MIRIAD

Managing and Infusing Research Investment And Development

Yorkshire and Humber Knowledge Investment Strategy

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1. Introduction

This document presents the strategic recommendations, and the key findings from which these recommendations have been formulated, of the Yorkshire and Humber aspect of the EU-funded project entitled 'Managing and Infusing Research Investment and Development (MIRIAD). MIRIAD (www.miriad.org) is a two-year project principally operating between 2006 and 2007 funded under the European Commission's Regions of Knowledge 2 initiative (part of Framework Programme 6).

The key aim of MIRIAD is to stimulate policy intervention focused on raising levels of R&D investment in four regions across Europe.These four regions consist of Yorkshire and the Humber in the UK, the Western Turkish region from Istanbul (inclusive) to the Greece and Bulgarian borders of Turkey, East Macedonia and Thrace (including Thessaloniki) in Greece, and the South Eastern Bulgarian region from Sofia (inclusive) to the border with Greece and Turkey, including also the Bulgarian Black Sea region. The choice of regions represents an opportunity to build upon inter-regional cooperation and linkages that already exist between the regions and the proposed project partners.

In the past, knowledge and R&D investment policies and strategies have focused either on stimulating transfers/spillovers or facilitating knowledge absorption. However, it is clear that successful strategy building must take account of both simultaneously. The aim of MIRIAD is to integrate both these aspects, so as to remove both the supply and demand-side barriers associated with knowledge and R&D transfer, absorption, and investment. In essence, knowledge and R&D investment is a function of a region's ability to transfer, spillover and absorb knowledge. MIRIAD focuses on the inter-connectivity of these three factors as a catalyst and stimulator of enhanced knowledge and R&D investment.

The key objectives of MIRIAD are:

- To formalise policies with regional and national government aimed at improving levels of R&D investment by businesses, government and higher education.

- To establish tools by which SMEs are able to identify and measure their knowledge assets through developing a range of benchmarking and scorecard instruments tailored to the regions in which they are operationalised.

- To establish a regional mutual learning platform for promoting the trans-national exchange of practices for enhancing regional R&D investment.

- Facilitate the transfer of good practices in terms of participation to EU funded research, links and co-operation between SMEs and research performers, methodologies and models for the creation and development of research oriented businesses.

- Establish and launch an R&D Investment Strategy for each of the regions complementary to the existing policy initiatives and activities already being undertaken, but also has a real and positive impact on future R&D investment performance. The processes underlying the development of these strategies can then be applied in other regions across Europe.

This document represents the contents of Investment Strategy established for the Yorkshire and Humber region, although in this case we refer to it as a 'Knowledge Investment Strategy' – see note below.

The main part of the work undertaken for MIRIAD consisted of the following activities for each of the four regions:

- Scoping and Analysis of R&D Performance.

- Foresight and Scenario Workshops.

- Benchmarking Regional Knowledge Demand and Absorption.

- Benchmarking Regional Knowledge Supply and Transfer.

- Regional Policy Roundtables.

- Trans-National Regional Learning Platform.

- Regional R&D (Knowledge) Investment Strategies.

As a means of achieving the objectives of the project, the key analytical components of the project included the following:

- To examine the current and potential knowledge capability of SMEs and the scope for improving their competitiveness through the development of

knowledge transfer and business alliances strategies within supply chains and across industries and markets.

- To understand the current role played by SMEs in each region and some of the barriers and opportunities for their expansion.
- To draw out the specific knowledge deficits and/or surpluses within SMEs.
- To identify and understand the likely intermediaries and institutions (particularly universities) required to be involved in establishing knowledge transfer platforms.
- To understand the processes best suited to stimulating engagement from SMEs in each region.

This report presents the strategic recommendations formulated by the MIRIAD project team set within the context of the key findings established during the undertaking of the activities listed above.

Innovation or R&D?

It is important to note that whilst the focus of the MIRIAD process at the outset concerned R&D and R&D investment, during the consultation process undertaken in Yorkshire and Humber it became abundantly clear that the narrowness of investment in R&D would miss much of the opportunity to invest and exploit service sector innovation, as well as innovation and change not necessarily deriving from R&D in the strictest sense. As a result the MIRIAD study in Yorkshire and Humber evolved to consider wider investment in knowledge that facilitates innovation, rather than just R&D investment. However, the obligations of the project to the European Commission (as well as the available metrics) meant that much of the early work of the project – some of which is summarised below – focused on the concept of R&D.

2. Competitiveness

As shown by the two tables below, the competitiveness of the Yorkshire and Humber region lags behind that of the UK as a whole, as well as that of Europe. A key issue for the future competitiveness of the region is addressing the relatively low levels of labour productivity. Labour productivity is largely determined by industrial structure, especially its knowledge intensity, and the effectiveness of human capital deployment.

Table 2.1 UK Regional Competitiveness Index 2006

Table 2.01: UK Regional Competitiveness Index 2006 (UK=100)

Rank	Region	Index 2006	Index 2005	Rank in 2005	Change in Index Score 2005-2006	Change in Rank
1	London	113.9	114.7	1	-0.8	0
2	South East	110.5	114.6	2	-4.1	0
3	Eastern	106.0	109.0	3	-3.1	0
4	East Midlands	96.1	95.5	4	0.7	0
5	South West	94.9	93.2	5	1.7	0
6	Scotland	94.2	91.0	8	3.2	2
7	West Midlands	92.7	91.8	6	0.8	-1
8	North West	92.3	91.2	7	1.1	-1
9	Yorkshire and The Humber	90.5	86.7	9	3.8	0
10	Northern Ireland	88.0	84.0	10	3.9	0
11	Wales	86.7	83.5	11	3.2	0
12	North East	84.2	81.2	12	3.1	0
	United Kingdom	100.0	100.0			

Source: R. Huggins and J. Day (2006) *UK Competitiveness Index 2006*, London: The Work Foundation

Unpacking some of the constituent variables of competitiveness, we find that the Gross Domestic Product (GDP) per head of population in Yorkshire and the Humber is more than 3,000 Euros less than the UK average. Also, Gross Monthly Earnings statistics indicates that the pay gap between Yorkshire and the Humber and the UK as a whole is more than 100 Euros per month lower than the UK average. Undoubtedly the key reason for these gaps are that the relatively rich regions in the south-eastern regions of England have increased their wealth and prosperity at a faster rate than other regions of the UK.

Table 2.2: European Regional Competitiveness Index 2006-07

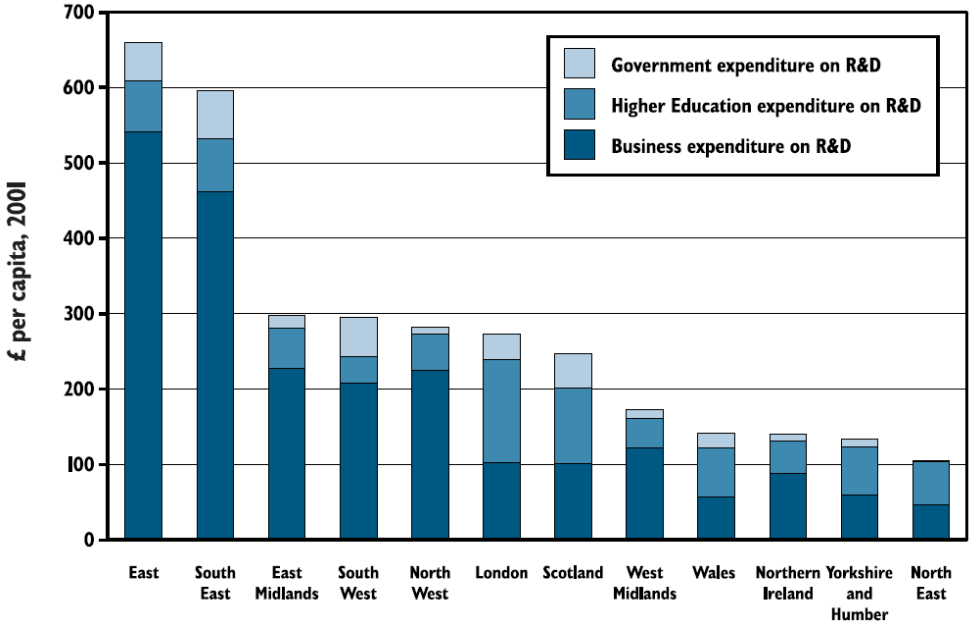
Rank	Region	Regional Competitiveness Index Score	Rank 2004	Change in Rank
1	Brussels, Belgium	193.5	3	2
2	Uusimaa, Finland	188.3	1	-1
3	Île de France, France	185.2	4	1
4	Stockholm, Sweden	177.8	2	-2
5	Etelä-Suomi, Finland	175.4	28*	23*
6	Luxembourg	165.9	6	0
7	Prague, Czech Republic	165.7	-	-
8	Hamburg, Germany	163.5	7	-1
9	London, UK	162.6	8	-1
10	Bratislavský kraj, Slovakia	159.6	-	-
55	Est, France	102.4	51	-4
56	Méditerranée, France	102.4	53	-3
57	Yorkshire and The Humber, UK	102.3	60	3
58	Saarland, Germany	99.6	38	-20
59	Attiki, Greece	97.8	78	19
60	Rheinland-Pfalz, Germany	97.3	33	-27

Source: R. Huggins and W. Davies (2006) *European Competitiveness Index 2006-07*

3. Innovation and R&D

The region possesses an R&D investment gap when compared with the UK and EU averages. In particular, the region has a major structural deficit in terms of the expenditure on R&D undertaken by the business sector (see Figure 3.1). This highlights the R&D challenge the region is facing, and encapsulates the reasoning behind a requirement for policy intervention. More positively, there is significant R&D spending undertaken by the region's higher education sector, which is higher than the EU average and only slightly lower than the UK average.

Figure 3.1: Regional Investment in R&D in the UK



Source: Office for National Statistics

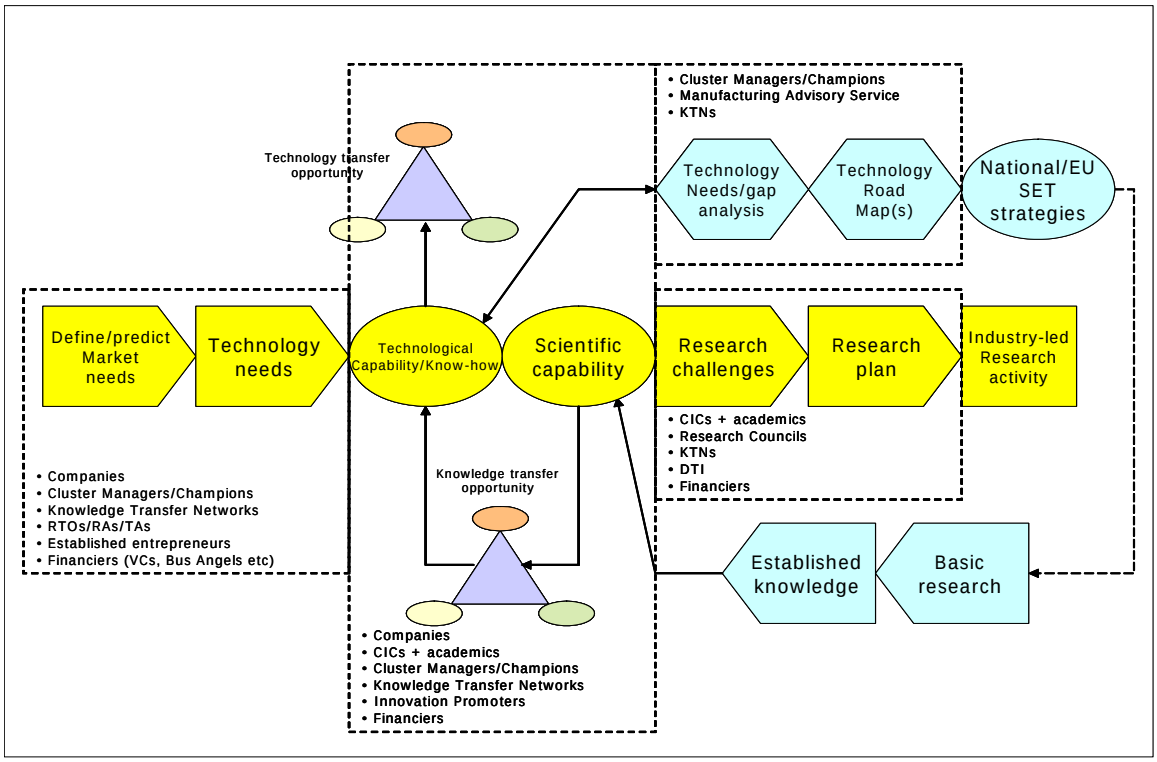
Table 3.1 presents a SWOT summary of Yorkshire and the Humber's R&D investment capabilities. It highlights the potential to further exploit the R&D capabilities and commercialisation potential of the region's higher education sector. The potential problem in relation to regional intervention is the dependency on national institutions and decision-making authorities as the main funders of higher education research. The key stakeholders involved in policies relating to R&D investment are the UK National Government, Yorkshire Forward and Yorkshire Science.

