA; Hitchens, D.M.W.N., O'Farrell, P.N. and Conway, C.D. (1996) The competitiveness of business services in the Republic of Ireland, Northern Ireland, Wales, and the South East of England. 'Environment and Planning A.' 28(7), pp.1299-1313.

which in turn facilitates even more frequent engagement. Yet, more informal interaction may result in more dynamic knowledge sources than formal partnerships, as firms continually update and change their contacts.

And not all strategic knowledge networks are stable. For instance, existing knowledge networks may become redundant once firms acquire similar knowledge profiles.⁷⁵ As firms become increasingly familiar with each other's knowledge, negative network effects may emerge, locking firms into the network and stifling the creation of new knowledge and innovation.⁷⁶ Respondents were asked if the organisations from which they source knowledge change or remain mainly the same (Figure 8). Only 25 per cent say their networks virtually never or rarely change. Half the firms say that their networks occasionally change, and a further 24 per cent report frequent or constant change, suggesting significant evolution.

Respondents were also asked how often overseas companies source knowledge from them⁷⁷ (Figure 9). 16.8 per cent of firms never act as a source of knowledge for companies outside the UK while 83.2 per cent of firms do so on some occasions, with 9.1 per cent doing so very often.

3.3 The use of intermediary organisations

In the UK, intermediary organisations are often set up by government or collective bodies of private-sector firms to support companies and particularly SMEs in their knowledge sourcing. Respondents were asked how often they use 'intermediary organisations' (either in the form of business support organisations or other companies that act as an intermediary) to access knowledge. Three geographical areas are considered – accessing knowledge in the respondent firm's own region, elsewhere in the UK, and overseas⁷⁸ (Figure 10).

Nearly three-quarters of respondents (72.8 per cent) use intermediary organisations to access knowledge in their own region. The frequency with which they do so varies. The proportion drops to 69.9 per cent when asked if they use intermediaries to access knowledge elsewhere in the UK and to 53.7 per cent if they seek knowledge overseas.⁷⁹

The frequent use of local intermediaries may explain why firms often engage with local universities (Figure 4). Yet, cost aside, firms often consider the knowledge available in their own region is poor. And while universities possess good technological knowledge, they

Figure 9: Frequency of acting as a source of knowledge for companies outside the UK

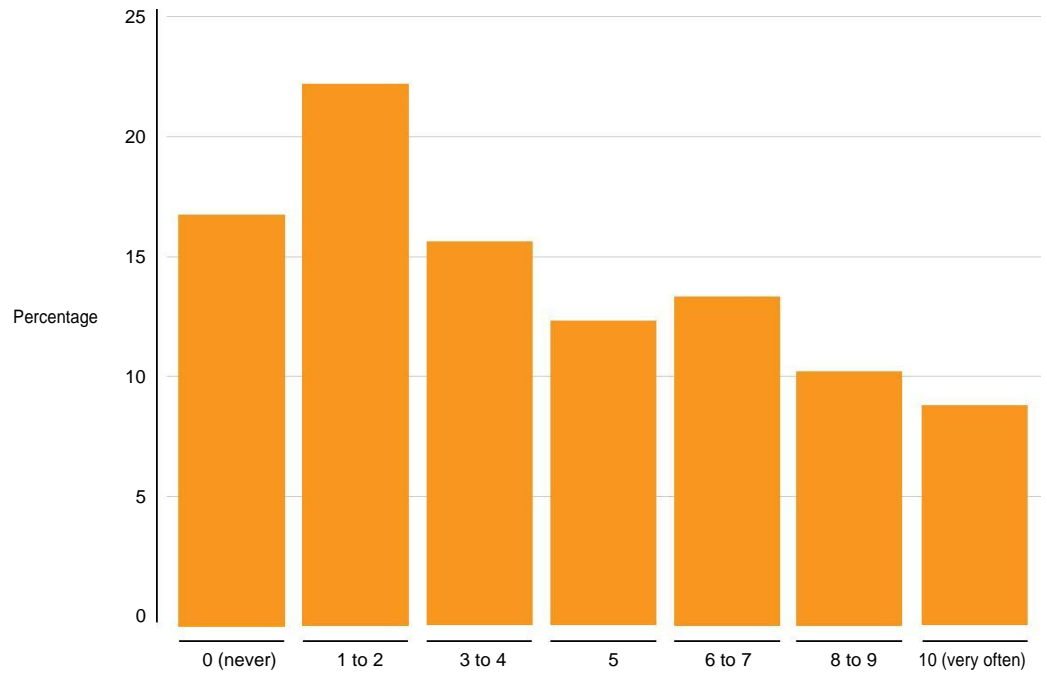


Figure 10: Frequency of the use of intermediary organisations

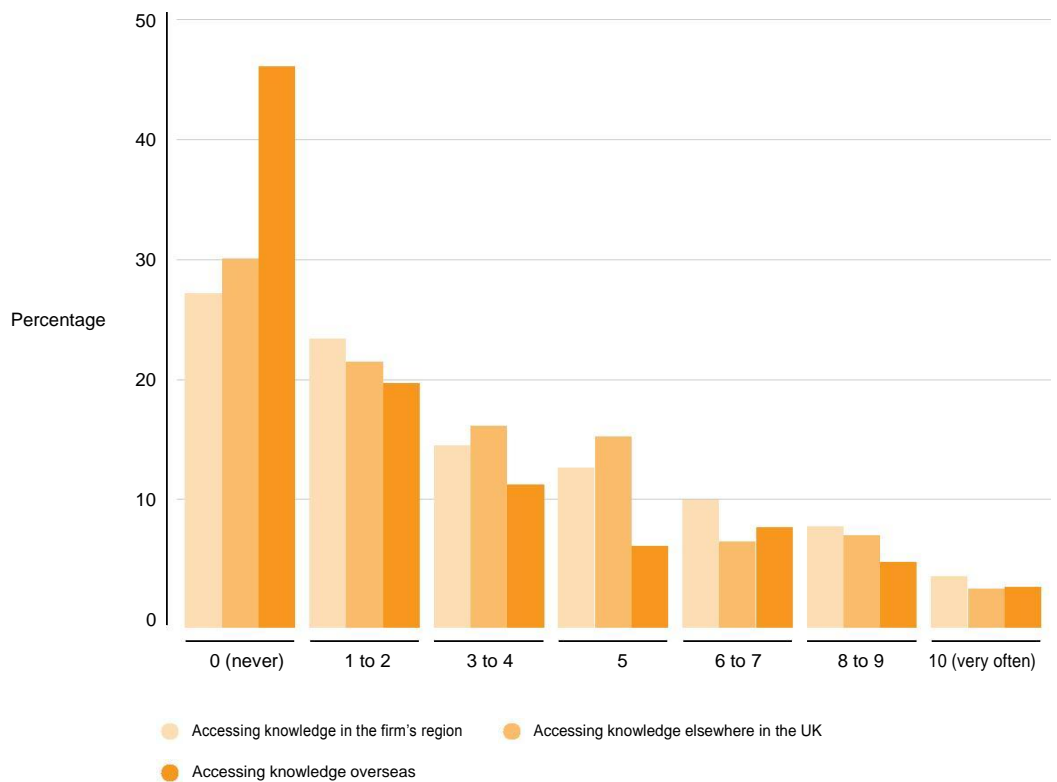
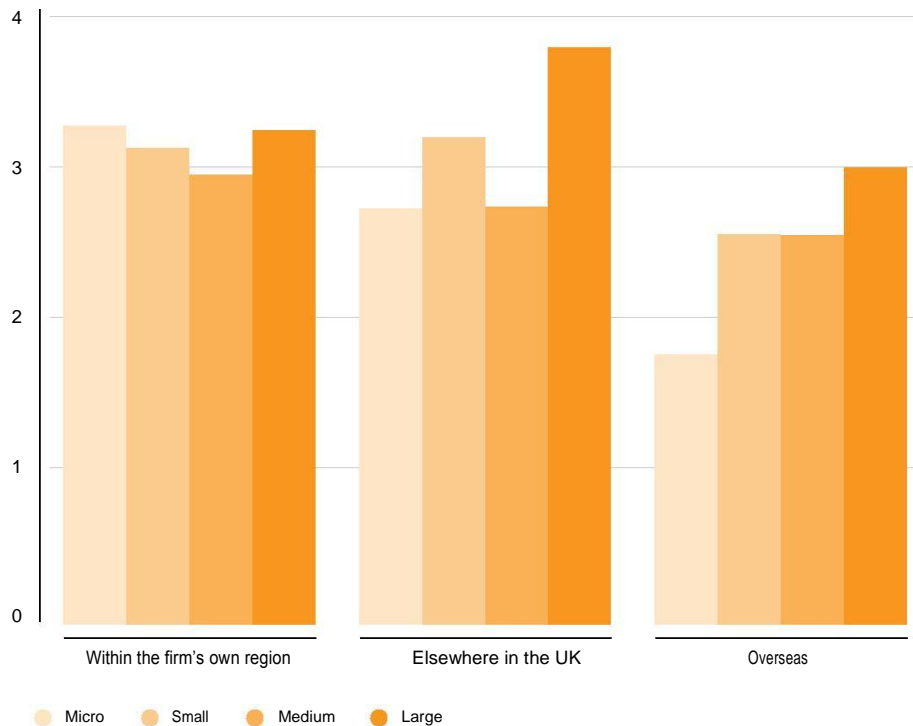


Figure 11: Frequency of use of intermediary organisations



80. For rating, we used a 0-10 scale where 0 is 'not a barrier' and 10 is 'a very significant barrier'.

81. Leonard-Barton, D. (1995) 'Wellsprings of Knowledge: Building and Sustaining the Source of Innovation.' Boston, MA: Harvard Business School Press.

are often seen as hard to reach. There have been a range of initiatives by government, RDAs, business and university organisations to develop greater collaboration between higher education and companies, often through intermediaries. Given the dearth of other good local knowledge available, respondents are likely to use these local intermediaries to access universities.

In part reflecting their keener recognition of barriers to knowledge sourcing, respondent firms in peripheral regions use intermediaries more often than their counterparts in the Greater South East. Other studies have argued that the least competitive and most peripheral regions are usually less well endowed with high quality private sector business service providers, and are therefore more likely to turn to public sector intermediary support.⁸⁰

When comparing companies by size, there are significant differences – larger firms are more likely to use intermediaries, whereas there is no significant difference in the extent to which they access knowledge in their own region or elsewhere in the UK (Figure 11).

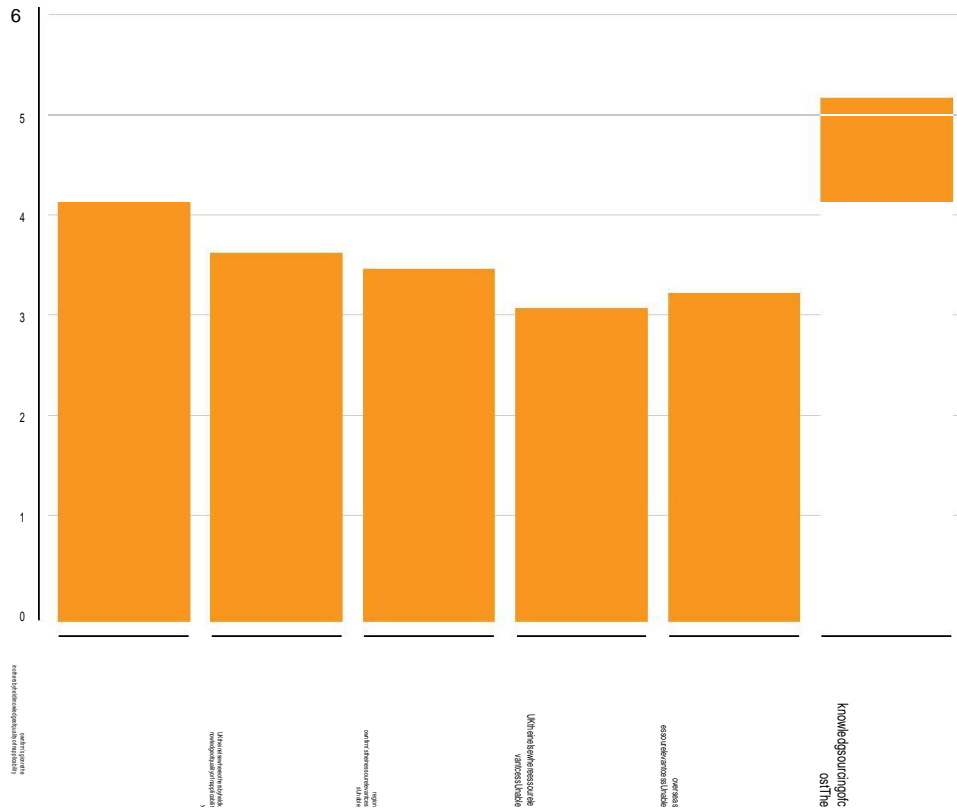
3.4 Barriers to knowledge sourcing

Barriers to developing new sources of knowledge include cost and the inappropriate or poor quality of available knowledge. These inhibitors may vary by the geographical distance of sources from those seeking to access them. The respondents were asked to rate the significance of a range of barriers⁸¹ (Figure 12). The cost of sourcing knowledge is considered the most significant barrier followed by inapplicability or quality of knowledge in the respondent's region and inapplicability or quality of knowledge elsewhere in the UK. Non-monetary barriers to accessing relevant sources (particularly elsewhere in the UK) are less significant. Small and large firms feel the same. However, when analysed on a regional basis, firms in peripheral regions of the UK consider all the barriers more significant than do their counterparts in the Greater South East.

3.5 Innovation, competitiveness and absorptive capacity

Firms often continuously build a portfolio of external sources of knowledge, and repeat

Figure 12: Barriers to knowledge sourcing



82. Defined as the introduction of new or adapted products, processes, services, or organisational methods.

83. Mahroum, S., Huggins, R., Clayton, N., Pain, K. and Taylor, P. (2008) 'Innovation by Adoption: Measuring and Mapping Absorptive Capacity in UK Nations and Regions.' London: NESTA.

84. For example, see Commission of the European Communities (1994) 'Research and Technology Management in Enterprises: Issues for Community Policy.' Brussels: Office for Official Publications of the European Communities.

the cycle of learning about new, unfamiliar sources outside their own technological area. Dorothy Leonard-Barton suggests that high performers keep up a consistent, continuous relationship with knowledge sources of all types.⁸² The respondents were asked to rate the contributions of knowledge sourcing practices⁸³ to innovation and competitiveness. Figures 13 and 14 show the results. The responses to the two questions are almost identical. Six in ten firms consider their knowledge sourcing practices to be either significantly or extremely helpful, whereas a very small minority see the practices as no help. This supports existing evidence suggesting that external knowledge sources improve the innovative performance of businesses.⁸⁴

The great majority of the respondents are actively innovating. Respondents were queried as to the innovations they had introduced in the three years prior to the survey. In this question, innovations were divided into three types: 'new or significantly improved goods or services (e.g. in quality, user friendliness, timelines)', 'new or significantly improved methods for the production or supply of goods and/or services', and 'new or significantly

improved forms of organisation, business structures or practices aimed at improving competitiveness'. Figure 15 shows the number of product innovations – new or significantly improved goods or services – that respondent firms had introduced in the previous three years. Those firms that produced no product innovations represent a small minority – 7.2 per cent of the total.

Figure 16 shows the number of process innovations – new or significantly improved methods for the production or supply of goods and/or services – introduced in the previous three years. Those firms that had not introduced any process innovation amounted to 22.9 per cent of respondents.

Figure 17 shows the number of organisational innovations introduced in the previous three years. The mean average is 2.5 and the median is one single innovation. Organisational innovations are often hard to implement when they require a change in the organisational culture. Despite this, nearly two-thirds of the respondents introduced one or more organisational innovations.

