West Midlands Regional Observatory

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First Steps in Measuring Regional Innovation

Baseline sector analysis and the Innovation Dashboard

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First Steps in Measuring Regional Innovation

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1 Background

The West Midlands Regional Economic Strategy reveals a £10bn GVA output gap between the region and the UK average. It identifies the region's relatively poor performance around innovation as one of the key challenges that the region faces in closing that output gap. As a result, Advantage West Midlands has commissioned the Observatory to carry out a programme of research to develop the evidence base around innovation, to inform future policies.

This paper proposes an approach to the on-going monitoring of innovation activity in the West Midlands. It sets out current approaches to measuring innovation and highlights projects commissioned nationally to improve the metrics for measuring innovation.

The paper includes three main elements:

1. An analysis of the scale and performance of the industrial sectors which correspond to the West Midlands clusters and ITC themes in the West Midlands and nationally

2. A proposed dashboard of indicators of regional innovation performance in terms of inputs, links and outputs

3. An outline of the further analysis of the Community Innovation Survey commissioned to provide richer evidence about the involvement of regional businesses in innovation activities

2 Economic characteristics of West Midlands' Clusters and selected ITC Innovation themes

2.1 Introduction

This section provides an analysis of the economic position of key sectors within the region. The sectors cover the West Midlands clusters and the majority of the Innovation Technology Council (ITC) priority innovation themes. Some of the data was commissioned from the Office for National Statistics Annual Business Inquiry, a two-part survey of a representative sample of employers in the UK. ABI/1 collects information on employment and ABI/2 collects financial information. The analysis below uses data from the ABI/2 component of the survey.

Our ultimate aim is to be able to quantify, for each of the sectors within the region, measures such as:

- Total output (GVA)
- Total employment
- Productivity (GVA per employee)
- Growth (historic and projected)
- Market size
- External tradeability

The data presented in this report, particularly in Tables 2-4 cover many of these measures for most of the sectors. Further work will be required to establish figures for market size and external tradeability. We propose that this should form part of the next stage of this work. Many of the figures presented below relates to 2006. Obviously the current economic recession will have had an impact on the key sectors outlined in Table 1. However, comparative results using ABI/2 data for 2008 or 2009 will not be available until 2010 or 2011. To get an earlier assessment of the latest economic conditions would need primary research.

Table 1 shows the sectors covered within this analysis. The cluster industries have been defined using the sectors listed in the recent Evaluation of AWM's Cluster Programme undertaken by EKOSgen. The parallel ITC themes have been agreed in discussion with colleagues from Advantage West Midlands. A full table outlining the individual Standard Industrial Classification (SIC) codes that make up the sectors is included in Annex 4.

An important distinction should be made between clusters and sectors. There are three important differences in approach between sectors and clusters:

- Clusters are not easily defined or captured by SICs. This is primarily because they refer to groups of firms that are built around a product or technology. They also include (varying degrees of) supply chain linkages, as well as specialist infrastructure.
- Clusters are conspicuous by the co-operation and linkages that exist between firms, which is not necessarily evident in a sector.
- Finally, clusters are typically embedded in a particular place (area, region or country).

Table 1: Clusters and parallel ITC themes

AWM Clusters	ITC Theme
Environmental technologies[1]	Energy
ICT	ICT
Food and drink	
Building technologies	
Aerospace Automotive Rail	Transport Technologies
Business and professional services	
Medical technologies	Healthcare Technologies
Interiors and lifestyle	
Tourism and leisure	
Digital Media	Digital Media

[1] Note that the term 'technologies' in the sector titles relate to the production elements and are not an indication of the innovation strategies.

While it is common for people to discuss 'clusters' as a bespoke group of sectors, AWM correctly interpret clustering to be the actions of firms within sectors to engage in activity that facilitates clustering or agglomeration benefits – in short it is the verb 'to cluster' as opposed to a noun 'a cluster'. To avoid confusion therefore the analysis below refers to sectors rather than clusters.

Furthermore, SIC codes can constrain the scope for analysis. Ekosgen in their reports highlight the issues of narrow definitions using SIC codes, particularly for the medical technologies and digital media clusters. In both cases, the definitions exclude a large proportion of the businesses within these clusters in the West Midlands. In addition, the make-up of the clusters in the region differs significantly from those in other regions which means that comparisons are of limited value. The impact of this is explored in more detail in the following section.

Through discussion with the senior team at AWM we have linked the defined sectors to most of the key ITC themes (see Table 1), although we recognise that the match is not perfect in most cases. There is a particular issue with the Advanced Materials theme since this covers new markets as opposed to particular sectors. Firms engaged in the innovation activity will come from a variety of sectors but not all firms in any given sector will be relevant.

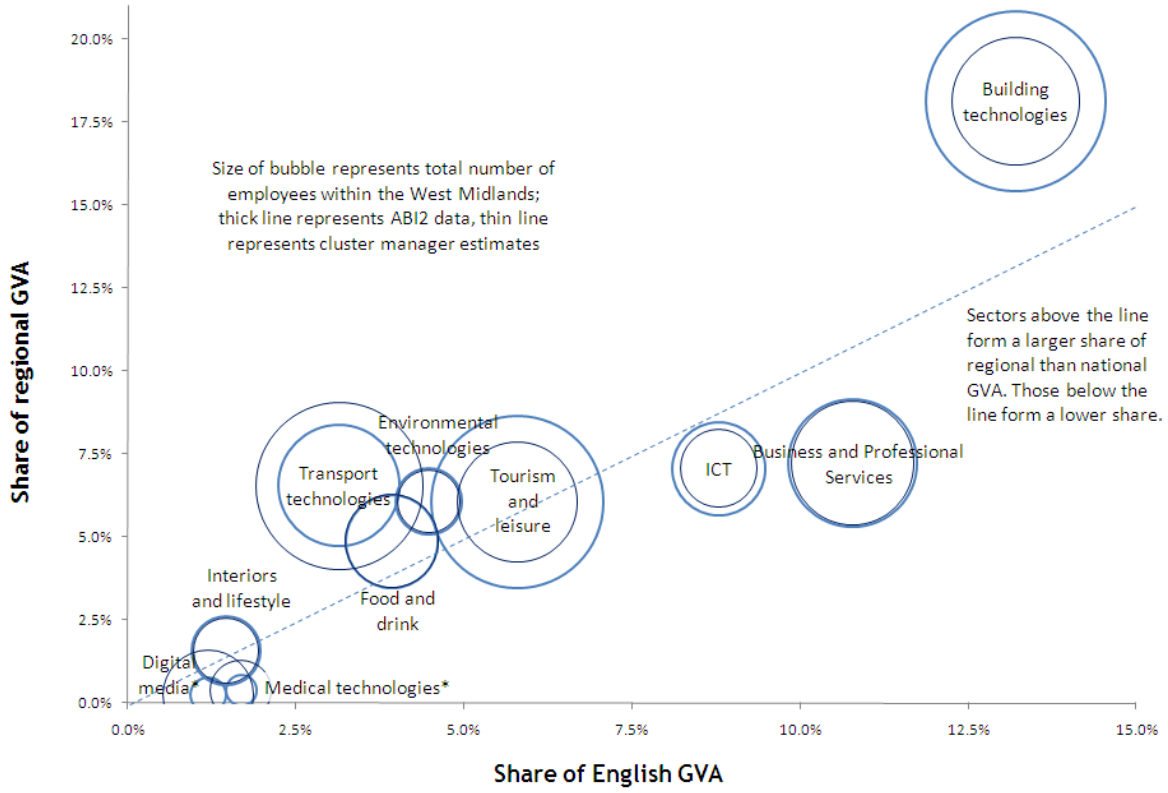
2.2 Key findings for sectors

The descriptions which follow provide some key findings from our analysis for each of the sectors identified in Table 1. This draws on data from the ABI about levels of employment, GVA and recent growth, productivity levels as measured by GVA per employee, and some additional analysis of the linkages to the wider economy through purchases of intermediate goods. Note that GVA data is given in nominal (current prices) terms. The sections also draw on wider evidence, including findings from the Ekosgen reports mentioned previously.

The figures based on the analysis of ABI data are summarised in Tables 2-4 which follow the descriptions of each sector. The ABI covers most sectors of the economy but excludes some, most importantly many financial services. Therefore, the shares of GVA quoted in the remainder of this report are as a proportion of total GVA excluding financial services and the public sector. Collectively, the sectors we are considering accounted for GVA of £36.6 billion, approximately 58% of non-financial private-sector GVA (or just over 40% of total GVA).

To illustrate the relative size of sectors compared to the national picture we have combined them into Figure 1. The vertical axis shows the regional share of GVA for each of the sectors while the horizontal axis shows the national figure. The sizes of the bubbles represent the shares of regional employment in each sector, according to both the SIC-based definition and the cluster's own assessment.

Figure 1: Sector contributions to GVA and scale of employment, 2006



Note: * Estimates for these sectors significantly understate their true size (GVA and employment) due to the limited coverage of the SIC-based definitions used.

Caution should be taken in the interpretation of Figure 1 for number of reasons:

- Since the GVA figures are based on the SIC-based definitions, those sectors which are significantly under-represented in terms of employment by these definitions, such as medical technologies and digital media, are also likely to be understated in terms of GVA.

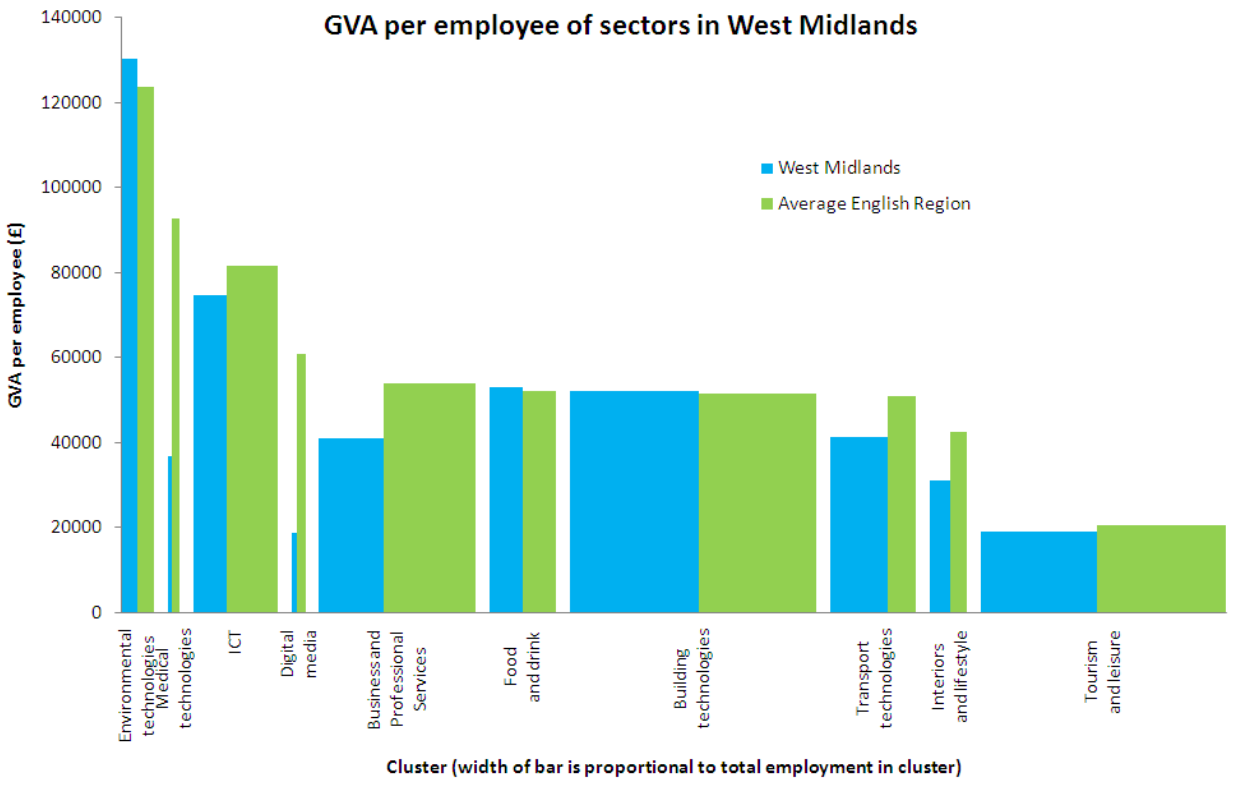
- The SIC definitions for building technologies includes several construction-related industries that are influenced by central government spending such as education and infrastructure which may underpin the sectors performance.

- The figures in the chart date from 2006 (the latest available data) which pre-dates the current economic recession. Some of the sectors have been hit particularly hard by the recession so the picture is likely to have changed somewhat, in the short term at least.