Table 3.1: R&D Investment SWOT Summary

Strengths	Relative strong higher education sector, with a core of world-class research establishments.
Weaknesses	A clear lack of R&D investment by the business sector, which is largely dominated by SMEs.
Opportunities	The potential to build on the R&D undertaken by the region's higher education sector, so as to fully exploit its latent commercialisation capacity.
Threats	The dependency of UK government policies as the key funder of higher education research in the region.

Yorkshire Science is a relatively new incarnation, but is increasingly set to become they key player responsible for science and innovation strategy development in the region. Figure 3.2 provides a summary of the delivery framework proposed by Yorkshire Science. Yorkshire Forward, as the region's primary economic development institution, has recognised the region's R&D investment deficit and has set a broad target of doubling the level of current investment in the coming years.

Figure 3.2: Yorkshire Science – A Framework for Innovation



Source: Trevor Gregory, Director, Yorkshire Science

R&D investment policies impacting on the Yorkshire and Humber region are double pronged. First, there is national policy intervention in the form of the UK Science & Innovation Investment Framework 2004–2014, which aims to increase the level of

knowledge intensity in the UK (as measured by the ratio of R&D across the economy to national gross domestic product) from its current level of around 1.9% to 2.5% by around 2014. Second, there is the emerging Yorkshire Innovation Strategy, which aims to provide more coordinated regional intervention, from both a demand and supply perspective, with regard to linking the science and industrial base of the Yorkshire and Humber region.

R&D: A National Policy Priority

Key national targets include increased business investment in R&D, and increased business engagement in drawing on the UK science base for ideas and talent:

- Increase business investment in R&D as a share of GDP from 1.25% per cent towards the goal of 1.7% over the decade.
- Narrow the gap in business R&D intensity and business innovation performance between the UK and leading EU and US performance in each sector, reflecting the size distribution of companies in the UK.

R&D: A Regional Policy Priority

The key aim of Yorkshire Forward with respect to R&D, innovation and knowledge transfer can be summarised as follows:

- Key Objective - Double R&D expenditure from 0.5% of GVA in 2002 to at least 1% of regional GVA.
- Underpin the strength of relevant HE and research expertise (including the science base) in the region, and increase utilisation of this and levels of R&D within regional businesses.
- Utilise the transfer of R&D grants to stimulate levels of R&D carried out by key companies in the region, which will act as a platform for future and better linkages between companies and HEIs.

It is important to note that during the consultation undertaken in the region there was a strong and consensual message that ‘innovation is not necessarily about R&D’, and tackling the innovation problem in Yorkshire and Humber may require a focus on other, softer, facets of innovation. The lack of a culture of innovation in the region means that many SMEs are reluctant to embrace change and are liable to see their competitive position eroded over time. Innovation is not necessarily about big ideas, and firms also need to be encouraged and supported to make incremental changes and

realise the benefits of these changes. However, such small-scale company development often falls below the policy radar, with the focus on R&D and developing new products.

Recommendation 1	**Rationale**
Ensure that future policies are committed to furthering innovation in the broader sense, rather than being restricted to a narrower focus on R&D.	Due to recessions of the 1980s and 1990s, which decimated many of the regionally established large firms, the business stock is comprised of a larger proportion of younger firms, often in service-based sectors, that are not sufficiently developed in terms of their ability to innovate.

Recommendation 2	**Rationale**
Continue to build on the work of Yorkshire Science to develop a data capture methodology focused on analysing attitudinal changes towards innovation, as part of a region wide methodology sensitive to measuring changes in innovation culture.	Promoting cultural changes requires relatively sophisticated and sensitive methodologies in order to measure the impact of policy, particularly those policies where the impact will only be determinable over a significant period of time

Recommendation 3	**Rationale**
Develop new regional metrics that incorporate a holistic means of measuring investment in knowledge.	Whilst R&D expenditure continues to be an important measure of innovation and the conversion to a knowledge-based economy, it is limited due to it relative inapplicability to service-based sectors.

4. R&D Investment Scenarios

This section illustrates three scenarios for the Yorkshire and Humber region based on future investment in R&D by the region's business community. The three scenarios are:

- Scenario 1 – Continuing the Current Trend.
- Scenario 2 – Moderate Increase in R&D expenditure.
- Scenario 3 – Substantial Increase in R&D Expenditure.

Scenario 1 – Continuing the Current Trend

This scenario is based on R&D levels in the Yorkshire and Humber region continuing at the current level of growth, which was approximately 2% per annum between 1998 and 2004. Assuming an average increase in GDP of 2.5% per annum, business expenditure on R&D as a percentage of GDP in Yorkshire and the Humber will decrease from 0.49% to 0.39% of GDP over the next 10 years. This is illustrated by Figure 4.1, which assumes that R&D expenditure as a percentage of GDP for the UK as a whole stays constant, as was the situation between 1998-2004.

Figure 4.1 shows that maintaining the current 2% per annum increase in R&D expenditure will actually decrease the proportion of GDP spent on R&D (assuming GDP grows at 2.5% per annum). A divergence from the UK as a whole will be observed, having the effect of further weakening the competitiveness of the region and ensuring that it remains substantially behind the UK as a whole. This translates into a low impact on economic growth and little in terms of demand for more highly skilled workers.

The wider implications of this scenario are:

- Increased divergence from the more prosperous core regions of the UK and Europe as a whole. This continues the vicious circle of decline initiated by the contraction of core industries in the region over the past three decades.
- Further relative decline could be witnessed as regions from new member states of the EU catch up and surpass the region.

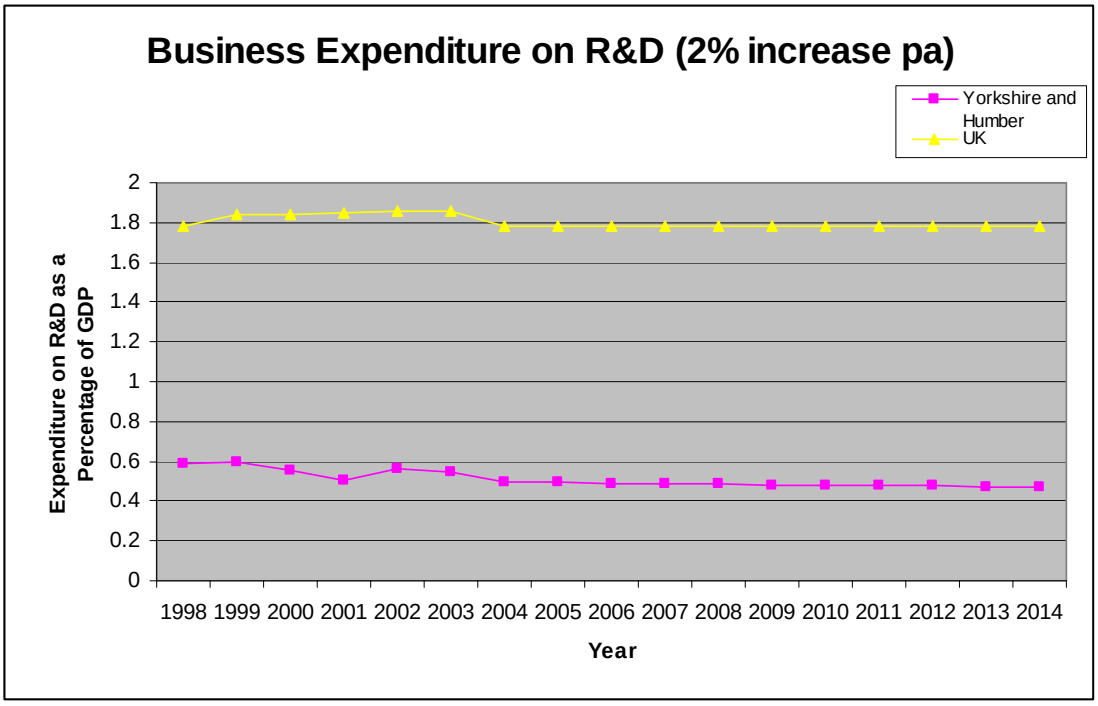
- The lack of opportunity for highly skilled jobs in high technology sectors may lead to the migration of skilled workers to other regions where such jobs do exist.

- The lack of skills and dominance of low technology sectors would deter potential foreign direct investment, especially from new technology high added value sectors, which demand highly skilled labour as well as a supply chain to provide the necessary inputs.

- A lack of R&D will hamper the development of the regional clusters, with there being fewer spillovers if there is less knowledge generated.

- The lack of R&D expenditure by the business sector puts further pressure on the higher education sector to produce the knowledge necessary for the region's businesses to innovate.

Figure 4.1 Business Expenditure on R&D 1998-2014 Based on Current Trends



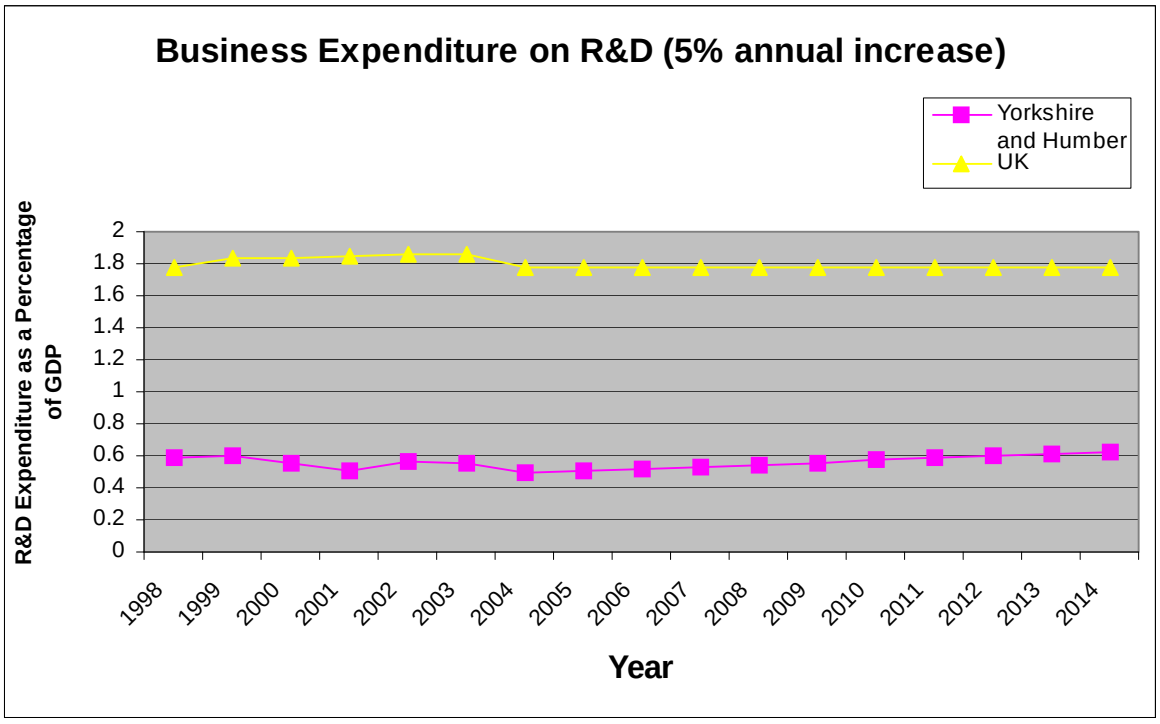
Scenario 2 – Moderate Increase in R&D expenditure

This scenario is based around a moderate increase in rate of growth of R&D expenditure from 2% per annum to 5%. Figure 4.2 shows that this would lead to an improvement in the relative position of the region, with expenditure on R&D increasing from 0.49% to 0.63% of GDP. However, this improvement is very slight and only restores the region to a level of R&D investment slightly above that im 1998 (0.59%) and, with it taking a considerably long time period to converge with the UK, assumes there is no increase in the proportion of UK GDP spent on R&D.