Figure 13: Contribution of knowledge sourcing practices to innovation

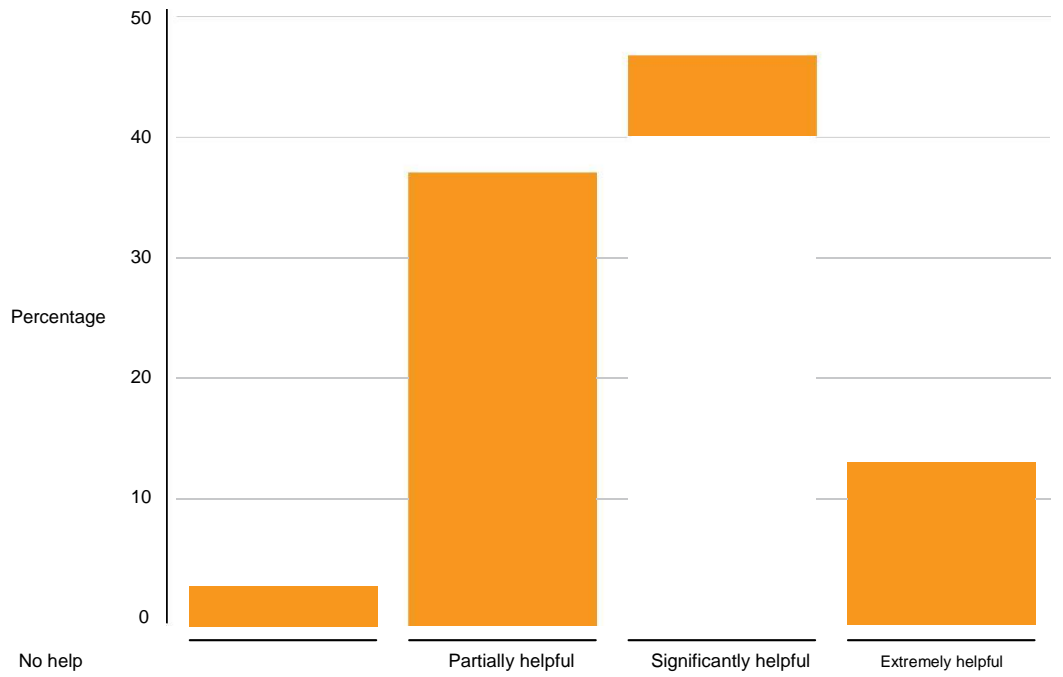


Figure 14: Contribution of knowledge sourcing practices to competitiveness

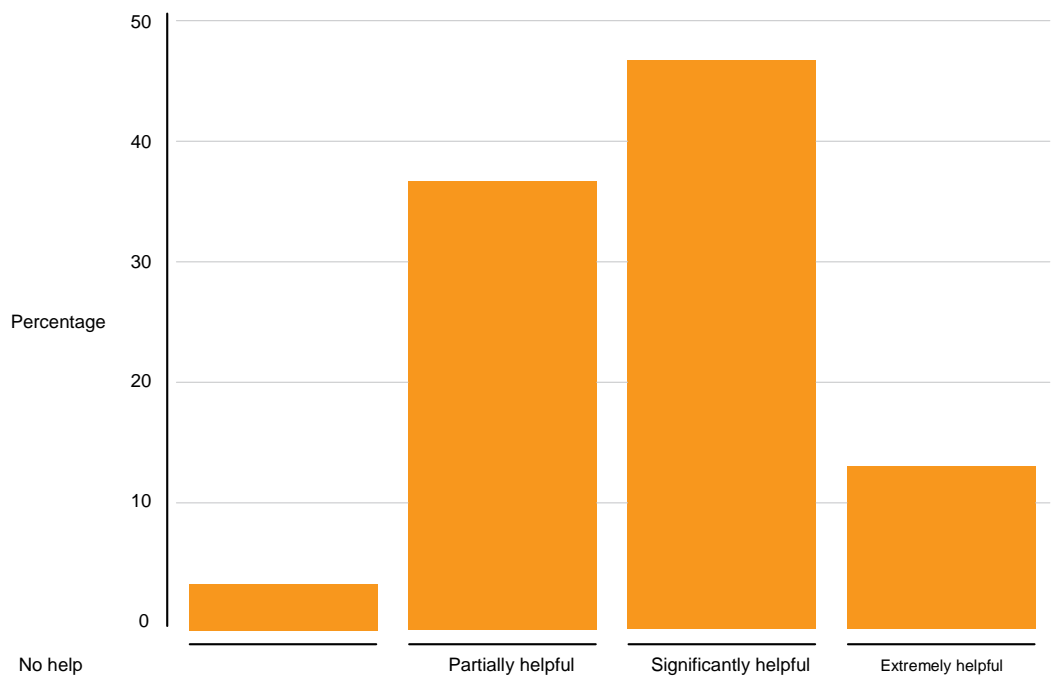


Figure 15: Number of new or significantly improved goods or services introduced in the last three years

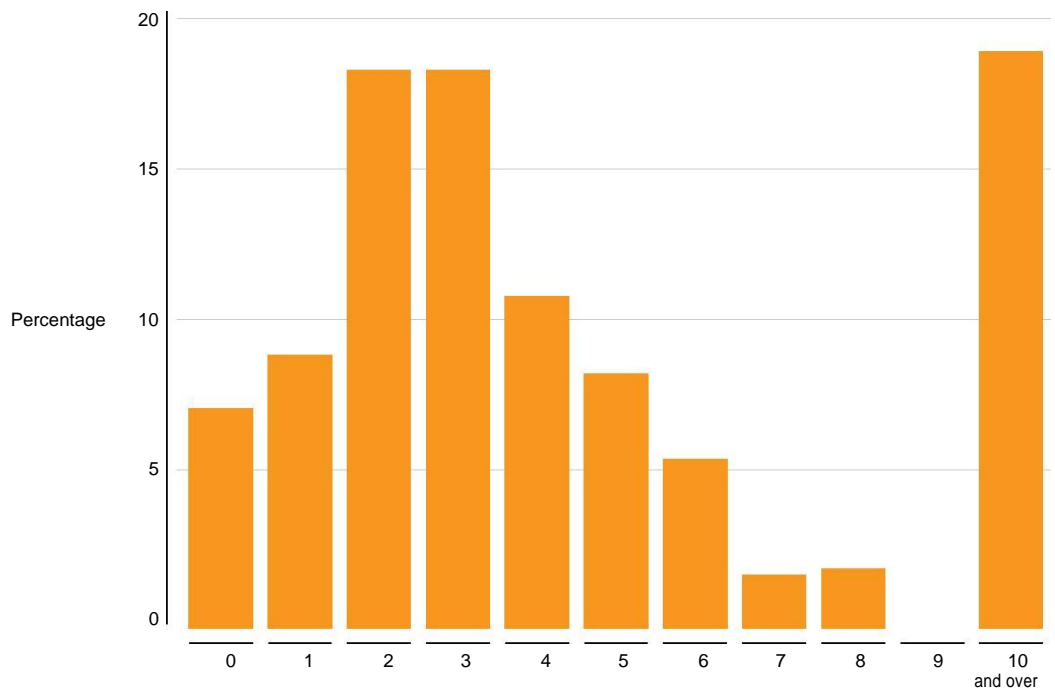


Figure 16: Number of new or significantly improved methods introduced in the last three years for the production or supply of goods and/or services

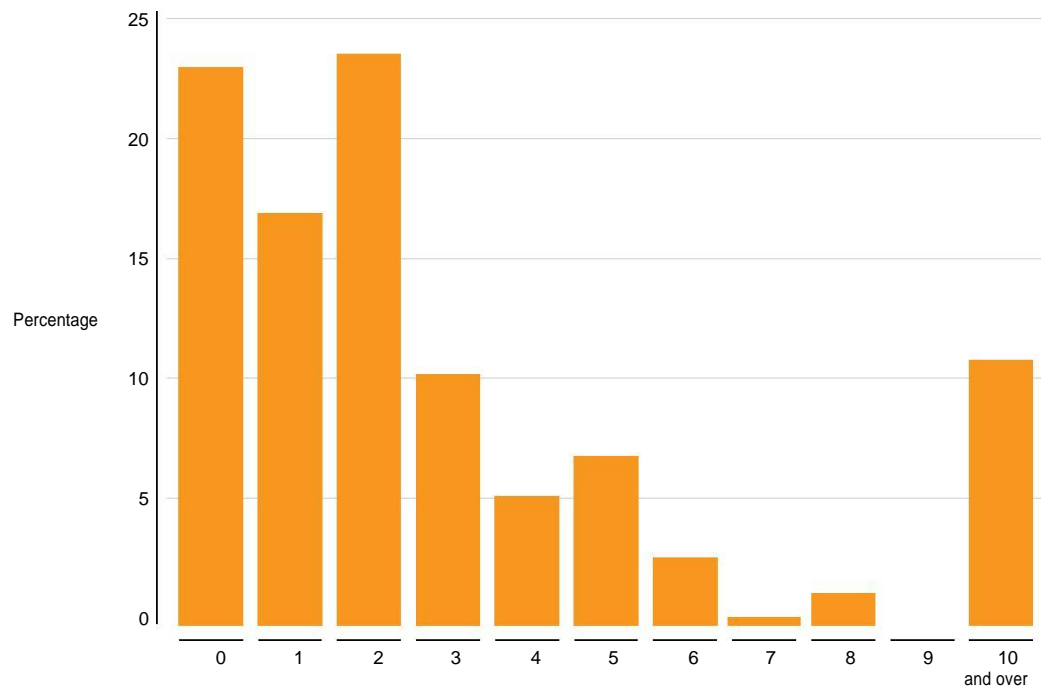


Figure 17: Number of new or significantly improved, competitiveness-enhancing forms of organisation, business structures or practices introduced in the last three years

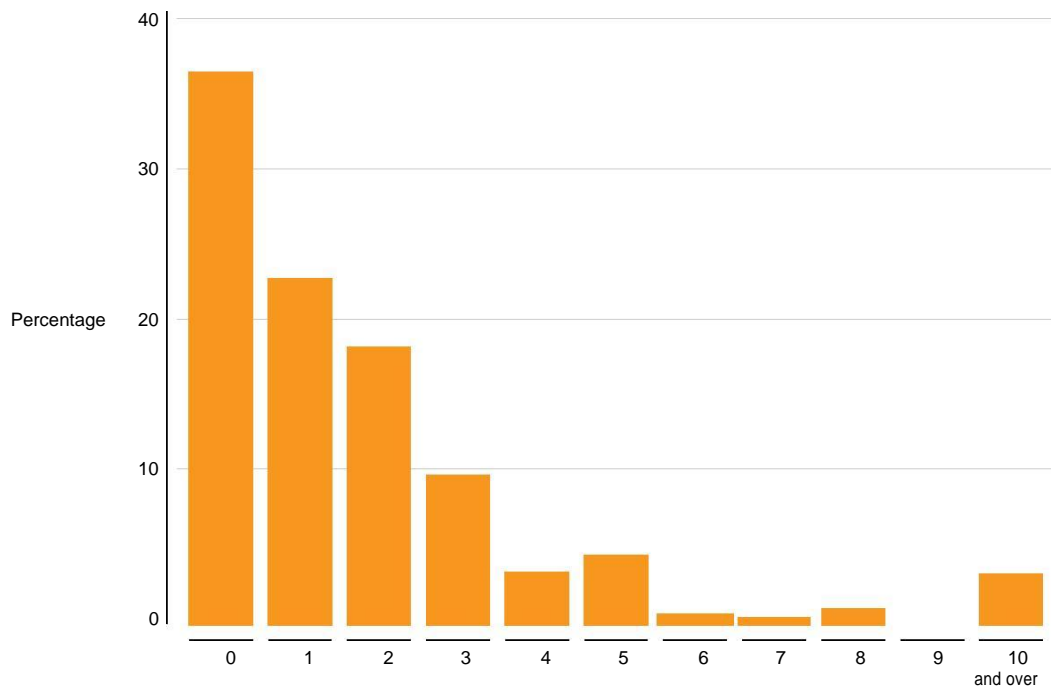
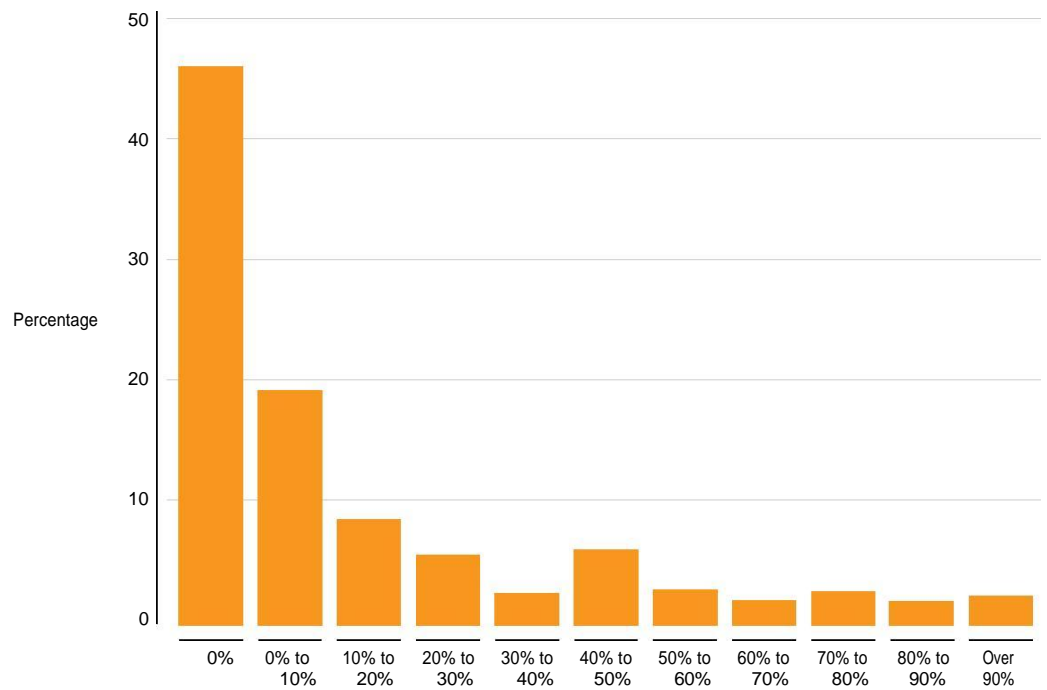


Figure 18: Value of inputs sourced from overseas as percentage of the purchased inputs for innovations made in the last three years



Knowledge is one of the inputs for innovation, coming in a variety of forms such as skills of individuals, education and training, and technology embodied in hardware and software. The above indicators of knowledge sourcing measure the importance of knowledge sources by the frequency of use. To complement this, we asked the respondents about the value of innovation inputs sourced from overseas (Figure 18). Over half the respondents (53.7 per cent) bought some inputs for innovations from overseas, with 11.4 per cent of the respondents buying over half their purchased inputs for innovation overseas. Overall, manufacturing firms source the greatest percentage of innovation inputs from overseas, followed by firms in the service sectors.

We now compare the nature of the knowledge practices undertaken by the more innovative and competitive firms with those adopted by poorer performers. The survey's respondents are divided into two groups in their performance of innovations and competitiveness – the number of product, process and organisational innovations introduced in the previous three years and the change in turnover in that period.

The types of knowledge sourced – although no significant differences are found in the frequency of sourcing the seven types of knowledge examined and the generation of product innovations, significant positive differences are found for the generation of both process and organisational innovations. Firms in the above-average group of innovators source new technology, research and development, skills or expertise (process innovations) and professional information and intelligence, skills or expertise, and market or competitor intelligence (organisational innovations) more frequently than poorer performers. Firms in the higher turnover growth group source new technology, scientific information, and research and development more frequently (Figure 19) than those with lower growth.

The frequency of sourcing by types of sources – the above-average groups for product and process innovations both source knowledge more frequently than their below-average counterparts from suppliers of equipment, materials, services or software, clients or customers (in all three geographical areas), and competitors or other businesses in the respondent's industry (within the respondent's own region and elsewhere in the UK).

The location of international sources of knowledge – the above-average groups for product innovations and turnover/sales growth source knowledge from significantly more countries than their below-average counterparts. No significant difference is found in the comparisons with process and organisational innovations.

Reciprocity of international knowledge sourcing – the above average product and organisational innovators and those firms with high sales growth act as a source of knowledge for companies outside the UK more frequently than their below-average counterparts. In general, the more innovative or the faster growing a firm is, the more likely it is to act as a source of knowledge for overseas companies.

International sourcing of inputs for innovation activity – similarly, significant positive differences are found between the above-average and below-average groups for product innovations, organisational innovations and changes in turnover, and the percentage of the new or improved goods, services, methods or organisational changes bought overseas. In short, the more innovative or fast growing a firm is, the greater proportion of innovation inputs it is likely to have bought from overseas.

