1 OBJECTIVES, BACKGROUND AND METHODS

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1.1 AIMS AND OBJECTIVES

The main objective of the project has been to *"draw up a detailed systematic inventory of existing clusters across all sectors of the UK economy"*[2]. The intention is to identify what clusters exist and to map them on a nationwide basis while at the same time detailing their geographical distribution region by region.

Within this overall objective, three subsidiary aims have been:

- *to inform existing DTI policies, and support programmes and activities e.g. Regional Selective Assistance (RSA), Invest UK, the Small Business Service (SBS), various sectoral activities and other forms of business support;*
- *to assist in the design of effective cluster promotion policies for both regional and central government; and*
- *to raise general awareness of clusters both within and outside government, and in particular to provide information to business, regional and local planners and others on the location and strength of specific clusters*.

In summary, the project's scope is limited to the identification of clusters across the UK, and their regional locations. The approach therefore is an *extensive* one - that is to investigate each and every national industry to determine whether and to what extent it is clustered, and to map the locations of any such clusters. It is not intended to be an *intensive* study of the detailed inter-firm, institutional and socio-cultural, relationships within and underpinning individual clusters. An extensive approach, of the sort followed here, is a necessary prerequisite for this kind of intensive analysis. Having said that, some of these subtleties are identified, and notwithstanding the project's limited objectives this is the first attempt to provide a nationwide 'audit' of what clusters exist, where they are and what the relevant policy issues are. The *precise* working and arrangement of individual clusters must be the focus of further work.

The main findings of the study are set out in the Executive Summary and Introduction and in Chapter 2. The remainder of this chapter provides some background on the approach adopted and on the concepts and terms used in the rest of this report. Further theoretical and methodological background is contained in the technical annexes.

2 Invitation to tender: DTI - November 1999. Full text available at www.tbr.co.uk and www.dti.gov.uk/clusters

1.2 PREVIOUS RESEARCH ON CLUSTERS

The attraction of the cluster approach stems partly from recent academic work by economists and geographers (discussed in more detail in Annex 1). One of the findings of this work is that, as a result of localisation economies and spillover effects, the more geographically concentrated is an industry within a given nation, the more internationally competitive that particular industry is likely to be.

According to this literature, clusters lead to higher growth in three main ways. *First*, they raise productivity by allowing access to specialised inputs and employees, by enhancing access to information, institutions and public goods and by facilitating complementarities. *Second*, they increase firms' capacity for innovation by diffusing technological knowledge and innovations more rapidly. *Third*, clusters stimulate higher rates of new business formation, as employees become entrepreneurs in spin-off ventures.

Over the past few years, the cluster approach has found a ready audience amongst policy-makers at all levels, from the World Bank, to national governments, to regional development bodies, to city authorities. The argument is not that governments can create clusters, but that they can help to provide the business, innovative and institutional environments vital for cluster success.

The examples used in the literature to illustrate clusters have been drawn from a wide range of countries. They include the Italian ceramic tile and leather and footwear industries, semiconductors in Silicon Valley, entertainment in Hollywood, flowers in the Netherlands, automobiles and engineering in Southern Germany, finance in New York, forest products in Sweden and furniture in Eastern Denmark. There are also significant cluster initiatives in Scotland that have attracted considerable attention in the UK and abroad.

Notwithstanding Scotland, it is striking that lists of successful clusters rarely include any references to British industries or localities. While Michael Porter's classic 1990 study[3] covered the United Kingdom's cluster structure in some detail, mentioning strengths in consumer products (notably sweets, soaps and whiskey (sic), services (especially financial), trading, chemicals, engines (aerospace), textiles and oil, his later work[4] merely refers to cluster development initiatives in Scotland and Northern Ireland, and mentions specifically only confectionery in York. Indeed, it tends to be assumed that clusters in Britain are synonymous with the old Marshallian manufacturing industrial districts that may have been the bases of Britain's economic success in the 19th century, but which have since suffered from long-term chronic decline.

How far this assumption remains valid is unclear. *In general there has been a lack of research into clusters in Britain*. An exception has been Scotland, where Porter's Competitive Advantage of Nations methodology was rigorously applied in 1992. Scottish Enterprise, the Scottish Executive, Local Enterprise Companies and local authorities in Scotland have since then, and especially since 1997, used cluster models to inform their work in economic development and in specific cluster initiatives.

There are also a number of recent case studies of particular industrial districts, such as the City of London, the Oxbridge high-technology clusters, Silicon Glen and motor-sport engineering[5]. However, there is a lack of extensive and comparative research into the importance and distribution of clusters within the UK economy.

3 Porter, M. (1990) The Competitive Advantage of Nations. London: Macmillan.

4 Porter, M. (1998) Clusters and the new economics of competition, Harvard Business Review, November/December.

5 See, for example, Henry, N. and Pinch, S. (1998) "The industrial agglomeration of Motor Sport Valley: A knowledge space economy approach," Department of Geography, University of Birmingham.

1.3 THE APPROACH

Our starting point is Michael Porter's definition of clusters as:

"Geographic concentrations of interconnected companies, specialised suppliers, service providers, firms in related industries, and associated institutions (for example, universities, standards agencies, and trade associations) in particular fields that compete but also co-operate" (Porter (1998), op. cit. page 197).