The wider implications for this scenario are:

- It stops the divergence from the rest of the UK; and while there is only a low level of growth observed it is enough to arrest the decline and offers a base to build on for the future.
- Arresting the decline may prevent the higher skilled jobs from leaving the region, ensuring there is demand for skilled workers and ending the migration to more prosperous regions.
- Pressure is eased on the higher education sector as business R&D catches up and compliments the activities of this sector.
- There is greater scope for the region's cluster strategy to succeed, as the higher levels of R&D allow greater amounts of innovation to be undertaken and a higher level of knowledge spillover occurs.

Figure 4.2 Business Expenditure on R&D 1998-2014 Based on an Increase of 5% per Year



Scenario 3 – Substantial Increase in R&D Expenditure

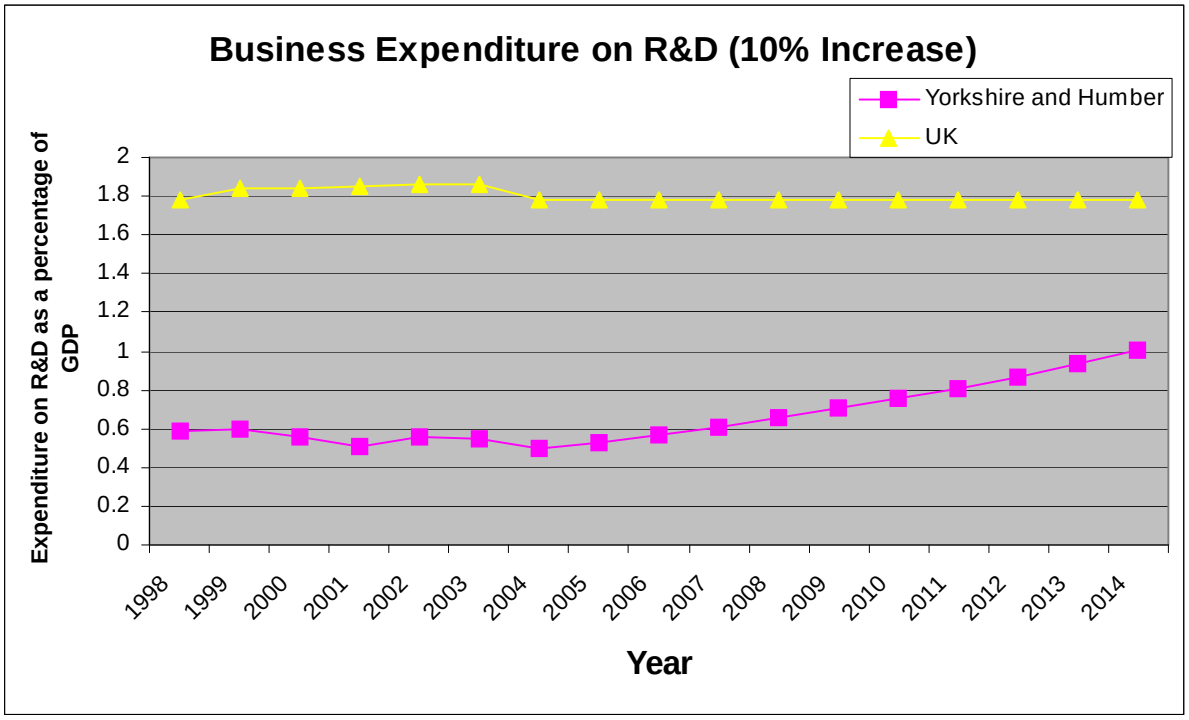
This scenario is based on an increase of 10% per annum in R&D expenditure by businesses (again, assuming GDP increases at 2.5% per annum and R&D expenditure as a proportion of GDP stays constant for the UK as a whole). Figure 4.3 illustrates that with a 10% increase per annum R&D expenditure promotes significant convergence with the UK as a whole. Although significant convergence is observed, it

would still take a long time period for the Yorkshire and Humber region to reach UK levels. However, it is only by ensuring a scenario such as this takes place will there be further development of the knowledge driven economy in the Yorkshire and Humber region.

The wider implications of this scenario are:

- The increased levels of R&D will create a higher number of skilled jobs, which will act as an incentive for skilled workers to stay in the region as well as attracting others from the outside.
- Attraction of FDI from high added value firms would further boost the regional economy.
- The Yorkshire and Humber region will be more competitive region in an increasingly globalised economy and be able to compete with emerging regions with significantly lower costs of production.

Figure 4.3 Business Expenditure on R&D 1998-2014 Based on an Increase of 10% per Year



In Summary:

- Scenario 1 – if the region continues its current trends then the regional economy continued divergence from the UK will be observed.

- Scenario 2 – small improvements will prevent further decline relative to the UK but will merely maintain the region's current lagging position.

- Scenario 3 – large improvements in R&D expenditure will not only arrest the decline but ignite a process of catch up with the UK.

5. The Knowledge Economy

The key stakeholders responsible for regional knowledge supply and creation are within the region's higher education sectors. In particular, a group of regionally 'elite' institutions – the Universities of Leeds, Sheffield and York – appear to be the key drivers of knowledge creation, accounting for a large proportion of the sector's research spend within the region. Also, the key policies relating to knowledge supply and creation are those involving the region's higher education sector.

The overarching regional framework set by the sector is the strategic plan signed-up to by the region's universities. A key feature of this plan is to ensure that the region's higher education sector is represented by and contributes to the regional and sub-regional agenda, as well as providing an intelligence gateway for and about higher education in the region. These policies are also recognised by the group of 'elite' universities, as part of the White Rose Research Triangle, and within the region's overall economic strategy.

Knowledge demand and absorption are crucial to innovation but are difficult to measure. At a regional level, the best available indicators relate to industrial structure and the human capital capacity of the existing workforce. Industrial structure analysed in terms of the knowledge intensity of the region's businesses is a useful indicator of the potential demand for knowledge, while human capital capacity indicators are able to monitor the likely ability to absorb appropriate knowledge.

As shown by Table 5.1, the proportion of businesses within the Yorkshire and the Humber economy operating within knowledge-based sectors is significantly below the UK average. This strongly suggests that knowledge demand in the region is potentially weak, particularly in relation to the UK economy as a whole. Also, the higher order skills capacity of the region's workforce is below that of the UK as whole, indicating potential issues of the ability to absorb knowledge.

Table 5.1: Regional Proportion of Knowledge-Based Businesses

Rank	Region	Proportion of Knowledge-Based Businesses (2004)	Proportion of Knowledge-Based Businesses (2003)	Rank in 2003	Change in Rank	CAGR
1	London	28.4%	28.6%	1	0	-1%
2	South East	24.6%	26.9%	2	0	-9%
3	Eastern	21.0%	21.6%	3	0	-3%
4	North West	18.6%	20.2%	4	0	-8%
5	South West	18.5%	18.7%	5	0	-1%
6	West Midlands	17.7%	17.6%	6	0	0%
7	Scotland	17.0%	17.0%	7	0	0%
8	East Midlands	16.8%	16.6%	8	0	1%
9	Yorkshire and The Humber	16.0%	15.6%	9	0	2%
10	North East	15.7%	15.4%	10	0	2%
11	Northern Ireland	14.9%	15.2%	11	0	-2%
12	Wales	14.1%	14.1%	12	0	0%
	United Kingdom	20.6%	21.2%			-3%

Source: R. Huggins and J. Day (2006) *UK Competitiveness Index 2006*, London: The Work Foundation

Recommendation 4	**Rationale**
Identify and prioritise the growth of the region's leading knowledge-based SMEs.	Despite the fact there are a number of top universities within the region the retention of postgraduate students in the region is very low. The region has problems retaining and attracting skilled workers.

Policies relating to knowledge demand and absorption tend to be an implicit feature of other policies targeted at the private sector, rather than explicit policies in themselves. At a national level, R&D policies in the form of tax credits and co-funded R&D initiatives are one implicit measure aimed at stimulating knowledge demand. Another is the Small Business Research Initiative, which is attempting to improve the knowledge and R&D interface between SMEs and the government. Within Yorkshire and the Humber, Yorkshire Forward's cluster policy is an important potential means of improving the knowledge demand absorption capacity of targeted businesses within the region.

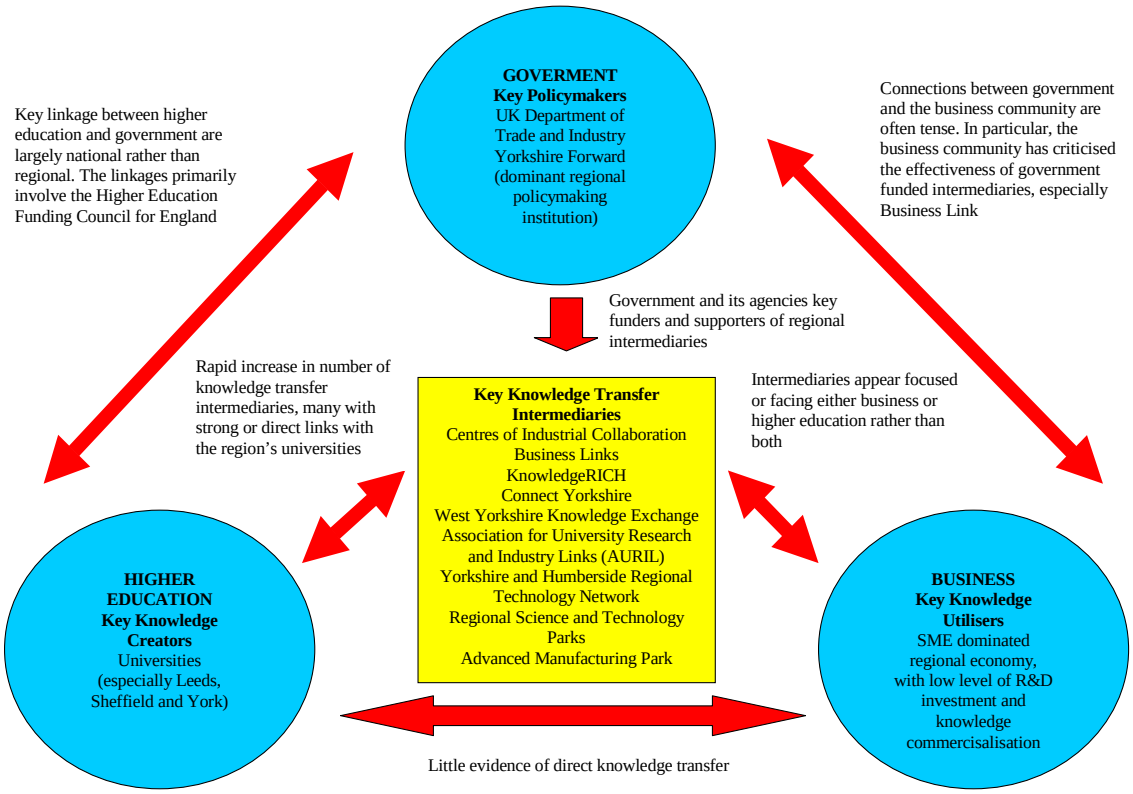
As shown by Table 5.2, there is a relative plethora of stakeholders with some form of responsibility for knowledge transfer and flow within the Yorkshire and the Humber region. A number of these stakeholders are relatively new institutions, and there is little evaluative evidence of their performance. An exception here is the Business Link programme, which is the Government's mainstream business support provider, which has received significant criticism of effectiveness and performance.