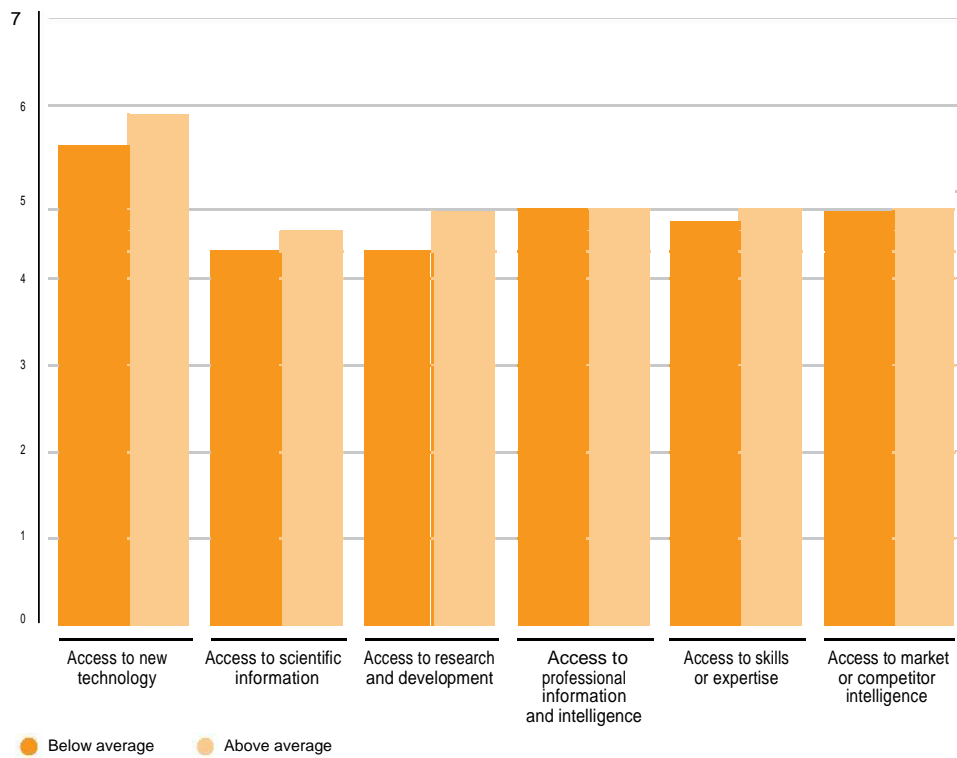
Development of Knowledge Sourcing Networks – the above-average groups for product, process, and organisational innovations access their strategic partners more frequently than their below-average counterparts. The same pattern is found in the frequency with which they access non-strategic partners.

The use of intermediary organisations – the above-average product innovators use intermediary organisations more frequently when sourcing overseas knowledge whilst the above-average organisational innovators use intermediary organisations more frequently when sourcing knowledge within their own region or the UK.

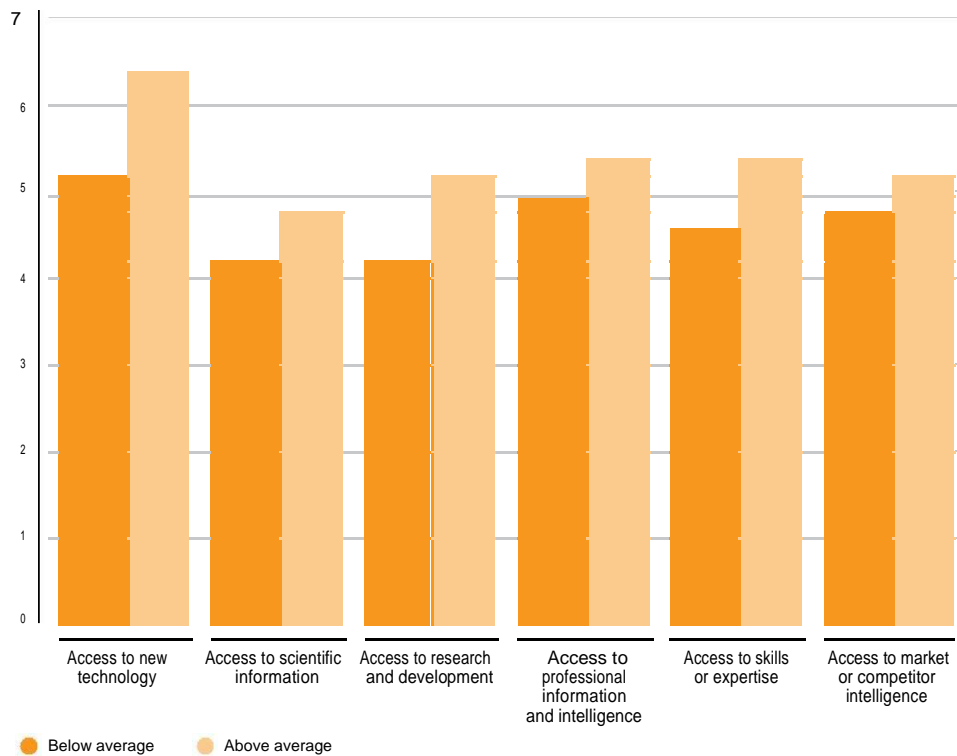
Overall, the comparisons of knowledge sourcing practices between the two groups for the four performance indicators reveal a number of differences, and provide some evidence of the association between international knowledge sourcing and a firm's levels of innovation and growth. Better-performing firms tend to be more active in accessing knowledge as shown in their frequent sourcing of new technology, skills or expertise and their accessing a greater range of sources at different locations. Better-performing firms

Figure 19: Frequency of knowledge sourcing by types of knowledge – comparisons of above-average and below-average groups by four performance indicators

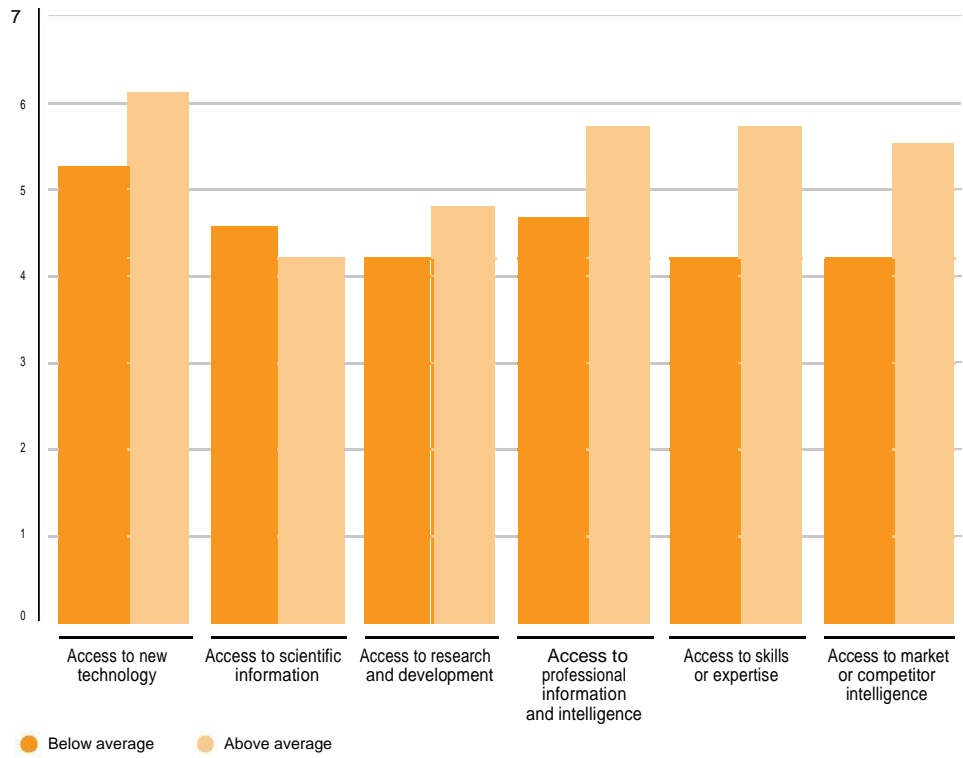
Comparison by product innovations



Comparison by process innovations



Comparison by organisational innovations



Comparison by changes in turnover/sales

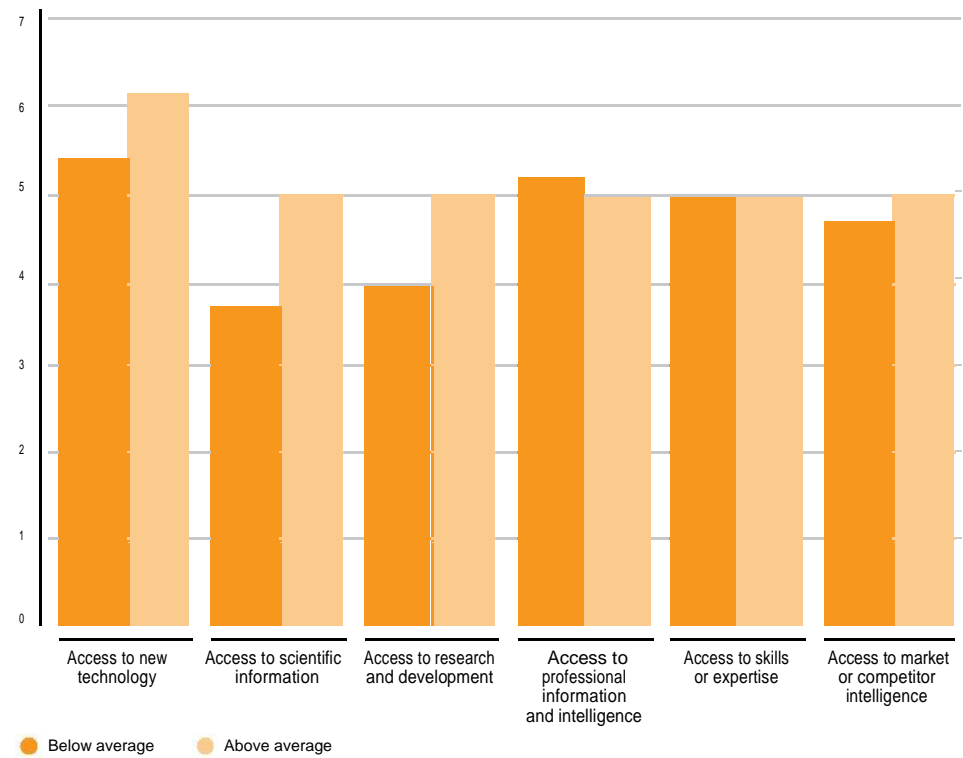
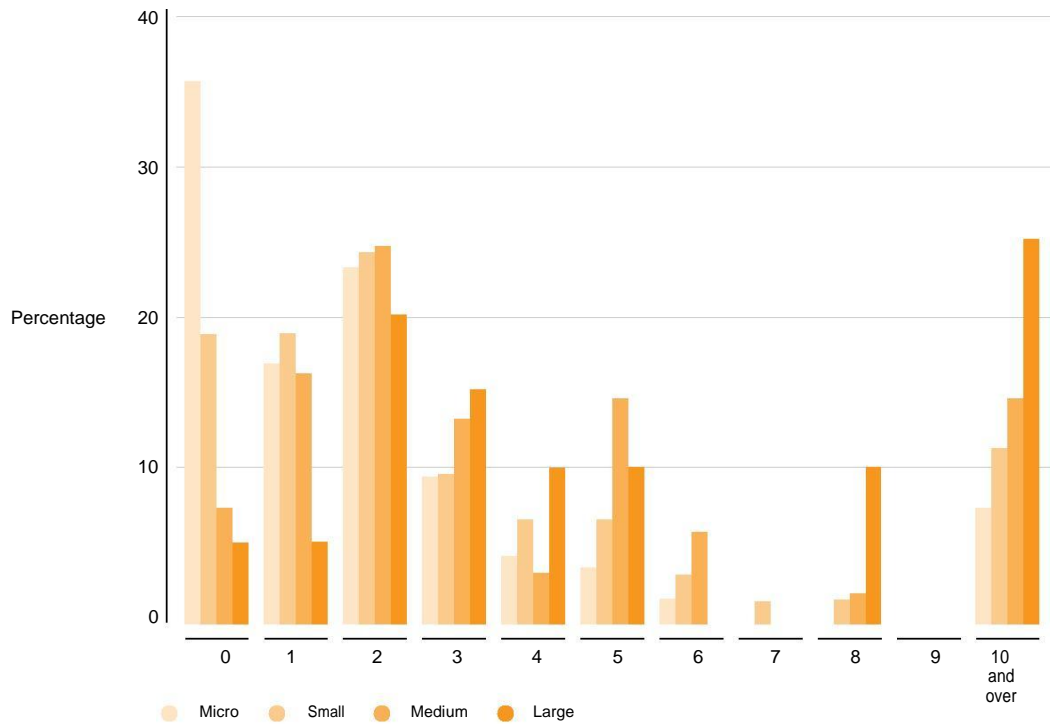
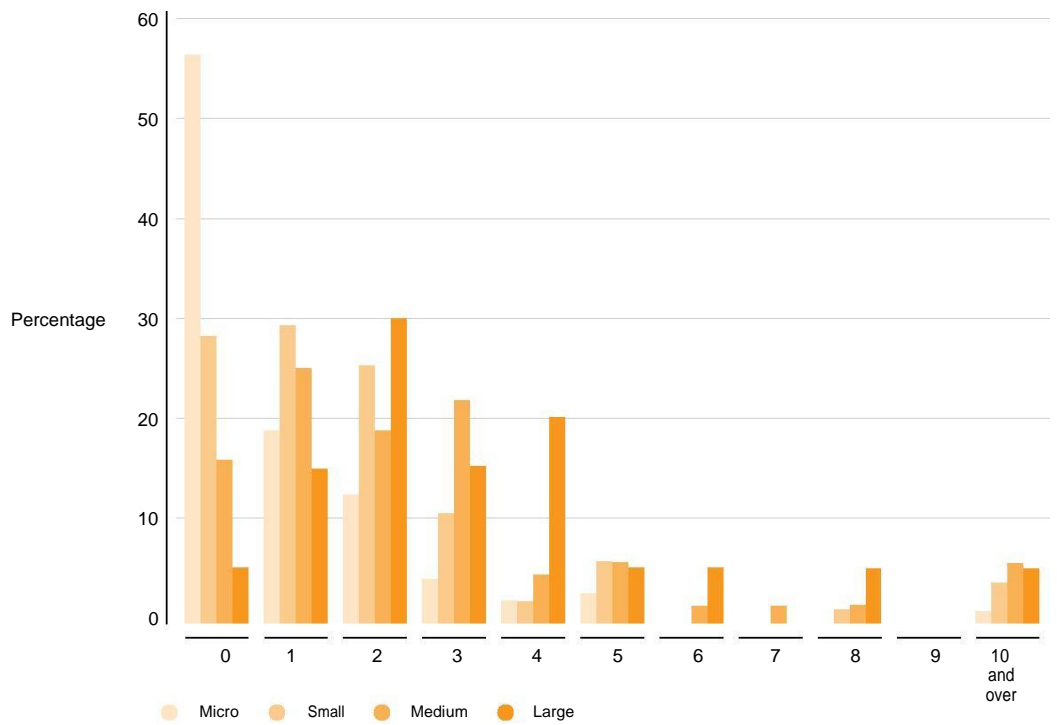


Figure 20: Number of innovations introduced in the last three years

(a) Product innovations



(a) Process innovations



also source knowledge more often from their network partners.

We are particularly struck by the more active involvement of better-performing firms in two-way flows of knowledge exchange with overseas sources. Better-performing firms have sources of knowledge in more countries, though mainly in Europe, the US, and Asia. They also act as a source of knowledge for companies outside the UK more frequently. This international orientation of knowledge sourcing appears to be motivated by a stronger recognition of the barriers to knowledge sourcing within their own region. Furthermore, these cross-border flows of knowledge

are accompanied by the purchase of other innovation inputs overseas.

Accessing external knowledge depends not only on the availability of appropriate sources but also on internal factors, particularly their capacity to assess and absorb knowledge.⁸⁵ In their seminal article, Wesley Cohen and Daniel Levinthal argue that the ability of a business to recognise the value of new external knowledge, assimilate it, and apply it to commercial ends is critical to its innovation capabilities.⁸⁶ This ability, which Cohen and Levinthal call 'absorptive capacity', reflects a firm's history and how much a business has invested in its specialist area of expertise. Absorptive capacity largely depends upon a firm's investment in innovation.⁸⁷ Good in-house capabilities in R&D, design and engineering help to capture and appropriate knowledge, in both codified and tacit forms, in the process of learning from external sources.⁸⁸

Respondent firms were asked to assess to what extent their internal resources (skills, R&D, IT, and physical infrastructure, etc.) were sufficient effectively to utilise and implement the knowledge they source externally. Only a small minority (2.6 per cent) considered their internal resources 'not sufficient', whilst two-thirds regarded that resource base as either significantly or extremely sufficient.

3.6 The impact of company size

Although there is some debate about the relationship between a firm's size and levels of innovation, our survey results show that larger firms are likely to introduce more innovations, particularly in processes and organisation (Figure 20). Statistical tests show that the mean number of innovations is greater for

large firms. SMEs (and particularly micro firms and medium-sized firms) show a faster rate of growth in turnover and sales over the three year period.

Small firms tend to operate more locally.⁸⁹ Owner-managers of traditional firms often value their independence and are unwilling to seek knowledge from external partners, displaying what James Curran and Robert Blackburn call a 'fortress enterprise mentality'.⁹⁰ Conversely, we find that large firms (with 250+ employees) source knowledge from overseas more frequently than SMEs (Figure 21). Large firms and medium-sized firms name more countries as their main locations for international knowledge sourcing than micro and small firms. Large and medium-sized firms name an average of four countries, whereas micro and small firms average 2.4 and 3.0 countries respectively.