In using this definition as a guide, and with the limitations of data and approach in mind, we also set the following boundaries on our notion of a cluster. First, we have thought of an industry as a group of companies supplying essentially the same product. The linkages between them can be of different forms including supply chain relationships, shared science and technology, skills, know-how, infrastructure, image and resources.

Second, industries are defined by what they make, not their technology (e.g. software or engineering) or main market (e.g. defence or healthcare). It is not normally possible to purchase a technology. It is possible to purchase products/services derived from a technology (e.g. a peptide, enzyme, drug, software advice). Nevertheless, it can be the technology or market that links a group of industries to form a cluster.

This distinction may cause difficulty. For example, companies do not sell "biotechnology". Biotechnology is an 'enabling technology' and not an industry in itself and as a result it is difficult to distinguish from the pharmaceutical industry and some parts of the medical devices industry[6].

Thirdly, and importantly, the cluster concept applies to all industries and not just those making 'high tech' products. For example, a food cluster may arise from the links between agriculture, food processing, feed manufacturers, food processing equipment manufacturers, logistics and retailing. The competitive advantage of agriculture and food processing are interdependent and affected by the performance of the other industries. Similarly, much tourism depends upon a variety of inter-related industries - tour operators, transport companies, hotels, restaurants, visitor attractions, etc. Because the focus is on interdependence, there is nothing that restricts our interest to growing industries.

Fourthly, a significant degree of geographical localisation is assumed to be a quintessential defining characteristic of a cluster. This is central to Porter's definition. Localisation is key to the processes that contribute to cluster formation, development and success. Hence measuring the degree of relative spatial concentration of industries across the country is a basic element of our approach to identifying and mapping clusters.

1.3.1 Outline of methodology

Here we *outline* our methodology; a detailed description is given in Annex 2. We have also analysed separately the UK's globally competitive industries (Michael Porter's original starting point). The result of this analysis are set out in Annex 3 and the methodology relating to this part of the project is detailed in Annex 4.

The methodology used to identify clusters can be characterised as follows.

- The analysis encompasses all sectors of economic activity and is nation-wide.
- The analysis is firm-based, using data up to September 1999 on more than 2 million firms relating to their type of activity, their employment and their location.
- The analysis of these data is systematic, involving the use of standard statistical measures of localisation.
- This analysis is supplemented by qualitative evidence on local clusters, local institutional 'thickness' (the extent of institutional involvement with clusters) and other aspects of the local business community derived from interviews with relevant agents, bodies and organisations within each of the major regions of the country. Each region of the UK was visited twice and contact was made with all industry directorates of the DTI. These interviews also provided checks on cluster identification and significance.

6 Porter noted this speaking at the Bio 2000 Economic Forum in Boston. He emphasised that "biotechnology is not an industry, but a collection of enabling technologies". The 'industry' he argued was one of two: either the supply of tools for drug companies or the successful development of a drug or treatment. Michael E Porter, 'Strategic Issues for Biotechnology Companies'. Bio2000 Economic Forum, Boston, March 27 2000.

The approach combines the application of data with the input of 'soft' data from regional and other discussions. The end result is, in most cases, a preliminary list of *clusters* - as far as possible defined in the way we identify above.

This means that reference to the industries that make up the clusters will often reveal a combination of manufacturing and service industries (and where there is not a combination, the cluster may be defined as 'shallow' as a result). Reference also to the brief analysis of the cluster in the appropriate regional context will reveal those institutional and other linkages that we have been able to identify, or which have been brought to our attention during visits to the region.

This is not to say that the identified clusters are all fully operational, that all the linkages are identified or that those that have are being exploited. These are all questions that we might expect would form the basis of further work. In some cases, the entity we have identified might more appropriately be considered as a concentration of industries rather than a cluster. These will include the 'creative industries' in some regions and for example environmental industries. In these cases, we have not been able, in the context of this project, to tease out the linkages with clarity.

1.3.2 Employment as key variable

The fundamental quantitative measure of firm activity we have used is that of employment. Data for other measures are difficult to compare and access. We have used an absolute measure in some cases (i.e. the actual number of employed persons) but we have relied upon the use of a measure of relative employment density known as the location quotient (LQ) as the main technique to determine the degree of localisation of a given sector.[7]

7 The location quotient (LQ) is a standard measure of concentration. It measures the relative concentration of a given industry or sector in a region or area. It is defined as:

$LQ = (E_{ij}/E_j)/(E_{in}/E_n)$ or $LQ = (E_{ij}/E_{in})/(E_j/E_n)$

where E_{ij} is employment in industry i in region j, E_j is total employment in region j, E_{in} is national employment in industry i, and E_n is total national employment. The LQ measures a region's share of a given industry's national employment relative to the region's share of total national employment. It is a measure of relative concentration.

An LQ greater than1.0 indicates that there is an above average proportion of employment in a given industry in a given region. Conversely for an LQ of less than 1.0.