Table 5.2: Role of Key Knowledge Transfer and Flow Stakeholders

Stakeholder	Role
Centres of Industrial Collaboration	The network of Centres of Industrial Collaboration (CIC) was established by Yorkshire Forward to help businesses harness the innovation and expertise available from universities within Yorkshire and Humber.
Business Links	Main business support providers in England, operating through a network of sub-regional offices. Overseen by the Small Business Service.
KnowledgeRICH	Under European Innovative Actions programme Yorkshire Forward established a Regional Innovation Clearing House (RICH) to facilitate the dissemination and diffusion of available knowledge on key innovation assets.
Connect Yorkshire	Set up to support early stage high technology, high growth companies and unlock the full potential of the wealth of technology businesses in Yorkshire and Humber.
West Yorkshire Knowledge Exchange	Established to represent a central hub for the digital expertise, skill and resources present within the four West Yorkshire Universities.
Association for University Research and Industry Links (AURIL)	Professional association representing all practitioners involved in knowledge creation, development and exchange in the UK.
Yorkshire and Humberside Regional Technology Network	Exists to assist Business Support organisations in the Yorkshire and the Humber region develop and deliver an effective and cohesive range of services to support innovation and technology transfer amongst the region's businesses.
Regional Science and Technology Parks	The region is home to six Science and Technology Parks. These parks focus on the incubation of innovative, high-growth, knowledge-based start-ups. They aim to provide an environment in which companies, regardless of size, can develop operational links with universities, higher education and research institutes.
Advanced Manufacturing Park	Provide a base for research organisations and high-tech industries. Provides high quality accommodation. Provides 'scope for technology interchange minimising risks and costs'. Target sectors such as aerospace, medical implants and automotive components which have been identified as technologies and companies likely to benefit from the 'clustering effect.'

As a means of summary, Figure 5.1 presents a broad conceptualisation of knowledge creation, demand, transfer and flow primarily based on the evidence collected by the MIRIAD project team.

Figure 5.1: Triple Helix Representation of Yorkshire's Knowledge Flow Model



Recommendation 5	Rationale
Streamline the maze-like business support infrastructure, reducing red tape and excessive bureaucracy and improving its 'user friendliness'.	Although numerous regional initiatives have been put in place to provide 'business gateways' and 'one-stop-shops' entrances to universities, most SMEs are still very reluctant to enter.

A summary of the key issues on the development of the knowledge economy in Yorkshire and Humber raised during the consultation process is shown below:

- The Regional Innovation Strategy - Alongside the regional economic strategy, there is also the newly formulated regional innovation strategy, which will form the key lever of future policy intervention in the region.

- University Necessity - Universities want to improve relations with business support agencies as it is forms part of their Third Stream Funding for knowledge transfer activities.

- Positive Outlook - New regional initiatives are generally positively received although there is still far more to do.

- Sub-Regionality - There is a need to bring geography/location into regional thinking on innovation – and innovation thinking into future strategy formulation.

- Institutional Learning - There is a need to understand and build on existing experience and thinking, and integrate Yorkshire Forward's sector and cluster-based approaches.

- Finance Capital - There may not be sufficient risk capital in the region for entrepreneurs to capitalise on R&D and innovation.

- Network-Based Cluster Building – There is an opportunity to amplify network-based activities cluster activities across the region, where a boost in R&D investment could considerably improve performance.

- University Innovation Strategies - Two of the key universities, Leeds and York, are publishing an innovation strategy setting out their plans for interaction with SMEs and the internationalisation of their research output.

- University Foresight Audits - The Universities Foresight Audit looks at the offering of all universities in the region in terms of knowledge and expertise.

- National Health Service R&D strategy - The region's universities are currently considering the opportunities presented by the National Health Service R&D strategy. The universities of Sheffield and Leeds are attached to two of the largest teaching hospitals in Europe and stand to benefit from enhance R&D opportunities.

Recommendation 6	**Rationale**
Review the consistency between policies and initiatives at the regional and sub-regional (city/city-region, locality) level to ensure 'scale economies' are achieved.	Alongside regional policy development, a range of institutions has been established in recent years at the sub-regional level related to knowledge transfer and innovation development that are not necessarily consistent with regional policymaking.

6. SME Competitiveness, Innovation, and Knowledge Networks

As part of the MIRAID process, we gathered detailed data on the innovation and knowledge network activities of both SMEs and universities in the region through a range of surveys, in order to gain a fuller understanding of these activities and how they relate to SME performance. Initially, SMEs were asked to rate a range of factors in relation to their perceived importance to competitiveness and the effectiveness of use of a particular factor in relation to its importance. Table 6.1 presents a summary of those factors SME managers consider to either effective or ineffective in their firm. Amongst the range of factors identified, it noticeable that many managers consider factors relating to the 'innovation culture' of their firm to lack effectiveness.

Table 6.1: The Perceived Determinants of Competitiveness for SMEs in the Yorkshire and Humber Region

	Lack Effectiveness - in relation to perceived importance to competitiveness	**Do Not Lack Effectiveness** - in relation to perceived importance to competitiveness
Human Capital	Management skills, employee skills, employees commitment	Management qualifications, employee qualifications, employee loyalty
Intellectual Assets	Market intelligence, website, IT facilities	Patents filed, trademarks registered, copyrights held
Physical Capital	Industrial buildings (although only a minor difference)	Retail premises, leased plant, proximity to suppliers
Network Capital	Customer relationships and loyalty, supplier relationships, brand/image	Licence agreements with other firms
Knowledge Creating Capability	R&D teams/workers, management, other employees	-
Innovation Culture	Competitive intelligence and benchmarking, development of new products, services and markets, development of external networks	Development of new materials

Recommendation 7	**Rationale**
Regionally-focused marketing exercises should be introduced to promote and embed the link between competitiveness and innovation across the business community.	Although an innovation culture exists in pockets, it is still far from being integrated across the region as whole, and differs across segments of both the region's economy and society.

Recommendation 8	Rationale
Provide further resources to develop innovative tools to measure the determinants of SME competitiveness and demand for knowledge.	The MIRIAD initiative has attempted to develop an SME competitiveness benchmarking tool, but further work is required in this area.

It was found that the most frequently utilised sources of knowledge for SMEs in the region are their customers and suppliers. As Figure 6.1 highlights, both of these are more frequently utilised with sources outside the region, indicating that it is customers and suppliers outside the region that are generally considered more valuable sources. Within the region, customers and suppliers are followed by business and professional networks (in the form of chambers of commerce, trade or business associations, business clubs and other professional networks), universities and other higher education institutions, and private sector organisations (in the form of private training or research providers, and consultants) as the sources of knowledge most frequently utilised by firms.

Outside the region, with the exception of customers and suppliers, rival firms are the next most frequently utilised source of knowledge, indicating the relative importance of competitors as sources of knowledge, especially those that are not spatially proximate. In general, customers, suppliers and rivals outside the region are the most frequently utilised sources of knowledge.

Figure 6.1: Key External Sources of Knowledge for SMEs

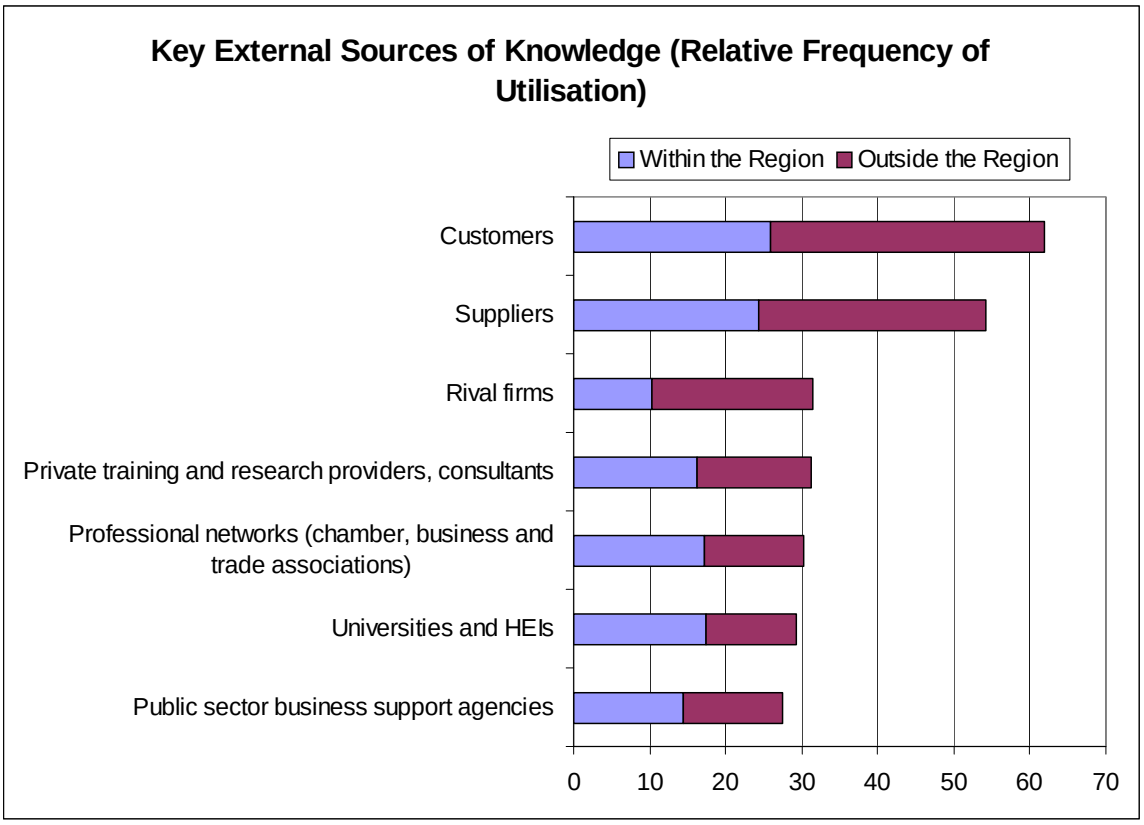
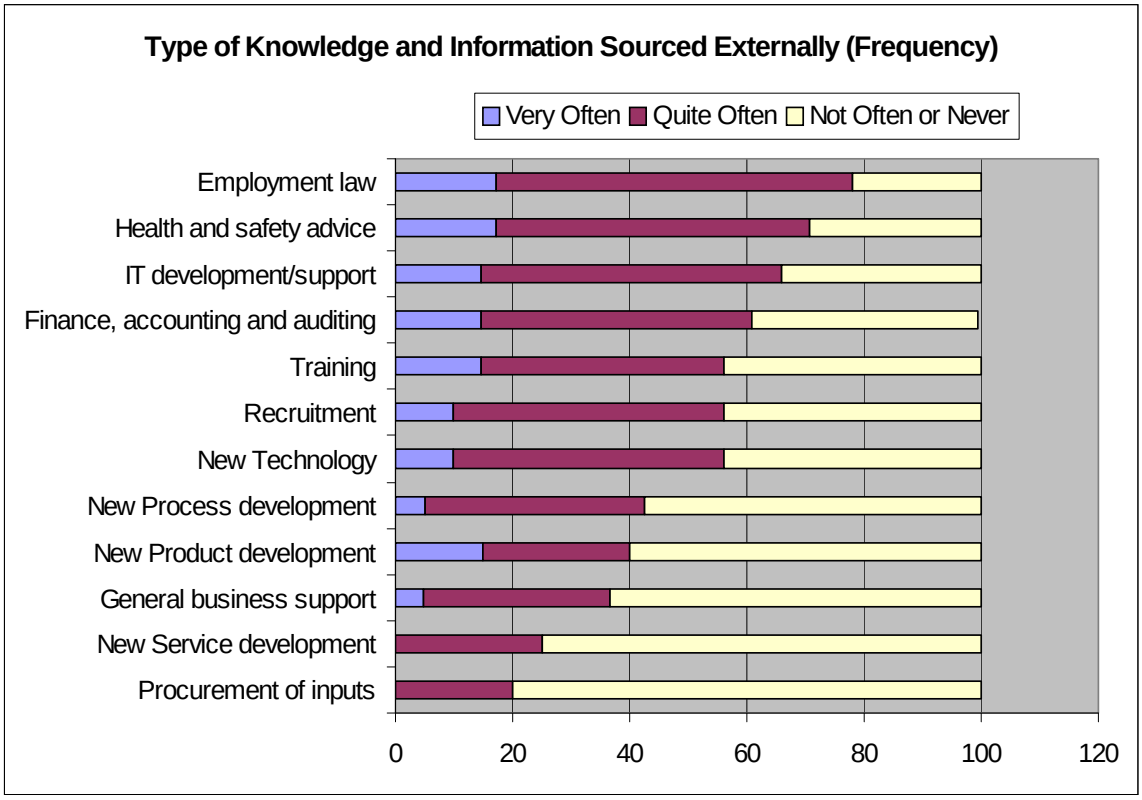


Figure 6.2 illustrates how often different forms of knowledge are sourced by SMEs. As might be expected, the most frequently sourced types of knowledge are those which are tightly bound to the overall day-to-day operation and strategic management of SMEs. Employment law, health and safety advice, finance and accounting are features which often require external expertise due to the need to meet regulatory requirements (and frequently form part of the 'red tape', which SMEs often consider inhibit their development). IT development and support also score highly, which again is to be expected, given that many SMEs will externally contract such provision.