Larger firms are also more likely to access knowledge from countries in Europe and Asia, including China, than smaller firms. They also show a greater propensity to access knowledge from Africa (Figures 22 and 23).

Manufacturing firms use overseas suppliers, engage with overseas clients or attend conferences abroad more frequently than service or 'other' firms. They also access knowledge in more countries than firms in other sectors.

3.7 The impact of sector

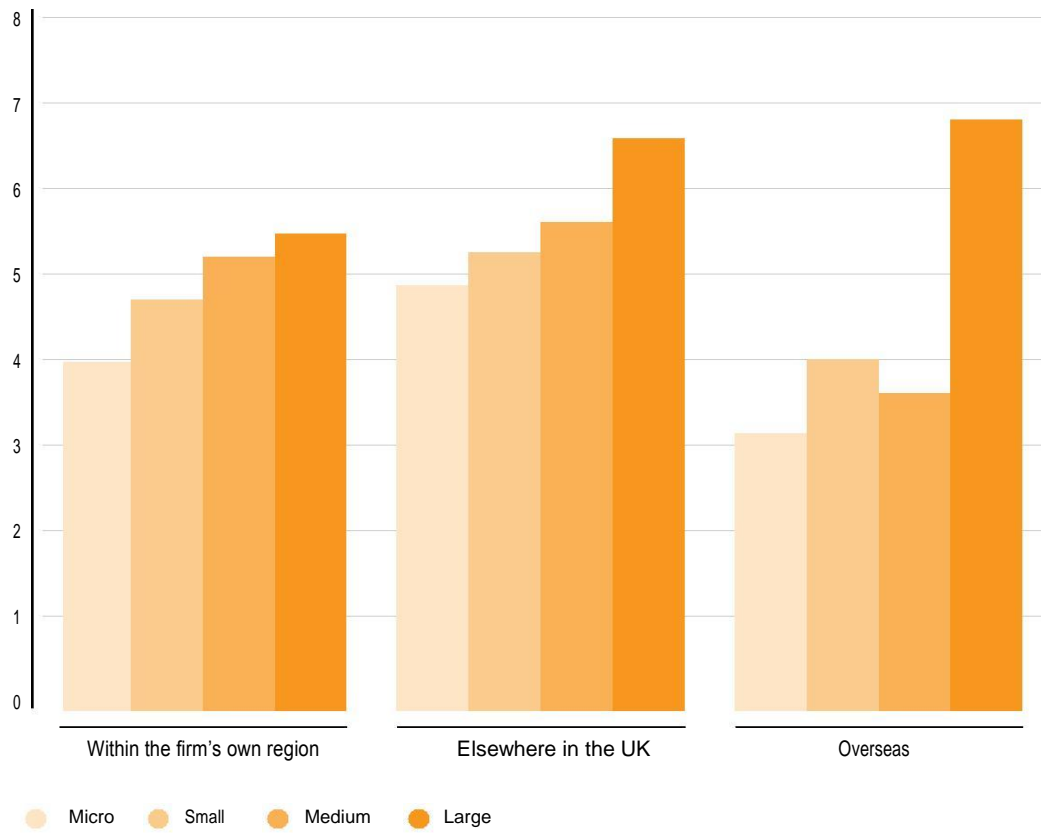
In general, manufacturing firms are more active in sourcing knowledge overseas than firms in other sectors. They source knowledge more frequently from equipment suppliers, overseas customers and attending international events. Manufacturing firms source knowledge from more countries, particularly in Europe and Asia (Figure 24). They also use intermediaries more frequently than other firms when doing so (Figure 25). Furthermore, this is confirmed as a two-way process – manufacturing firms act as a source of knowledge for companies outside the UK more frequently than their counterparts in other sectors. They also buy more innovation inputs from overseas than other firms. All this may reflect their access to more global production networks and supply chains.

Service-providing firms are more domestically-oriented in their knowledge sourcing, particularly when it comes to accessing

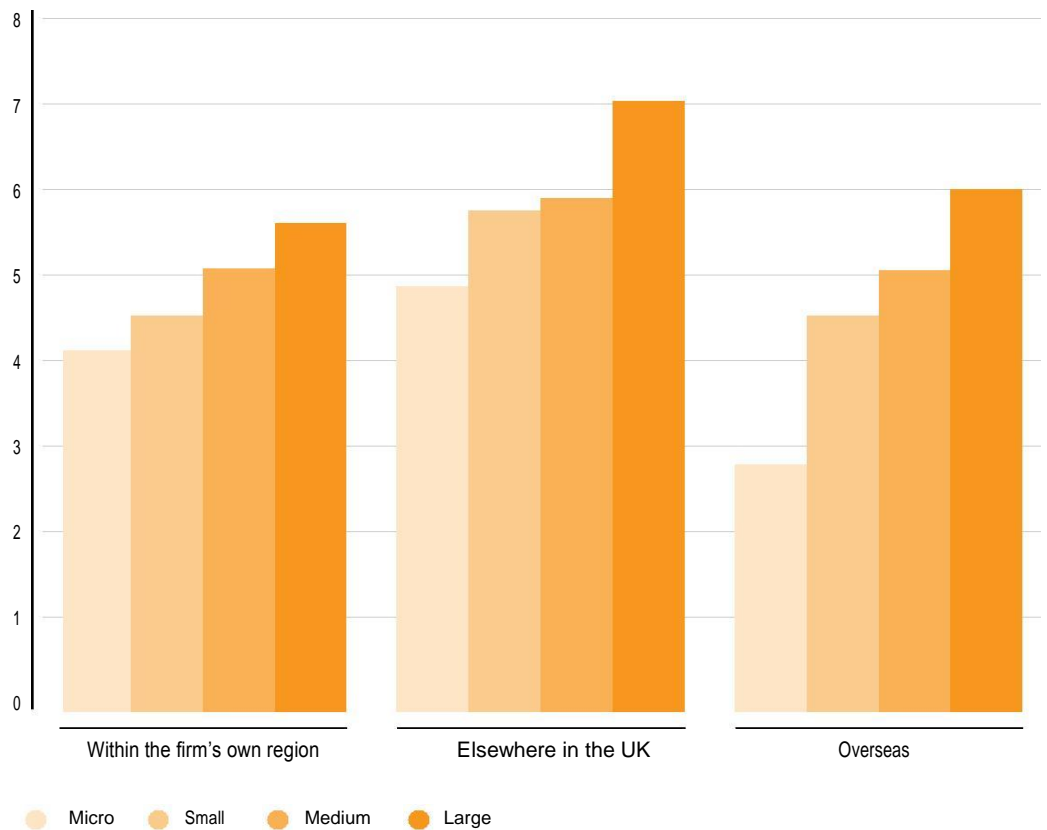
85. Cohen, W.M. and Levinthal, D.A. (1990) Absorptive capacity: a new perspective on learning and innovation. 'Administrative Science Quarterly,' 35(1), pp.128-152; Zahra, S.A. and George, G. (2002) Absorptive capacity: a review, reconceptualization, and extension. 'Academy of Management Review,' 27(2), pp.185-203.
86. Cohen, W.M. and Levinthal, D.A. (1990) Absorptive capacity: a new perspective on learning and innovation. 'Administrative Science Quarterly,' 35(1), pp.128-152.
87. Howells, J. (1996) Tacit knowledge, innovation and technology transfer. 'Technology Analysis & Strategic Management,' 8(2), pp.91-106.
88. Johannisson, B., Ramirez-Pasillas, M. and Karlsson, G. (2002) The institutional embeddedness of local inter-firm networks: A leverage for business creation. 'Entrepreneurship and Regional Development,' 14, pp.297-315.
89. Curran, J. and Blackburn, R. (1994) 'Small Firms and Local Economic Networks: The Death of the Local Economy?' London: Paul Chapman.
90. This may also be related to the greater concentration of service sector firms in the core regions.

Figure 21: Frequency of knowledge sourcing by types of external sources and their locations

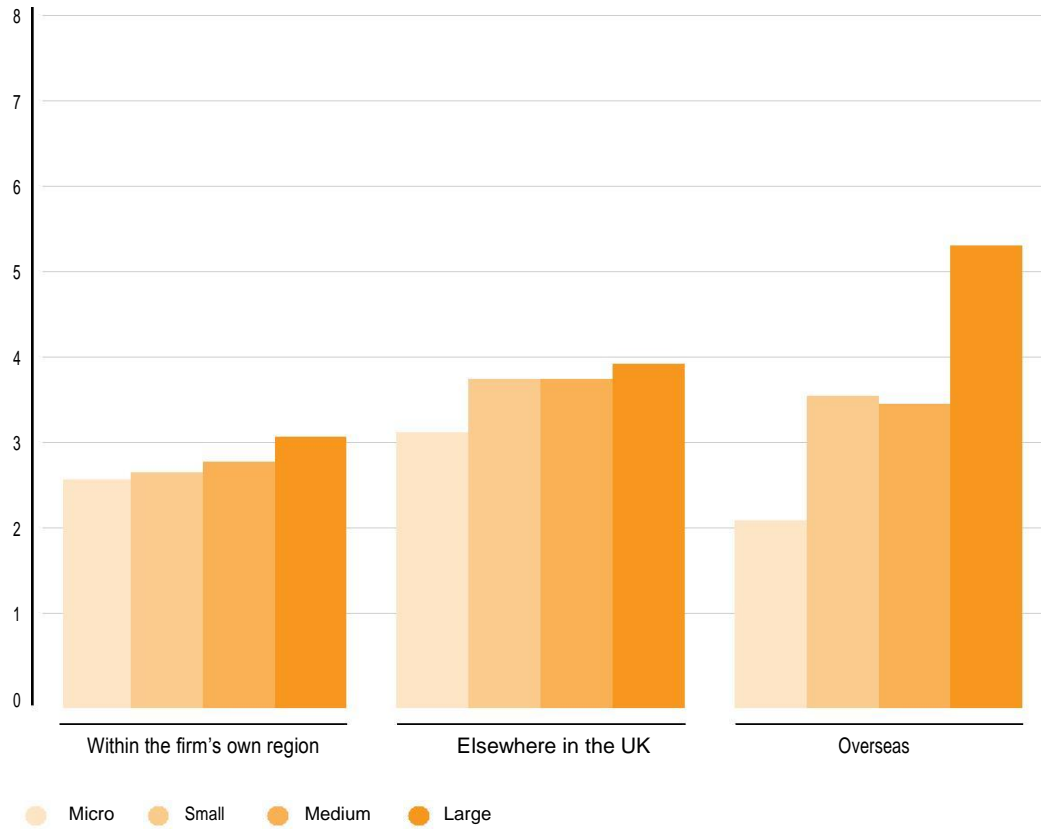
(a) Suppliers of equipment, materials, services, or software



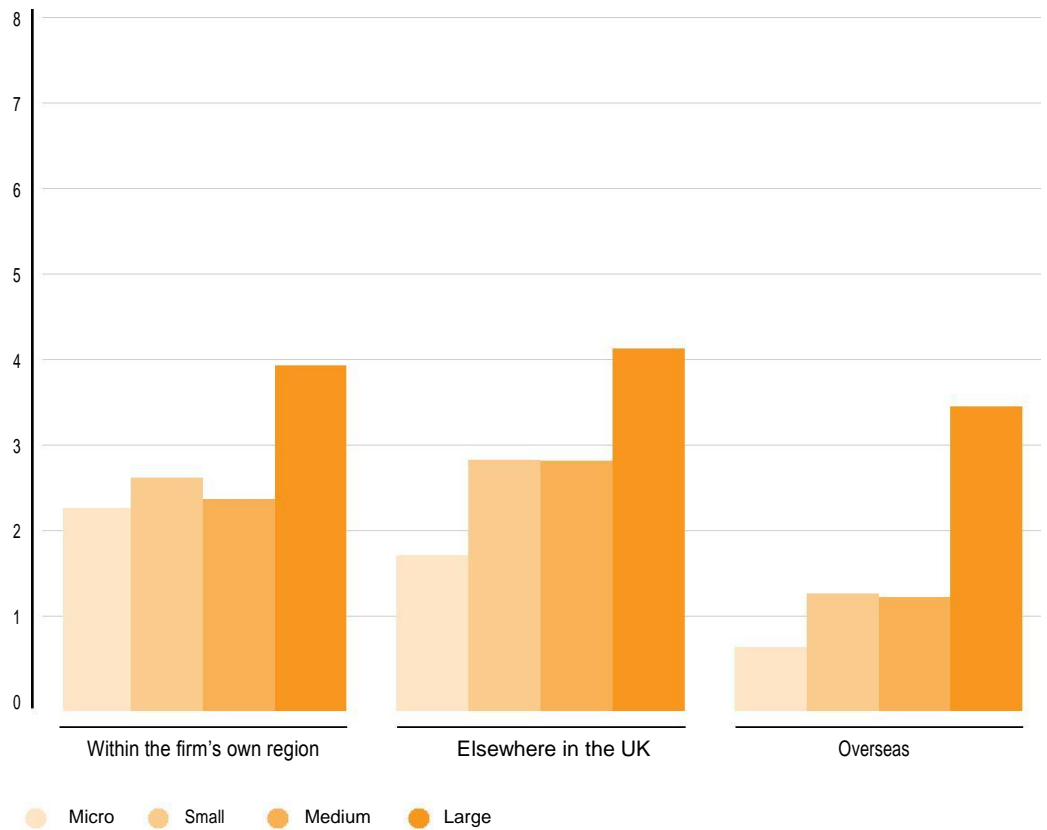
(b) Clients or customers



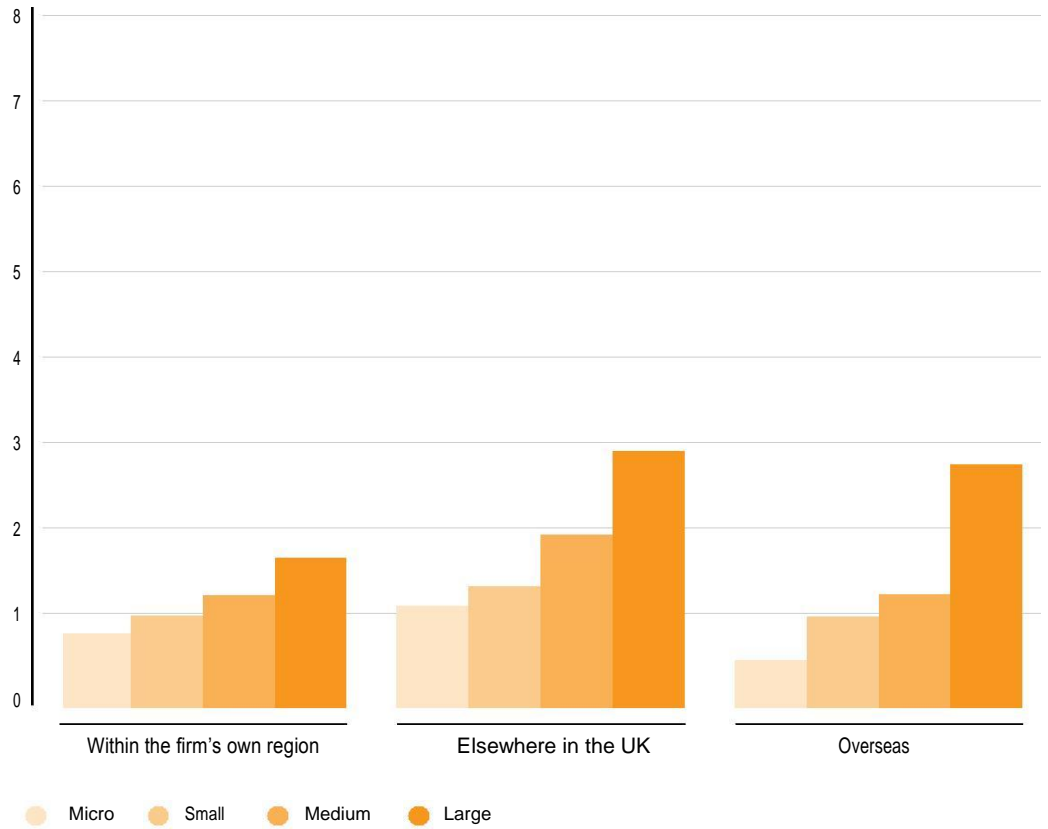
(c) Competitors or other businesses in your industry