Nevertheless, the chart indicates that some sectors may be underperforming in the region and would be worthy of further investigation to confirm whether the underperformance is real or whether it is due to the limitations of the data.

The productivity of each sector, relative to the national average is illustrated below. In figure 2, the height of the bar indicates the productivity of each sector, in terms of GVA per employee. The width of the bar indicates the proportion of regional (or national) employment in the sector. This means that the area of the bar represents the total GVA of the sector.

Figure 2: GVA per employee of sectors in the West Midlands, 2006



Once again, figure 2 should be interprted with caution:

- The figure uses the SIC-based definitions of sectors, which under-represents some clusters, particularly medical technologies and digital media, both in terms of employment and productivity. The composition of these sectors within the region also differs significantly from the national composition. Therefore, further investigation would be needed to determine whether the relatively poor apparent performance is real or whether it is due to the limitations of the data.

- The capital intensity of a sector has a direct impact on the GVA per employee. For example, environmental technologies includes more capital intensive industries than food and drink, therefore the GVA per employee is likely to be higher.

- There is a marked difference in the external tradability of outputs from different sectors. Manufactured products and some services can be traded outside of the region, but others such as tourism and leisure are largely confined to consumption within the West Midlands.

2.2.1 Building Technologies

The largest sector by most measures, including total employment and GVA, is building technologies, with nearly 220,000 employees (9% of all regional jobs) in 2006, an increase of an average 3% per year between 2003 and 2006. The sector generated nearly £11.5bn in GVA in 2006, 18% of the regional total – the highest share in the country. The impact of building technologies is also felt across the wider economy: purchases by the sector account for over £19bn. Typically the cluster has been characterised by high levels of self employment (approximately 25%) which reflects the dynamics of the industry - high numbers of skilled tradesmen and labourers.

Within the West Midlands, the sector compares well with other parts of the country. Productivity is the highest outside London and the South East and growth has been significantly faster than the national average over recent years.

The figures above are based on the sector as defined by SIC codes. These figures are generally over-representative of the cluster since the definition includes site workers, some labourers and retail stockists of building materials. Estimates from the cluster itself suggest that the true scale of employment is around half that quoted above. However, these comments apply to all time periods and all regions, so the trends reported above, and the comparisons with other regions remain valid.

Building technologies play a vital role in the continued development of the region. It is at the heart of the physical and social regeneration of the region with new hospitals, schools, housing and infrastructure creating major opportunities for jobs and improvements in quality of life.

The scale of employment, activity and high levels of job creation (pre-downturn) that have been experienced over the cluster lifetime mean that building technologies can be regarded as being both a means of stimulating economic growth and a major wealth creator in and of itself. However, the squeeze on credit has had a profound effect on the performance of the cluster at both a national and regional level. New project starts in the West Midlands in the three months to August were 37% down on the previous year. Planning approvals have fallen across most sectors, with private housing approvals decreasing by 74% in the first seven months of 2009[2].

Perhaps unsurprisingly, the workforce is male dominated (comprising approximately 88%) the majority of whom are white (96%). Typically workers also tend to have fewer high level qualifications when compared to other workers within the West Midlands, with only 17% achieving NVQ levels 4 and 5 compared to the regional average of 24%.

2.2.2 Tourism and Leisure

The next largest sector in terms of employment is tourism and leisure, with over 200,000 employees. The sector generates £3.8bn in GVA and is an important purchaser of intermediate goods and services of over £7bn in 2006. However the sector is one of the lowest in terms of generating GVA per employee of only £19,000, increasing on average by 3% per year. This is lower than the overall English average for the same cluster grouping of £20,500 and significantly below the total economy national GVA per employee of £32,000.

The share of regional non-financial GVA from tourism and leisure is 6%, the third highest concentration in all regions, with the South West highest with 7%. The West Midlands region share of national output in this sector is 9%. Growth has been stronger than average, although this has not been reflected in improved productivity relative to the national average.

The tourism and leisure cluster makes a significant contribution to the West Midlands regional economy, comprising 15% of all businesses and 8.4% of all employment. Tourism and leisure related businesses experienced the largest growth in job creation of any of the sectors (more than 52 000 additional jobs) between 2001 and 2006.

As with building technologies, the SIC definition used above is regarded as being broader than the cluster it represents. One issue particular to this sector is the high proportion of part-time and seasonal workers. Separate estimates consider that the sector employs around 98,100 FTE jobs. Again, this will not affect the trends over time or the comparisons with other regions.

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[2] http://www.glenigan.com/free_downloads/glenigan_newsletterSep09.pdf

2.2.3 Business and Professional Services

The business and professional services cluster employed approximately 110 000 people. This represents 4.7% of the total employment in the region and is an increase of 79% on 2001 levels. This growth rate is comparable with the national rate of growth. Productivity is substantially below the national average at around £41,000 compared to £54,000, although the national figure is significantly inflated by London and the West Midlands productivity is comparable to many other regions.

The size of the cluster business base within the West Midlands is 24,000. However if micro-businesses and the self employed are included, this figure increases to 54,009, accounting for 11.7% of the business base within the region. Most significantly, the number of specialist business service firms has more than doubled between 2001 and 2006, an increase from 10,000 to 24,000. This is slightly higher than the average growth for England over the same period. This growth is unlikely to continue as the recession takes hold and affects different sectors in different ways.

The business and professional services sector in the West Midlands is a key driver of the regional economy and has experienced significant growth in its business base and employment levels. Yet despite the scale of the activity within the business and professional services sector, the region is not recognised for any particular specialism though there are modest unique selling points that are easily identifiable. This may be a manifestation, in part, of its close proximity to the capital.

The SIC definition for business and professional services is seen as presenting a fairly accurate picture of employment in the cluster within the region. The clusters own estimates are very similar to those quoted above.

2.2.4 Transport Technologies

Transport technologies, which covers three clusters – aerospace, automotive and rail, contracted in size between 2003 and 2006, with employment down by nearly 30,000 over the period, an average annual loss of 8%. However, as the sector has reduced in size, average productivity has risen by an average 6% per year although profit as a share of turnover continues to be low at around 7%.

While transport technologies has declined in terms of share of the regional non financial output, down from 9% in 2003 to 7% in 2006, the region continues to account for nearly 20% of the total output in this sector nationally. The transport technologies share of regional output is higher in the West Midlands than in any other region.

However, while the regional share of total output in this sector is high, the productivity levels, whilst improving, are the lowest among all English regions at £41,200 compared to £51,000 nationally and over £60,000 in the North West and London. This suggests that there is scope for improvements in productivity, though innovation or otherwise, which would have a significant effect on the regional economy, given the relative importance of the sector.

The available figures also indicate that there are 3,852 transport technology related companies within the West Midlands, with estimates putting this figure nearer 8,880 if microbusinesses are included. This number has also declined significantly since 2001, losing 646 businesses between 2001 and 2006, a decline of 14% which is significantly more than the national average of 9%.

The manufacturing industry, and particularly automotive manufacture, has traditionally been the mainstay of the West Midlands economy accounting for a significant share of regional GDP. The Automotive cluster is one of the more mature clusters in the region. The cluster has undergone significant restructuring in recent years as a result of intensive competition from low cost international competitors and the closure of many large vehicle manufacturing plants in the region.

The SIC definition for transport technologies is relatively broad and includes industries such as metal casting which, whilst important to these clusters, are not specific to them alone. Nevertheless, estimates are considered to provide a reasonably accurate representation of the three clusters concerned. Previous estimates for the three clusters separately included significant areas of overlap and so the combined estimates were significantly higher.

2.2.5 ICT

The most recent report on the ICT cluster in the West Midlands indicates that the cluster has more than 3,000 ICT businesses ranging from large global companies (such as Fujitsu, Ericsson, IBM) to small and medium sized software companies. The cluster employs almost 60 000 people and contributes in excess of £4.4 billion in GVA.

ICT has performed well, with GVA per employee growing at an average rate of 12% between 2003 and 2006, closing the gap on the English average which grew at only 6%. However the GVA per employee in ICT in the region is still 25% below London levels and trails two other regions.

The ICT sector represents around 7% of regional GVA, but this is only the 6th highest figure amongst English regions and only half that in the South East. Overall the region provides around 7% of the nation's ICT output.

The information and communications technology (ICT) cluster plays a key role in the development of the West Midlands region. The rapid growth and ubiquity of ICT means that regional economic success is now also dependent upon the effective adoption and use of ICT products and services by businesses and citizens. ICT is both a key enabler of economic growth across sectors and a significant generator of wealth in its own right.

The ICT theme is difficult to map and Standard Industrial Classification (SIC) is not sufficiently precise to define the business base of the sector. This is largely because ICT can not be fully bounded by traditional definitions as it is an enabling technology for a majority of industries and therefore overlaps with several SIC areas. However, the SIC definition does provide a fairly accurate representation of the ICT cluster.

2.2.6 Food and Drink

The food and drink sector employs around 58,000 people in the West Midlands. This number has been stable over recent years. Over the same period, GVA from the sector has risen by around 7% each year, due to a marked improvement in productivity.

The regional growth rate has been significantly higher than the national average of 3% per year since 2003 and the West Midlands now represents around 11% of the sector. Nevertheless, at 5% of the regional economy, the share of output is only the fourth largest in England. Productivity is comparable to the national average but growing more quickly and is now higher than any other region outside London and the South East.

These estimates cover the food and drink cluster only and they are considered to accurately represent the extent of the cluster. However, they do not include agriculture or related industries. If agriculture is also included, a further 46,000 employees are added to the employment figure. *Improve* – the Sector Skills Council for food and drink – estimates total employment in the sector to be 170,000 in 2004. Employment is distributed between food and drink manufacturing (62%), machinery manufacture (2%) and wholesaling activity (36%). There has been recent growth in the numbers in food manufacturing, but those in machinery and wholesaling have reduced.

The Food and Drink sector represents a strong and diverse component of both the regional and national economies and has a key role to play in the development of the West Midlands region. The sector has experienced considerable growth since the cluster programme began.

2.2.7 Interiors and Lifestyle

The interiors and lifestyle sector employs around 31,700 people in the region, a figure which has declined significantly in recent years. Sectoral GVA has also fallen, but not as quickly as productivity has improved slightly. Despite the recent falls, which have been sharper than the national average, the region still represents 10% of the national total GVA for the sector.

Although productivity has improved in recent years, at £31,200 it is still significantly below the national average of £42,450, and the gap is widening. In fact, productivity in the West Midlands is lower than in any other English region.

The worldwide market for luxury goods has expanded in line with the growth in prosperity and disposable income, notably in rapidly developing countries. The interiors and lifestyle cluster comprises of a series of high skilled, creative and innovative designers and manufacturers. Its focus is to enhance and foster the growth of businesses that produce "design rich consumer products". In that respect, this is one of the few clusters which aims to be identified by interconnected and design oriented firms as opposed to companies producing similar goods.

The cluster has been undergoing a period of structural change over the last few years. It was defined as containing firms that were engaged in the production of goods within the interiors and high end lifestyle product sectors. However, the current cluster recognises the fact that these actually overlap and on that basis, the cluster, previously known as High Value Added Consumer Products, was renamed the Interiors and Lifestyle cluster.

The SIC-based definition used for the figures above was a good match with the original HVACP sector. The change to the interiors and lifestyle cluster definition has broadened the footprint of the cluster, meaning that the estimates probably underestimate its size on the new coverage.

2.2.8 Environmental Technologies

Although it is relatively small in terms of employment, about 29,400 people in the region and falling, environmental technologies is the sector with the largest GVA per employee, with over £130,000 per employee. This is unsurprising as it encompasses some highly capital intensive industries. The lower employment costs are a further confirmation of the contribution that capital intensity has had on the GVA per employee: £945m compared to a GVA figure of over £3.8bn.

GVA per employee growth was also strong, increasing by over 21% on average every year between 2003 and 2006. The sector is also the most profitable. Profit, or as termed by ONS operating surplus, is measured by GVA minus the cost of employment and is estimated to be £2.9bn, which works out as 34% of total turnover.

Productivity in environmental technologies also compares well to the English average. GVA per employee is nearly £7,000 higher than the English average and has grown at a higher rate, 21% compared to 15% on average each year between 2003 and 2006. However, the region ranks 4th among the nine English regions with Yorkshire and Humber the highest at nearly £175,000 per employee. It should be noted however that the sectors that make up the environmental technologies are historically concentrated in the Yorkshire and Humber region with its industrial base of power stations, oil refineries and chemical plants.