Competence-based knowledge in the form of training and recruitment is less frequently obtained than knowledge linked to regulation. Amongst the least most frequently sourced knowledge type is creative-based knowledge linked to new service, process or product development. Towards the lower end of the table is also knowledge in the form of general business support to aid firm development.

Figure 6.2: Type of Knowledge and Information Sourced Externally by SMEs



In order to analyse the relationship between the frequency of sourcing different types of knowledge, the knowledge types listed above were grouped into two categories. The first category, 'knowledge for innovation', consists of: new product development; new process development; new service development; and new technology. The second category is 'knowledge for strategy and operation' and consists of the remaining knowledge types.

The frequency of sourcing knowledge for innovation is significantly correlated with the numbers of innovations established per employee during the last 3 years, indicating that more innovative SMEs in the region tend to more frequently source knowledge related to innovation practices from external sources. Conversely, the sourcing of knowledge for strategy and operation is negatively correlated with turnover growth achieved during the last 3 years. This suggests that SMEs with lower or contracting levels of competitiveness are more likely to seek knowledge from external sources related to improving their strategy or operations.

A summary of the other key relationships found include:

- There is a strong positive association between levels of innovation and the sourcing of knowledge for innovation from customers, suppliers, and from business and professional networks.

- Turnover growth is negatively associated with the frequency sourcing of knowledge for strategy and operation from public sector organisations, universities and higher education institutions, and private sector organisations such as private training or research providers, and consultants. This indicates that these organisations tend to become increasingly important external sources of knowledge for those SMEs facing competitive market pressures.

- There is a positive association between levels of innovation and the frequency of sourcing knowledge for innovation from sources within the region: suppliers; universities and other higher education institutions; business and professional networks; and customers.

- The sourcing of knowledge for strategy and operation for business and professional networks within the region is also correlated with levels of innovation. This implies that those SMEs that are able to access relevant knowledge at the local level tend to achieve higher levels of innovation.

- High innovators also tend to more frequently source knowledge for innovation from both customers and suppliers outside the region. Therefore, SMEs appear to be more innovative when they are able to more frequently source knowledge from a range of both local and non-local sources.

- Turnover growth is negatively associated with the frequent sourcing of knowledge for innovation from public sector organisations outside the region, as well as sourcing knowledge for strategy and operation from public sector organisations outside the region, and universities and HEIs outside the region.

- SMEs facing competitive pressures tend to broaden the focus of their knowledge acquisition, stretching to public sector and universities possibly at a more national (or even international) level as means of attempting to overcome current difficulties.

- Innovators require a balance of both local and non-local knowledge sources - innovation levels are not significantly associated with a bias towards utilising sources of knowledge within or outside the region.

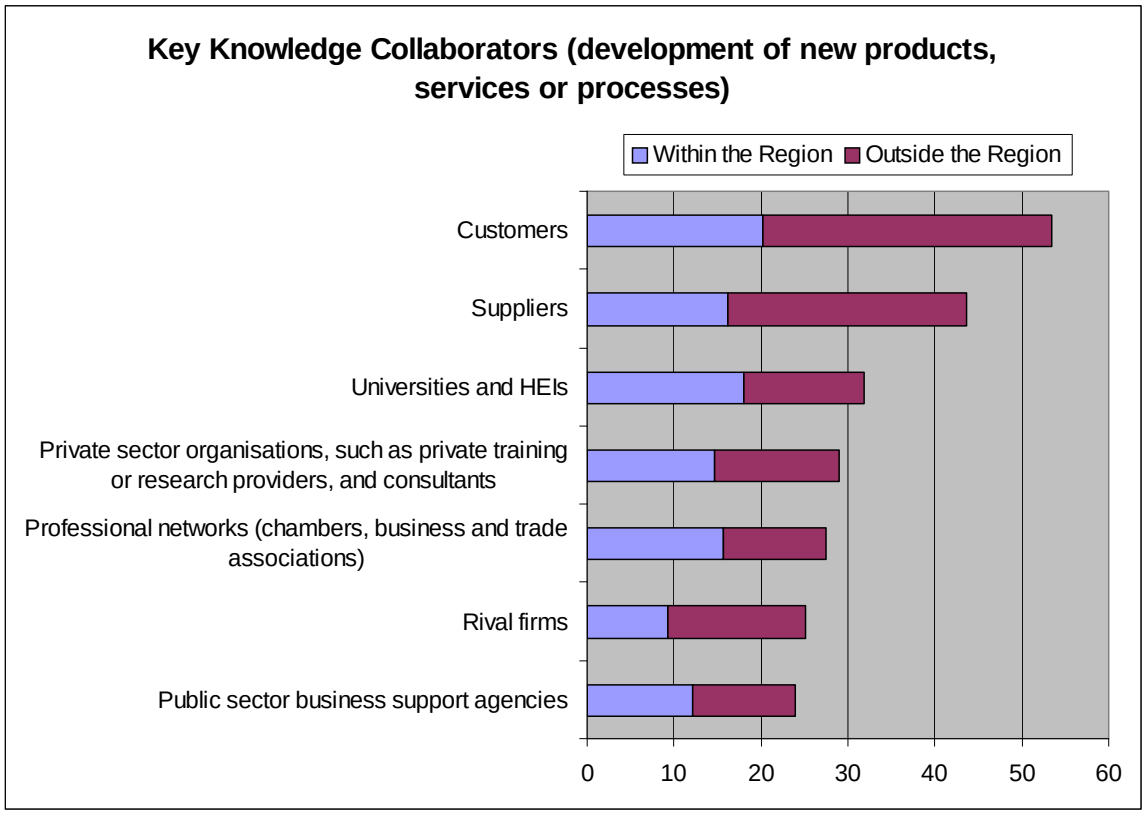
- However, turnover growth is positively associated with a bias towards sourcing knowledge from customers, suppliers, rival firms, public sector organisations, and private sector organisations within the region.

Recommendation 9	Rationale
Ensure public sector business support initiatives more proactively engage with both high and low growth SMEs, rather than reactively wait to be approached by SMEs experiencing competitive pressures.	At present, SMEs in the region experiencing relatively low levels of growth are more likely to utilise public sector business support initiatives as sources of knowledge.

Alongside the importance of knowledge contacts networks, in the form of external knowledge sources, it is also important to analyse more embedded interaction in the form of knowledge alliance networks. In this case, knowledge alliance networks consist of collaborations with external partners in order to engage in innovation. Figure 6.3 highlights that the most important knowledge alliance partners for the SMEs are customers and suppliers, with customers and suppliers outside the region considered to be of more importance than those within the region. This implies that collaborative innovation is mainly rooted within the supply-chains of these SMEs, and is more predominate outside, rather than within, the region.

Other knowledge alliance partners of relative importance within the region are universities and HEIs, as well as business and professional networks. Outside of the region, rival firms are relatively important partners, indicating that the potential for collaboration to achieve innovation is higher for SMEs when engaging with competitors located outside their home region.

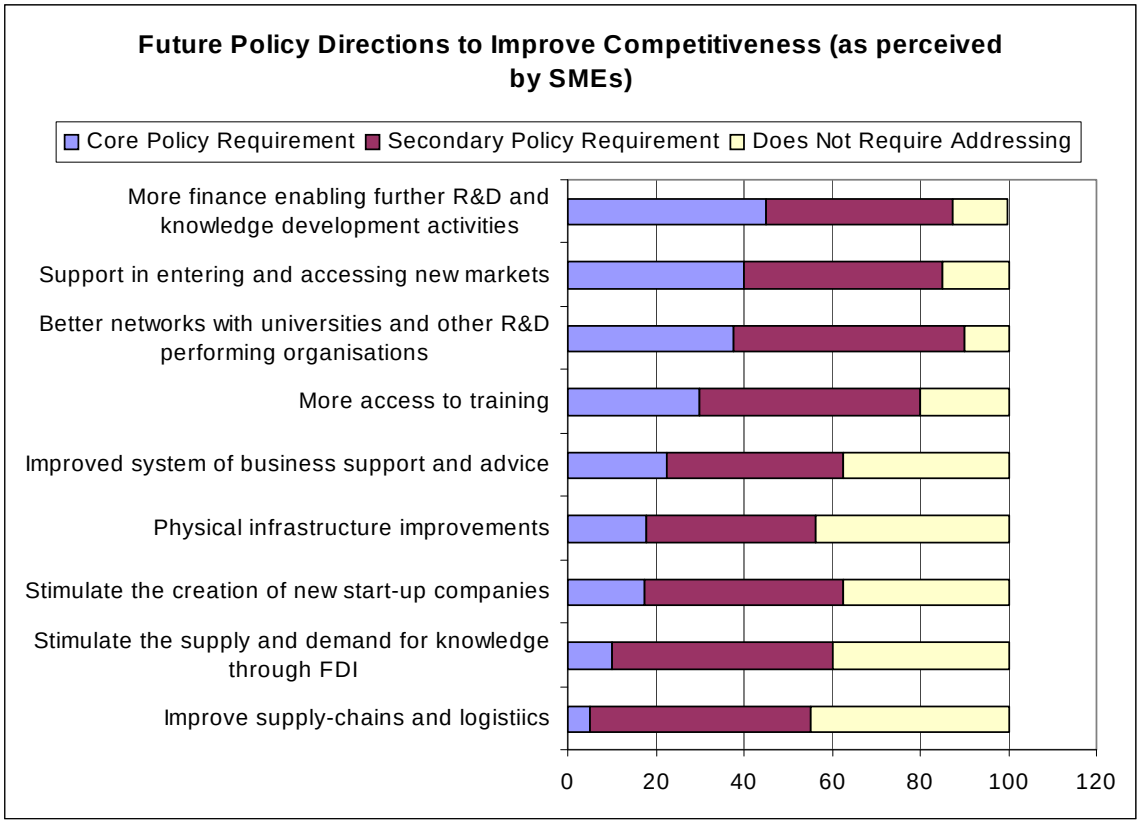
Figure 6.3: Key Knowledge Collaborators for SMEs



It was found that more innovative SMEs are putting a greater emphasis on cultivating knowledge alliances with HEIs in the region, and are also utilising existing membership of local and regionally-based business and professional networks, such as chambers of commerce, trade or business associations, and business clubs, to source collaborative innovation partners.

According to those SMEs surveyed in the region, future regional policy targeted at improving the competitiveness should be focused on the three keys areas: (1) improved access to risk capital enabling their further engagement in R&D and other knowledge-based activities; (2) support in entering and accessing new markets; and (3) creating better networks with universities and R&D performing organisations. This indicates that despite the existence of a relatively weak innovation culture in the region, many business managers do consider there to be a need to prioritise innovation activities in the future.

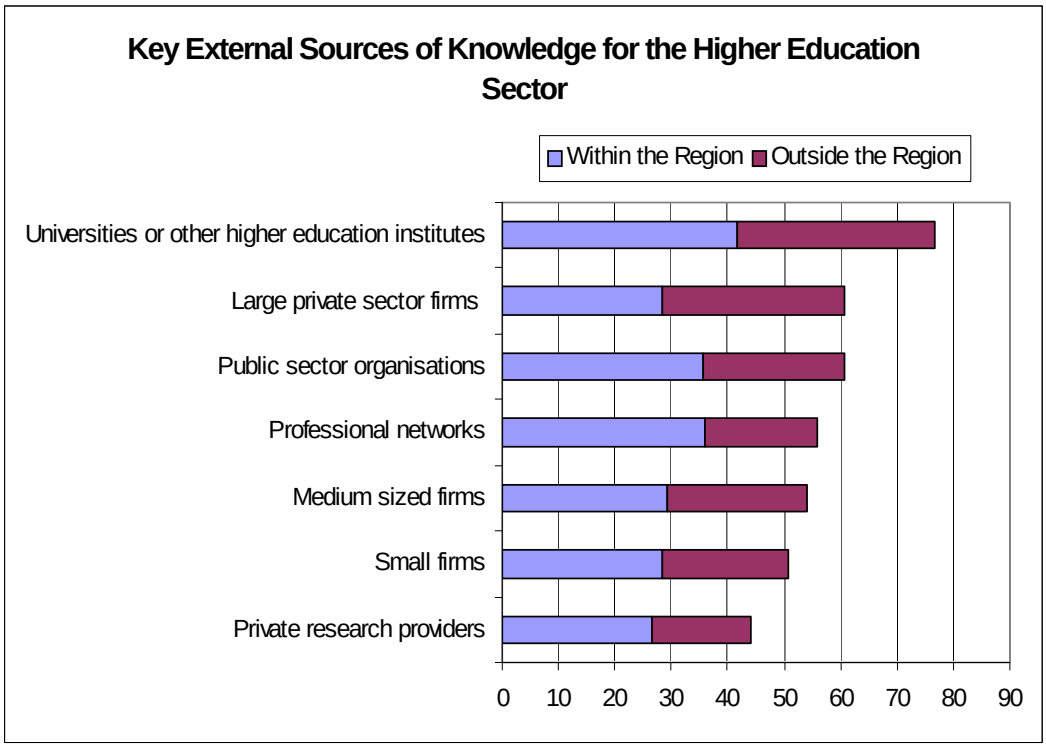
Figure 6.4: Future Policy Directions to Improve Competitiveness (as perceived by SMEs)



7. The Knowledge Networks of Universities

The key sources of knowledge for the region's universities tend to be other universities, both within and outside the region, followed by large companies and public sector organisations. Less knowledge is sourced from SMEs, indicating that the likelihood of joint collaboration is less between universities and SMEs, than with these other knowledge sources.