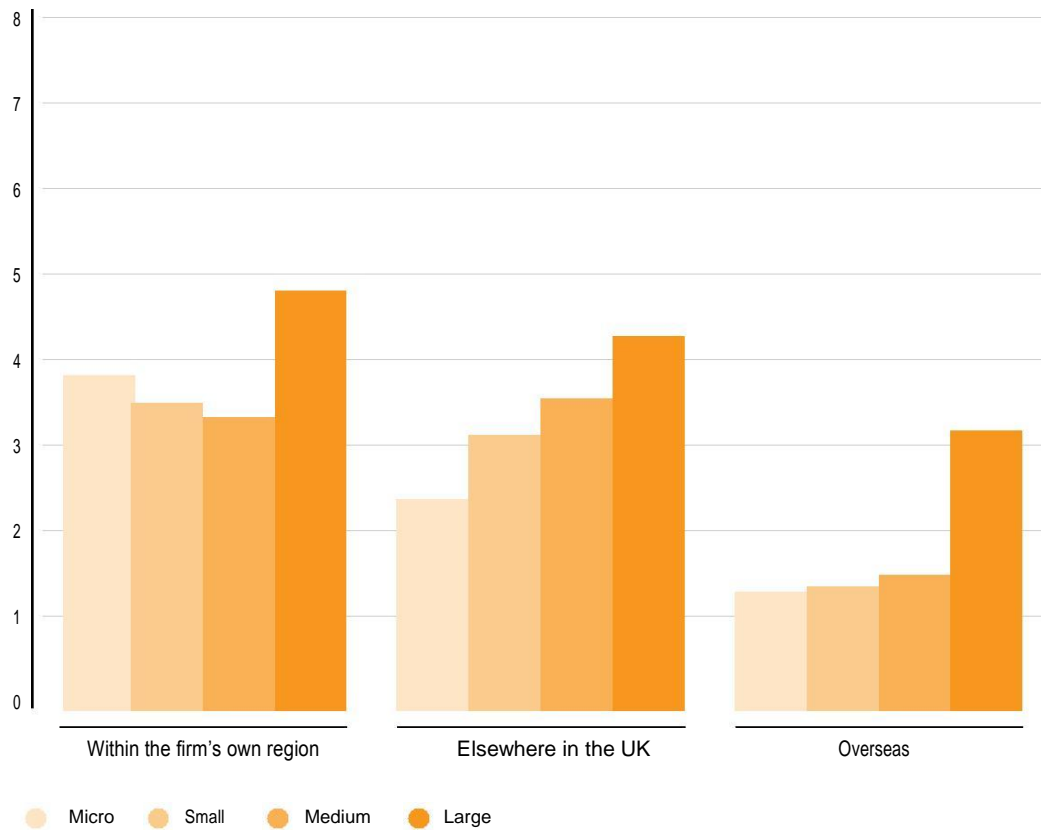
(d) Consultants



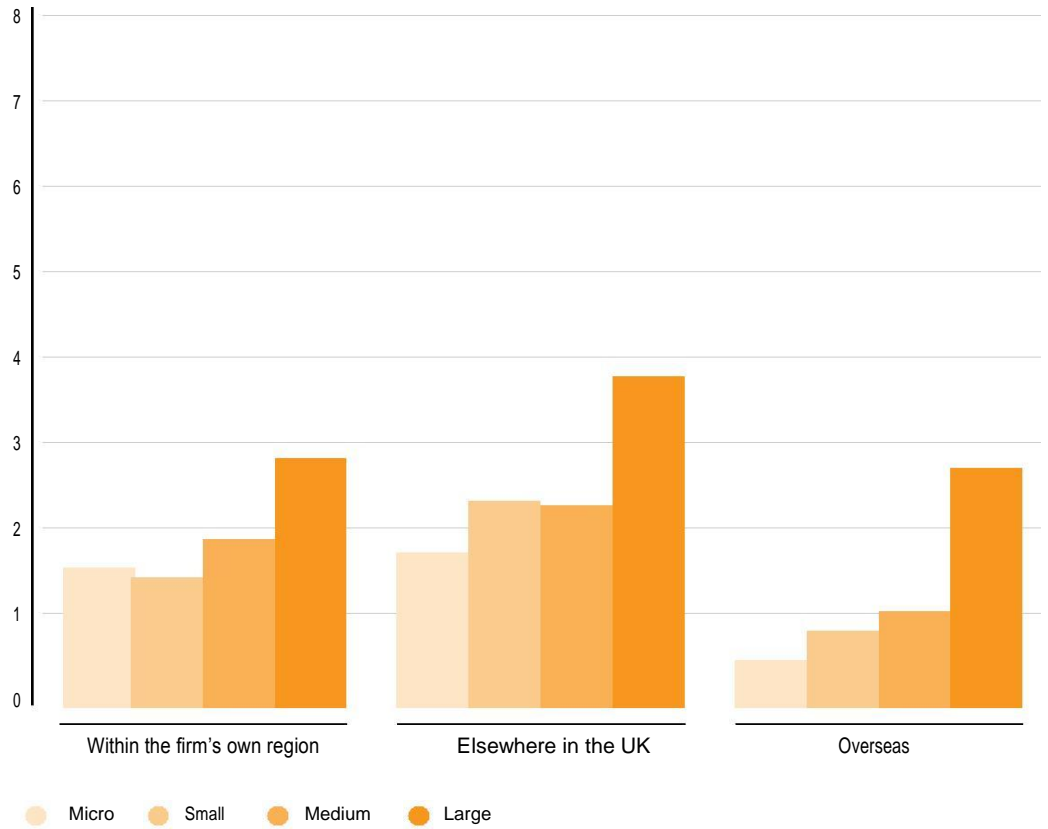
(e) Commercial labs or private R&D institutes



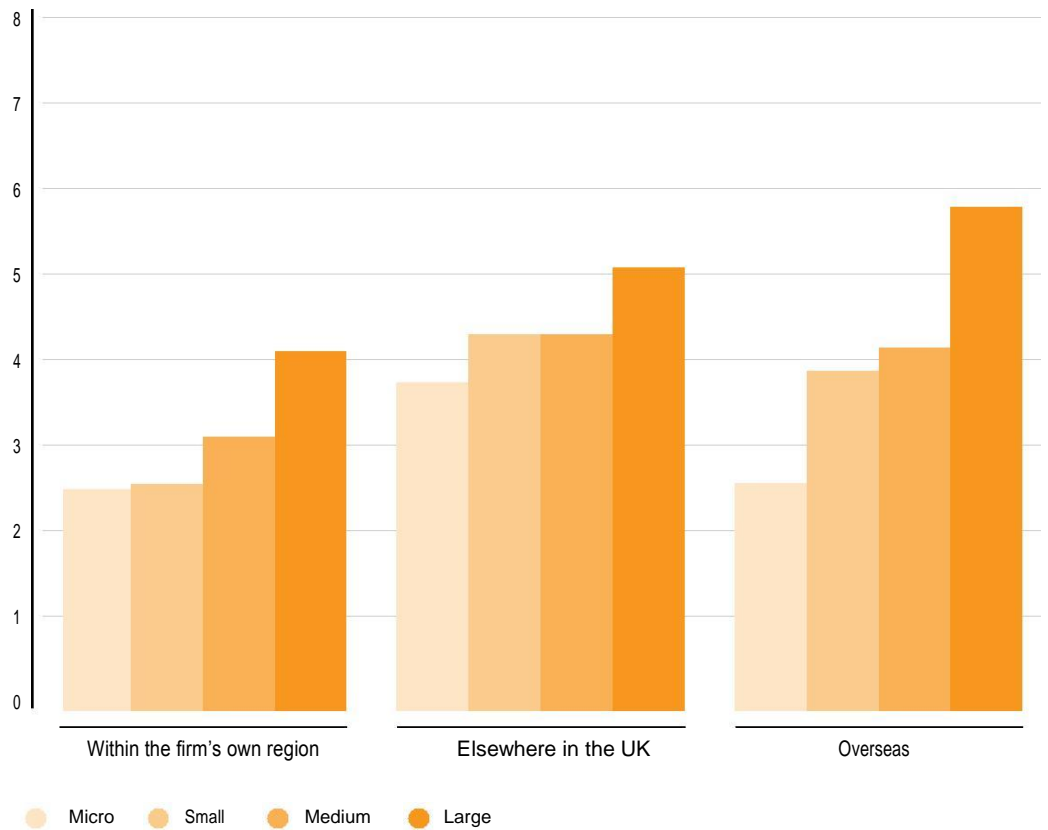
(f) Universities or other higher education institutes



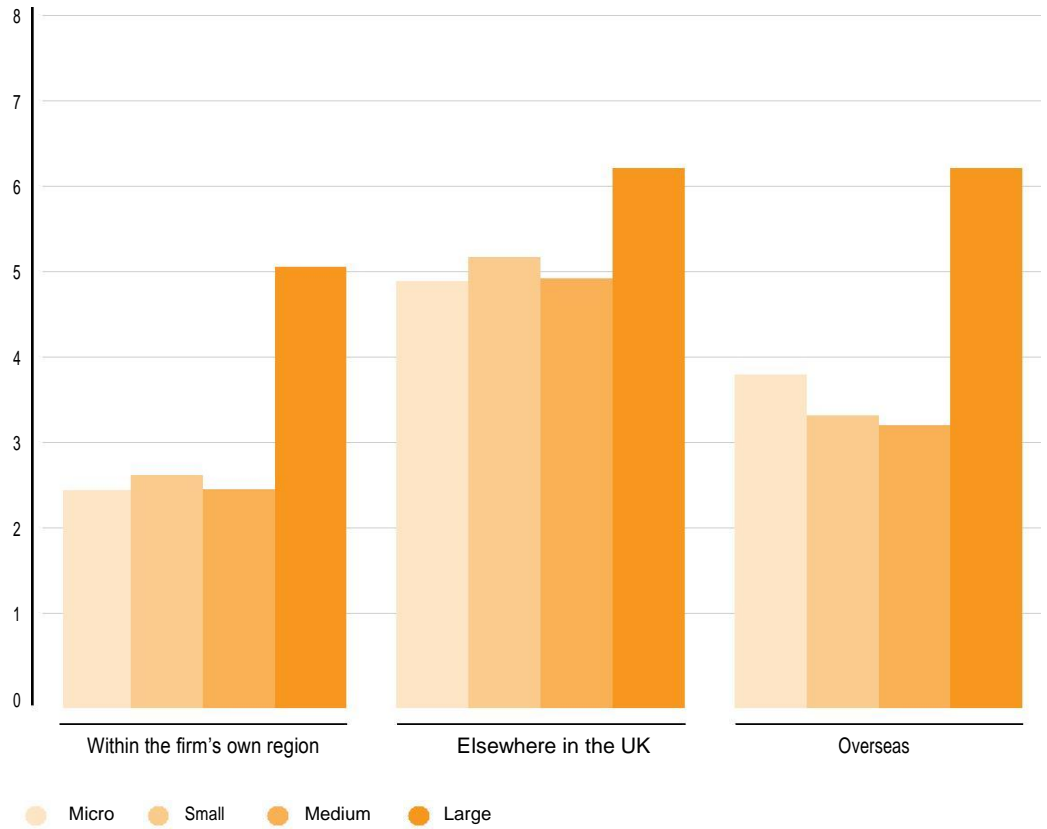
(g) Government or public research institutes



(h) Conferences, trade fairs, exhibitions



(i) Scientific journals and trade/technical publications



(j) Technical, industry or service standards

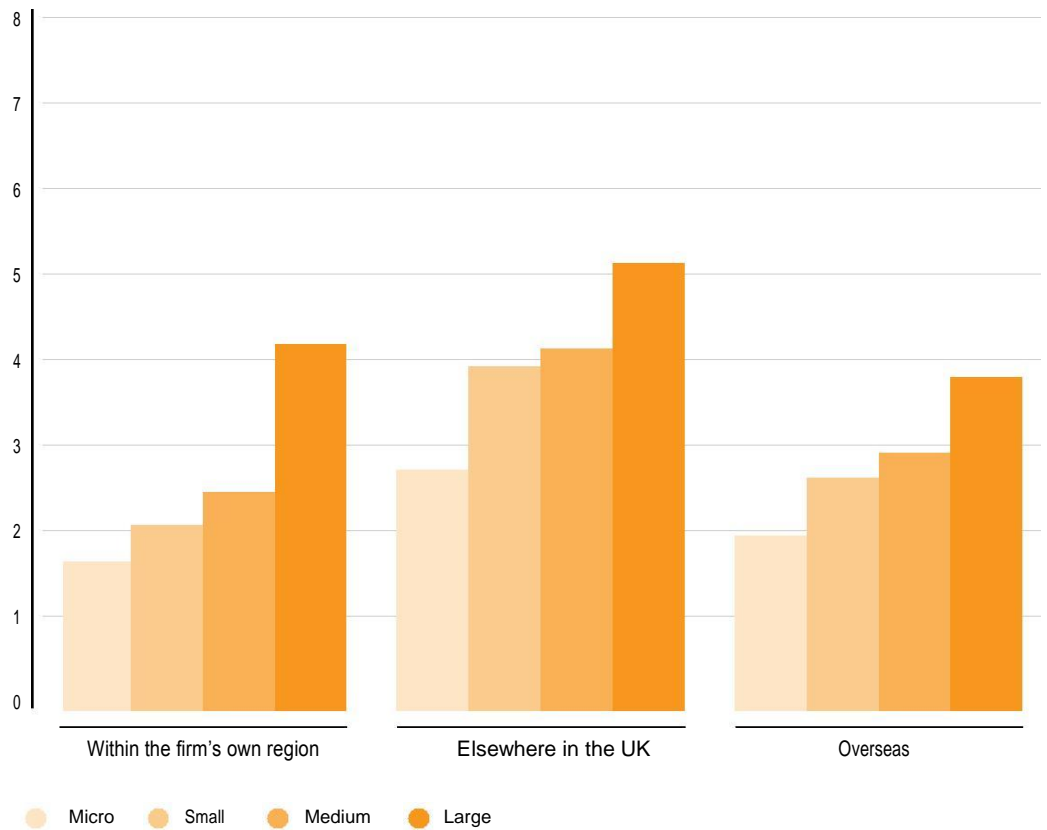


Figure 22: Regions listed as main locations of international knowledge sourcing

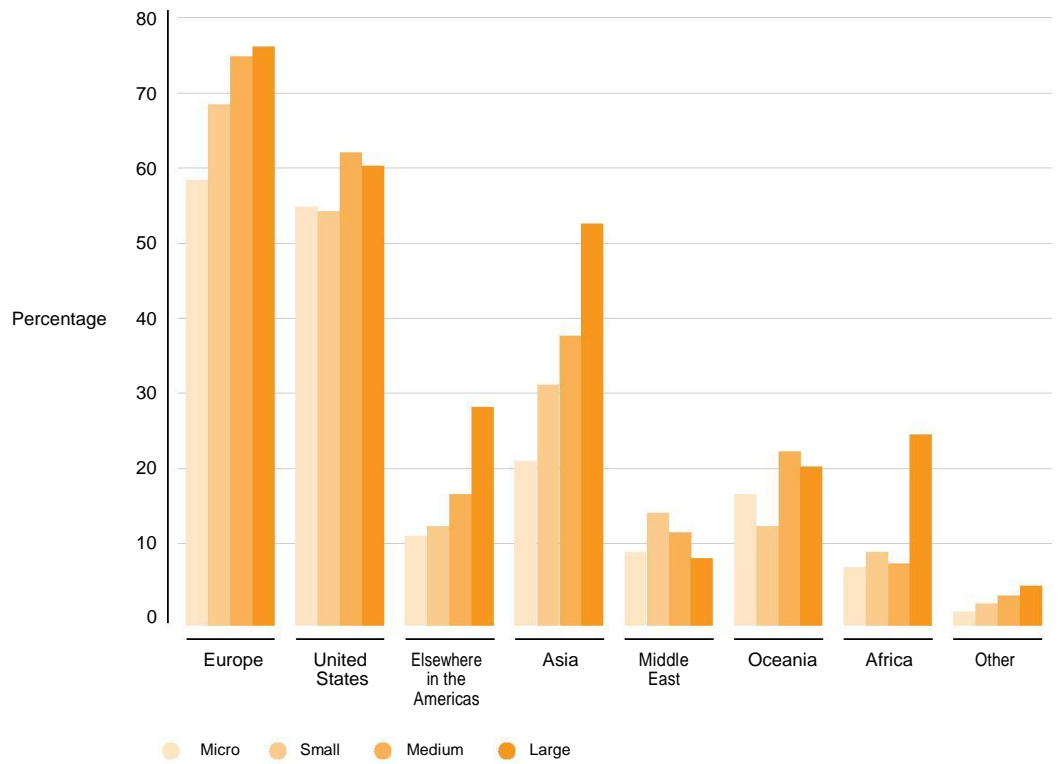
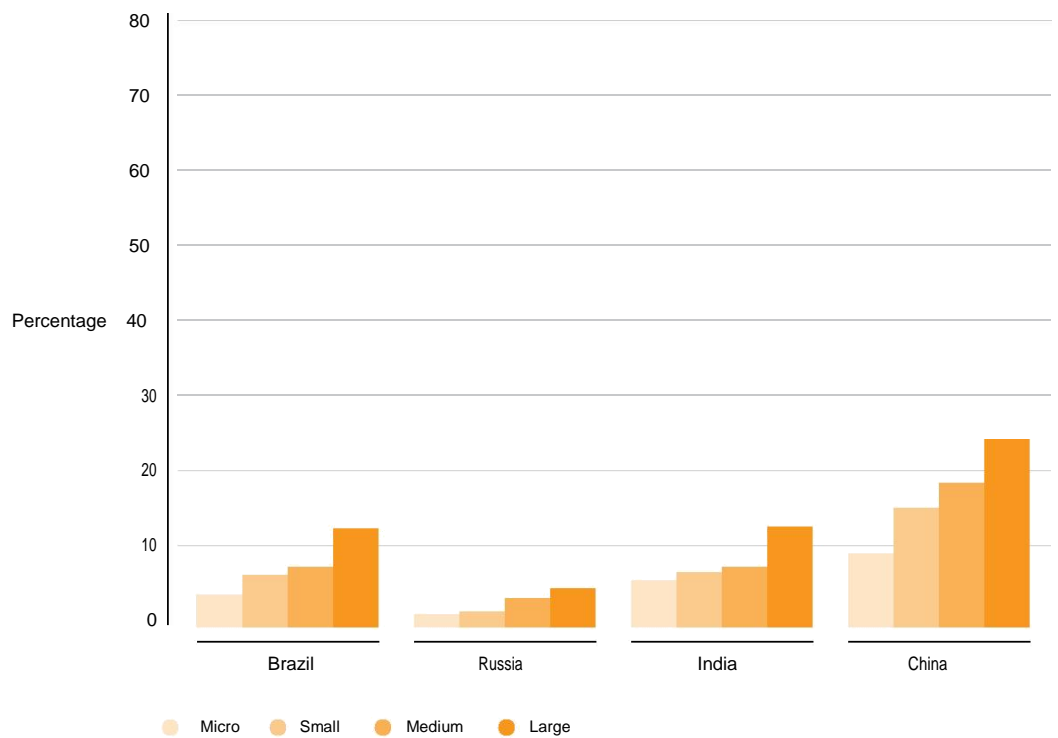


Figure 23: Four fast-growing development economies as main locations of international knowledge sourcing



expertise within their own region. They also source knowledge more frequently from competitors or other businesses in their own industry located elsewhere in the UK. They obtain professional information and intelligence more frequently than manufacturing firms, whereas manufacturing firms are more likely to seek scientific information.