Despite its low levels of employment, the sector accounts for some 6% of regional GVA, nearly £4 billion, and the region has around 12% of the national total output. Growth rates have matched the national average in recent years but are higher than most other sectors at 13% per annum in the three years to 2006.

The environmental technologies sector offers a long term growth opportunity for the West Midlands. It provides opportunities for new businesses, diversification and employment in high, medium and low value added activities. It has been primarily driven by the expansion of related legislation, policy and regulations as the environment has risen up the political agenda. Consequently there have been increasing expectations for industry to improve its environmental performance through growing awareness of potential cost and resource efficiency savings. These trends will continue into the future as will the growing demand for environmental products and services.

The environmental technologies cluster is typically hard to measure as it is defined by types of products as opposed to sector of activity. Complex supply chains also mean that its impact is often hidden. That said the SIC definition of the Environmental Technologies cluster is a moderately accurate reflection of the cluster.

2.2.9 Digital Media

Digital media is one of two sectors which are significantly under-represented by the SIC-based definitions used in our analysis. The definition we have used gives an estimate of only around 8,300 employees in the sector in the West Midlands. Based on this definition, the sector has the lowest productivity within the region of any of those we have looked at. The regional figure of £18,900 is less than a third of the national average productivity of £60,800. However, this figure is massively inflated by the influence of London which dominates this

An organisation called Frontier Economics has been working with DCMS on a new creative industries definition using a set of nine broad sub-sector definitions (Annex 6). It provides a more detailed definition using more 5-digit codes than DET. It also splits definitions into five layers to allow for detailed analysis in certain sub-sectors by core and peripheral activities. Again, the scope of the definition includes a bias towards cultural activities, but a number of the sub-sectors can be described as being digital media activities – advertising; design; film, video & photography; and music & the performing arts. However, even though these four sub-sectors include a wider definition of SIC codes, they do not cover some of the SICs which comprise the existing AWM Digital Media definition[5].

The four Frontier Economics digital media sub-sectors listed above generated a combined turnover of £1.5bn in 2007 with employment growing by 1.4% to 15,800 between 2004 and 2007. Turnover per employee in 2007 measured £96,000, putting it in the middle of regional rankings, but significantly less than London (£247,000).

The difference between the estimates produced using existing AWM compared to DET and Frontier Economics SIC codes indicates the impact of using a wider but consistent definition of the digital media sector. We propose to review the different definitions to identify the most appropriate (and comprehensive) SIC-based definition of the digital media sector, in consultation with the cluster team. Once this has been agreed, we will undertake the same GVA analysis as that undertaken as part of this study for the revised definition.

2.2.10 Medical Technologies

As with digital media, medical technologies is thought to be significantly under-represented by the SIC definition. Our estimates, using this definition, show only around 6,500 people employed in this sector in the West Midlands. However, this definition only includes the manufacture and (some) retail of medical products. It excludes some key areas of research which are located within wider industries, some of which overlap with other clusters. Research by the cluster team suggests that the true figure for employment is closer to 25,000 people, although this still leaves it amongst the smallest of the clusters.

[5] 9220 Radio and television activities, 9220 Radio and television activities, 9251 Library and archive activities, 2233 Reproduction of computer media.

Comparisons with other regions are difficult because of the inclusion of the pharmaceutical industry which dominates in other parts of the country, but which provides only a small share in the West Midlands. This leads to the regional productivity figure being less than half the national average and around a quarter of the figure in the North West. It also means that both productivity and GVA have declined against the national trend.

The difficulties with SIC definitions of the sector outlined above means that it is difficult to draw any firm conclusions from our analysis. However, the Department for Business, Innovation and Skills (BIS) are launching a mapping exercise of the medical technologies sectors. This has been produced using data provided by the regional Medilinks. This mapping exercise, due in early November, is likely to use a narrow definition of the medical technology sector, those businesses solely focused on medical technologies. This will hopefully provide an analysis of the sector using a more comprehensive definition than the existing SIC analysis.

Medilink West Midlands have a database of around 630 businesses which fit this narrower definition. They also hold details of a further 550 businesses for whom part of their turnover is generated from the medical technologies sector. However, they do not hold complete information on all of these businesses so a calculation of GVA and employment is not possible. If the national mapping exercise does not provide the necessary regional breakdown and indication of performance as required by this study, it may be possible to obtain company details from Medilink West Midlands and produce an analysis of the region, through an anonymised aggregation of GVA data available through administrative or other sources. This approach is recommended should the BIS study not provide sufficient information.

We propose to review the output from the BIS study once it becomes available. If it is suitable then we will use it to undertake the same range of analysis of the sector as has been included in this report. If this database is unable to provide the evidence that we require then we will discuss with Medilink West Midlands the options for obtaining information from their database which will allow us to carry out some of the analysis.

2.2.11 Advanced Matreials

Advanced Materials has a significant scope and includes areas such as Biomaterials; Ceramics; Composites; Multifunctional Materials; Electronic Materials; Magnetic Materials; Metals; Optical-Photonic Materials; Polymers; Superconducting Materials; Catalysts; Nanostructured Materials; Coatings and Computational Science, which is universally seen to be an integral aspect of Advanced Materials.

Measuring the contribution of advanced materials is the most problematic of all the sectors covered in this report, since businesses are market rather than sector focused. Defining the theme through SIC code definitions is not possible. Mapping and analysis undertaken as part of the development of the Advanced Materials Strategy provides an in-depth review of the broad sectors in which advanced materials businesses are likely to operate and support, including many which are covered elsewhere in this report (notably transport technologies, medical technologies and environmental technologies). Therefore, estimating the contribution to the regional economy that advanced materials businesses make in the same way as for the other sectors covered in this report is not practical.

A number of previous studies, at regional and national level, have attempted to quantify the economic impact of advanced materials. We propose to review these studies to determine whether it will be possible to extract suitable information to allow us to analyse the impact of the sector in at least some of the dimensions covered in this report for other sectors. To obtain a more accurate indication of the contribution of the advanced materials sector, a mapping or survey exercise might be the most informative. However, this would be subject to issues of self-definition, coverage and comparability.

Table 2: Economic position of analysed sectors 2006

	Employees		Growth % average 03- 06	Employment costs, £ million	Growth % average 03- 06	Total purchases 2006, £ million	Growth % average 03- 06	Total turnover, £ million	Growth % average 03- 06	GVA, £million	Growth % average 03- 06	GVA per employee, (£)	Growth % average 03- 06
	SIC Definition	Cluster Manager Estimates											
Environmental technologies **ITC Theme Energy**	29,410	26,100	-7%	945	+3%	4,812	+14%	8,584	+13%	3,835	+13%	130,391	+21%
ICT **ITC Theme**	59,643	41,000	-3%	2,458	+5%	5,438	-1%	9,773	+2%	4,450	+8%	74,613	+12%
Food and drink	57,988	58,661	+0%	1,347	+4%	10,747	+4%	14,360	+4%	3,070	+7%	52,945	+7%
Building technologies*	219,679	110,000	+3%	5,654	+9%	19,434	+9%	30,650	+11%	11,432	+14%	52,041	+11%
Transport technologies **ITC Transport Technology Theme**	100,059	189,820	-8%	3,042	-2%	12,247	-2%	16,330	-2%	4,123	-3%	41,207	+6%

	Employees		Growth % average 03- 06	Employment costs, £ million	Growth % average 03- 06	Total purchases 2006, £ million	Growth % average 03- 06	Total turnover, £ million	Growth % average 03- 06	GVA, £million	Growth % average 03- 06	GVA per employee, (£)	Growth % average 03- 06
	SIC Definition	Cluster Manager Estimates											
Business and Professional services	111,087	102,500	+8%	2,769	+9%	3,154	+8%	7,711	+9%	4,554	+9%	40,998	+1%
Medical technologies+ **ITC Healthcare Technologies**	6,461	25,000	-4%	149	-1%	1,819	+4%	2,040	+1%	237	-17%	36,718	-14%
Interiors and lifestyle	31,739	29,380	-8%	633	-5%	3,317	+4%	4,312	+2%	991	-6%	31,236	+2%
Tourism and leisure	200,509	98,100	+6%	1,950	+12%	7,225	+16%	11,092	+14%	3,814	+10%	19,020	+3%
Digital Media+ **ITC Digital Media**	8,255	55,000	+3%	159	-0%	396	-10%	555	-10%	156	-10%	18,865	-12%

Table 3: Comparative performance in GVA per employee

	WM GVA/ employee 2006, £	WM av. growth pa, 2003-2006	Eng GVA/ employee 2006, £	Eng av. growth pa, 2003-2006	Highest GVA/ employee, £		Second Highest GVA/ employee, £		WM rank
Environmental technologies **ITC Theme Energy**	130,391	21%	123,658	15%	Yorkshire and the Humber	174,686	North East	171,260	4
ICT **ITC Theme**	74,613	12%	81,508	6%	London	101,643	North East	91,268	4
Food and drink	52,945	7%	52,170	5%	London	69,989	South East	68.392	3
Building technologies*	52,041	11%	51,593	6%	London	69,236	South East	58,577	3
Transport technologies **ITC Transport Technology Theme**	41,207	6%	50,978	6%	London	67,801	North West	62,478	9
Specialist business services	40,998	1%	53,934	2%	London	81,127	South East	47,424	5

	WM GVA/ employee 2006, £	WM av. growth pa, 2003-2006	Eng GVA/ employee 2006, £	Eng av. growth pa, 2003-2006	Highest GVA/ employee, £		Second Highest GVA/ employee, £		WM rank
Medical technologies+ **ITC Healthcare Technologies**	36,718	-14%	92,762	6%	London	193,483	North West	145,415	9
Interiors and lifestyle	31,236	2%	42,450	4%	London	64,517	South East	48,014	9
Tourism and leisure	19,020	3%	20,535	4%	London	26,662	South East	22,146	5
Digital Media+ **ITC Digital Media**	18,865	-12%	60,763	9%	London	88,803	South East	32,111	8

Table 4: Comparative performance in total GVA

	WM GVA 2006, £ million	WM av. growth pa, 2003-2006	Eng av. growth pa, 2003-2006	WM % Eng GVA, 2006	% WM GVA, 2006	Highest % regional GVA		WM rank
Environmental technologies **ITC Theme Energy**	3,835	13%	14%	12%	6%	North East	8%	4
ICT **ITC Theme**	4,450	8%	5%	7%	7%	South East	14%	6
Food and drink	3,070	7%	3%	11%	5%	Yorkshire and the Humber	6%	4
Building technologies*	11,432	14%	8%	12%	18%	West Midlands	18%	1
Transport technologies **ITC Transport Technology Theme**	4,123	-3%	1%	19%	7%	West Midlands	7%	1
Specialist business services	4,554	9%	9%	6%	7%	London	20%	5
Medical technologies+ **ITC Healthcare Technologies**	237	-17%	5%	2%	0%	North West	3%	9

	WM GVA 2006, £ million	WM av. growth pa, 2003-2006	Eng av. growth pa, 2003-2006	WM % Eng GVA, 2006	% WM GVA, 2006	Highest % regional GVA		WM rank
Interiors and lifestyle	991	-6%	-2%	10%	2%	East Midlands	2%	4
Tourism and leisure	3,814	10%	5%	9%	6%	South West	7%	3
Digital Media+ **ITC Digital Media**	156	-10%	7%	2%	0%	London	4%	6
Total Economy (Excludes Financial services)	63,011	7%	6%	9%	100%	N/A		

+Since the GVA figures are based on the SIC-based definitions, sector is significantly under-represented in terms of employment by these definitions. GVA is also likely to be understated. See previous sections for more details

* The SIC definitions for building technologies includes several construction-related industries that are influenced by central government spending such as education and infrastructure which may underpin the sectors performance.

2.3 Conclusion

The above analysis represents an initial step in developing a better understanding of the economic performance of the key ITC themes and clusters. The discussion on the key economic measures – employment, GVA, and GVA per employee – highlight the various characteristics of each of the sectors. However, the analysis was limited to the West Midlands. A more effective analysis is undertaken when the regional performance is compared to the same sectors' performance nationally and in other regions.

The analysis highlights a number of key areas for discussion. Up to 2006, the environmental and building technologies sectors are relatively fast growing, and the latter in particular is a key driver for overall economic growth, as it is growing quickly regionally and nationally and the contribution to the total regional economy is large. Transport technologies, which have a high public profile, demonstrate the importance of a more detailed analysis. While the region contributes nearly 20% of total national output in this sector, the workforce are estimated to have the lowest level of productivity across all English regions.

Using the existing methodology, medical technologies and digital media appear to be the worst performing sectors, although the data we have available only cover a limited number of business activities in these sectors. However, wider definitions of these sectors indicate that the performance may be higher than our current estimates suggest.