Figure 7.1 Key External Sources of Knowledge for the Higher Education Sector



The SME sector is considered by universities to be the key recipients of the knowledge they generate. This suggests an interesting possibility, which was confirmed during the consultation process – rather than the collaborative knowledge networks universities in the region develop with other actors, the interaction and knowledge exchange universities engage with in the SME sector is likely to be far more market-based. It is market-based to the extent that the universities are either directly seeking an economic return from SMEs or are receiving it indirectly from the government funding they receive – through initiatives such as the Higher Education Innovation Fund – as means of attempting to stimulate their knowledge transfer and engagement levels with business and industry. Therefore, if such funding were removed it is probable that universities would be less inclined to seek to transfer their knowledge to SMEs, particularly as they would be less likely to receive potentially

useful knowledge in return from SMEs. This raises the important issues of whether regional policy intervention should be seeking to catalyse knowledge networks or knowledge markets.

Recommendation 10	Rationale
Provide support to SMEs to engage in sustained and long-term collaborative ventures.	Engagement with universities is often a long-term venture where as small firms usually require solutions in the short term.

Figure 7.2: Main Recipients of Higher Education Knowledge (as perceived by the HE Sector

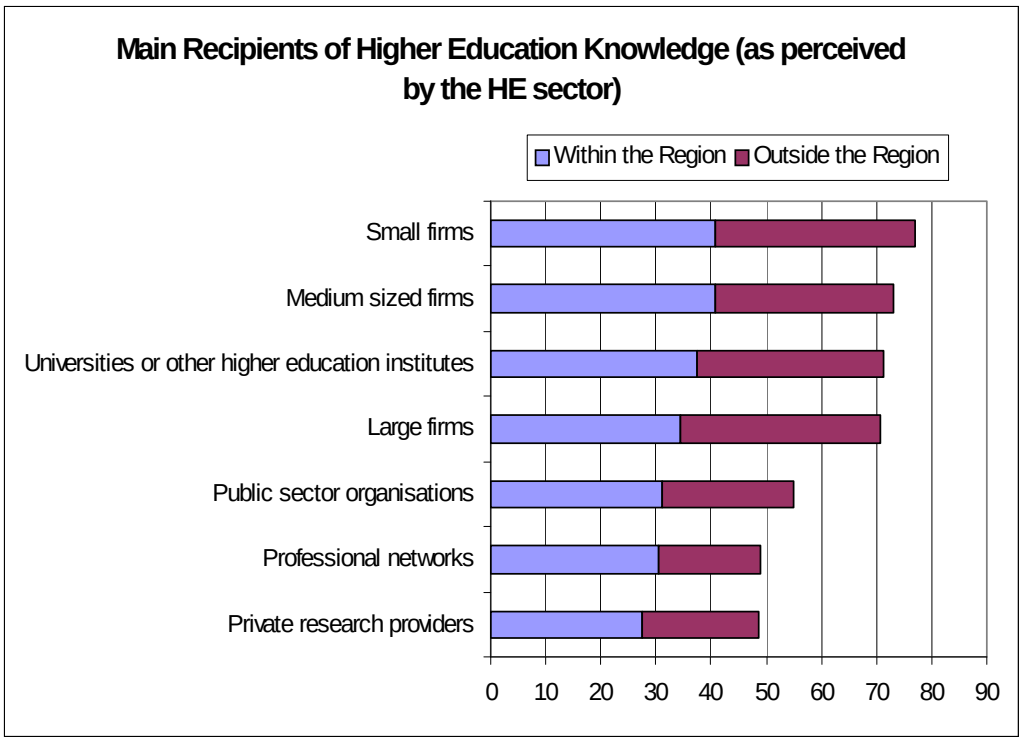
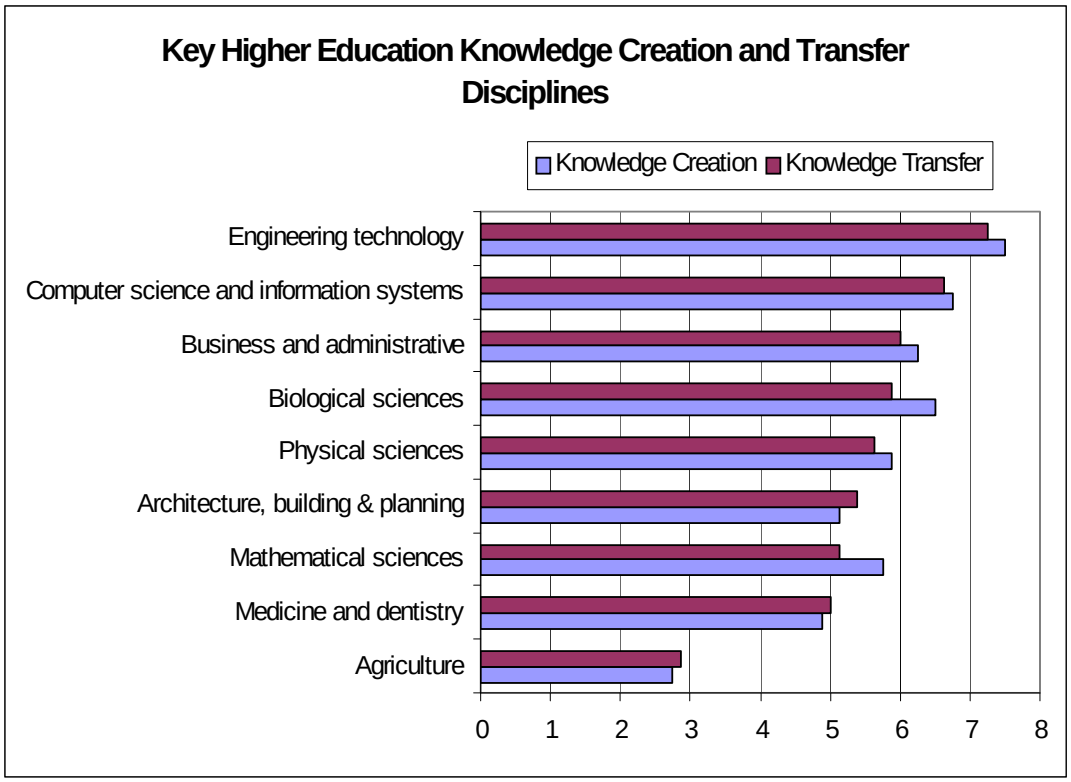


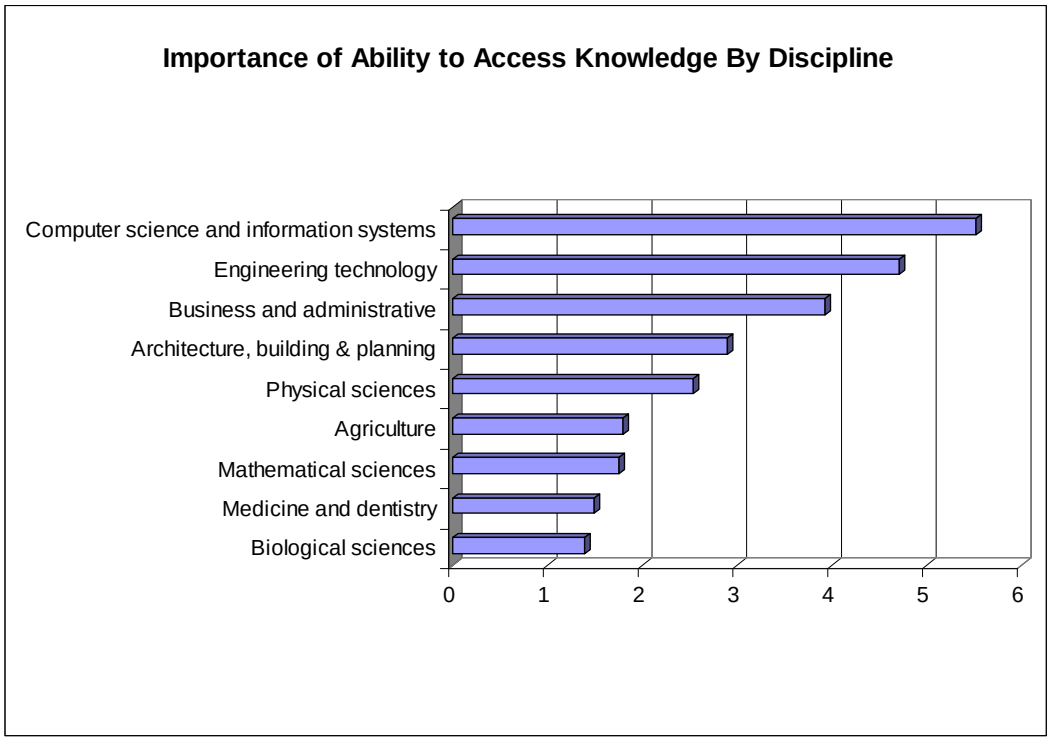
Figure 7.3 illustrates the key knowledge created and transferred by universities in the Yorkshire and Humber region. It is unsurprising that given the traditional strengths of universities in the region – especially the White Rose universities – that science-based disciplines are the key areas of both knowledge creation and transfer. However, it is also notable that knowledge related to business and administration is also ranked highly, highlighting the growing importance of this discipline as potential source of commercialisable knowledge.

Figure 7.3: Key Higher Education Creation and Transfer Disciplines



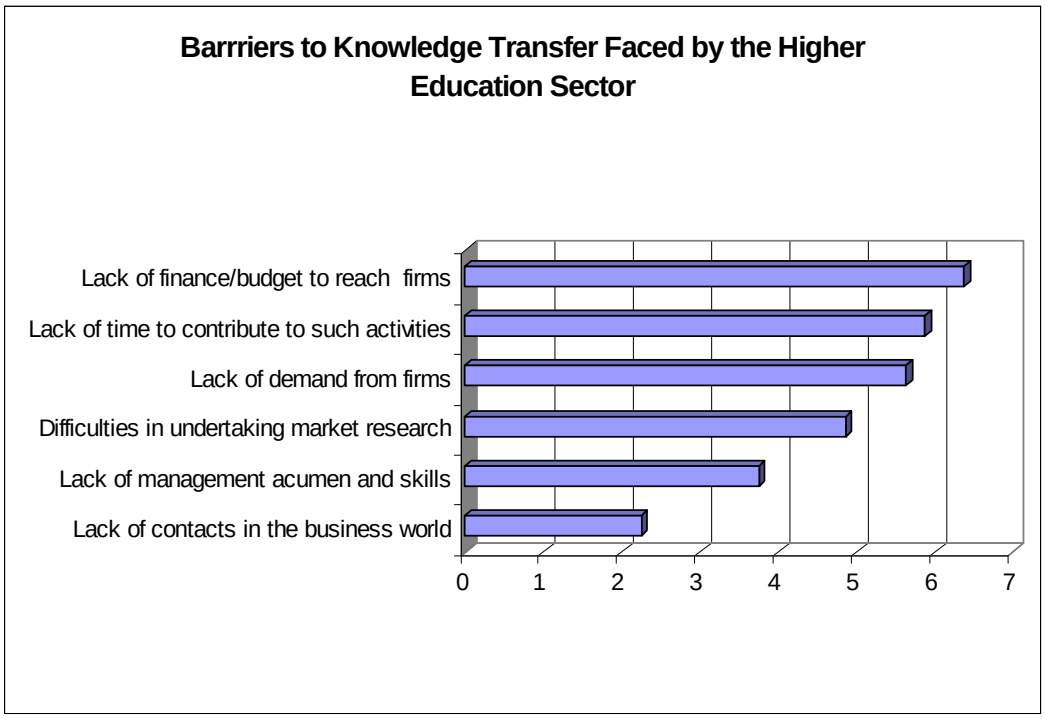
In order to gauge the discipline match between university knowledge creation and transfer and potential SME demand for such knowledge, SMEs rated these disciplines in terms of the need to access knowledge (Figure 7.4). As can be seen by comparing Figure 7.3 and 7.4 there is a relatively strong match between university knowledge creation and transfer and potential SME demand. This indicates that it is the propensity to establish mutually beneficial networks and markets, rather than necessarily adjusting knowledge types, which requires future support.