1.3.3 Measuring comparative scale and significance

The questions of scale and significance are central to the analysis. The research attempts to identify clusters in terms of *comparative scale* (i.e. the size of a cluster in relation to the relevant sector(s) nationally); and *significance* (i.e. the size of the cluster in relation to the regional economy in which it is located).

We have also sought to identify local pockets of significant activity that might not show up regionally.

There is, therefore, something of a tension running through the analysis, in that a 'cluster' in a particular sector or group of interrelated sectors may be deemed significant at the regional level - for example in terms of its share of regional employment - but in national terms is not significant. A 'national cluster' - i.e. one which is identifiable in national terms - will have one or more significant regional localisations; but some 'regional clusters' - i.e. those important in local terms - need not be clusters from a national point of view.

Further, there may be small local concentrations that are not significant in scale terms but which development agencies at the regional or local level may wish to develop. An example of this may be the grouping of companies in Cardiff built around media activity. These firms are thought to be associated with Welsh language film and TV and to this extent are clearly important in the cultural context of Wales. However, the firms although identifiable in the statistical data are small in total scale and size.

It should also be emphasised that our approach seeks to measure *comparative* scale (as well as absolute significance). This means that adding employment to one regional cluster that logically should be added also to a similar cluster in another region will have no effect on comparative scale. For example, again in relation to creative industries, several interviewees in the regions stressed that there are a lot of people - university teachers and so on - that offer simple web design services to local businesses, and that these people are 'lost' in the statistical data. Of course, this is true; but it will be the case in all regions and unless there is an argument that one region has proportionately more of these people than another then their distribution across the country makes no difference to comparative regional scale. This is the localisation issue referred to above.

1.3.4 Building the clusters

The statistical methodology, which is fully described in Annex 2, is briefly summarised in the box.

In addition to the statistical analysis described in steps 1-5 in the box, we also carried out an activity analysis and spoke to experts in each region of the UK and in the sector directorates of DTI.

For the **activity analysis**, we examined the business activity of the larger companies in a number of industries to establish (as far as possible) the specific nature of their products or services. This gives further clues to potential linkages and relationships.
For example, we tried to answer questions such as:

- Is the region's 'general or specific purpose machinery' making equipment relevant to other local clusters?
- What are companies in the 'Non-domestic ventilation and cooling equipment' industry actually making?
- Is the region's 'hollow glass' industry making products relevant to the region's food industry?
- Why does the region have a high LQ in food or clothes retailing?

This part of the analysis also focused on industries with high regional LQs that could be, but were not obviously, part of a regional cluster.

For the **regional discussions**, we visited each region twice for discussions at local level and secured considerable input from sources such as DTI industry directorates. We met representatives of identified and other clusters, higher education institutions, RDAs and other regional agencies such as the Bank of England regional agent.

Before and during these discussions, cluster 'nominations' were sought from regions. These were tested using our methodology and where possible tested against any other criteria used by regions for nominating the cluster.

Regional discussions were designed also to 'flesh out' the analysis presented in Chapter 3 and the regional annexes.

Box: Methodology in brief

Step 1: A combination of data sources was assembled, comprising mainly the Inter-Departmental Business Register (IDBR), the Dun and Bradstreet (D&B) company data set and the National Online Manpower Information System (NOMIS) employment database (See Annex 2.1)

Step 2: Using employment data, we identified regional "high points", defined as industries which account for at least 0.2 per cent of the regional workforce and which are at least 25 per cent more concentrated than the average (LQ>1.25)

Step 3: Based on knowledge of national and local economic structures, these "high points" were then grouped to from the basis of a cluster

Step 4: The remaining industries were examined to see if groupings of industries emerged which should belong to the identified clusters or could be combined to form a cluster in their own right.

Step 5: We then examined Local Authority District data to see if any sub-regional clusters emerged and to establish the location and nature of regional and national clusters more precisely.

Step 6: Preliminary findings of the data analysis were tested further in regional discussions and the process repeated as necessary.

1.3.5 The cluster components

Generally, each of the industries in the cluster has at least 25 per cent more than its "share" of the industry's UK employment (i.e. it is substantially over-represented in the region). Each cluster also includes at least one "high point" industry (i.e. an industry which employs at least 0.2 per cent of the regional workforce).

In the cases of biotechnology, environmental industries, the creative industries and one or two others, clusters have a somewhat different meaning. In essence, these clusters are groups of companies involved in areas of emerging technology (for example, biotechnology, new/digital media), serving a specific market (for example, environmental markets) or industries identified by regional interests (for example, direct/telemarketing). In some cases, the clusters shown have over 25 per cent more than their UK share of employment (for example, the environmental industries). However, in other cases because of the dominance of London (or other southern regions), a more pragmatic approach to cluster identification is adopted. Consequently, several clusters (for example, biotechnology in Scotland, creative industries outside London) do not have more than their "share" of UK activity.