However, there is little difference between service sector firms and manufacturing firms when it comes to their frequency of access to strategic and non-strategic partners, the frequency of actor change in their knowledge sourcing networks, or the barriers they face in sourcing knowledge. Overall, firms in 'other' sectors (mostly construction with some agribusinesses) are the most domestically oriented in knowledge sourcing of the three sectoral groups.

3.8 Conclusion

Our analysis suggests that firms do not conform with the picture set out in the literature emphasising the importance of regional clusters to competitiveness of firms. We find that firms source knowledge more frequently from a variety of sources outside their own region, rather than within it. For the great majority of firms, knowledge sourcing networks have become international.

Over two-thirds source knowledge from at least one overseas source, while the average firm lists three countries as key sources. These locations are often developed economies in Europe, the US, and Asia, but increasingly stretch to developing economies. For instance, one in eight firms sources knowledge from China. International networks are often associated with other flows of goods and services. Over half our respondents buy innovation inputs from overseas. Furthermore, international networks often involve two-way exchanges of knowledge. Over 80 per cent of firms act as a source of knowledge for companies outside the UK. The interdependent nature of these relationships helps strengthen the development of international knowledge sourcing networks.

Our analysis also provides some evidence supporting the association between international knowledge sourcing and a firm's innovation and competitiveness. Stronger performers are more likely to be engaged in international knowledge sourcing than

firms with limited innovation or sales growth. Innovation-intensive and high growth firms source knowledge from overseas more frequently, typically from Europe, the US and Asia. Better-performing firms are also more likely to identify the poor quality of knowledge available in their own region, as well as a lack of access to regional sources of knowledge, as serious barriers than their counterparts. This is probably their main reason for seeking knowledge from overseas sources. In addition, better-performing firms buy more innovation inputs overseas, and are more likely to act as a source of knowledge for companies and organisations outside the UK. The reciprocal nature of their international knowledge sourcing networks helps cement the virtuous circle of their network development.

The beneficial association between international knowledge sourcing and a firm's own innovation and competitiveness calls for a greater examination of the need for policy support in international knowledge sourcing. Our analysis identifies some variations between firms based on company size and industrial sector. Larger firms source knowledge from overseas more frequently, and access sources in more countries than smaller firms. As a result they benefit from the virtuous circle. And they use intermediaries more often than their smaller counterparts. All of this suggests that more could be done to support smaller firms in this regard.

Similar patterns are evident between manufacturing and service sector firms. Manufacturing firms are more likely to look overseas than those in the service sectors, benefiting from a greater degree of reciprocity as a result. They also use intermediaries more frequently in doing so.

The impact of a firm's location is more limited. When firms are divided into those located in London, the South East, and East of England (the Greater South East) and those located elsewhere in the UK, there is no significant difference in their international knowledge sourcing practices. However, firms in peripheral regions show a greater recognition of the barriers to knowledge sourcing and they use intermediaries more often to source sourcing knowledge both from home and overseas.⁹¹

The findings suggest that smaller firms and those operating in service sectors may be at a disadvantage, since they are less active in international knowledge sourcing and use intermediary organisations less frequently than

91. In this report the case studies are summarised in the form of vignettes. The full case studies can be found in the standalone case study report.

their counterparts. In this sense, government initiatives aimed at facilitating international knowledge sourcing may be required to help SMEs and service sector firms gain the benefits of wider knowledge.

Part 4: Good practice SME international knowledge sourcing case studies

4.1 Introduction

This chapter presents case studies of SMEs in the UK with a high propensity for engagement in international knowledge sourcing activities.

The cases were identified from our larger postal survey and other intelligence known to the project team. The case studies highlight good practices in sourcing knowledge from overseas, and aim to represent the diversity and variety of sourcing practices, covering:

- Different types of knowledge sources, e.g. customers, suppliers, rival/competitor firms, universities, public and private sector research organisations, etc.
- Different types of firms, e.g. manufacturing sector firms, service sector firms, established firms, start-ups, etc.
- SMEs in different locations, e.g. a mix of more urban and rural locations.
- Different types of knowledge sourced, e.g. scientific knowledge, technical knowledge, organisational knowledge, know-how, contacts, etc.

In general, the case studies aim to capture the following core themes:

- The drivers of international knowledge sourcing.
- The processes and channels through which international knowledge is sourced.
- The innovation and competitiveness outcomes of internationally sourced knowledge.

- The barriers facing SMEs in accessing international knowledge.

The methodology used to capture relevant data included:

- An initial review of publicly available company-level documentation (e.g. website, company accounts, marketing and promotional literature) to gain an overview of key activities and markets.
- A minimum one-day visit to the firm to interview key decision-makers and executives involved in the knowledge sourcing process.
- Where possible, telephone interviews and email exchanges with those overseas organisations and firms from which case-study firms source their knowledge. Also, for those case studies where sourcing is mediated through third parties and other brokers, contact was sought with these actors.
- Final follow-up telephone interviews with the firms to investigate any information gaps or to clarify any outstanding issues.

Following the initial drafting of the case studies, each report was presented to the respective firm to ensure they contain no points of conflict and that all the material is an accurate portrayal of the firms and their activities.

The case study SMEs are:

- Badley Geoscience – a structural geology company that specialises in providing high end, technically specialist work for the international oil and gas industry.

- Biocatalysts – a wholly independent manufacturer of enzymes used primarily for improving product quality and process efficiency within the food industry.
- Easylab – a company involved in the design, development, manufacture and support of scientific equipment related to the extreme conditions of ultra-high pressures.
- Ingenza – an industrial biotechnology company that provides practical industrial scale methods to manufacture chemicals and biopharmaceuticals.
- Kinetic Cubed – a specialist provider of international business solutions to international economic development, trade and investment promotion agencies.
- Melin Tregwynt – a designer and weaver of traditional woollen fabrics.
- Prosonix – a specialist in the commercialisation of proprietary pharmaceutical ultrasonic particle engineering technologies.
- Psynova Neurotech – a developer of diagnostic products to aid the diagnosis and treatment of psychiatric disorders.
- QCTR – a niche Contract Research Organisation (CRO) specialising in clinical trial management.
- Sitekit – a company involved in the development of web content management systems.
- WHS Tools – a family-owned, manufacturing business specialising in injection moulding.

4.2 Badley Geoscience

Badley Geoscience Ltd is a small structural geology company founded in 1980. The company, which has 12 employees, specialises in providing high end, technically specialist work for the international oil and gas industry. Ensuring a continual process of innovation is essential to remain at the forefront of its industry, and international knowledge is critical. The company uses a range of mechanisms including conferences, online forums, international literature and publications, and their customers. This case study explores three

specific ways that the firm establishes mutually beneficial knowledge relationships.

Badleys' work primarily revolves around software to support the oil and gas industry. Their software includes a suite of modules that deliver a focused set of advanced tools for the geological analysis of faults and fault-related processes that supports companies in the search for oil and gas. There are many software tools on the market that enable geoscientists to build geological models.

The company collaborates with The Fault Analysis Group (FAG) at University College Dublin. FAG provides the basic idea, underlying research and prototype, while Badleys develops ways for oil companies to apply and use it. Badleys also sources knowledge internationally through a strong collaborative relationship with the University of Liverpool, engaging in global geology research projects with consortia involving academic institutions and energy companies. The Université Louis Pasteur, Strasbourg is also a research partner. As a small company, Badleys depends on the support of overseas agents, such as Australian company Gingko ENP GNG. Such cooperation enables the company to keep up-to-date with the latest global developments, whilst ensuring that they have a stronger overseas presence.

www.badleys.co.uk

4.3 Biocatalysts

Biocatalysts Ltd is a wholly independent manufacturer of enzymes used primarily for improving product quality and process efficiency within the food industry. The company, which was founded in 1983, is located north of Cardiff. The firm has 30 employees and a turnover of around £5 million, with 90 per cent of sales from exports. The company operates a unique customer orientated approach requiring Biocatalysts to work successfully as a co-development partner with its product end users.

This niche business model requires a highly focused and effective knowledge-sourcing strategy. Its team attends a wide range of international events, and seeks to develop links with leading universities in the field in the UK and around the world. A key issue is the effective storage and retrieval of the huge amount of knowledge to which they have access. The lack of a dedicated

internal knowledge management system may be leading to the inefficient use of that knowledge. This makes the firm's most significant connection its link with Nerac, a US-based provider of targeted market and technology reports.

In an environment where information overload is often a problem, Nerac's key contribution has been in aiding their understanding of current and future technological trends within the industry. This then allows Biocatalysts better to anticipate customer demands, rather than simply boosting in-house technical capabilities. Biocatalysts have won numerous business and industry awards including a Queens Award. The company now supplies three of the world's five largest food companies.

www.biocatalysts.com

4.4 Easylab

Easylab's core business is the design, development, manufacture and support of scientific equipment that extends the current boundaries of experimental science into the extreme condition of ultra-high pressures. Easylab aims to be the de facto provider of instruments that enable science under pressure. Founded in 2004 by two physicists, the company currently employs seven people and supplies laboratories, research institutions and universities around the world working in the fields of physics, geophysics, chemistry, and biology.

Starting life in an incubation unit at Royal Holloway, University of London in Egham, Surrey, where one of the co-founders had previously done his doctoral research, Easylab quickly outgrew these facilities. The company is currently located in the Science and Technology Centre of the University of Reading, although there are no direct scientific links with the university.

Maintaining effective links to the global academic community, both as a source of knowledge, and as end-users of its products, continues to be a crucial success factor for Easylab. Similarly, collaborating with and learning from customers and the other suppliers of related scientific products has enabled the company to offer new technical solutions. The firm has sought to maintain the right balance between external and that which is internalised – and codified – where possible.

Although much of this knowledge is in principle 'open innovation' – in the public domain – the firm intends over time to involve academic scientists directly in projects that utilise their work. Fundamental to this is an understanding of individuals' motivations and expectations from the collaborative relationship. All this is helped by Easylab's ability to maintain an effective balance – external vs. internal, core science vs. the exploration of synergies and new areas – in its knowledge-sourcing strategy.

www.easylab.com

4.5 Ingenza

Ingenza, an industrial biotechnology company based at the Roslin Biocentre in Midlothian, started as an Edinburgh University spinout in 2003. The company, which now employs 14 people, provides practical industrial scale methods to manufacture chiral chemicals and biopharmaceuticals. It was acquired by Richmond Chemical Corporation (RC Corp.) a Chicago-based fine chemical company, in 2007.

Ingenza applies biotechnological approaches to obtain novel biocatalysts, engineered microbial strains and integrated chemo-enzymatic processes, resulting in more cost effective and efficient molecule manufacture in the fine chemical, pharmaceutical, biotech and agrochemical industries. Its customers are typically global organisations. Through their work with these customers, the company undergoes a natural process of knowledge sourcing. This enables the firm to develop further and expand its enabling technology. It also allows a quicker response to customers' problems with a better chance of success.

Ingenza is linked into a wide range of different organisations, both in the UK and overseas, which ensures that the firm is up-to-date with the latest opportunities and events in its field. Staff members endeavour to attend a number of symposia each year all over the world. These events encourage discussions and knowledge exchange and also provide an opportunity to network with other individuals operating in industrial biotechnology. Ingenza has also engaged with Scottish Development International (part of the Regional Development Agency), which has supported attendance at events and trade shows. The company believes that meeting face-to-face is critical to successful knowledge exchange and that having a short technical presentation that

can be delivered at trade shows or symposia is the best way to stimulate networking.

In addition, Ingenza has contributed to a European Framework 6 Contract, which provided an opportunity for it to access much better enabling technology that improved efficiency and competitiveness. The company also works with the Applied Biocatalysis Research Centre in Graz further to improve this technology.

<http://ingenza.com>

4.6 Kinetic Cubed

Kinetic Cubed Ltd is a specialist provider of international business solutions to international economic development, trade and investment promotion agencies. Its core services and activities rely on an ongoing commitment to sourcing and providing international knowledge in order to support their clients. The company has its headquarters in the North West of England, with branch offices in Lancaster, Cardiff, New Delhi, Madrid and Barcelona. It applies a range of mechanisms to source international knowledge that is judged to work particularly well for the business. Associates and partners are particularly important, as is attendance at international conferences.

Kinetic Cubed is very much an international knowledge provider, supporting clients through the application of their knowledge. However, knowledge transfer is a two-way process and the firm also endeavours to source knowledge internationally as a means of better supporting their clients and fuelling business development. The company often builds on existing knowledge and networks to meet client requirements. However, knowledge sourcing is also an ongoing process for the business; highlighting new opportunities, new markets and new ways of doing things.

Kinetic Cubed provides a sustained market entry and market development support service that helps European companies to access 'black box' markets, for example BRIC countries; defined as markets that offer great potential, but are little understood, and therefore require sustained effort to realise opportunities. Therefore, it places great importance on local representation. Kinetic Cubed works with partner offices in the black box markets – including strategic partners in Turkey, Kenya and South Africa in addition to its own

branches – to ensure that companies have local representation that will support the in-depth development required. As a contractor, the company acts as a 'culture translator', which allows for a high degree of quality assurance and enables the needs of the European customer to be fully understood and relayed to the partner offices. Kinetic Cubed also maximises business opportunities by attending international conferences.

www.kinetic3.co.uk

4.7 Melin Tregwynt

Melin Tregwynt is a designer and weaver of traditional woollen fabrics, with its origins in the 18th century Tregwynt mill that became the basis of a family-run business that is now nearly 100 years old. The company employs over 20 local people.

Though still rooted in local Pembrokeshire tradition, recent years have seen an emphasis on producing cloth for fashion and interior design use, increasingly for export markets. Trade shows and exhibitions have played a role in this transition, but probably the most significant factor has been the link with an agent in Japan. Melin Tregwynt now exports nearly 30 per cent of its products to customers in North America, Europe, Scandinavia and Japan, and the firm's products can be found in design-led shops and hotels all over the world.

Attending trade shows in the early to mid 1980s began to expose Melin Tregwynt to the demands of a wider customer base. These shows were initially domestic 'craft' shows, initially within Wales and later across the UK, but they helped to facilitate the process of gaining the knowledge required to produce new products and access new markets – ultimately internationally. Moreover, they also helped to expose the firm's designs to media coverage in design magazines and lifestyle supplements.