2.4 Next steps

This analysis is the initial step in developing a more comprehensive economic evidence base to support the work of the ITC and clusters. The paper presents data for each of the clusters and for most of the ITC innovation themes, where they can be defined using sector data. It also highlights some of the gaps in the evidence base where there is a reliance on data reported through sector classifications. This method of reporting data limits the possibilities for analysis of those important businesses engaged in multi-sector innovation activity, particularly in new technologies and advanced materials.

In an attempt to address these gaps, we have sought additional sources and definitions of clusters. Within the sections relating to the sectors concerned – digital media, medical technologies and advanced materials – we have proposed some areas for further work to provide a more comprehensive and/or comparable picture of these sectors. We also recognise that there are some important aspects for the understanding of sector performance that we have not yet analysed, particularly market size and external tradeability – which influence the extent to which the sectors can be expected to grow within the region. We propose to investigate these issues further.

Any findings emerging from this work will form part of the ongoing work programme which the Observatory is undertaking and, where appropriate, will be incorporated into ongoing reporting of sector performance. We also plan to build on this analysis by moving from a general analysis of the sectors to focus more specifically on their innovation performance.

3 Innovation Dashboard

The next section looks at the proposed innovation dashboard project. It reviews the issues surrounding the accurate measurement of innovation activity before providing an overview of indicators that may be adopted for future monitoring.

3.1 What are we trying to measure?

What is innovation? To be in a position to measure innovation we must first be able to focus our definition for what we mean by innovation.

Innovation is widely defined as the commercial exploitation of new ideas. The concept of innovation extends beyond simply 'invention' as, while invention is a necessary prerequisite for innovation, other more complex factors interplay to generate economic benefits from the new ideas.

A more encompassing definition of innovation identifies 5 main themes. These are -

- new products and processes
- new techniques for production
- the implementation of new organisational frameworks
- creation or diversification of new markets
- new sources of supply

Recently NESTA[6] proposed a more encompassing definition of innovation to that described above. They propose defining innovation as 'change associated with the creation and adoption of ideas that are new-to-world, new-to-nation/region, new-to-industry or new-to-firm'.

3.2 Measuring innovation

Measuring innovation is hugely difficult. The traditional 'linear' model lends itself more to quantification than the more complex definition given above. The basic linear model of innovation posits a process that moves from one stage to another:

Basic Research --> Applied Research --> Development --> Diffusion/production.

[6] National Endowment for Science Technology and the Arts

There are numerous variations, with differing descriptions and titles for the stages. There are also variations that employ feedback mechanisms. But they are essentially the same: science goes in and products (innovations) come out. The linear model of innovation originally gained acceptance and continues to drive analysis today because of the availability and power of the statistics used in the model. The model took hold and became the norm - and the statistics were developed to reinforce the model.

The West Midlands Regional Observatory has already undertaken work to calculate a Regional Innovation Index. The methodology behind this project was the 2007 European Innovation Scoreboard[7]. However, the European Innovation Scorecards changed between 2007 and 2008 making direct comparisons difficult so we have based our proposals on a benchmarking exercise undertaken in the East of England. A table of the indicators used by both methodologies can be found in Annex 1: Comparison of innovation indicators in European and East of England methodologies.

3.3 Coverage of the Innovation Dashboard

A dashboard is a business analysis tool that presents data within a structured framework. It gives the user the ability to define, track and monitor specific indicators to help determine the status of strategic interventions. The dashboard structure definition, the selection of adequate indicators and their visualization are the key elements of this approach. A dashboard enables users to identify trends at a glance and drill down into data sets to facilitate timely, evidence based decision-making.

The primary measure is an initial presentation of the main variables adopted to measure and compare regional innovation environments. The variables selected for the innovation dashboard are set out in sections 3.5, 3.6 and 3.7 below. For each, the dashboard:

- compares the performance of the West Midlands Region to those of other geographic areas as well as the UK average
- grades the region's position in the table to provide an 'at-a-glance' summary of the Region's performance
- indicates the English region's with the best performance allowing the West Midlands to learn from the best

Accompanying this report, we have provided a mock-up of how the innovation dashboard might be presented. This illustrates each of the indicators selected for the dashboard in graphical format.

[7] http://www.proinno-europe.eu/admin/uploaded_documents/European_Innovation_Scoreboard_2007.pdf

3.4 Framework for the innovation dashboard

The dashboard indicators are categorized as inputs, links or outputs.

Innovation **'inputs'** are considered to be those actions undertaken by the region which contribute to innovative practice and which create a climate of innovation and entrepreneurship. **'Links'** indicators measure the things that bring people or businesses engaged in innovation together; including collaborative working and aspects of the supporting infrastructure and **'Outputs'** are the indicators that reflect how successful innovative practices have been; be it patent applications, firms introducing novel products or processes, knowledge intensive business density, or long term change in GVA per capita.

The traffic light scheme records either 'red', 'amber' or 'green' according to whether the region falls into the top, middle or bottom third of performance across the 9 English Regions. In future iterations of the dashboard, we will also be able to incorporate a separate indication of the direction of travel of the indicator in the West Midlands relative to other regions.

This paper follows an initial draft where WMRO presented a more complete list of proposed indicators. This was discussed at the last meeting of the strategy and data sub group and it was agreed that the dashboard should comprise primary and secondary measures. While we do not provide detailed commentary on each individual indicator in this paper, each table is accompanied by a short overview.

More detailed tables containing metadata for each indicator is provided in annexes 2 and 3.

The following section details suggested indicators that will form the basis of the innovation dashboard.

3.5 Inputs

Innovation 'inputs' are considered to be those actions undertaken by the region which contribute to innovative practice; those activities and socio-economic indicators which create a climate of innovation and entrepreneurship. As can be seen in the tables below the West Midlands region underperforms the England average and falls in the bottom half of the regions in 12 of the 16 indicators so far measured. In fact in just one, relating to job related training, does the West Midlands appear in the top half of English Regions. However it must be highlighted that the differences between regions are often very small, for instance the 'proportion of businesses in the WM making innovation related expenditure' is only 1% below the England average (55%) yet the region still ranks 7th.

Despite this, the dashboard highlights the work needed to foster an innovative environment in the West Midlands in order to improve economic prosperity and productivity, and to attempt to close the productivity gap.

Table 5 presents the six agreed priority indicators for the inputs to innovation activity. They show that in half the cases the region is in the bottom third of the English regions. In particular the region's businesses are investing less than counterparts in other regions in innovation input activities. There may be sectoral issues that contribute to these lower relative investment levels. These issues may be explored in the more sophisticated analyses proposed in section 4 below.

Table 5: Priority indicators - inputs

	Variable	WM figure	Rank (of 9)	National figure		Best English region		Second-best region	
Private investment	Proportion of businesses making innovation-related expenditure	54%	7	UK	55%	East of England	61%	East Midlands	59%
	R&D performed within businesses as proportion of GVA	1.1%	6	Eng	1.5%	East of England	3.7%	South East	1.9%
	Proportion of businesses investing in external knowledge creation	13%	7*	UK	14%	South East	16%	London	15%
Education	Proportion of pupils achieving 5+ A*-C grades including English & mathematics GCSEs	46%	7	Eng	48%	South East	52%	London	51%
	Higher education qualifications obtained per 10 000 population	98	6	Eng	111	London	155	North East	133
Human capital	Proportion of employed working age residents participating in job-related training in past 13 weeks	27%	4	Eng	27%	North East	30%	South West	29%

7* indicates joint 7th.

Table 6 presents the indicators which the ITC data and strategy group identified as secondary measures of innovation inputs. They show a similar picture to the investment indicators in Table 5. However, the indicator of lifelong learning, as measured by firms' provision of staff training places the region bottom of the English regions with only 65% of firms providing staff training in the last 12 months compared to an English average of 67%.

Table 6: Secondary indicators – inputs

	Variable	WM figure	Rank (of 9)	National figure		Best English region		Second-best region	
Private investment	BERD R&D personnel as proportion of workforce	0.6%	5	Eng	0.6%	East of England	1.3%	South East	1.0%
	Proportion of businesses investing in 'tangibles'	61%	6	UK	61%	East of England	66%	South East	64%
Human capital	Proportion of employers providing staff with either on or off the job training in 12 month period	65%	9	Eng	67%	North East	70%	South East	69%

3.6 Links

'Links' indicators measure the things that bring people or businesses engaged in innovation together; including collaborative working and aspects of the supporting infrastructure.

Effective measurement of links is difficult. The indicators presented in Table 7 and Table 8 are broad measures. These measures do not, however effectively reflect the depth and/or quality of these links.

Broadband take-up among the region's SMEs is marginally above the national average but significantly below the London and South East regions. Potentially this is a reflection of urbanisation, with some of the more rural regions having lower rates. The region with the lowest take up is the Yorkshire and Humber with a take up rate of 57%.

The other indicators show the region is in a mid-table position; however these show the region only marginally above the UK average and so the position going forward will be more uncertain as other regions catch up.

Table 7: Primary indicators - links

	Variable	WM figure	Rank (of 9)	National figure		Best English region		Second-best region	
Communications	Broadband take-up rate amongst SMEs	63%	5*	UK	62%	South East	74%	London	70%
Interactions	Proportion of businesses with co-operation agreements	11%	4	UK	10%	East Midlands	12%	East of England	11%

*5 means joint 5th

Table 8: Secondary indicators - links

	Variable	WM figure	Rank (of 9)	National figure		Best English region		Second-best region	
Communications	Proportion of households with broadband internet connections	57%	5	UK	57%	East of England	67%	South East	66%
Interactions	Total funding for business-university research and consultancy per 100 academic staff	£112	4	Eng	£108	North East	£157	East of England	£123

3.7 Outputs

'Outputs' are the indicators that reflect how successful innovative practices have been; be it patent applications, firms introducing novel products or processes, knowledge intensive business density, or long term change in GVA per capita.

It is worth noting that the causal links between inputs and outputs are not clearly defined. The levels of the output measures listed in Table 9 and Table 10 are not necessarily determined by the levels of the input measures in Table 5 and Table 6. An individual output indicator may not be directly affected by shifts in individual inputs, but rather be an outcome of a range of activities.

Table 9: Primary indicators - outputs

	Variable	WM figure	Rank (of 9)	National figure		Best English region		Second-best region	
Innovative firms	Knowledge intensive business density	47%	5	Eng	52%	London	67%	South East	57%
	Proportion of innovation active enterprises	62%	7	UK	62%	East of England	68%	North West	66%
Novel innovation	Overall proportion of firms introducing novel products	8.9%	3	UK	7.7%	South East	9.1%	East of England	9.0%
	Overall proportion of firms introducing novel processes	2.7%	7	UK	3.0%	North East	3.8%	South East	3.6%
Incremental innovation	Overall proportion of firms introducing existing products	15%	6	UK	15%	East of England	17%	South West	17%
	Overall proportion of firms introducing existing processes	11%	1	UK	9%	West Midlands	11%	Yorkshire and the Humber	10%

The region heads the other regions in terms of introducing existing processes into their businesses. While a positive step – learning and adopting from others – it indicates that the region's businesses are not good at developing new processes, as indicated by the lower percentage of firms, 2.7% who introduce new processes.

Overall the traffic lights in Table 9 reaffirm the fact that the region sits mid-table but close to the overall national average.

Table 10: Secondary indicator - output

	Variable	WM figure	Rank (of 9)	National figure		Best English region		Second-best region	
Intellectual property	Successful IPO patent applications per 10 000 population	0.28	5	Eng	0.36	South East	0.52	East of England	0.50

Table 10 shows the standard output measure of innovation as traditionally pursued by the linear methodology outlined in section 3.2 above. This measure is sensitive to sector activity, population size as well as legal and institutional factors[8]

3.8 Next Steps

The priority and secondary indicators discussed above have been agreed with the ITC sub group. The data has been presented graphically and incorporated into a single dashboard, a copy of which can be found at annex 7.

We propose to update the dashboard on a regular basis as the release of the indicators permits. The results will be presented to the ITC and will be published by the Observatory. The indicators will be kept under review and will be updated as new or improved measures become available. Given a large number of the indicators are sourced from the Community Innovation Survey (CIS) the release of the CIS6 will signify the next major update of the indicators. The date for this release is not yet known but will be monitored.

[8] See Economist July 23 2009 *Europe's unwieldy patent regime* http://m.economist.com/h/business_14105584.php

4 Additional analysis of the Community Innovation Survey (CIS)

4.1 Background

The Observatory has been commissioned by Advantage West Midlands (AWM) to develop the economic evidence base to support the work of the Innovation Technology Council.