1.3.6 Classification of the clusters

Finally, we made an initial assessment of cluster characteristics according to four criteria:

- **Stage of development:** the possibilities are 'embryonic', 'established', and 'mature'. The intention here is to suggest the possibility of growth coincident with the notion of 'life cycle'. An embryonic cluster can be assumed to be at the early stage and therefore with obvious growth potential. An established cluster will have room for further growth and finally, a mature cluster will find further growth difficult.
- **Cluster depth:** the possibilities here are 'deep', 'shallow' and 'unknown'. Cluster depth is a key variable in the assessment of cluster strength. A deep cluster will have a comparatively large number of industrial linkages and/or where possible other linkages that have been identified. In some cases, the depth of the cluster has been difficult to determine.
- **Emploment dynamics:** based on job growth between 1991 and 1998 the possibilities are 'growing', 'declining' or 'stable'. Where the employment change is plus or minus 10 per cent, the cluster is classified as 'stable'.
- **Significance:** here the intention is to suggest the geographic significance of the cluster - regional, national or international. The classification is based on regional discussion and analysis of globally competitive industries.

These characteristics are indicative only, designed to encourage discussion and further investigation of cluster potential. The results of this analysis are shown in Table 2:2 which accompanies the UK cluster map in Chapter 2.

2 THE UK CLUSTER MAP

2 THE UK CLUSTER MAP

2.1 MAIN FINDINGS

The map summarises the results of the data analysis and discussions with the regions and sector directorates of the DTI. Based on data up to September 1999, it identifies a total of 154 “clusters”, with some 8 to 18 per UK region.

There are a relatively large number in London and the South East, which may simply reflect the size of their economies. However, in general the clusters in the smaller regions are less deep, with the size of the region typically impacting on cluster depth and not the number of clusters.

Since one of the main conclusions of the research is that the UK is not strongly clustered, a key question is how many of the 154 “clusters” shown on the map are real and not simply industrial concentrations. Although the industries making up the clusters have been grouped in terms of inter-relatedness (see methodology), this does not necessarily imply that the linkages are functioning or being exploited in a way that enhances the performance of the constituent industries.

For this reason, the map is very much a “first assessment”. Many of the listed examples will, on closer examination, tend more towards concentrations of industries rather than clusters. It would not be appropriate to identify all 154 cases as targets for cluster development policies. However, the map does represent a useful starting point for more detailed analysis, which should include further testing for the presence of - or potential for - the linkages and knowledge flows that would be expected to be found in a fully functioning Porter-type cluster.

The clusters identified include both manufacturing and service industries, and cover a very wide range of sectors and technologies, including agriculture and food processing, metals, automotive, ICT, biotechnology, financial services, tourism and Internet services. The distribution of clusters by region is shown in Table 2:1. As a broad generalisation, the clusters in the North of the UK tend to be manufacturing-based (for example, automotive, textiles and metals) and those in the South more service-based (for example, software, business services and R&D).

However, it is important to note that the more traditional manufacturing based clusters that appear predominantly in the North may often be using new or high technology processes. Further, many of the clusters in the south such as financial services and the creative industries deal in products that are hundreds of years old.

There are a number of “unique” clusters, which are found in only one region or area. These include nuclear fuel processing in the North West, motor sport in the southeast of the country and ceramics in the West Midlands.

A number of clusters also cross regional boundaries. Motor sport is one example, marine engineering and technologies along the south coast is another.

It is important to note that the study may have missed some clusters which are very vibrant at the local level because they are too new or too small to show up in the national data.