Melin Tregwynt first went overseas directly on a trade mission to the USA organised by the Welsh Development Agency (WDA); the US customers they initially supplied were buying in fabrics from a number of Welsh mills and using this to put together their own 'traditional' look for bedding and other products. Today, the company works with the Tokyo-based Homestead, which deals with the wholesale and distribution of garments and accessories

in Japan, working with products from the UK but also from other countries such as France, India and the USA. Homestead provides the company with the specific tacit knowledge required to develop an international market.

www.melintregwynt.co.uk

4.8 Prosonix

Prosonix is a small business based in Oxford that specialises in the commercialisation of proprietary pharmaceutical ultrasonic particle engineering technologies and added value ultrasonic process chemistry solutions for the pharmaceutical industry. Prosonix uses a range of mechanisms to source knowledge from international organisations, perhaps the most fundamental of which is the way in which it absorbs knowledge from customers to keep abreast of industry trends, problems and opportunities.

Prosonix's core expertise is the development of new 'molecule to particle' methods for the manufacture of inhaled medicines. Their core market is the pharmaceutical industry, particularly in the US and Europe. With a team of chemists and chemical engineers in Oxford, most of its work focuses on R&D to solve complex pharmaceutical problems. Other income is derived from proprietary intellectual property and patented bespoke sonoprocessing equipment. Prosonix views itself as a technology licensing business: the firm develops solutions, including physical examples of the product, for customers and then provides the customer with the licence to implement the solution.

Prosonix was initially supported by three venture capital investors, based in Belgium, Holland and London. Each brought individual knowledge of the pharmaceutical industry and business start-ups to support the business. For Prosonix, agency representation is an important way of sourcing knowledge from overseas. This is particularly the case in countries such as Japan where there may be cultural barriers.

There are two main outcomes of Prosonix's international knowledge sourcing. Firstly, it enables the company to keep up-to-date with latest developments in the pharmaceutical industry, thus highlighting opportunities for potential work. Secondly, it helps the firm to understand more about its technology, for example its capabilities,

limitations and opportunities, enabling further process development.

www.prosonix.co.uk

4.9 Psynova Neurotech

Psynova Neurotech Ltd is a spinout company, set up in 2005 to build on biotechnology research at Cambridge University. The company often collaborates with academics and large pharmaceutical companies, a business model that is widely accepted in the biotech industry, to develop products to aid the diagnosis and treatment of psychiatric disorders. The highly global nature of this industry means that knowledge is frequently sourced from international organisations.

The company develops and tests new hypotheses of the pathological basis of conditions like schizophrenia and bipolar affective disorder. It determines the cellular mechanisms which regulate the expression of biomarker molecules altered in these states, with a view to developing therapeutic strategies. The research is patient-focused, with an overall aim of improving the diagnosis, treatment and outcome of these disorders. Psynova operates internationally, but the US and Europe are its principal markets.

Psynova works with a range of collaborators, many of them overseas, to undertake research with the overall aim of improving diagnostic tests and supporting the development of more effective drugs to treat severe mental illnesses. The company forms part of an eight-member European consortium to develop minimally invasive, high throughput, low cost molecular assays for the early diagnosis of these disorders.

www.psynova-neurotech.com

4.10 QCTR

QCTR, based at the Stirling University Innovation Park, is a niche Contract Research Organisation (CRO) with a clinical specialism in psychiatry, neurology and orphan diseases. Set up in 2005, the company's 14-strong team provides Phase 2 and 3 clinical trial management, as well as medical writing and regulatory advice services for its pharmaceutical industry sponsors.

QCTR needs to ensure that it is abreast of the latest knowledge relating to the diseases it works with. Alongside this, it also needs to have up-to-date knowledge of processes enabling it to operate in a streamlined and efficient manner. Given the specialist nature of its work, QCTR requires a lot of highly specific knowledge, which can only be obtained from a large pool of different individuals. As a result, it has established a network of individuals and organisations allowing it to source this knowledge when it is required.

QCTR has adopted a range of processes to build its networks of knowledge. These include the existing networks of staff – who all have different but complementary skills and backgrounds – and contacts established through membership of professional organisations, as well as events and conferences. Through these networks, QCTR also sources knowledge from experts and investigators who are normally from the medical community; it outsources work to other CROs that provide valuable knowledge, particularly on overseas work. Without this specialist knowledge, QCTR would struggle to differentiate itself from its competitors. The company can see the long-term benefits gained from investing in relationships and also recognises that providing knowledge, as well as sourcing it, facilitates more effective knowledge exchange.

www.qctr.co.uk

4.11 Sitekit

Established in 1995, Sitekit is at the forefront of web content management systems development in the UK. The company has a total of 22 employees and more than £1 million in annual revenue. The company is located in the relatively remote and rural setting of the Isle of Skye, Scotland, complemented by a sales office in Oxford. The company has also recently established a new partner office in Perth, Australia. Sitekit's successes, such as attaining Deloitte Fast 50 status in Scotland for five successive years, highlight its growth and competitiveness.

With partners across the UK, Sitekit has built substantial expertise in delivering high performance mission critical websites across a range of commercial and public sector clients. Key clients include 17 NHS Trusts. The company also has an international client

base, including Tyco and ADT (who use Sitekit software in 22 countries), and the company has delivered training across Europe, the Middle East and Africa.

Sitekit aims to empower website designers and website managers by removing the technical barriers to creativity, and delivering online excellence through technology, training and support. The company has established Sitekit Labs as its research arm, which aims to collaborate with leading researchers worldwide in semantic web science and intelligent web applications – to help inventors turn new technology into commercial products and get to market as quickly as possible. Sitekit Labs specialises in research in advanced web applications for e-Health and is working on an online tool – in collaboration with Stirling, MIT and Harvard Universities – to make the diagnosis of coronary disease much quicker and more efficient for physicians.

www.sitekit.net

4.12 WHS Tools

WHS Tools is a manufacturing business based in Sutton Coldfield, in the West Midlands. The company has a turnover of £20 million and employs 330 people. It is a good example of a medium-sized company that uses external knowledge to understand and react to competition from low cost countries. WHS Tools's main activities are around injection moulding – approximately 10 per cent of the business is tool making and 90 per cent is moulding and assembling products. It supplies products to many of the world's leading automotive companies as well as customers in the leisure, home products and electronics industries.

In line with many UK manufacturing companies, WHS Tools has been hit hard by the recession and the highly competitive nature of the global market, particularly from lower cost countries in Asia. However, the company remains stable and sources knowledge from overseas to maintain a good understanding of its international competitors and customers. In turn, this enables WHS Tools to innovate appropriately and develop the company to remain competitive.

As a result of working with Toyota and endeavouring to meet their requirements, WHS Tools has developed a niche product which

differentiates the business from its low cost competitors. In response to losing tool orders from Black and Decker, the company also went to China to explore tool making in one of its biggest competitor countries. Discovering that China had more up-to-date and modern equipment encouraged WHS Tools to invest in more automated manufacturing machinery, resulting in significantly reduced production costs.

www.whs-tools.com

4.13 Key lessons

Sourcing international knowledge and engaging in a process of continuous innovation enables small firms to stay ahead of the competition. When local markets are in decline, expanding into overseas markets and overcoming the barriers of relatively remote locations is possible if SMEs are proactive and seek new avenues and sources of knowledge from outside their home region. This may not always generate direct pecuniary benefits. But it sustains innovation and enhances a reputation for being a leading company in a particular sector, indirectly securing work as a result. For small firms operating in a global market, collaborations with organisations that provide complementary knowledge and expertise are essential.

“Being tucked away in West Wales, it’s not as if the market was around us” (Melin Tregwynt).

“Where we are there are no universities within a hundred miles anyway. But it’s a global village and there’s no certainty that your local university is actually going to be involved in an area that is relevant to your company” (Sitekit).

“You might not see why you’re doing that [sourcing] right now, but somewhere down the line it might be very valuable” (QCTR).

The extent to which industrial sectors share knowledge internationally may, however, be dependent on their structure. For example, the geology and energy industries are close-knit communities. As global communities of practice, they are more open to international knowledge sharing. For certain sectors, professional membership organisations are a more important starting point for accessing international knowledge.

“Our world is a very small world, which makes it a lot easier to source knowledge” (Badley Geoscience).

“The best place to start is the professional membership organisations” (QCTR).

Building networks and relationships is clearly key to sustaining access to international knowledge, and the significance of informal networks should not be underestimated. Strong personal relationships are often at the heart of successful knowledge networks, as is ensuring that the goals of all parties involved are aligned and complementary. As a starting point, SMEs could initially provide – rather than simply acquire – knowledge, by presenting at international conferences. This would raise their profile and act as a stimulus for developing more effective knowledge exchange.

“It is a mixture of personal relationships and making sure you’re singing from the same hymn sheet” (Psynova).

“Stay visible – go out and engage with people, don’t stay in thinking I’ve got too much work to do here” (QCTR).

“It’s all about being out there and telling people what you do...giving presentations is a huge thing. It’s like a rite of passage. When you give presentations, people pay a lot more attention to you” (Ingenza).

Sustaining an overseas relationship is often more complex than working with a local organisation. However, overseas organisations can offer valuable and unique knowledge and expertise that is not available locally. Allowing time to nurture and maintain relationships is important. Face-to-face contact is often essential to build trust and understanding. Collaborative projects, in particular, rely on sharing knowledge and information between partners. Although all this can take time, it is ultimately vital to delivering appropriate and realistic outcomes.

“You have to work a bit harder to establish the relationship and get the communication functioning well if you’re working with an overseas company” (Psynova).

“It’s about knowing the right person or knowing the right person who might know the right person” (Kinetic Cubed).

As larger firms – many of which were once among the most secretive in the world –

have adopted open innovation regimes, the scope for SMEs to increase engagement through collaboration and cooperation has been significantly enhanced. Some sectors have a relatively long history of international knowledge sharing, whereas in others, SMEs will need to invest more time in establishing new relationships and encouraging more open innovation.

“Anyone that has been involved in these sorts of [collaborative] programmes soon realises that if you don’t have an open approach to sharing data and information with everyone, it’s not going to work” (Psynova).

“The best way to learn is to sit in the middle of it and do it, rather than relying on books” (WHS Tools).

“It’s all about making connections. Information sourcing through online databases and scientific literature is great but in our business the vast majority of the rapid route is who you know and that comes from going to trade shows, going to symposia and going on customer visits” (Ingenza).

Language differences can make it harder to source knowledge from overseas providers. Identifying and appropriately responding to underlying cultural differences can also be challenging. Successful SMEs tend to use international knowledge brokers, agents and associates to overcome these barriers. Recognising and addressing cultural differences is fundamental when working with international knowledge providers, and overseas agents can be critical for sourcing international knowledge, particularly where there are bureaucratic and cultural issues.

“The translator is translating the cultural differences as well as the language differences” (Prosonix).

“It was a comfort factor that I could speak French” (Kinetic Cubed).

Overseas associates can also be a valuable mechanism for obtaining international knowledge and ensuring a presence in an international market. Many small firms seeking to expand overseas may understand their business inside out, but not understand their potential new markets. Here, agents and associates based in other countries often provide a vital link between the firm and the

market. Understanding what customers are looking for, particularly in overseas markets – which often involve different sets of symbolic values deeply embedded in the culture – may be extremely difficult without someone to facilitate the process with local knowledge. The greater the cultural differences, the more important it is to have the right broker.

“You need to have someone who knows the market and can tell you the market is looking for this” (Melin Tregwynt).

“You really need to be very open-minded and very aware of what you don’t know” (QCTR).

The absorptive capacity of SMEs – their pre-existing skills, knowledge and experience – can affect their ability to generate effective international networks. Although open and user-led innovations are growing, some international customers may still wish to limit the knowledge that they are prepared to share, especially with smaller firms. Previous experience of working with similar customers, products or issues ensures that small firms possess the requisite intelligence to extract the relevant knowledge required. Knowledge sourced from old or existing customers can enable firms better to support new customers. In other words, ‘real’ experience is the key to being able to absorb and apply international knowledge. Applying international knowledge to improve process innovation often requires a culture change among the workforce which can be challenging for more established and older businesses.

“We had a good experience but other companies [who also went to MIT] weren’t at the stage where they could take advantage of the opportunity” (Sitekit).

“If you don’t know where they [i.e. the customers] are trying to go, that makes it very hard to help them” (Biocatalysts).

“You need experience to learn to ask the right questions” (Prosonix).

“The importance of previous experience should not be underestimated” (EasyLab).

A related issue highlighted by some SMEs is the need to store knowledge. When externally sourced knowledge is not used immediately, it may need to be stored until it can support a client or improve the business. Establishing a knowledge repository is increasingly important

for smaller firms. After all, they are less likely than larger firms to possess strong knowledge management systems. Their expertise is more often held by individual employees in a tacit and embodied form, which can easily be lost if the employee moves on. As the case studies indicate, high levels of staff retention and loyalty within an SME environment can be important if externally sourced knowledge is to be effectively utilised and implemented.

"The problem is often not obtaining knowledge itself; it is the storage and retrieval of that knowledge" (Biocatalysts).

"If all the know-how is outside, you run the risk of just being an empty shell" (Easylab).

4.14 Conclusion

Leading SMEs recognise the value of developing mutually beneficial relationships that do not necessarily deliver quick-wins. These relationships that support a two-way flow of knowledge, delivering benefits to both parties, are often the most effective. They are often stronger relationships delivering greater benefits in the long term. But the economic benefits of international links can take time to emerge and SMEs have to be prepared to take short-term risks for long-term gains. Successful relationships take time to develop too. SMEs need to ensure that they continually invest in maintaining relationships; even in cases where there is not an immediate or obvious need for sourcing knowledge at that time. Regular and sustained communication makes it much easier to source knowledge when it is required.

There are many ways to source international knowledge, and often a combination of them delivers the best results. Complementary knowledge networks enable SMEs appropriately to apply and subsequently to provide innovative goods and services. Leading SMEs often use a range of channels to obtain overseas knowledge, providing a complementary mix that ensures that they keep abreast of latest industry trends, developments, problems and opportunities. For instance, through strong, long-term relationships with academia both at home and overseas, SMEs can engage in a continual process of innovation that maintains their competitive strength.

The importance of informal links and networking should not be underestimated: they are fundamental for building links and

identifying suitable organisations from which to source international knowledge. Informal networks and contacts are extremely valuable and leading international sourcing SMEs continually invest time and resources in generating and maintaining relationships with key individuals. Interestingly, the case studies indicate that many highly innovative and progressive SMEs do not need to be located near their major customers.

SMEs seeking to operate in a global market must have a good knowledge of international competitors and customers. This allows them to respond to emerging trends and adapt to changes in the global market, to remain competitive. International knowledge sourcing often enables SMEs to adapt and augment a product for new and global markets. More generally, knowledge of the future direction of key markets is critical to business success. The role played by the international sourcing of knowledge often has a more significant impact on SMEs when it gives them an enhanced understanding of customer demands and market trends, complementing more 'conventional' channels such as raising technological capacity and innovation performance. Deploying international knowledge brokers, particularly where there are cultural differences that need to be overcome, is often advisable. They enable SMEs to have a greater international knowledge reach and enable overseas knowledge sources to be more effectively accessed.

Finally, effective absorption of this knowledge is crucial, allowing firms to innovate technologically and stay ahead of competitors. In the first instance, recognising knowledge gaps is the initial challenge that many SMEs need to overcome. Once these gaps have been identified, the process of acquiring knowledge becomes much more focused.

Part 5: Public policy

This chapter assesses the public policy framework associated with international knowledge sourcing, as well as outlining a set of key policy recommendations emanating from this study. The first section reviews existing and emerging international, national and regional policy and thinking in relation to international knowledge sourcing strategy. The review begins by assessing international policymaking and then considers national and regional level policymaking in the UK. The second section presents the policy recommendations and the rationale underlying their inclusion.

5.1 Policy review

International policy

Internationally, the United Nations (UN), the Organisation for Economic Co-operation and Development (OECD) and the World Bank are seeking to enhance the global flow and sourcing of knowledge. The UN Conference on Trade and Development (UNCTAD) has long sought to ensure that the benefits of the international knowledge networks established by multinational enterprises are harnessed, especially to facilitate economic development in emerging and developing nations. In particular, UNCTAD promotes a range of fiscal and support interventions to capture the potential spillovers emerging from the technology transfer associated with foreign direct investment (FDI).

The OECD clearly has a specific role to promote international cooperation and, like UNCTAD, it has played an important role in seeking an understanding of the role of FDI in stimulating global knowledge exchange. More recently, the OECD has recognised the importance of

regions as centres of knowledge, whilst also highlighting the positioning of regions within global knowledge networks.

The World Bank promotes links with international networks to share experiences on the development of knowledge economies, and has implemented a programme called the Global Development Learning Network (GDLN), which uses technology to enhance knowledge sharing through an interactive, multi-channel distance-learning network with a mandate to serve the developing world.

Perhaps more than any other institution, the European Commission (EC) has been the strongest advocate and funder of international knowledge sourcing. Through an array of policy mechanisms, the EC promotes cross-border innovation collaborations, principally within the European Union, but also beyond.