As part of this larger project we propose delivering more detailed analyses on key themes. This proposed analysis will require a focus on key innovation metrics. Of these metrics the most comprehensive is the bi-annual Community Innovation Survey (CIS), although previously the survey was conducted every 4 years. The survey is managed by the Department for Business, Innovation and Skills (BIS) and is made available through the Office for National Statistics (ONS).

The aim of this paper is to:

- To provide an overview of innovation measures and an introduction to the CIS
- Provide initial headline findings for the West Midlands from current and previous CIS data
- Propose more detailed analysis of headline findings. This would require commissioning an approved researcher to extract data from ONS Virtual Micro Lab (VML)[9]

4.2 Measuring innovation

Traditionally innovation has been measured using R&D and patent data. The traditional model of innovation is one based on the 'linear' approach – basic research leads to applied research before undergoing development and ultimately being moved into production and consumption. However this is a restricted measure of innovation as it excludes innovation in the service sectors. As output from services becomes increasingly important surveys need to be able to capture the more subtle innovation activities that occur in new knowledge based sectors.

The CIS can provide a richer picture of innovative activity. This allows a more encompassing definition of innovation. This would include activities in the areas of:

- New products and processes
- New techniques for production
- The implementation of new organisational frameworks

[9] The Virtual Micro Lab is a secure data access facility which provides researchers with access to a wide range of ONS survey data. A data linking facility provides an opportunity to cross reference enterprises' survey responses across a range of ONS surveys. Access is strictly limited to ONS approved researchers.

- Creation or diversification of new markets
- New sources of supply

The next section is a short overview of the Community Innovation Survey.

4.3 Community Innovation Survey

The Community Innovation Survey collects data on the innovative characteristics of UK enterprises. The data include measures of innovation-related expenditure, rates of innovation and factors which have either encouraged or hindered innovation. Within the CIS, innovation is defined as *major changes aimed at enhancing a firm's competitive position, performance, know-how or capabilities for future enhancements. These innovation activities could be new or significantly improved goods, services or processes (including organisational) for making or providing them. This covers expenditure on innovative activities, including machinery and equipment, R&D, training and service design and marketing.*

The survey covers 5 key aspects of an enterprise's innovation activity. These areas are:

- What type of innovation activity and level of expenditure
- Sources of information and type of co-operation to support innovation
- Barriers to innovation
- Levels of public support
- Protection methods

The survey data can be reported by sector, size and region. Issues of sample size may limit the degree to which cross tabulation (for example comparing innovation activity by sectors by size and by region may be difficult), but the reporting categories do enable more detailed analysis to be undertaken.

The next section presents some broad headline results. This is followed by our proposals for a more detailed analysis of the data by an approved researcher.

4.4 Innovation performance in the West Midlands – selected indicators

The data presented in Figure 3 is sourced from the main data annex published by BIS. This data is limited to headline variables but is sufficient to provide a background to our proposal detailed in section 4.5 below.

Figure 3: Summary of selected headline data from CIS3, CIS4 and CIS5

Summary of selected indicators

West Midlands Regional Observatory
www.wmro.org

Indicator		WM CIS3 (1998 – 2000)	WM CIS4 (2002 – 2004)	WM CIS5 (2004 – 2006)
Innovation active firms		52%	55%	64%
Skills – employees to degree level or above		9%	11%	15%
Turnover from innovation		-	36%	38%
Cooperation agreements		-	11%	11%
Barriers to innovation		-	£	££

1. **Total innovation activity**

The principal metric within the CIS is the 'innovative activity rate'. This measures the percentage of enterprises surveyed who reported some form of innovation activity within the previous 3 year period. The West Midlands saw increased rates on innovative activity over the period, with 64% of enterprises reporting some level of innovation activity in the period 2004 to 2006, compared to 52% in the 3 years to 2000.

2. **Skills**

This indicator provides a measure of the share of the enterprises' employees that are educated to degree level or above. Economic theory suggests that higher qualified workers are more likely to be both innovative and better able to adopt new innovations from external sources.

The share of the workforce educated to degree or above has increased in the region from 9% in the period between 1998 and 2000 to 15% between 2004 and 2006. While the share of graduates in science and engineering subjects has remained static at 5% between CIS4 and CIS5, the increase in total graduates is due to an increase in graduates from other subjects increasing from 6% in CIS4 to 10% in CIS5.

<u>There are more graduates in innovative enterprises than in non-innovative enterprises</u>

If we compare the skills profile of innovative and non-innovative enterprises we get a more detailed picture. Among enterprises who reported innovative activity in the two survey periods, the share of engineering and science graduates increased marginally from 6% to 7% but fell from 3% to 2% in enterprises who reported no innovative activity.

Graduates from other subjects increased in both innovative and non innovative enterprises. Between 2002 and 2004 the share of non science and engineering graduates was 8% in innovative enterprises; this increased to 12% between 2004 and 2006. Non innovative enterprises reported increases in the graduate share of their workforce between the surveys – up from 4% between 2002 and 2004 to 7% between 2004 and 2006.

3. Commercial success from innovation

Innovation is widely defined as the commercial exploitation of new ideas. The CIS captures this by asking respondents to report the share of turnover that can be attributed to innovation. Between 2002 and 2004 innovative enterprises in the West Midlands reported that 36% of turnover was due to innovation. This increased to 38% in the period 2004 and 2006.

Enterprises report that the majority of this comes from improving existing products, either through adopting products previously launched by other enterprises or through improving their own existing products.

4. Cooperative agreements

Collaboration is becoming a new and important source of competitive advantage: innovations are increasingly brought to the market by networks of enterprises, selected according to their comparative advantages, and operating in a coordinated manner.

The CIS asks respondents if they undertook any cooperative innovation over the period and, if so, with what type of cooperative partners. There is no reported change in the percentage of enterprises surveyed who undertook cooperative innovation. However, the types of partners through which this was undertaken changed between the CIS4 and CIS5 surveys.

Respondents increasingly undertook innovation with other parts of their enterprise (internal), with 57% reporting this type of cooperative activity between 2004 and 2006, up from 45% between 2002 and 2004. Enterprises reported lower rates of cooperation with suppliers and customers (vertical) as well as lower rates with competitors (horizontal). There was some increased cooperation with universities but not a significant amount.

Enterprises increased the rate of cooperation with other UK regions, up from 66% between 2002 and 2004 to 72% between 2004 and 2006. This activity however was against a background of a significant reduction in local cooperation arrangements: down from 74% between 2002 and 2004 to 55% between 2004 and 2006.

5. Barriers to innovation

There may be a number of factors that impact on a firm's ability to innovate. The CIS asks respondents to rate certain factors on a scale of importance. These factors can be used to provide policymakers with an insight into the most important aspects of the wider environment and the impact they have on rates of innovation activity.

Fewer enterprises reported difficulties accessing knowledge and skills as barriers to innovation. Costs were an increasing barrier to enterprises who did not engage in innovation activity. However, among innovation-active enterprises fewer reported costs as being a high barrier. This suggests that costs are a barrier to innovation, but if enterprises succeed initially to undertake some innovation activity the issue becomes less important.

4.5 Proposal for further research of CIS

The brief analysis presented in section 4.4 above is based on the headline results published by BIS on their web-site. Because of the limitations of this data, further research is needed to provide a more detailed analysis.

Data access

While the Observatory has access to the full survey results for CIS4, data for detailed results for CIS5 has not been released. The ONS have developed CIS4+, a longitudinal sub-sample of the CIS5 data. This has been made available through ONS's Virtual Microlab (VML). Access to the VML is strictly controlled and is limited to ONS approved researchers. Dr. Vania Sena of Aston Business School has been commissioned to undertake the data analysis on our behalf.[10]

The following section outlines the research questions that will be explored through the VML access. The first question looks at the broad question of the characteristics of innovative enterprises while the following questions are categorised as input, links and output questions.

1. **Research questions**

   General

- What are the characteristics of an innovative enterprise nationally and in the best region? How does an innovative enterprise in the West Midlands compare?

This question looks at what are the features – size, sector, skills in workforce etc – of an innovative enterprise. This could also focus on some measure of successful output, e.g. relative turnover, to discriminate between innovative enterprises.

[10] Dr. Sena is currently undertaking work within the VML as part of an Advanced Institute of Management Fellowship grant. Her work is to examine the impact of geographical density of high quality workers on rates of innovation.

Inputs

- Within each division[11] and on average, what are the most important information sources for innovative firms? How do firms in the West Midlands compare?

This question focuses on the sectors in which innovative firms exist and the information sources they use. Different sectors will have different rates of activity as competitive pressures will vary. If analysis can highlight the sources these firms used it would be possible to compare the region against the national picture.

The CIS differentiates between internal sources of information and external, including market information, links with other bodies such as universities and network activities.

- What are the relative levels of expenditure on innovation activities in each division regionally and nationally? Does increased expenditure translate into higher turnover?

This question focuses on expenditure and differentiates by division as different divisions will have different scales of activity. The key value to this question is if we can link higher expenditure to higher shares of turnover both across the survey as a whole and within the West Midlands.

- What are the most important barriers to innovation? Do West Midlands' enterprises see barriers as being higher than the average? Are there differences between sectors and size of enterprise?

This question looks at the potential informational market failures. If innovation activity is lower in the region, what factors might contribute to this?

Links

- How do innovating enterprises in the region compare to the national picture in terms of type of cooperative partner and the geographical coverage? Is sectoral mix a factor in any variation from the national picture?

This question focuses on the networks that innovative enterprises participate in. As stated above collaboration is becoming a new and important source of competitive advantage. How do West Midlands enterprises compare and what is the geographical extent of their collaborative links?

[11] Annex 1: Comparison of innovation indicators in European and East of England methodologies shows the Standard Industrial Classifications that make up the divisions.

Outputs

- In each division what percentage of turnover comes from the different types of innovative activity? How do innovative enterprises in the region compare to the national picture?
- What are the most important effects arising from innovation activity (higher GVA, diversification etc)? How do these compare across divisions? Do West Midlands' enterprises differ from their national counterparts in each division?

These final questions focus on the financial and strategic outputs arising from innovation activities.

4.6 Next Steps

Work on this commission is currently underway with outputs expected in January 2010.

Annex 1: Comparison of innovation indicators in European and East of England methodologies

Inputs

	European Innovation Scoreboard Indicator 2007		European Innovation Scoreboard Indicator 2008		East of England Innovation Indicator
Innovation drivers	New S&E graduates per 1000 population aged 20-29	Human resources	S&E and SSH graduates per 1000 population aged 20-29 (first stage of tertiary education)	Education system	
			S&E and SSH doctorate graduates per 1000 population aged 25-34 (second stage of tertiary education)		
	Population with tertiary education per 100 aged 25-64		Population with tertiary education per 100 population aged 25-64		Higher education qualifications obtained per thousand population
	Participation in life-long learning per 100 population aged 25-64		Participation in life-long learning per 100 population aged 25-64		
	Youth education attainment level		Youth education attainment level		GCSE attainment relative to national average
				Human capital	Net within-UK migration of individuals of working age
					Human Capital Index (NVQ weighted average)
					Proportion employed with NVQ level 4 and above
					Workforce training
					Organisation Training
Knowledge creation	Public R&D expenditures (% of GDP)	Finance and support	Public R&D expenditures (% of GDP)	Public investment	R&D performed within government establishments (as a % of GVA)
	Business R&D expenditures (% of GDP)				
	Employment in medium-high & high-tech manufacturing (% of workforce)		Employment in medium-high & high-tech manufacturing (% of workforce)		R&D performed with higher education institutions (as a % of GVA)
	Employment in high-tech services (% of workforce)		Employment in knowledge-intensive services (% of workforce)		RAE 2008: proportion of university research that is world leading or internationally excellent
	Share of enterprises receiving public funding for innovation				
				Private investment	Private equity investment in early stage and expansion businesses per capita
	Early stage venture capital (% of GDP)		Venture capital (% of GDP)		
			Private credit (relative to GDP)		
	Innovation expenditures (% of turnover)	Firm investments	Business R&D expenditures (% of GDP)		R&D performed within businesses (as a % of GVA)
					Businesses investing in innovation activities
					Businesses investing in 'tangibles'
			Non-R&D innovation expenditures (% of turnover)		
	ICT expenditures (% of GDP)		IT expenditures (% of GDP)		
	Share of medium-high-tech and high tech R&D (% of manufacturing R&D expenditure)				
					Business R&D personnel
					Businesses investing in external knowledge