Figure 2
Cluster map

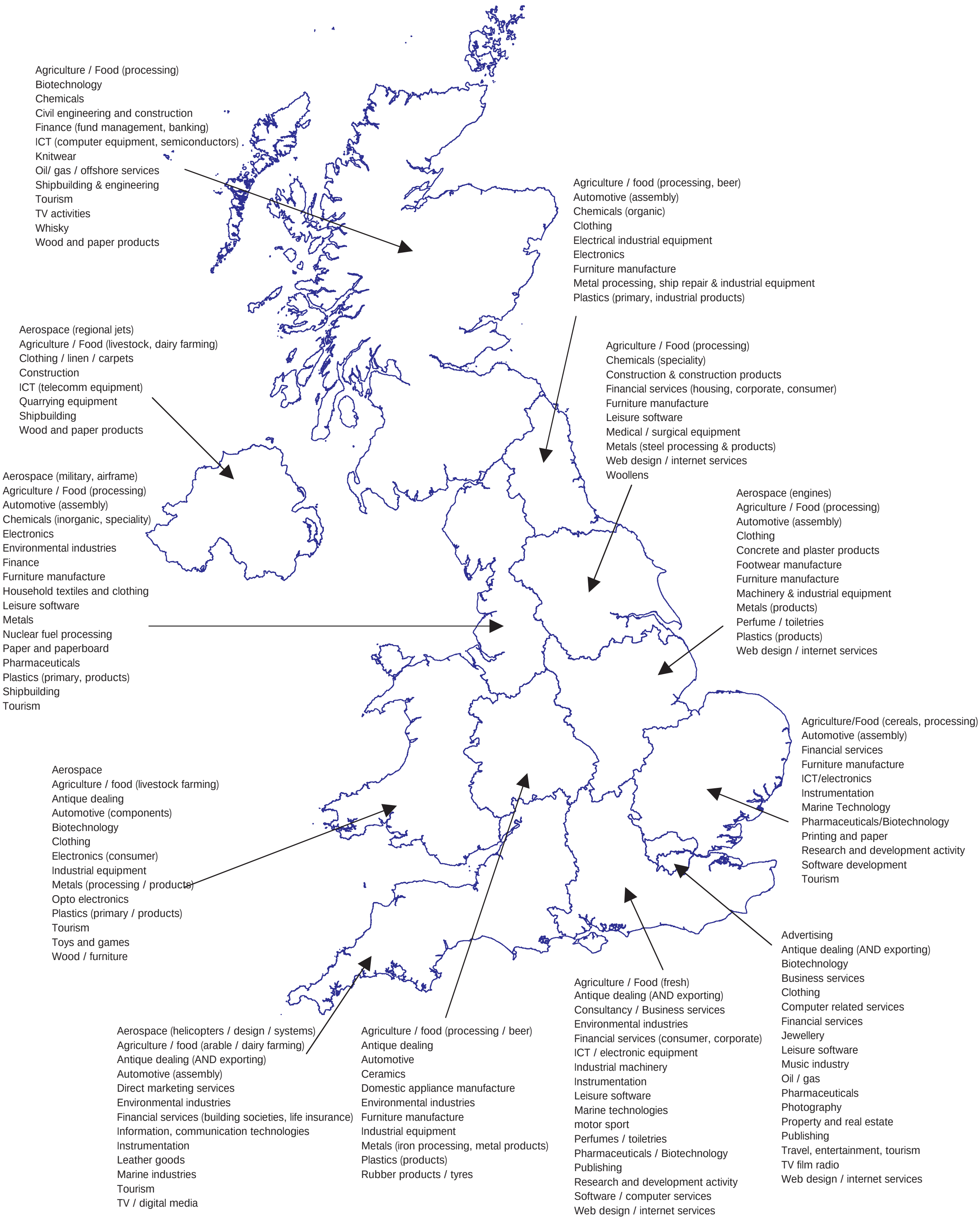

Table 2:1

Distribution of clusters by region

	PRINCIPAL REGIONAL SPECIALISMS				
Cluster dimension	North West	North East	Yorkshire & Humberside	East Midlands	Eastern
Aerospace	military/ airframe			engines	
Agriculture/food	processing	processing/ beer	processing	processing	processing/ cereals
Automotive	assembly	assembly		assembly	assembly
Biotechnology					
Business services					
Ceramics					
Chemicals	inorganic/ speciality	organic	speciality		
Civil engineering and construction					
Clothing		X		X	
Clothing/linen/carpets					
Computer related services					
Concrete & plaster products				X	
Construction					
Construction & construction products			X		
Consultancy/business services					
Creative Industries	leisure software		leisure software/ web design/ internet services	web design/ internet services	software development
Direct marketing services					
Domestic appliance manufacture					
Electronics	X	X			
Electrical industrial equipment		X			
Environmental industries	X				
Finance	pension funding factoring		housing, corporate, consumer		life insurance/ mortgage brokers
Footwear manufacture				X	
Furniture manufacture	X	X	X	X	X
Household textiles & clothing	X				
Industrial machinery					
Information, communications technologies					ICT/electronics
Instrumentation					X
Jewellery					
Knitwear					
Leather goods					
Machinery & industrial equipment				X	
Marine engineering/technology					X

PRINCIPAL REGIONAL SPECIALISMS						
London	South East	South West	West Midlands	Scotland	Wales	Northern Ireland
		helicopters/ design/systems			maintenance	regional jets
	fresh	arable/ dairy farming	processing	processing	livestock farming	livestock/ dairy farming
		assembly	automotive (all)		components	
X				X	X	
X						
			X			
				dyes, pigments/ organic		
				X		
X					X	
						X
X						
						X
	X					
advertising antique dealing/exporting leisure software music photography publishing TV/film/ radio web design/ internet services	software development leisure software publishing web design/ internet services	antique dealing exporting/ TV/ digital media	antique dealing	TV activiites	antique dealing	
		X				
			X			
					consumer	
	X	X	X			
all services	consumer/ corporate	building societies life insurance		fund management, banking		
			X			
	X		X		X	
	ICT/ electronic equipment	ICT		computer equipment/ semi conductors		telecoms equipment
	X	X				
X						
				X		
		X				
	X	X				

Table 2:1

Distribution of clusters by region *CONTINUED*

	PRINCIPAL REGIONAL SPECIALISMS				
Cluster dimension	North West	North East	Yorkshire & Humberside	East Midlands	Eastern
Medical/surgical equipment			X		
Metal processing, ship repair & industrial equipment		X			
Metals	Processing		steel processing, metals products	products	
Motor sport					
Nuclear fuel processing	X				
Oil and gas					
Oil/gas/offshore services					
Opto-electronics					
Paper & paperboard	X				
Perfume/toiletries/essential oils				X	
Pharmaceuticals	X				
Pharmaceuticals/biotechnology					X
Plastics	primary, products	primary, industrial products		products	
Printing and paper					X
Property & real estate					
Quarrying equipment					
Research & development activity					X
Rubber products/tyres					
Shipbuilding					
Shipbuilding & engineering	X				
Textiles					
Tourism	X				X
Toys and games					
Travel, entertainment, tourism					
Whisky					
Wood/furniture					
Wood and paper products					
Woollens			X	X	

A number of clusters appear in several regions, examples include financial services, aerospace, ICT, furniture manufacture. Although these clusters have the same name they are in practice very different as Table 2:1 illustrates. They have different core industries and the strengths of the linkages and interdependencies also vary. They are also different in size and depth. For example, the financial services cluster in London employs 465,000 and is comprised of 25 industries, whereas in Yorkshire and Humberside it employs 31,000 and is comprised of just 7 industries.