Figure 7.4: Importance of Ability to Access Knowledge by Discipline as Perceived by SMEs



According to universities in the region, the key barriers they face in undertaking effective knowledge transfer are a lack of finance or budget to actually engage with business, followed by a lack of time to contribute knowledge transfer activities. These factors again suggest a market – rather than a network – orientation towards engaging with business and industry, which appears to be often overlooked in policy intervention within this area. It is often the case that a market-based relationship is first required before more collaborative knowledge sourcing and transfer is undertaken. For example, as we have already seen customers and suppliers are the most important sources of knowledge sources for many SMEs in the region.

Figure 7.5: Barriers to Knowledge Transfer Faced by the Higher Education Sector



8. Financing the Knowledge Economy

A key issue in developed nations regarding the effective and successful transfer and commercialisation of knowledge is the availability of suitable finance to facilitate and invest in these processes and activities. In the UK, knowledge-based venturing and transfer related to commercialisation are viewed as a relatively high-risk proposition for those investors who could potentially finance such development. This has led many to argue - including the UK government - that a gap, or a bias against, exists for the type of seed, early-stage and other finance required by such activities if they are to become commercially viable and sustainable.

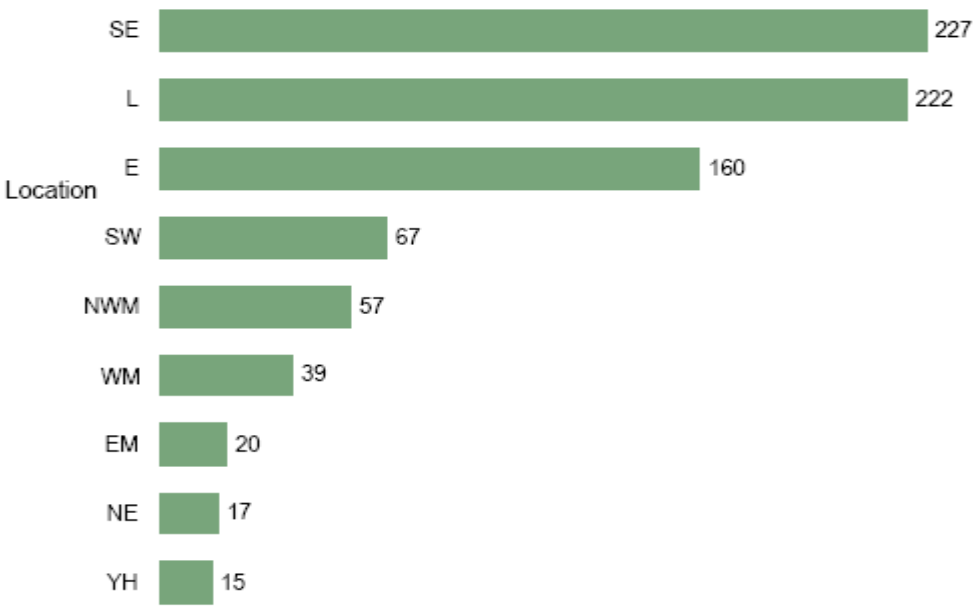
In general, the Yorkshire and Humber region has considerably less access venture capital than might be anticipated given it size, especially for early stage venture capital (Almeida Capital, 2005, *A Mapping Study of Venture Capital Provision to SMEs in England*, Sheffield: Small Business Service). London is by far the most dominant player with more than one-half of all the UK's VC funds. In contrast, the Yorkshire and Humber region is the location for only 5% of the UK's funds, indicating a paucity of regional venture capital money that can be utilised stimulate knowledge transfer and R&D investment.

In order to plug a perceived market failure in the provision of venture capital, particularly for seed and early stage capital, the public sector in the UK is increasingly playing a role in the provision of such capital. In the Yorkshire and Humber region the number of privately-backed investments per annum (33 in 2003-04) is only slightly more than those backed by the public sector (29 in 2003-04). This strongly suggests the possibility of market failure in the region. However, such potential failure is not as pronounced as in the North East and North West of England, where the number of publicly-backed investments significantly outweighs those made by the private sector.

Along with the number of investments, it is important to analyse the size of these investments as a measure of their potential impact. London is the recipient of by far the highest average investment size at more than £1 million per investment. On the other hand, the average size of investment in the Yorkshire and Humber region is amongst the lowest at £130,000 per investment. This highlights the failings of the

region's venture capital system. Figure 8.1 provides a regional estimate of the total value of venture capital investments in 2003-04. The Yorkshire and Humber region is at the bottom of the table with a total estimated investment of only £15m. Given the size of the region, and in comparison with other regions, this represents a major shortfall in its requirements if it is to convert itself to a knowledge-based economy.

Figure 8.1: Estimated Value of Investment for 2003-04 (£m)



Source: Almeida Capital, 2005, *A Mapping Study of Venture Capital Provision to SMEs in England*, Sheffield: Small Business Service.

Recommendation 11	Rationale
Develop new sources of both private and public sector venture capital.	Innovation involves the risk of committing resources – especially financial capital - towards an uncertain outcome. The region has a clear lack of risk capital.

9. Analysis of Key Findings

One of the key points to arise from the MIRIAD findings is that many SMEs located in the Yorkshire and Humber region tend to utilise and value more knowledge networks with actors outside the region. In general, these SMEs source codified knowledge more frequently than more tacit knowledge (Table 9.1). However, those SMEs that more often source tacit forms of knowledge are significantly more innovative. Therefore, SMEs that are better able to source sticky knowledge are better producers of new products, services, and processes. On the other hand, SMEs with a lower competitive performance (measured by turnover growth) are more likely to source codified knowledge from sources such as public sector support organisations, private consultants and universities. Although this may sound a surprising finding, it is in line arguments stating that when firms experience uncertainties of a particular kind they tend to explore new network relations with new network actors. In other words, SMEs appear to establish relationships with certain actors more often when 'the going gets tough'.

Table 9.1: Knowledge Sourcing among SMEs in Yorkshire and Humber

Sourcing of tacit knowledge	High level of sourcing – more innovative	Low level of sourcing – less innovative
Sourcing of tacit knowledge through regional networks and universities	High level of sourcing – more innovative	Low level of sourcing – less innovative
Sourcing of knowledge from customers and suppliers	High level of sourcing – more innovative	Low level of sourcing – less innovative
Sourcing of codified knowledge from public support organisations, consultants and universities	High level of sourcing – less competitive	Low level of sourcing – more competitive

Whilst more innovative SMEs source knowledge more frequently from customers and suppliers both within and outside the region, their sourcing of knowledge from existing business and professional networks and universities is restricted more to networks within the region, and usually concerns the sourcing of tacit knowledge. This suggests that the Yorkshire and Humber region possesses a semblance of what might be considered a regional innovation system or regional knowledge cluster.

Innovative SMEs in the region resemble the nodes of the networks linking the global pipelines of knowledge and local networks. However, the density of actors constituting such sub-systems is limited to only a small number of leading firms in the region, or what we might call a skeletal innovation system. The fact that the most innovative SMEs are networked with firms both inside and outside region means that they are taking a role in linking the region to sources of innovation nationally and globally, which is a principal feature of the commercialisation of knowledge through regional innovation systems.

Recommendation 12	**Rationale**
Facilitate the engagement of SMEs in global knowledge networks.	Processes of globalisation mean that state-of-the-art knowledge is less likely to be sourced within regional boundaries.

While innovative SMEs in the Yorkshire and Humber region possess a balance of inside and outside the region knowledge networks, the most competitive SMEs are biased towards the utilisation of networks within the regions. Whilst recognising that regional competitiveness is not simply the aggregation of the competitiveness of the firms located in a region, the relationship between firm growth and inter-regional knowledge networks, suggests that these networks involving SMEs are important sources of regional competitiveness. However, these networks are largely of a firm-to-firm nature, rather than between firms and other non-firm actors, pointing to the limitation of a regional innovation or knowledge system. Indeed, it is the strength and functioning of this system which forms a constituent feature of highly competitive regions i.e. regions with relatively low competitiveness 'lack strength in-depth'.

There is a high level of association between actors that are both sources of knowledge, through contact networks, and innovation collaborators, through knowledge alliance networks, which tends to confirm much existing research relating to knowledge networks suggesting that some form of underlying interdependence (e.g. an existing customer or supplier from which knowledge is already sourced, or membership of a common business or professional network) increases the propensity for the formation of future alliances. In the case of SMEs in Yorkshire and Humber this may be compounded by the fact that many of the knowledge networks are stable in nature, with most SMEs only occasionally seeking new network partners. This

network stability is usually considered to be a positive feature of knowledge networks, especially alliances. However, there is also the possibility that stable knowledge networks will lead to inertia.

Whilst the MIRIAD research confirms the pattern of networks proposed by theory in relation to SMEs in a relatively weak and peripheral region, it does draw into question the extent to which SME network patterns vary across more or less competitive regions. For instance, it appears that the knowledge networks of SMEs in less competitive environments do not significantly differ from those of SMEs in more competitive environments. Specifically, they appear to be coming increasingly international and non-localised, resulting in a balance between global and regional connections.

Therefore, while there is significant evidence of the internationalisation of networks in leading regions, the same processes are also occurring in regions such as Yorkshire and Humber. However, while the network configurations may be taking a similar form, it is less clear if the quality and effectiveness of the networks to transfer knowledge is of a comparable standard. For example, SMEs in leading regions usually have strong clusters of similar firms and supports institutions to support collective learning and further exploit knowledge obtained through regionally external knowledge networks.

10. Future Policy Approaches

For a number of years many of the policies relating to the development of SMEs in less competitive economies such as the Yorkshire and Humber region have concerned the utilisation of the cluster model of development. This has mainly focused on seeking to develop key sectors of the economy, often knowledge-based sectors, with a focus on hard infrastructure, such as science parks, business incubators, laboratories, etc., to the detriment of the building the networks, value and supply-chains, underlying successful growth. Also, where networking initiatives have been instigated they have often been local or regional in their scope. While such initiatives are necessary, there has been less concern from policymakers with supporting more global connections, which this project has shown to be of importance to SMEs. This illustrates one of the weaknesses of the cluster approach as a regional policy tool. In general, regional policy needs to shift from a 'cluster approach' to an innovation systems approach which places emphasis on cooperation and networking, and increasing the interactive capacity of SMEs. Such cooperation, networking and interacting must be equally set in both regional and global dimensions and contexts.

Recommendation 13	**Rationale**
Refocus regional economic development policy from a 'cluster approach' to a 'regional innovation system' approach that prioritises the creation of knowledge networks linking the region's SMEs to its universities.	There is a lack of linkage between SMEs and the regional knowledge base. The integration of the region's business community – the majority of which consists of SMEs - with the higher education system is a very important starting point.