Links

	European Innovation Scoreboard Indicator 2007		European Innovation Scoreboard Indicator 2008		East of England Innovation Indicator
Innovation drivers	Broadband penetration rate (number of broadband lines per 100 population)			Communication	Household broadband access
			Broadband access by firms (% of firms)		
					SME broadband take up
				Transport	Passengers at regional international airports
					Effective average speed of off-peak travel to London by road
					Effective average speed of fastest peak train travel to London Terminals
Innovation and entrepreneurship	Innovative SMEs collaborating with others (% of SMEs)		Innovative SMEs collaborating with others (% of SMEs)		
	SMEs innovating in-house (% of SMEs)		SMEs innovating in-house (% of SMEs)		
	New-to-market sales (% of turnover)		New-to-market sales (% of turnover)	Interactions	Proportion of businesses with cooperation agreements
	New-to-firm sales (% of turnover)		New-to-firm sales (% of turnover)		Total funding for business-university research and consultancy (per academic staff)
					Co-authorships between UK regions and non-UK partner organisations
			Public-private co-publications per million population		

Outputs

	European Innovation Scoreboard Indicator 2007		European Innovation Scoreboard Indicator 2008		East of England Innovation Indicator
				Innovative firms	Knowledge-intensive business density
					Innovation active enterprises
			SMEs introducing product or process innovations (% of SMEs)		
	SMEs introducing organisational innovation (% of SMEs)		SMEs introducing marketing or organisational innovations (% of SMEs)		
				Novel innovation	Proportion of firms introducing novel products
					Proportion of firms introducing novel processes
		Innovators	Share of innovators where innovation has significantly reduced labour costs (% of firms)		
			Share of innovators where innovation has significantly reduced the use of materials and energy (% of firms)		
				Incremental innovation	Proportion of firms introducing existing products
					Proportion of firms introducing existing processes
	USPTO patents per million population	Intellectual property	USPTO patents per million population	Intellectual property	Successful patent applications per capita
	EPO patents per million population		EPO patents per million population		
	Triad patents per million population				
	Community trademarks per million population		Community trademarks per million population		Successful trademark applications per capita
	Community industry designs per million population		Community industry designs per million population		Successful design applications granted per capita
					Software and non-software licenses issued per 1,000 academic staff
	Exports of high technology products as a share of total exports	Economic effects	Technology balance of payments flows (% of GDP)	Economic performance	Regional GVA per Capita: Workplace Based
			Medium and high-tech manufacturing exports (% of total exports)		Regional GVA per Capita: Residence Based
			Knowledge-intensive services exports (% of total services exports)		Change in regional GVA per capita: short term
			Firm renewal (SME entries plus exits) (% of SMEs)		Change in regional GVA per capita: long term

Annex 2 Priority Indicators Metadata

category	variable	source	latest data
inputs	proportion of businesses making innovation-related expenditure	CIS	2004-2006 (CIS5)
inputs	R&D performed within businesses as proportion of GVA	ONS BERD / regional GVA	2007
inputs	proportion of businesses investing in external knowledge creation	CIS	2004-2006 (CIS5)
inputs	proportion of pupils achieving 5+ A*-C grades including English & mathematics GCSEs	DCSF, GCSE and Equivalent Results in England (table 18, row 75)	2007/2008
inputs	higher education qualifications obtained per 10 000 population	HESA	2007/2008
inputs	proportion of employed working age residents participating in job-related training in past 13 weeks	APS	Oct 2007-Sep 2008 (quarterly release of annual data)
links	broadband take-up rate amongst SMEs	Ofcom	2006; irregular update
links	proportion of businesses with co-operation agreements	CIS	2004-2006 (CIS5)
outputs	knowledge intensive business density	IDBR, based on OECD definition of KI sectors as transport, post and telecommunications, finance, property and business services, education, health, public administration and other services	2008
outputs	proportion of innovation active enterprises	CIS	2004-2006 (CIS5)
outputs	overall proportion of firms introducing novel products	CIS	2004-2006 (CIS5)

category	variable	source	latest data
outputs	overall proportion of firms introducing novel processes	CIS	2004-2006 (CIS5)
outputs	overall proportion of firms introducing existing products	CIS	2004-2006 (CIS5)
outputs	overall proportion of firms introducing existing processes	CIS	2004-2006 (CIS5)

Annex 3 Secondary Indicators Metadata

category	variable	source	latest data
inputs	BERD R&D personnel as proportion of workforce	ONS BERD / APS total workforce	2007
inputs	proportion of businesses investing in 'tangibles'	CIS	2004-2006 (CIS5)
inputs	proportion of employers providing staff with either on or off the job training in 12 month period	NESS (National Employer and Skills Survey)	2007 (next update 2009)
links	proportion of households with broadband internet connections	Ofcom	2008; irregular update
links	total funding for business-university research and consultancy per 100 academic staff		
outputs	successful IPO patent applications per 10 000 population	IPO / ONS mid-year population estimates	2007

Annex 4 Cluster SIC codes

Building Technologies

4 Digit SIC	Description
1411	Quarrying of stone for construction
1413	Quarrying of slate
1421	Operation of gravel and sand pits
2010	Saw milling and planning of wood, impregnation of wood
2020	Manufacture of veneer sheets; manufacture of plywood, laminboard, particle board, fibre board and other panels and boards
2030	Manufacture of builders carpentry and joinery
2430	Manufacture of paints, varnishes and similar coatings, printing ink and mastics
2523	Manufacture of builders ware of plastic
2622	Manufacture of ceramic sanitary fixtures
2626	Manufacture of refractory ceramic products
2630	Manufacture of ceramic tiles and flags
2640	Manufacture of bricks, tiles and construction products, in baked clay
2651	Manufacture of cement
2652	Manufacture of lime
2661	Manufacture of concrete products for construction purposes
2662	Manufacture of plaster products for construction purposes
2663	Manufacture of ready-mixed concrete
2664	Manufacture of mortars
2665	Manufacture of fibre cement
2666	Manufacture of other articles of concrete, plaster and cement
2670	Cutting, shaping and finishing of stone
2681	Production of abrasive products
2721	Manufacture of cast iron tubes
2722	Manufacture of steel tubes
2732	Cold rolling of narrow strip
2733	Cold forming or folding
2811	Manufacture of metal structures and parts of structures
2812	Manufacture of builders' carpentry and joinery of metal
2821	Manufacture of tanks, reservoirs and containers of metal
2822	Manufacture of central heating radiators and boilers
2863	Manufacture of locks and hinges
2923	Manufacture of non-domestic cooling and ventilation equipment

4 Digit SIC	Description
3150	Manufacture of lighting equipment and electric lamps
4511	Demolition and wrecking of buildings; earth moving
4512	Test drilling and boring
4521	General construction of buildings and civil engineering works
4522	Erection of roof covering and frames
4523	Construction of highways, roads, airfields and sports facilities
4524	Construction of water projects
4525	Other construction work involving special trades
4531	Installation of electrical wiring and fittings
4532	Insulation work activities
4533	Plumbing
4534	Other building installation
4541	Plastering
4542	Joinery installation
4543	Floor or wall covering
4544	Painting and glazing
4545	Other building completion
4550	Renting of construction or demolition equipment with operator
5113	Agents involved in the sale of timber and building materials
5153	Wholesale of wood, construction materials and sanitary equipment
5154	Wholesale of hardware, plumbing and heating equipment and supplies
5182	Wholesale of mining, construction and civil engineering machinery
7132	Renting of construction and civil engineering machinery and equipment
7420	Architectural and engineering activities and related technical consultancy

Digital Media

4 Digit SIC	Description
2231	Reproduction of sound recording
2232	Reproduction of video recording
2233	Reproduction of computer media
2465	Manufacture of prepared unrecorded media
9211	Motion picture and video production
9212	Motion picture and video distribution
9220	Radio and television activities
9231	Artistic and literary creation and interpretation
9251	Library and archive activities

Environmental Technologies

4 Digit SIC	Description
2830	Manufacture of steam generators, except central heating hot water boilers
2911	Manufacture of engines and turbines, except aircraft, vehicle and cycle engines
2912	Manufacture of pumps and compressors
3110	Manufacture of electric motors, generators and transformers
3120	Manufacture of electricity distribution and control apparatus
3710	Recycling of metal waste and scrap
3720	Recycling of non-metal waste and scrap
4011	Production of electricity
4012	Transmission of electricity
4013	Distribution and trade in electricity
4021	Manufacture of gas
4022	Distribution of gaseous fuels through mains
4030	Steam and hot water supply
4100	Collection, purification and distribution of water
5157	Wholesale of waste and scrap
9001	Collection and treatment of sewage
9002	Collection and treatment of other waste
9003	Sanitation, remediation and similar activities

Food and Drink

4 Digit SIC	Description
1511	Production and preserving of meat
1512	Production and preserving of poultry meat
1513	Production of meat and poultry meat products
1520	Processing and preserving of fish and fish products
1531	Processing and preserving of potatoes
1532	Manufacture of fruit and vegetable juice
1533	Processing and preserving of fruit and vegetables not elsewhere classified
1541	Manufacture of crude oils and fats
1542	Manufacture of refined oils and fats
1543	Manufacture of margarine and similar edible fats
1551	Operation of dairies and cheese making
1552	Manufacture of ice cream
1562	Manufacture of starches and starch products

4 Digit SIC	Description
1571	Manufacture of prepared feeds for farm animals
1572	Manufacture of prepared pet foods
1581	Manufacture of bread; manufacture of fresh pastry goods and cakes
1582	Manufacture of rusks and biscuits; manufacture of preserved pastry goods and cakes
1583	Manufacture of sugar
1584	Manufacture of cocoa, chocolate and sugar confectionery
1585	Manufacture of macaroni, noodles, couscous and similar farinaceous products
1586	Processing of tea and coffee
1587	Manufacture of condiments and seasonings
1588	Manufacture of homogenised food preparations and dietetic food
1589	Manufacture of other food products not elsewhere classified
1591	Manufacture of distilled potable alcoholic beverages
1592	Production of ethyl alcohol from fermented materials
1593	Manufacture of wines
1594	Manufacture of cider and other fruit wines
1595	Manufacture of other non-distilled fermented beverages
1596	Manufacture of beer
1597	Manufacture of malt
1598	Manufacture of mineral waters and soft drinks
1600	Manufacture of tobacco products
2953	Manufacture of machinery for food, beverage and tobacco processing
5111	Agents involved in the sale of agricultural raw materials, live animals, textile raw materials and semi-finished goods
5117	Agents involved in the sale of food, beverages and tobacco
5121	Wholesale of grain, seeds and animal foods
5122	Wholesale of flowers and plants
5123	Wholesale of live animals
5124	Wholesale of hides, skins and leather
5125	Wholesale of unmanufactured tobacco
5131	Wholesale of fruit and vegetables
5132	Wholesale of meat and meat products
5133	Wholesale of dairy produce, eggs and edible oils and fats
5134	Wholesale of alcoholic and other beverages
5135	Wholesale of tobacco products
5136	Wholesale of sugar and chocolate and sugar confectionery
5137	Wholesale of coffee, tea, cocoa and spices

4 Digit SIC	Description
5138	Wholesale of other food including fish, crustaceans and molluscs
5139	Non-specialised wholesale of food, beverages and tobacco
5188	Wholesale of agricultural machinery and accessories and implements, including tractors

Interiors & Lifestyle

4 Digit SIC	Description
1751	Manufacture of carpets and rugs
1810	Manufacture of leather clothes
1821	Manufacture of workwear
1822	Manufacture of other outerwear
1823	Manufacture of underwear
1824	Manufacture of other wearing apparel and accessories not elsewhere classified
1830	Dressing and dyeing of fur; manufacture of articles of fur
1920	Manufacture of luggage, handbags and the like, saddlery and harness
1930	Manufacture of footwear
2613	Manufacture of hollow glass
2621	Manufacture of ceramic household and ornamental articles
2741	Precious metals production
3350	Manufacture of watches and clocks
3611	Manufacture of chairs and seats
3612	Manufacture of other office and shop furniture
3613	Manufacture of other kitchen furniture
3614	Manufacture of other furniture
3621	Striking of coins and medals
3622	Manufacture of jewellery and related articles not elsewhere classified
5115	Agents involved in the sale of furniture, household goods, hardware and ironmongery
5116	Agents involved in the sale of textiles, clothing, footwear and leather goods
5141	Wholesale of textiles
5142	Wholesale of clothing and footwear
5143	Wholesale of electrical household appliances and radio and television goods
5273	Repair of watches, clocks and jewellery

ICT

4 Digit SIC	Description
3002	Manufacture of computers and other information processing equipment
3210	Manufacture of electronic valves and tubes and other electronic components
3220	Manufacture of television and radio transmitters and apparatus for line telephony and line telegraphy
3230	Manufacture of television and radio receivers, sound or video recording or reproducing apparatus and associated goods
5184	Wholesale of computers, computer peripheral equipment and software
6420	Telecommunications
7133	Renting of office machinery and equipment including computers
7210	Hardware consultancy
7221	Publishing of software
7222	Other software consultancy and supply
7230	Data processing
7240	Data base activities
7250	Maintenance and repair of office, accounting and computing machinery
7260	Other computer related activities