Clearly it is not possible from the map to compare the complexity and size of the clusters, either within or across regions. Further, it is not possible to tell from the map what proportion of a region's employment is accounted for by the clusters. This ranges from 43 per cent in London to 15 per cent in the North West. This is discussed in Chapter 3.

	PRINCIPAL REGIONAL SPECIALISMS						
	London	South East	South West	West Midlands	Scotland	Wales	Northern Ireland
				iron processing, metals products		processing, products	
		X					
	X						
					X		
						X	
		X					
	X						
		X					
				products		primary, products	
	X						
							X
		X					
				X			
							X
					X		
			X		X	X	
						X	
	X						
					X		
						X	
					X		X

2.2 CLUSTER CLASSIFICATION

Taking account of variations between clusters in factors such as size, export performance and employment growth, Table 1:2 classifies the clusters in each region and assesses them in terms of:

- stage of development - whether, based on regional discussion and observed behaviour, they are embryonic (early stage), established (further growth possible), and mature (further growth difficult);
- depth - whether deep or shallow based on the mix and range of industries present in the cluster;
- employment dynamics - whether growing in terms of employment; and
- significance - whether of regional, national or international significance based on regional discussion, analysis of the UK's globally competitive industries and judgement.

Table 2:2
Classification of regional clusters

East Midlands	Stage	Depth	Employment	Significance
Aerospace (engines)	established	deep	growing	international
Agriculture/Food (processing)	established	deep	growing	national
Automotive (assembly)	established	deep	growing	national
Clothing	mature	deep	declining	national
Concrete and plaster products	mature	shallow	growing	national
Footwear manufacture	mature	deep	declining	national
Furniture manufacture	mature	unknown	growing	regional
Machinery & industrial equipment	established	unknown	stable	regional
Metals (products)	established	unknown	growing	regional
Perfume/toiletries	established	deep	growing	international
Plastics (products)	established	unknown	growing	regional
Web design/internet services	embryonic	shallow	growing	regional
London	**Stage**	**Depth**	**Employment**	**Significance**
Advertising	established	deep	growing	international
Antique dealing (AND exporting)	established	deep	growing	international
Biotechnology	embryonic	shallow	growing	international
Business services	established	deep	growing	international
Clothing	established	deep	growing	international
Computer related services	established	deep	growing	national
Financial services	established	deep	growing	international
Jewellery	mature	deep	stable	international
Leisure software	embryonic	shallow	growing	international
Music industry	established	deep	growing	international
Oil/gas	mature	shallow	stable	international
Pharmaceuticals	established	unknown	growing	international
Photography	established	deep	growing	regional
Property and real estate	established	deep	growing	national
Publishing	mature	deep	stable	international
Travel, entertainment, tourism	established	deep	growing	international
Tv film radio	mature	deep	stable	international
Web design/internet services	embryonic	deep	growing	national

Overall, the results suggest that for most of the regions, cluster job creation performance is no better than the regional average and in some cases is significantly worse. Exceptions to this include London, the South East and Eastern regions where overall cluster job creation performance is significantly better than the regional average.

The table also highlights that the deepest clusters or those with the most industries and institutional and other linkages often perform the best.

Examples of clusters that are established, deep, growing and international are concentrated in London and the South East. These include finance and business services, clothing, travel/entertainment/tourism, advertising and the music industry in London, and pharmaceuticals/biotechnology, R&D, motor sport and software/computer services in the South East. Of these, the strongest UK cluster is financial services in London.

Eastern	Stage	Depth	Employment	Significance
Agriculture/Food (cereals, processing)	established	deep	static	national
Automotive (assembly)	established	shallow	growing	national
Financial services	established	shallow	growing	national
Furniture manufacture	mature	unknown	declining	regional
ICT/electronics	established	deep	growing	international
Instrumentation	established	deep	declining	national
Marine Technology	established	shallow	growing	national
Pharmaceuticals/Biotechnology	established	deep	growing	international
Printing and paper	established	deep	growing	national
Research and development activity	established	deep	growing	international
Software development	established	deep	growing	international
Tourism	established	unknown	growing	national
North East	**Stage**	**Depth**	**Employment**	**Significance**
Agriculture/food (processing, beer)	mature	shallow	growing	national
Automotive (assembly)	established	shallow	growing	national
Chemicals (organic)	established	deep	declining	national
Clothing	mature	shallow	declining	national
Electrical industrial equipment	mature	unknown	declining	national
Electronics	established	unknown	growing	national
Furniture manufacture	mature	unknown	declining	regional
Metal processing ship repair & industrial equipment	mature	unknown	declining	national
Plastics (primary, industrial products)	mature	shallow	growing	national