Policymakers are keen to develop a European Research Area (ERA). The idea grew from a realisation that European research suffers from a combination of insufficient and poorly targeted funding, a weak environment in which to stimulate research and exploit results, and the fragmented nature of research activities. The aim of the ERA is to create an 'internal market' in research, an area of free movement of knowledge, researchers and technology. This would increase cooperation, stimulate competition and achieve a better allocation of resources. As part of this agenda, the EC Framework Programme aims not only to exploit the European Union's research capacities through large-scale research infrastructure, but also to enhance regional cooperation and innovating SMEs.

As part of its commitment to SME innovation, the Commission has a range of interventions supporting international knowledge sourcing activities, such as technology transfer, through its system of Innovation Relay Centres, and other assistance through its Euro Info Centres. In many ways, the proposed European 'internal' market for knowledge resembles that which already operates within the US.

UK national policy

In recent years, the internationalisation of knowledge and innovation as a source of competitive advantage has become increasingly recognised within central government in the UK. The 2008 *Innovation Nation* White Paper published by the former Department for Innovation, Universities and Skills (DIUS),⁹² acknowledged that innovation is increasingly an international endeavour, whereby businesses are internationalising their research and development (R&D), supply chains and customer bases and adopting open innovation practices. In response, DIUS noted its role in managing the Foreign and Commonwealth Office's (FCO's) Science and Innovation Network (SIN), which brings scientific, diplomatic, policymaking and administrative skills to achieve objectives in science collaboration, innovation, influencing international policy and best practice in science and innovation policy. That role is now undertaken by the Department for Business, Innovation and Skills, which took on most of DIUS's functions.

Innovation Nation also highlights the establishment of the Global and Science Innovation Forum (GSIF), which aims to provide an overarching framework to enable better coordination and prioritisation between the various organisations promoting UK science and innovation overseas. The Forum is intended to ensure that the UK is the partner of choice for global businesses seeking to locate R&D activities overseas, and for foreign universities seeking overseas collaboration. As with other national innovation initiatives, GSIF is formulated under the Science and Innovation Investment Framework. Although this framework is a welcome addition to the innovation policy infrastructure, its implicit focus on 'Big Science' initiatives and activities, does not resonate with most firms in the UK, particularly SMEs.

The UK Trade and Investment's (UKTI) R&D programme, which has been implemented in the North East of England, has helped research-focused businesses in the region

to internationalise and penetrate overseas markets. The R&D programme identifies a partner company where appropriate, drawing up relevant agreements so that each party knows what is expected of them. It also develops business plans and taxation agreements, sets up third party vehicles for technology transfer, and structures all agreements to protect Intellectual Property (IP). Evaluation of the programmes indicates significant benefit for participating firms, suggesting scope to extend the programme beyond the limited number of firms so far engaged.

More generally, UKTI, working in collaboration with Regional Development Agencies (RDAs), is the key arm through which the government is seeking to increase the international marketing of the strengths of the UK economy. It is crucial, therefore, that recognition of the increasingly international flows of knowledge and innovation are further integrated into UKTI initiatives.

Regional and local policy

International networks: As part of its policy of cooperation, the UK government has implicitly sought to develop intermediary organisations to connect knowledge seekers with knowledge suppliers such as universities. These intermediaries include the business support infrastructure, such as Business Link, as well as a range of specific agencies and institutions. However, many connections established by these organisations are within regions, rather than UK-wide or international: one reason is that the funding restricts engagement to actors within a particular region, artificially restricting networks (as is often also the case with EU structural funds).

International networks designed to promote economic development within regions are largely associated with exports and FDI. RDA links with UKTI are seen as a key mechanism for delivering these initiatives. The economic strategy for South West England,⁹³ for example, highlights the requirement to '...continue to develop a climate in which more of our businesses trade internationally, and where companies from outside of the South West are attracted to invest in the region'. The sourcing of knowledge is not generally explicit in these strategies. For instance, the international dimension of activity within the cluster programmes of the RDAs and their partners mainly concerns the promotion of exports through international trade missions.

92. DIUS (2008) 'Innovation Nation.' London: DIUS.

93. SWRDA (2006) 'SWRDA Regional Economic Strategy for South West England 2006-2015.' Exeter: SWRDA.

There are, however, some specific cases of international knowledge network development within cluster initiatives. For example, the ICT cluster initiative in the West Midlands has taken the lead on the European Regions Research Innovation Network's (ERRIN) ICT working group on behalf of the West Midlands, and is also closely involved with the launch of the international Serious Virtual Worlds conference, through the Screen, Image and Sound cluster. In Yorkshire and Humberside, there are similar efforts to internationalise the activities of its digital industries cluster through the development of new networks. In the East Midlands, the promotion of knowledge sourcing appears to be an implicit feature of international trade policy, by seeking to facilitate firms to move beyond export arrangements, as the only means of internationalisation. Indeed, the RDA has moved towards the establishment of outsourcing, offshoring or partnering with other firms to share the risk of large investments or research projects, with support made available for firms internationalising such activities.

International networks within regional economic development strategies are also highlighted in the context of the development of policy cooperation and partnerships, particularly within the European Union and through political and civic links with key global partner regions. UK regions are increasingly forging such links through cooperation agreements with regions in emerging nations, especially China. In the North East, the One NorthEast China office has been key to developing Memoranda of Understanding between the North East and the Shanghai Ministry of Science & Technology, the Shanghai Ministry of Foreign Technology Exchange Companies, and the Jiangsu Province. The aim of these memoranda is to allow for cultural and technological exchange to benefit businesses through supply chain and investment opportunities.

The North West and the East of England are two regions that have developed a bespoke international strategy, some of the features of which have a capacity to stimulate international knowledge sourcing. As well as the usual focus on exports, the North West's international strategy identifies the scope to internationalise supply-chains as a whole. The strategy highlights a specific need to facilitate the internationalisation of knowledge intensive firms through targeted advice and support. And it has a stated aim of 'helping companies

access global innovation'. The main initiatives targeted at this objective are enhancing engagement with the Framework Programme; running promotional programmes to raise the profile of major international research projects in key sectors, e.g. ITER (a joint international research and development project that aims to demonstrate the scientific and technical feasibility of fusion power) led by UKTI, RCOs and HEIs; and helping companies access technology providers across Europe through Enterprise Europe Northwest (led by Enterprise Europe Northwest (EENW)).

In the North West, the Business Link Knowledge Platform, in association with the Northern Leadership Academy, is providing support – through the North West's Leadership Action Plan – for the leaders and managers of firms wishing to internationalise their activities. The North West is also engaged with the BOND initiative, operated by the British Council, which provides UK companies with low-cost introductions to potential business partners in key developing international markets.

In the East of England, the RDA is bringing together 'disparate' strands of activity into a cohesive international strategy and supports the region's businesses in developing international alliances for R&D and open innovation. The strategy explicitly aims to stimulate international knowledge sourcing. Key objectives include: developing global impact science/innovation parks and international skills capacity; making the most of international knowledge transfer between industry, research institutes and higher education; a network of internationally significant ICT clusters and programme of global collaboration; and an international partnering programme. The strategy places a particular emphasis on the formation of global alliances with other regions, prioritising partnerships with strategically selected regions abroad. Interestingly, the East of England also identifies and recognises the capacity for sub-regional intervention, highlighting international partnerships that have been established by local authorities. More broadly, the East of England is also keen to promote the wider Greater South East, consisting of the East of England, London and the South East, as a geographic unit through which to coordinate international policies in a knowledge economy, especially from an international marketing perspective.

The role of universities: rather than the sourcing of knowledge from overseas, regional

economic and innovation strategies tend to emphasise the need for better utilisation of indigenous knowledge, especially in local universities. Notwithstanding the apparent success of the UKTI R&D Programme, there is a key focus in the North East on creating knowledge networks. However, knowledge sourcing is seen as something for intra-regional, supply-chain networks of businesses, including both indigenous firms and inward investors, and other innovation actors such as the region's universities. In this case, universities in a region are implicitly assumed to play the role of knowledge gatekeeper, feeding knowledge sourced from other parts of the UK and overseas to firms in the region.

The 'university as knowledge gatekeeper' is also a key feature of the 'Science City' initiatives in York, Manchester, Newcastle, Nottingham, Birmingham and Bristol, which we understand relate to the apparent success of Cambridge. Science Cities are characterised by a mix of world-class science and technology in their universities and research organisations, businesses capable of turning this knowledge into new products and services, and the communities, skills and infrastructure to facilitate this. Universities are seen as being key levers in establishing links with other cities as part of the cooperation efforts of Science Cities.

Devolved regions: The UK's other devolved regions of Scotland, Wales and Northern Ireland have different approaches to the international sourcing of knowledge.

Wales has a strategic intention to focus international trade and investment on projects with a heightened element of innovation, but there is little evidence of this being extended to practical policy.

Scotland is more advanced, with innovation playing a more transparent role in its international strategy. It combines support for new exporters with an increasing focus on assisting existing exporters to deepen their degree of internationalisation; and it fosters innovative international company relationships including partnerships, alliances and outsourcing. Notably, Scottish Development International (SDI) assists companies in the development of an international business development strategy. Advice and support takes the form of informal one-to-one meetings directed at companies at an early stage in their international process. As part of the strategy development process, SDI engages

with businesses through its Global Companies Development Programme, which focuses on building management team capability.

Northern Ireland lacks a land border with the rest of the UK, but shares an 'international' border with the Republic of Ireland, although since the Good Friday Agreement, policy is increasingly developing on a cross-border basis. Although the internationalisation of knowledge is not specifically a strategy of policymakers in Northern Ireland it is an adjunct to activity in another area, for example governance (collaborative working with the Irish Republic), workforce skills (improving management practice through learning from overseas companies), enterprise policy (the need to engage with external firms, need to export) or FDI (upskilling within the supply chain). These policies form part of the renewed focus of the UK and Irish governments have placed on increased North-South cooperation and the agreement of high level goals and specific initiatives to deliver mutual benefits, particularly around the areas of trade and investment, energy, telecommunications,

R&D and skills. Although these are clearly positive developments, it does mean that much internationalisation in Northern Ireland is through increased links with the Republic of Ireland.

5.2 Policy recommendations

The following section presents the recommendations we consider should be addressed further to promote international knowledge flows across UK firms, particularly SMEs.

1. SMEs should be provided with appropriate support to enable them to access the knowledge they require from home and abroad. Government could map key global communities of practice for the benefit of SMEs.
2. Small firms should be helped to identify and use international agents. With the help of embassies and overseas trade missions, lists of suitable agents, lawyers and financial advisers with knowledge of trade in different countries should be made available to firms. This should complement financial support for UK firms on overseas trade missions.

3. Overseas trade missions to the UK should be better supported. Financial assistance should be given to fund international customers, suppliers, collaborators and associates to undertake visits to the UK. This will help UK firms through the spread of ideas and shared expertise.
4. A register of global university expertise should be compiled. There should be a shift away from assuming that local universities are the fount of all knowledge. An online directory of expertise within UK and overseas universities should be made available to small firms, with encouragement to develop links with the most appropriate academic teams.
5. Better support should be made available to help SMEs engage with emerging economies including China and India. The four emerging BRIC economies – Brazil, Russia, India and China – are increasingly leading the way in new ideas, products and processes. UK small firms need support to engage with them, if they are not to be left behind in the new global economy.
6. Firms need advice on effective network management. While there is already significant management and leadership support, it doesn't sufficiently address the art of managing knowledge networks. This new discipline should be supported by government.⁹⁴
7. Government must continue to fund existing network support. With tighter public finances, there may be a temptation to cut back on support for organisations such as the Technology Strategy Board (TSB) and research councils which facilitate SME engagement in these activities. This would be a false economy. Such work is vital for UK competitiveness and trade.
8. Government should widen its regional focus. Knowledge sourcing and networking occur in a regional, national and global context. SMEs should be encouraged to source the most relevant knowledge wherever it is located.

focused on seeking to develop key economic sectors – often knowledge-based firms – with a focus on physical infrastructure, such as science parks, business incubators and laboratories. This has underplayed the importance of building the networks, value and supply-chains that underpin successful growth.⁹⁶ Also, where networking initiatives have been instigated they have often been local or regional in their scope. Although such initiatives are necessary, there has been little concern from policymakers with supporting more global connections.⁹⁷ Appropriate knowledge sources are now less likely to be local and future developments must be placed within a globalised knowledge environment. Policy must embrace more open and connected network systems.

Policymaking should further take into account the need for knowledge sourcing and networking to be equally set in both a regional and global dimension and context. For SMEs, which are seen as the primary sources of national and regional competitiveness, there should be two key policy developments:

- First, to increase the involvement of SMEs in the type of enduring knowledge networks required for effective collaborative innovation to be achieved.
- Second, to enable SMEs to source the most relevant and up-to-date knowledge by ensuring that their networks contain the requisite level of dynamism.

The diversity of SMEs means they require diverse flows of knowledge from an equally diverse range of sources. The 'pre-packaged' knowledge available from consultants is often of less use to SMEs. SMEs need access to 'non-standardised' and highly specific forms of knowledge. Public policy should establish such dynamism by promoting and facilitating global searches for appropriate knowledge sources.

94. Asheim, B., Cooke, P. and Martin, R. (Eds) (2006) 'Clusters and regional development: critical reflections and explorations.' London: Routledge.
95. Hospers, G. (2005) Best practices and the dilemma of regional cluster policy in Europe. 'Tijdschrift voor Economische en Sociale Geografie.' 96(4), pp.452-457.
96. Gertler, M. and Wolfe, D. (2004) Ontario's regional innovation system. In Cooke, P., Heidenreich, M. and Braczyk, H. (Eds) (2004) 'Regional innovation systems: The role of governance in a globalised world.' London: Routledge.
97. Rickne, A. (2006) Connectivity and performance of science-based firms. 'Small Business Economics.' 26, pp.393-407.

5.3 Conclusion

For some years, SME policy has focused on the cluster model of development.⁹⁵ This has mainly

Part 6: Conclusion

Access to external knowledge has become increasingly important for small firms which often cannot internally generate all the knowledge – the research, ideas, skills and expertise – they need to innovate and sustain their competitiveness. In this report we have assessed and analysed the knowledge sourcing activities of companies in the UK, especially SMEs, focusing on the extent to which these activities are international in their scope. We have shown that most UK companies do not just rely on domestic sources of knowledge. Instead, they are part of global knowledge networks. The cross-border sourcing of knowledge is meshing previously independent national (and regional) innovation systems into more inter-connected and more open global innovation systems.

Leading firms across the UK seek to develop and maintain close relationships with those knowledge sources they deem as strategic, regardless of location. In particular, the most innovative SMEs develop mutually beneficial relationships supporting a two-way flow of knowledge, delivering benefits to all parties.

The type of knowledge a company requires will influence where it goes to acquire it, with more tacit forms less likely to be purchased. In this case, knowledge networks provide access to new ideas through both formal and informal routes. These routes may themselves form important assets that firms can and should nurture to sustain access to valuable knowledge. Although ideas and know-how may be accessible locally, it is often only accessible from more distant sources. And even where local knowledge is available, its quality may be inferior to that available elsewhere.

Knowledge networks, therefore, enable SMEs to develop the relationships that allow them appropriately to apply knowledge and subsequently provide innovative goods and services. Although knowledge may be bought, problems in setting a price for such an intangible asset means that it is often transferred through more cooperative non-market-based relationships. As firms grow, their dependency may shift from social networks towards more strategic and intentionally managed networks.

External knowledge sourcing – especially in an international context – depends not only on the availability of appropriate local sources but also on the internal resources of firms, such as their capability effectively to assess and absorb the knowledge they seek. Firms that are not good at accessing ideas – with low levels of absorptive capacity – may tend to network locally, while those with higher absorptive capacity are often more connected to global networks.

The report has further emphasised the extent to which the number and quality of available knowledge sources varies across the UK's regions, cities, and other localities. The UK's least competitive and most peripheral regions and nations are usually less well endowed with high quality knowledge providers. The inability of small firms in the UK to access relevant and appropriate knowledge may damage their competitiveness and innovation performance.

Greater policy efforts are required to develop appropriate mechanisms to facilitate UK companies, particularly SMEs, access to the global knowledge environment and global communities of practice. More open and connected network systems should

be established. For instance, SMEs should be linked with universities that provide the knowledge and ideas they really need, regardless of location. There has been a strong drive to push small firms to make more use of their local universities but we have seen how some of the UK's most innovative SMEs have developed links with overseas universities to access the state-of-the-art knowledge they require.

SMEs are not always aware of how or where they can source the knowledge they require. Intermediary organisations should link small firms with the firms and organisations in possession of this knowledge. More generally, policymakers need better to understand the barriers firms face in seeking to access the knowledge they require, and provide mechanisms for alleviating bottlenecks. Furthermore, there is a need to assess the extent to which the existing policy framework, at all relevant levels of governance, is equipped with the systems to effectively promote knowledge flow across firms and other organisations facilitating wider economic development.

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