Specialist Business Services

4 Digit SIC	Description
7310	Research and experimental development on natural sciences and engineering
7320	Research and experimental development on social sciences and humanities
7411	Legal activities
7412	Accounting, book-keeping and auditing activities; tax consultancy
7413	Market research and public opinion polling
7414	Business and management consultancy activities
7415	Management activities of holding companies
7440	Advertising
7487	Other business activities not elsewhere classified

Medical Technologies

4 Digit SIC	Description
2441	Manufacture of basic pharmaceuticals
2442	Manufacture of pharmaceutical preparations
3310	Manufacture of medical and surgical equipment and orthopaedic appliances
3340	Manufacture of optical instruments and photographic equipment
5146	Wholesale of pharmaceutical goods

Tourism & Leisure

4 Digit SIC	Description
3630	Manufacture of musical instruments
3640	Manufacture of sports goods
3650	Manufacture of games and toys
5510	Hotels
5521	Youth hostels and mountain refuges
5522	Camping sites, including caravan sites
5523	Other provision of lodgings not elsewhere classified
5530	Restaurants
5540	Bars
5551	Canteens
5552	Catering
6120	Inland water transport
6322	Other supporting water transport activities
7110	Renting of automobiles
7122	Renting of water transport equipment
9213	Motion picture projection
9232	Operation of arts facilities
9233	Fair and amusement park activities
9234	Other entertainment activities not elsewhere classified
9252	Museum activities and preservation of historical sites and buildings
9253	Botanical and zoological gardens and nature reserve activities
9261	Operation of sports arenas and stadiums
9262	Other sporting activities
9271	Gambling and betting activities
9272	Other recreational activities not elsewhere classified

Transport Technologies

4 Digit SIC	Description
2511	Manufacture of rubber tyres and tubes
2512	Retreading and rebuilding of rubber tyres
2751	Casting of iron
2752	Casting of steel
2753	Casting of light metals
2754	Casting of other non-ferrous metals
2840	Forging, pressing, stamping and roll forming of metal; powder metallurgy
2851	Treatment and coating of metals
2852	General mechanical engineering
2874	Manufacture of fasteners, screw machine products, chains and springs
2914	Manufacture of bearings, gears, gearing and driving elements
2951	Manufacture of machinery for metallurgy
3140	Manufacture of accumulators, primary cells and primary batteries
3161	Manufacture of electrical equipment for engines and vehicles not elsewhere classified
3410	Manufacture of motor vehicles
3420	Manufacture of bodies (coachwork) for motor vehicles
3430	Manufacture of parts and accessories for motor vehicles and their engines
3511	Building and repairing of ships
3512	Building and repairing of pleasure and sporting boats
3520	Manufacture of railway and tramway locomotives and rolling stock
3530	Manufacture of aircraft and spacecraft
3541	Manufacture of motorcycles
3542	Manufacture of bicycles
3543	Manufacture of invalid carriages
3550	Manufacture of other transport equipment not elsewhere classified

Annex 5 DCMS SIC codes

Department for Culture Media and Sport – DET SIC Definition for Audio Visual

Those in bold form part of the ITC Digital Media SIC definition.

*Indicates SIC is part of other ITC theme

4 Digit SIC	Description
22.14	Publishing of sound recordings
22.31	**Reproduction of sound recordings**
22.32	**Reproduction of video recordings**
22.33	**Reproduction of computer media**
24.64	Manufacture of photographic chemical material
24.65	**Manufacture of prepared unrecorded media**
32.10*	Manufacture of electronic valves and tubes and other electronic components
32.20/2*	Manufacture of TV and radio transmitters
32.30*	Manufacture of TV and radio receivers, sound or video recording or reproducing apparatus etc
33.40/3	Manufacture of cinematographic equip
36.30	Manufacture of musical instruments
51.43/1	Wholesale of records tapes CDs videos and playback equipment
51.43/9	Wholesale or radios and TVs and other electrical appliances nec
51.47/5	Wholesale of musical instruments
51.47/6	Wholesale of photographic goods
52.45	Includes retail sale of TV goods and radios
52.48/2	Retail sales of photographic, optical and precision equipment and office supplies
71.40/3	Renting of radios, TVs, video recorders and DVD players
71.40/4	Renting of records and other prerecorded media
71.40/5	Renting of video tapes and DVDs
72.21*	Software publishing
72.22*	Other software consultancy and supply
74.40	Advertising
74.40	Advertising
74.40	Advertising
74.81/2	Portrait photographic activities – previously other portrait photographic activities
74.81/3	Other specialist photography
74.81/4	Film processing
74.81/9	Photographic activities NEC

92.11/1	**Motion picture production on film or video tape**
92.11/9	**Other motion picture and video production activities**
92.12	**Motion picture and video distribution**
92.13	Motion picture projection
92.20/1	**Radio activities**
92.20/2	**Television activities**
92.72/1	Motion picture, tv and other theatrical casting

Annex 6 Frontier Economics Creative Industries Definition

Advertising

Layer	4/5 Digit SIC	Description
1	74.40/2	Planning, creating and putting in place advertising campaigns
5	74.40/9	A "catch all" code for advertising, including handing out free samples and aerial advertising
5	74.40/1	Selling or leasing advertising space or time

Architecture

Layer	4/5 Digit SIC	Description
1	74.20/1	Architectural design and construction supervision
1	74.20/2	Urban planning and landscape architecture
2	74.20/4	Engineering advice and design for construction projects
3	74.20/6	Scientific consultancy like weather and geological surveying
3	74.15/3	Construction holding companies and head offices
3	70.11	Real estate developers
3	45.21/1, 45.21/2, 45.21/3, 45.22, 45.23, 45.24, 45.25	All types of construction work, like residential buildings, bridges, roads, sports facilities, dams and related work like laying foundations and putting up scaffolding.
4	74.20/3	Quantity surveying
4	51.54	Wholesale of hardware, plumbing and heating equipment and supplies
4	51.53	Wholesale of construction materials and sanitary equipment (e.g. toilets and sinks)
4	51.13	Agents who sell timber and building materials
4	45.41, 45.42, 45.43, 45.44, 45.45	All types of building completion like plastering, painting and glazing, Floor and wall covering and installing swimming pools
4	45.31, 45.32, 45.33, 45.34	All types of building installation like electrical work, insulation work and plumbing

Arts, antiques and crafts

Layer	4/5 Digit SIC	Description

2	74.87/3	Exhibition and fair organisation
2	52.50/1, 52.48/6	Retail sale of antiques and retail sale in commercial art galleries
3	36.63/9	Catch all SIC code for "other manufacturing" (potentially some craft firms, if they are large enough to be covered by the IDBR)
3	36.22, 36.61	Manufacture of jewellery and dinnerware made of precious metals and imitation jewellery
3	36.30, 33.50	Making musical instruments and watch & clock making
3	28.75, 28.61	Making various metal products like swords but also ship propellers etc. and making cutlery
3	27.54, 27.41, 26.82/9	Casting and production of heavy and precious metals and manufacture of mineral products
3	26.30, 26.25, 26.21, 26.70	Making ceramic tiles, pots, jars, tableware, statuettes etc. and cutting stone for building and ornamental use
3	17.51/9, 17.51/2, 17.51/1	Carpet and rug making
4	51.47/9	A catch all SIC code that includes the wholesale of floor coverings but also stationary and sportswear etc.
4	51.44, 51.47/8	Wholesale of china and of travel and fancy goods
4	51.47/3, 51.47/4	Wholesale of jewellery and imitation jewellery

Design

Layer	4/5 Digit SIC	Description
1	74.20/5	Engineering design for industry

Designer fashion

Layer	4/5 Digit SIC	Description
1	74.87/2	Fashion design but also interior design and graphic design
2	17.53, 17.71, 17.72, 18.10, 18.22/1, 18.22/2, 18.23/1, 18.23/2, 18.24/1, 18.24/3, 18.24/9, 18.30, 19.20, 19.30	Manufacture of clothing items like hats, shoes, outerwear and underwear or accessories like bags and luggage.

3	17.11, 17.12, 17.13, 17.14, 17.15, 17.16, 17.17, 17.21, 17.22, 17.23, 17.24, 17.25, 17.30, 17.54/1, 17.54/2, 17.54/9, 17.60, 19.10	Manufacture of fibres, textiles, prepared fur and prepared leather
3	51.16, 51.24/1, 51.24/9, 51.41, 51.42/1, 51.42/2, 51.42/3, 51.42/9	Wholesale of, and activates of agents involved in the sale of, fabrics, fur and clothing,
4	52.42/1, 52.42/2, 52.42/3, 52.42/4, 52.43/1	Retail sale of cloths, accessories and footwear

Film, video and photography

Layer	4/5 Digit SIC	Description
1	74.81/3	Specialist photography (e.g. underwater)
1	74.81/9	Photos for commercials, fashion, tourism etc.
1	92.11/1	Producing films, cartoons and documentaries
1	92.11/9	Dubbing, editing, post production etc.
2	74.81/2	Portrait photos (mainly passport photo companies, although doesn't include photo machines)
3	92.12	Motion picture distribution
3	74.81/4	Film processing
3	52.48/2	Retail sale of cameras but also office equipment
3	51.47/6	Wholesale of photographic goods
3	33.40/3	Manufacture of cameras, projectors etc.
3	24.65	Manufacture of unrecorded media (also includes unrecorded media for computers)
3	24.64	Manufacture of photographic chemicals
3	22.32	Reproduction of DVD's and tapes
5	92.13	Cinemas

Music and the performing arts

Layer	4/5 Digit SIC	Description
1	92.31/1	Live theatrical presentation

1	92.31/9	Artistic and literary creation and interpretation
2	92.72/1	Casting for theatres, motion pictures or television
2	92.32	Theatres, concert halls, arts facilities and ticket agencies
	22.14	Music publishing
3	92.34/9	"Other entertainment activities" code that includes VUE and Tussauds
3	51.47/5	Wholesale of musical instruments
3	22.31	Reproduction of sound recording
4	51.43/1	Wholesale of records, CD's etc. and players
5	92.72/9	"Other recreational activities" code