Table 2:2

Classification of regional clusters *CONTINUED*

North West	Stage	Depth	Employment	Significance
Aerospace (military, airframe)	established	shallow	declining	international
Agriculture/Food (processing)	established	unknown	growing	national
Automotive (assembly)	established	shallow	declining	international
Chemicals (inorganic, speciality)	established	deep	declining	national
Electronics	established	shallow	growing	national
Environmental industries	embryonic	shallow	growing	national
Finance	established	shallow	growing	national
Furniture manufacture	mature	unknown	growing	regional
Household textiles and clothing	established	deep	growing	national
Leisure software	embryonic	shallow	growing	international
Metals	mature	shallow	stable	national
Nuclear fuel processing	mature	deep	declining	international
Paper and paperboard	mature	unknown	stable	national
Pharmaceuticals	established	unknown	growing	national
Plastics (primary, products)	established	deep	growing	national
Shipbuilding	mature	shallow	stable	national
Tourism	established	deep	growing	national
Scotland	**Stage**	**Depth**	**Employment**	**Significance**
Agriculture/Food (processing)	established	deep	growing	national
Biotechnology	embryonic	shallow	growing	international
Chemicals	mature	shallow	unknown	national
Civil engineering and construction	mature	shallow	stable	national
Finance (fund management, banking)	established	deep	growing	national
ICT (computer equipment, semiconductors)	established	shallow	growing	international
Knitwear	mature	deep	stable	international
Oil/ gas/offshore services	mature	deep	growing	international
Shipbuilding & engineering	mature	deep	declining	national
Tourism	established	deep	growing	international
TV activities	established	shallow	growing	national
Whisky	mature	deep	stable	international
Wood and paper products	mature	deep	stable	national

Northern Ireland	Stage	Depth	Employment	Significance
Aerospace (regional jets)	mature	shallow	stable	national
Agriculture/Food (livestock, dairy farming)	mature	deep	growing	national
Clothing/linen/carpets	mature	deep	declining	national
Construction	established	unknown	growing	regional
ICT (telecoms equipment)	embryonic	shallow	growing	national
Quarrying equipment	established	deep	stable	international
Shipbuilding	mature	shallow	declining	international
Wood and paper products	mature	unknown	growing	regional
South East	**Stage**	**Depth**	**Employment**	**Significance**
Agriculture/Food (fresh)	mature	shallow	stable	regional
Antique dealing (AND exporting)	established	unknown	stable	international
Consultancy/Business services	established	deep	growing	national
Environmental industries	embryonic	shallow	growing	regional
Financial services (consumer, corporate)	established	shallow	growing	national
ICT/electronic equipment	established	unknown	growing	international
Industrial machinery	established	unknown	declining	regional
Instrumentation	established	unknown	growing	regional
Leisure software	embryonic	unknown	growing	international
Marine technologies	established	deep	growing	international
motor sport	established	deep	growing	international
Perfumes/toiletries	established	deep	growing	national
Pharmaceuticals/Biotechnology	established	deep	growing	international
Publishing	established	shallow	growing	international
Research and development activity	established	deep	growing	international
Software/computer services	established	deep	growing	international
Web design/internet services	embryonic	deep	growing	regional

Table 2:2

Classification of regional clusters *CONTINUED*

South West	Stage	Depth	Employment	Significance
Aerospace (helicopters/design/systems)	established	deep	declining	international
Agriculture/food (arable/dairy farming)	mature	shallow	static	regional
Antique dealing (AND exporting)	established	deep	growing	international
Automotive (assembly)	established	shallow	growing	national
Direct marketing services	embryonic	unknown	growing	regional
Environmental industries	embryonic	deep	growing	national
Financial (building societies, life insurance)	established	shallow	growing	regional
Information, communication technologies	established	unknown	growing	regional
Instrumentation	established	unknown	growing	regional
Leather goods	mature	unknown	declining	national
Marine industries	established	deep	growing	national
Tourism	established	deep	growing	national
TV/digital media	embryonic	shallow	growing	international
West Midlands	**Stage**	**Depth**	**Employment**	**Significance**
Agriculture/food (processing/beer)	established	shallow	stable	national
Antique dealing	established	shallow	stable	international
Automotive	established	deep	growing	national
Ceramics	established	deep	declining	international
Domestic appliance manufacture	established	deep	stable	national
Environmental industries	embryonic	shallow	growing	national
Furniture manufacture	mature	unknown	declining	regional
Industrial equipment	mature	deep	stable	regional
Metals (iron processing, metal products)	mature	deep	stable	regional
Plastics (products)	mature	unknown	stable	regional
Rubber products/tyres	mature	deep	stable	regional

Although the deepest and best performing creative industries clusters are found in London, most other regions also have creative industries. However, these have yet to achieve significant scale or significance. Exceptions to this include leisure software in the North West and Yorkshire and Humberside, and web design and Internet services in Yorkshire and Humberside and the East Midlands.

The table shows a number of embryonic clusters, including opto electronics in Wales, which is described as deep, growing and international. Further examples of embryonic clusters that are both growing and international but not deep include TV/digital media in the South West, and biotechnology in Scotland and Wales.