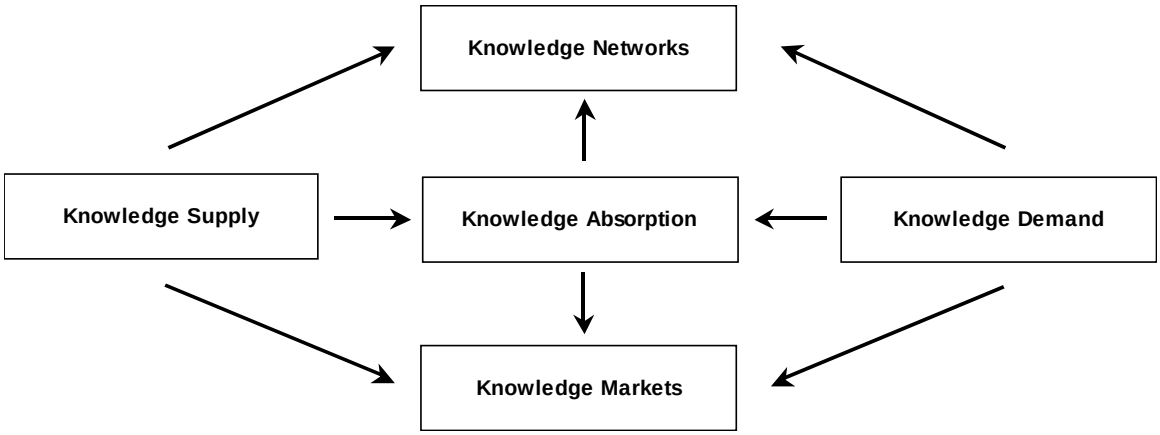
A Knowledge Network and Knowledge Market Approach

As Yorkshire and Humber continues to struggle to achieve improvements in its competitiveness, despite large investments in infrastructure, the role of policy in stimulating a networked environment must clearly return as a key focus of future intervention. For SMEs, which are one of the primary sources of competitiveness in the region, the focus of such developments is two-fold. First, to increase the involvement of firms in the type of enduring knowledge alliance networks required for effective collaborative innovation to be achieved. Second, and on the other hand, to enable SMEs to source the most relevant and up-to-date knowledge, which

necessarily means that their networks require a level of dynamism. The role of public policy as the '*animateur*' of such networks is ensure that such dynamism exists through the facilitation of global searches for appropriate knowledge sources.

Although it is desirable from a regional economic development perspective for knowledge to flow across networks, more emphasis must also be given to the formation of knowledge markets, which may act as the stimulus for the later formation of networks (Figure 10.1). Knowledge suppliers will not always be willing, or in a position, to transfer knowledge across networks, where there a low expectancy of a reciprocal return, as has been argued is often the case with university-SME networks in the region - with the flow of knowledge, and subsequent value added, tending to be one directional. This potentially has an impact on the ability of those demanding knowledge, such as SMEs, to absorb and infuse it. For instance, a simple market transaction of knowledge may lead to significant information asymmetries as to how such knowledge is effectively applied or utilised. In order words, effective knowledge absorption is more likely to be effective through collaborative networks than it is through market transactions. Therefore, there is clear policy role in ensuring that knowledge transfer opportunities are not lost through the lack of a knowledge market, and secondly, where knowledge markets are developed their transformation to networked forms of interaction is encouraged and facilitated.

Figure 10.1: Regional Knowledge Flow Across Networks and Markets



Recommendation 14	Rationale
Enhance the transparency of university-business knowledge processes by disseminating examples of successful practices from the region.	There is a perception that the higher education sector is still a very difficult sector for firms, especially SMEs, to access.

Recommendation 15	Rationale
Promote the development of regional knowledge markets to complement regional knowledge networks.	Universities aim to produce world-class research, and some of the 'problems' faced by regional firms are sometimes considered too 'simplistic,' reducing the incentive for collaboration.

Removing Cultural Barriers

There is a clear need to focus on the continuing cultural barriers the region has faced in attempting to establish a regional knowledge-based environment. This is a difficult task to achieve, but there would appear to be a stronger role for policymaking in this respect. For instance, in the Yorkshire and Humber region, as in many other economies, there has been a heightened policy focus on entrepreneurship, which is now established as major pillar of most competitiveness and economic development strategies. However, the nature and type of entrepreneurship is often unexplored resulting in an 'any new business will do' attitude being implicit in many policies. More focus is required and, although it may sound simplistic, it should be stressed that in pursuing a knowledge-based policy approach, the Yorkshire and Humber region should prioritise knowledge-driven entrepreneurship. Such prioritisation should consist of ensuring that entrepreneurs with sound ideas and visions for creating high value added businesses have access to the networks, skills, knowledge sources, working environments, and financial capital they require. As part of this process, links between business support agencies and higher education require improvement. The effectiveness of intermediary organisations is hampered by the fact there are so many within the region. There is also an issue of focus, as local authorities prefer funds to be directed towards infrastructure (i.e. premises) than 'softer' programmes.

Recommendation 16	Rationale
Prioritise knowledge-driven entrepreneurship ensuring that entrepreneurs with sound ideas and visions for creating high value added businesses have access to suitable resources.	Although national level enterprise polices have developed in recent year, such policies do not sufficiently prioritise the knowledge-based entrepreneurship required by the region.

Recommendation 17	Rationale
Lobby national government to ensure that innovation and enterprise become a key feature of the compulsory education curriculum the wider system of training and workforce development.	The development of a sustainable innovation culture must be led by the region's education system – and not just higher education, but also primary, secondary and further education.

Recommendation 18	Rationale
Regular and systematic monitoring to be introduced to understand how the region's innovation culture is evolving.	There is a need to understand why there is a lack of an innovation culture in the region and to examine which interventions are most likely to create improvement.

The Role of Universities

The higher education sector in the Yorkshire and Humber region is strong in terms of R&D, and the MIRIAD strategy recommends supporting the continuing excellence of the region's universities. However, university knowledge should not be considered as a panacea for tackling the region's lack of innovation. Although universities should and do play a role in regional economic development through knowledge transfer, such is the diversity of the roles that the higher education sector has to undertake, universities alone cannot shoulder the burden for transforming the region's innovation capability and knowledge economy. If universities are to continue to play a role it is vital that initiatives such as KnowledgeRICH are fully supported to ensure sustainability. Current business support systems are not well linked with the higher system and initiatives like KnowledgeRICH are required to fulfil this role, ensuring that there is a suitable balance between supporting networked and market oriented transfers of knowledge.

Recommendation 19	Rationale
Extend regional policymaking to incorporate knowledge generating actors other than universities, in particular the region's further education system and NHS.	There is a need to be realistic about the level of assistance SMEs can receive from universities. Exploiting research by universities is not a panacea and there is a danger that it has come to be regarded as an 'easy' method to solve the problem of low regional R&D.

Recommendation 20	Rationale
Identify and plug gaps in the region's knowledge base.	The dependency on the region's universities as principal knowledge generators means that there are likely to be regional supply gaps concerning knowledge outside the R&D, science and technology produced by these universities.

Strategy Status

Regional policy is already fairly well congested in Yorkshire and the Humber, with a range of regional and sub-regional strategies and interventions already in place. It is not the aim of the MIRIAD project to add another unnecessary addition to the existing stock. Rather, the MIRIAD Yorkshire and Humber Knowledge Investment Strategy should be considered as primarily supporting the development and evolution of Yorkshire Science's Regional Science and Innovation Strategy, focusing on engaging regional SMEs in knowledge networks and knowledge transfer mechanisms, which is recognised as an area requiring further support in the region. Second, the Knowledge Investment Strategy supports the wider economic development framework for Yorkshire and the Humber, as set out by Yorkshire Forward's Regional Economic Strategy.

11. Summary of Recommendations

The following summarises the recommendations proposed by this strategy:

Recommendation 1	**Rationale**
Ensure that future policies are committed to furthering innovation in the broader sense, rather than being restricted to a narrower focus on R&D.	Due to recessions of the 1980s and 1990s, which decimated many of the regionally established large firms, the business stock is comprised of a larger proportion of younger firms, often in service-based sectors, that are not sufficiently developed in terms of their ability to innovate.
Recommendation 2	**Rationale**
Continue to build on the work of Yorkshire Science to develop a data capture methodology focused on analysing attitudinal changes towards innovation, as part of a region wide methodology sensitive to measuring changes in innovation culture.	Promoting cultural changes requires relatively sophisticated and sensitive methodologies in order to measure the impact of policy, particularly those policies where the impact will only be determinable over a significant period of time.
Recommendation 3	**Rationale**
Develop new regional metrics that incorporate a holistic means of measuring investment in knowledge.	Whilst R&D expenditure continues to be an important measure of innovation and the conversion to a knowledge-based economy, it is limited due to it relative inapplicability to service-based sectors.
Recommendation 4	**Rationale**
Identify and prioritise the growth of the region's leading knowledge-based SMEs.	Despite the fact there are a number of top universities within the region the retention of postgraduate students in the region is very low. The region has problems retaining and attracting skilled workers.
Recommendation 5	**Rationale**
Streamline the maze-like business support infrastructure, reducing red tape and excessive bureaucracy and improving its 'user friendliness'.	Although numerous regional initiatives have been put in place to provide 'business gateways' and 'one-stop-shops' entrances to universities, most SMEs are still very reluctant to enter.
Recommendation 6	**Rationale**
Review the consistency between policies and initiatives at the regional and sub-regional (city/city-region, locality) level	Alongside regional policy development, a range of institutions have been established in recent years at the sub-

to ensure 'scale economies' are achieved.	regional level related to knowledge transfer and innovation development that is not necessarily consistent with regional policymaking.
Recommendation 7	**Rationale**
Regionally-focused marketing exercises should be introduced to promote and embed the link between competitiveness and innovation across the business community.	Although an innovation culture exists in pockets, it is still far from being integrated across the region as whole, and differs across segments of both the region's economy and society
Recommendation 8	**Rationale**
Provide further resources to develop innovative tools to measure the determinants of SME competitiveness and demand for knowledge.	The MIRIAD initiative has attempted to develop an SME competitiveness benchmarking tool, but further work is required in this area.
Recommendation 9	**Rationale**
Ensure public sector business support initiatives more proactively engage with both high and low growth SMEs, rather than reactively wait to be approached by SMEs experiencing competitive pressures.	At present, SMEs in the region experiencing relatively low levels of growth are more likely to utilise public sector business support initiatives as sources of knowledge.
Recommendation 10	**Rationale**
Provide support to SMEs to engage in sustained and long-term collaborative ventures.	Engagement with universities is often a long-term venture where as small firms usually require solutions in the short term.
Recommendation 11	**Rationale**
Develop new sources of both private and public sector venture capital.	Innovation involves the risk of committing resources – especially financial capital - towards an uncertain outcome. The region has a clear lack of risk capital.
Recommendation 12	**Rationale**
Facilitate the engagement of SMEs in global knowledge networks.	Processes of globalisation mean that state-of-the-art knowledge is less likely to be sourced within regional boundaries.
Recommendation 13	**Rationale**
Refocus regional economic development policy from a 'cluster approach' to a 'regional innovation system' approach that prioritises the creation of knowledge networks linking the region's SMEs to	There is a lack of linkage between SMEs and the regional knowledge base. The integration of the region business community – the majority of which consists of SMEs - with the higher

its universities.	education system is a very important starting point.
Recommendation 14	**Rationale**
Enhance the transparency of university-business knowledge processes by disseminating examples of successful practices from the region.	There is a perception that the higher education sector is still a very difficult sector for firms, especially SMEs, to access.
Recommendation 15	**Rationale**
Promote the development of regional knowledge markets to complement regional knowledge networks.	Universities aim to produce world-class research, and of the 'problems' faced by regional firms are sometimes considered too 'simplistic,' reducing the incentive for collaboration.
Recommendation 16	**Rationale**
Prioritise knowledge-driven entrepreneurship ensuring that entrepreneurs with sound ideas and visions for creating high value added businesses have access to suitable resources.	Although national level enterprise polices have developed in recent year, such policies do not sufficiently prioritise the knowledge-based entrepreneurship required by the region.
Recommendation 17	**Rationale**
Lobby national government to ensure that innovation and enterprise become a key feature of the compulsory education curriculum the wider system of training and workforce development.	The development of a sustainable innovation culture must be led by the region's education system – and not just higher education, but also primary, secondary and further education.
Recommendation 18	**Rationale**
Regular and systematic monitoring to be introduced to understand how the region's innovation culture is evolving.	There is a need to understand why there is a lack of an innovation culture in the region and to examine which interventions are most likely to create improvement.
Recommendation 19	**Rationale**
Extend regional policymaking to incorporate knowledge generating actors other than universities, in particular the region's further education system and NHS.	There is a need to be realistic about the level of assistance SMEs can receive from universities. Exploiting research by universities is not a panacea and there is a danger that it has come to be regarded as an 'easy' method to solve the problem of low regional R&D.
Recommendation 20	**Rationale**
Identify and plug gaps in the region's knowledge base.	The dependency on the region's universities as principal knowledge

	generators means that there are likely to be regional supply gaps concerning knowledge outside the R&D, science and technology produced by these universities.