Publishing

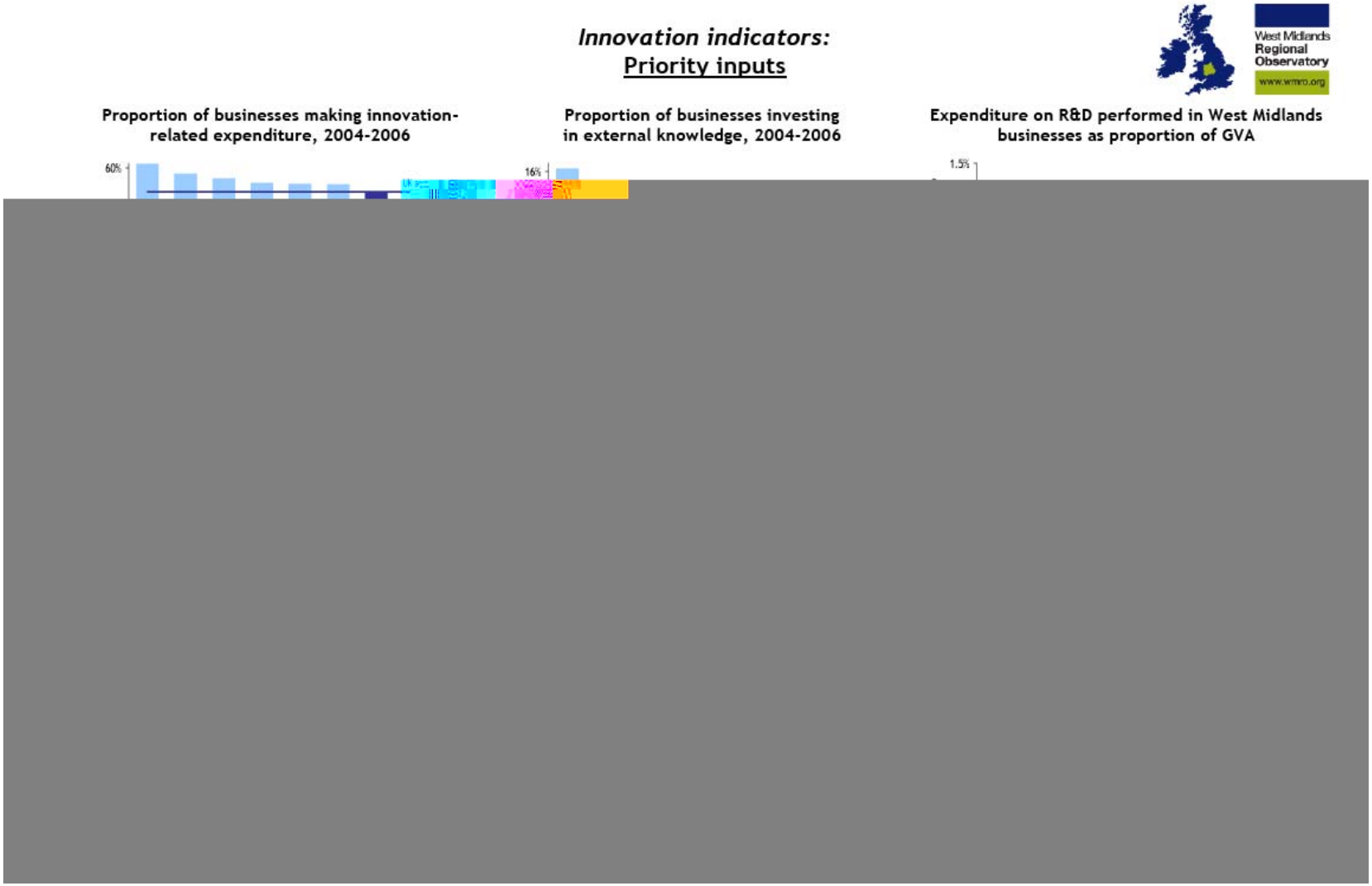
Layer	4/5 Digit SIC	Description
1	92.40	Journalists, press photographers and news syndicates
2	22.13	Publishing journals
2	22.12	Publishing newspapers
2	22.11	Publishing books
3	74.87/9	Business activities note covered by other SIC codes, including author's agents but also consultants etc.
3	22.25	Activities like embossing and laminating
3	22.24	Pre-press work, like composition and typesetting
3	22.23	Bookbinding
3	22.22	Printing maps, magazines, music manuscripts, diaries and similar items
3	22.21	Printing newspapers
3	22.15	Publishing photos, posters, timetables etc.
4	24.30/2	Manufacture of printing ink
4	21.12	Manufacture of paper and paperboard
4	21.11	Manufacture of pulp
5	52.47	Retail sale of books, newspapers and stationery
5	52.11/1	Retail sale by newsagents, confectioners etc.

Software and computer games

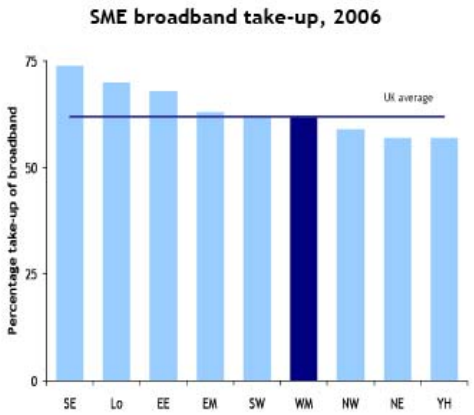
Layer	4/5 Digit SIC	Description
1	36.50/9	Manufacture of video game machines but also chess sets, dolls, playing cards etc.
1	72.21	Development and supply of ready made software "off the shelf"

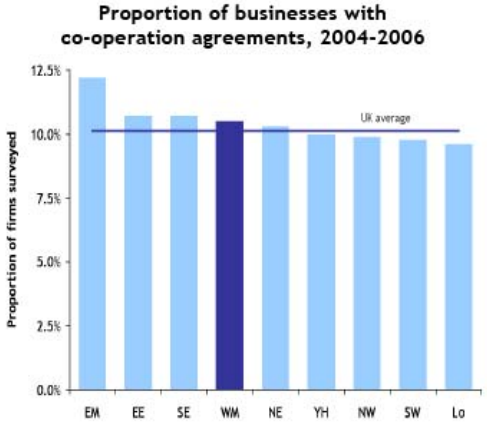
1	72.22	Development of made to order software, software consultancy and web page design
2	72.60	Computer related work not covered under other SIC codes
3	72.10	Hardware consultancy
3	22.33	Reproduction of software
4	51.84	Wholesale of computers, peripherals and software
4	51.47/7	Wholesale of toys, including video games
4	36.50/1	Manufacture of arcade games, including billiards etc.
5	52.48/5	Retail sale of toys (including video games), spots goods, stamps and coins

Annex 7 – Innovation Dashboard



Innovation indicators:
Priority links



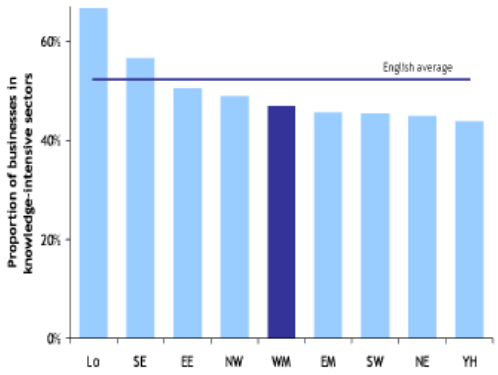


2

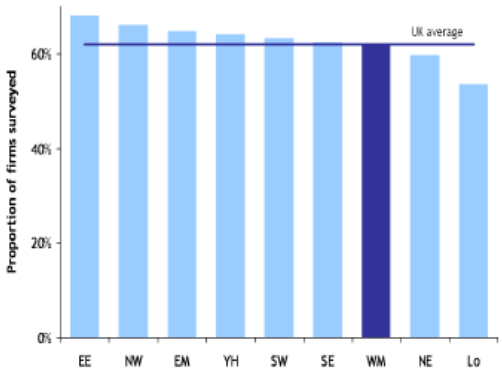
Innovation indicators:
Priority outputs

West Midlands Regional Observatory
www.wmro.org

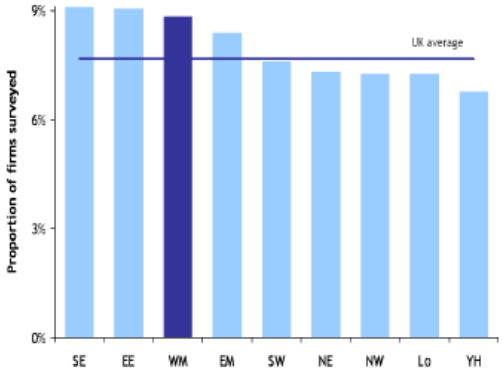
Knowledge intensive business density, 2008



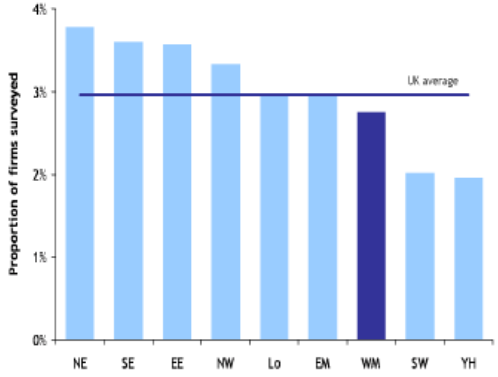
Proportion of businesses which were innovation-active, 2004-2006



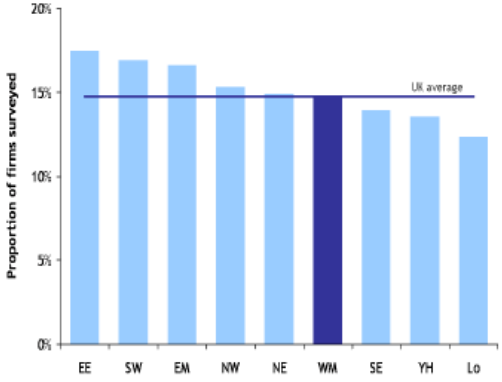
Proportion of businesses introducing novel products, 2004-2006



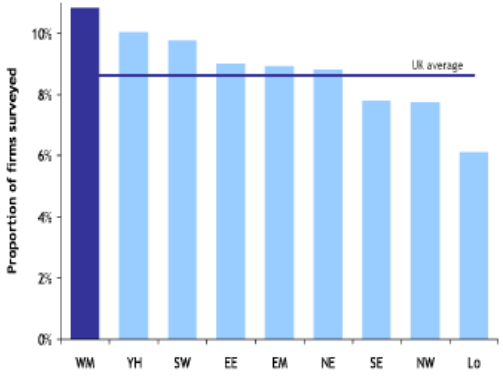
Proportion of businesses introducing novel processes, 2004-2006



Proportion of businesses introducing existing products, 2004-2006



Proportion of businesses introducing existing processes, 2004-2006

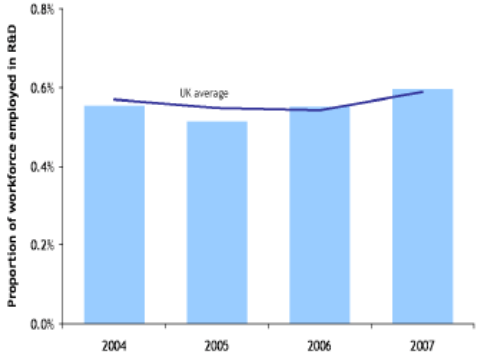


3

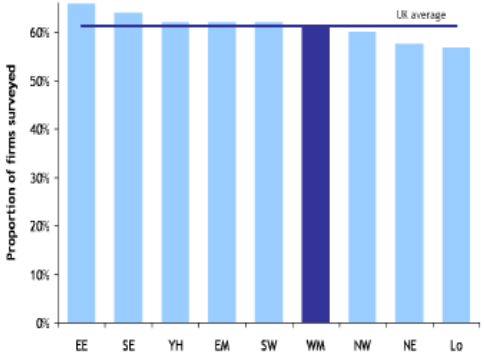
Innovation indicators:
Secondary indicators

West Midlands Regional Observatory
www.wmro.org

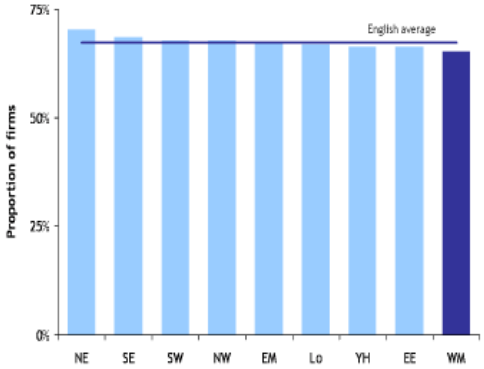
Employment in R&D as a proportion of total workforce, West Midlands (input)



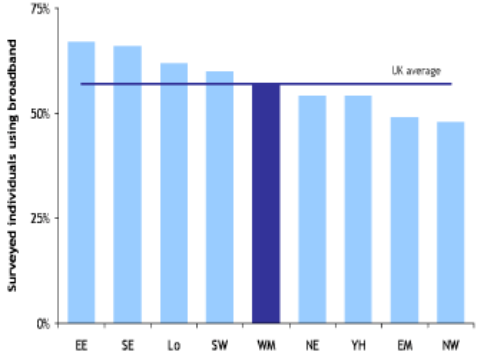
Proportion of businesses investing in machinery and software, 2004-2006 (input)



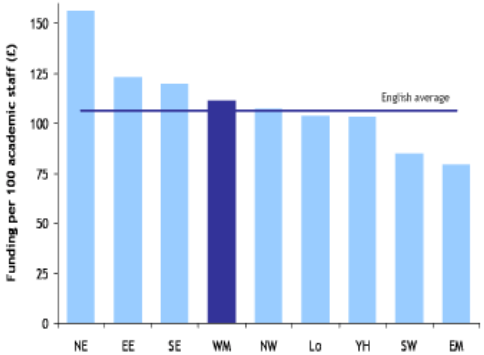
Proportion of employers providing staff with training in 12 month period, 2007 (input)



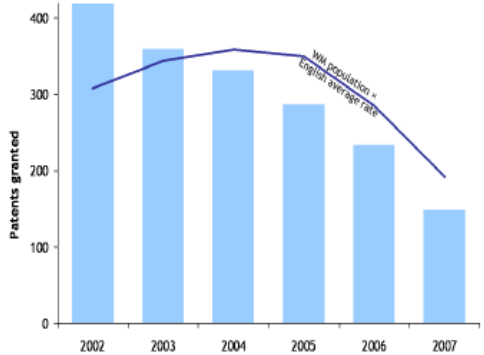
Broadband take-up, 2008 (link)



Funding for business-university research and consultancy, 2006 (link)



Patents granted, West Midlands (output)



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