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AN INVESTIGATION OF KEY GROWTH SECTORS IN WALES USING MULTI-SECTORAL QUALITATIVE ANALYSIS

Paper for European Regional Science Association Conference,

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Abstract: This paper examines the problem of key sector identification in regional economies. Whilst the paper questions the desirability of policy focusing on the promotion of key sectors, it suggests that tools are generally underdeveloped to identify these sectors. The paper suggests that multi-sectoral qualitative analysis provides one means of forming conclusions on sector potentials.

1. Introduction

Regional development agencies in the UK (spurred on by national government strategies) have demonstrated a preoccupation with promoting key industries and clusters which have potential to deliver economic benefit by virtue of their local linkages and through the value added they create. Unfortunately policy in the UK regions has not always been supported by a consistent economic rationale for selection of key sectors or groups of industries, or by methods that show how these industries will actually contribute to regional competitiveness. Too often it has been a case of simple followership of other regional strategies.

The selection of 'key' sectors, however defined, is unlikely to be straightforward. Moreover, several studies have questioned the underlying desirability of promoting

individual groups of industries. One framework in which to examine sectors with developmental potential has been Input-Output tables with, in many cases, sectors identified on the basis of the indirect activity and value added supported in the regional economy, or identified through more complex decompositions within the framework. However, the Input-Output approach to key sector identification is limited partially because one is trying to identify sectors with future development potential in an ex-post framework. Table decomposition also provides a poor characterisation of human capital, and fails to show the propensity of sectors to create a wider range of economic and social externalities (both positive and negative).

This paper reports on pilot research undertaken in Wales to develop a multi-sectoral quantitative analysis of key growth sectors. This approach following Roberts and Stimson (1999) allows the investigator to combine the perspectives gained from decomposition within the Input-Output framework, with a method for investigating regional and industry core competencies, and industry attitudes to trade and risk. The method then combines the Input-Output framework of linkage analysis with up to date market intelligence, and expert surveys. This allows policy makers to reduce their reliance on historical economic data and false optimism derived from other regions' experiences, while anticipating better trends in activities and shortfalls in knowledge infrastructure.

The remainder of the paper is structured as follows. The second section explores the way in which key sectors and cluster identification has become an implicit element of UK government and RDA strategies, and argues that RDA policy in particular has featured a strong element of followership in the identification of sectors expected to lead regional growth and prospects. The third section reviews the more mechanical methods of identifying key sectors, and the problems with these approaches. The fourth section considers whether multi-sectoral qualitative analysis can offer wider perspectives, and reports on pilot research in Wales using this method. The final section discusses the use of the MSQA further and concludes.

2. 'Key' Sectors in UK Regional Strategies

Setting the scene

A common theme in contemporary UK regional development agency strategies is the identification of sets of key growth sectors or clusters which are assumed to be critical drivers of regional competitiveness. The origins of this theme are complex.

Government white papers on competitiveness during the 1990s (see for example, *Competitiveness: Helping Business to Win (1995)*, *Our Competitive Future: Building the Knowledge Driven Society (1998)*, *Competitiveness: Forging Ahead*, and *Competitiveness Creating the Enterprise Centre of Europe*) were strongly influenced by the contributions of Thurow (1992) and Porter (1990). Key perspectives were that new industries of the (then) future would depend on 'brain power'. This even led to identification of key industries for the following decades including: microelectronics, biotechnology, new materials, civilian aviation, telecommunications, robotics/machine tools, and computer hard and software. The 1998 Competitiveness White Paper stated that: *'Our competitiveness depends on making the most of our distinctive and valuable assets, which competitors find hard to imitate. In a modern economy these distinctive assets are increasingly knowledge, skills and creativity rather than traditional factors such as land and other natural resources'* (Department of Trade and Industry, 1998). These papers provided *'the springboard for a large number of government micro-economic activities and policies'*. Unsurprisingly, then the UK government's strategy has focussed upon the opportunities for growth offered by 'knowledge industries' the success of which will *'substantially raise the overall competitiveness of the economy'*, (House of Commons Research Paper, 2000).