There are also a number of clusters that are in decline. Examples of such clusters that are also described as mature and shallow include shipbuilding in Northern Ireland, agriculture in Wales and clothing in the North East.

Wales	Stage	Depth	Employment	Significance
Aerospace	established	shallow	declining	international
Agriculture/food (livestock farming)	mature	shallow	declining	regional
Antique dealing	established	deep	stable	regional
Automotive (components)	established	unknown	stable	national
Biotechnology	embryonic	shallow	growing	international
Clothing	mature	shallow	declining	regional
Electronics (consumer)	established	unknown	growing	national
Industrial equipment	established	unknown	stable	regional
Metals (processing/products)	mature	shallow	declining	regional
Opto electronics	embryonic	deep	growing	international
Plastics (primary/products)	established	unknown	stable	regional
Tourism	established	deep	growing	national
Toys and games	mature	unknown	declining	national
Wood/furniture	mature	unknown	declining	regional
Yorkshire and Humberside	**Stage**	**Depth**	**Employment**	**Significance**
Agriculture/Food (processing)	established	deep	growing	national
Chemicals (speciality)	established	deep	growing	national
Construction & construction products	mature	deep	stable	national
Financial services (housing, corporate, consumer)	established	shallow	growing	national
Furniture manufacture	mature	unknown	declining	regional
Leisure software	embryonic	shallow	growing	international
Medical/surgical equipment	established	deep	growing	national
Metals (steel processing & products)	mature	shallow	stable	national
Web design/internet services	embryonic	shallow	growing	regional
Woollens	mature	shallow	stable	national

2.3 COMMENTARY

The data in Table 2:1 and the map identify regional clusters mainly on the basis of groups of industries with LQs over 1.25 (see methodology overview in Chapter 1 and Annex 2 for full details). For some industries, the distribution of firms and employment has also been considered. The following points should be taken into account when interpreting these findings:

- The clusters identify regional specialisms within a UK context. Consequently, there can be substantial employment in a regional industry (e.g. banking, legal services etc.) without it appearing as a regional cluster. Several industries are of interest in this context, for example:
  - The proportion of the regional workforce in software consultancy and supply varies from a low of 0.25 per cent in the East Midlands (4,300 jobs) to a high of 2.05 per cent in the South East. Consequently, while the industry is heavily concentrated in the South, areas such as Northern Ireland (with 2,100 jobs or 0.31 per cent of the workforce) may (rightly) view software as an important local industry.

- – Similar arguments apply to R&D. This varies from 0.11 per cent of the workforce in Wales to 0.99 per cent in Eastern England. An important question is the extent to which R&D supports local clusters. (This cannot be determined from IDBR data. Use of D&B data has enabled an assessment of this in some cases).
- – Both aerospace and automotive are substantial employers in several regions in which they do not emerge as clusters.

- Several internationally competitive industries (e.g. weapons and ammunition) are not regionally geographically concentrated or clustered with other industries.
- Some industries/clusters (e.g. furniture, plastics) are spread around the country - in other words, there is a relatively small cluster in several regions. These are often geographically concentrated within the region. In some cases, the regional clusters are differentiated in terms of their specialisms (e.g. they produce different types of furniture or plastic products). Similarly, several 'Northern' regions have fairly extensive clothing/textile clusters. Again, their specific nature varies from region to region.
- It is possible for a region to have a significant level of employment in what are essentially 'back office' or branch plants. These pose difficulties for defining regional clusters.
- All regions have some firms/employment in most industries including new/emerging industries and technologies. For example, every region has some biotech companies (and university/institutional research), multi/digital media, creative and environmental industries etc. In part this is because these represent technologies reflecting a range of industries. From a developmental perspective, this gives the region something to build on. However, they will not be identified as an established, or even embryonic, cluster in this research.
- This concept has to be applied flexibly. For example, neither shipbuilding nor aerospace in Northern Ireland (both, in reality single companies) would be identified via a strict application of the concept.

2.4 SHARED CLUSTERS

The table identifies clusters which cross regional boundaries. For example:

- Both automotive and aerospace have a strong presence in several regions. Much of the car industry (e.g. in the South East, South West, Wales) can be viewed as part of the Midlands cluster. Without specific cluster analysis, it is not possible accurately to define cluster boundaries.
- Much of the South East, Eastern England and South West finance industry appears to be 'back office' functions from the London financial services cluster. It is not clear whether these (often-significant) concentrations have cluster characteristics. We have assumed for the purpose of this exercise that they have, but this should be reviewed.
- Other clusters (e.g. opto-electronics in Wales, motor sport in the South East) have an obvious focus in one specific area/location but with companies/institutions located in adjacent regions.
- Others (e.g. marine technology) have no obvious centre but simply spread across boundaries. In this specific case, the cluster stretches along the South Coast.

These factors explain why some industries 'span' regions, while others simply 'spill over'.

2.5 CONCLUSION

The examples discussed in this chapter show that, as a result of the breadth of the cluster concept and the inclusive approach taken in the map, the clusters identified in the study need to be examined in more detail to determine their true nature. The following chapter begins this process by describing particular clusters in more depth. Further detail is contained in the regional annexes in Volume 2.