The UK government white papers on competitiveness then make it a short leap from identifying successful growth sectors to achieving success through the organisation of industries into 'clusters' or around science parks, and thence to attaining regional competitiveness. Biotechnology clusters are a case in point. In 1999, a team of experts from academia and industry, led by Lord Sainsbury, Minister for Science, reported to government on the results of a fact-finding mission to examine biotechnology clusters in the UK. Theoretical support for their mission derived from the works of Porter (1990) and

Cooke and Morgan (1998). Several recommendations emerged from the report. These were a further review of policy on intellectual property; that universities should introduce student business competitions and educate their science students in the field of management and entrepreneurship; that lessons should be learned from the US; that Regional Development Agencies (RDAs) should promote Urban Networks for Innovative Cluster Areas (UNICAs); that the Department (DETR) should issue guidance to regional planning bodies and local authorities to take account of UNICAs in their planning system and that the DTI and the RDAs should find ways to provide financial support for the regional biotechnology associations (see www.dtiinfo1.dti.gov.uk/clusters).

The outlined knowledge-growth principles, with competitiveness as their core objective, have generated a large number of apparently separate, but closely related policies; namely the strong impulse to isolate key sectors which appear to have growth properties (at least at the UK level), and to identify incipient clusters of ‘knowledge-based’ activity around distinct spatial nodes. These principles have quickly filtered down into RDA and devolved Assembly initiatives in the UK.

RDA policy and key sectors/clusters

Since 1997, significant adjustments have been made to UK institutional frameworks giving greater responsibility for economic development to the nine English regions, and Wales and Scotland. Devolution, together with greater empowerment for the English RDAs, has provided a fresh context for policy development. Both newly instituted and extant agencies and assemblies face pressures to produce coherent strategic economic development plans.

English RDAs, directly accountable to government ministers and parliament, were established under the Regional Development Agencies Act in 1998, each having a chairman and between 8 and 15 members appointed by the Secretary of State for the Environment, Transport and the Regions. These ‘*business-led boards reflect regional interests and more than a third of each board are representatives of local government*¹’. The government white paper *Your Region, Your Choice: Revitalising the English Regions* (2002) states that ‘*experience in Scotland and Wales has shown how a tailored approach to*

*economic regeneration can bring benefits; skills jobs, prosperity*². The government's regional strategy is intended to engender policies based on '*regions' own judgements about needs and priorities*'³.

An examination of economic strategies published by the English RDAs, together with their Welsh and Scottish forbears, however, shows a remarkable consensus on policies to promote local development. Common themes are development of ICT resources, Lifelong Learning and Skills, the identification of knowledge drivers and, relevant to this paper, the eponymous clusters and key sectors (see table 1 for key sectors identified in various RDA areas). Examples of these strategies are reviewed below.

For example, among the East Midlands Development Agency's (EMDA) objectives, published in '*Prosperity through People*', was the development of a regional urban cluster of new media and related cultural industries as an engine for the regions knowledge-driven economy. Other 'clusters' for focus were healthcare industries, clothing and textiles, high performance engineering, and tourism. A consultation paper was launched in May 2002, inviting views on what sectors should be included in a revised economic strategy for 2003-6. Other events were held in each of the strategic sub-regional partnerships to enable stakeholders to debate regional priorities throughout the summer of 2002. Feedback was analysed and published by private consultants. All stakeholders welcomed the opportunity to provide feedback, but interestingly, concerns were expressed that the thrust of the document prescribed a competition with other European regions, without sufficient regard for the needs and strengths of the East Midlands. Subsequently, the EMDA published a regional economic strategy for the East Midlands '*Destination 2010*' which reaffirmed the competitive aim to make the region one of Europe's top 20 by that date, and the cluster development programmed retained the sector focus identified in the original report.

A consultation draft '*Regional Economic Strategy 2003-2012 for Yorkshire and Humber*' manifests similar commitment to a cluster strategy. Three year actions included 'implementation of actions for 5 key clusters' and 'identification of the next 3 clusters for priority investment'. The initial clusters were identified as advanced engineering,

bioscience, chemicals, digital media and food and drink (including agriculture). It claimed *‘all clusters will be developed and delivered in ways that connect with employment, skills and inclusion’*. West Midlands ‘Creating Advantage’ also places faith in clusters for an economic resurrection. Here the emphasis was on high technology clusters based around universities, high tech firms and research facilities. A separate aim was the support and development of existing sectors that were potentially high growth and high value including: engineering design; food and drink; medical technology; the creative industries; tourism and leisure. Three established sectors were also identified for focus: ceramics, the motor industry and engineering.

The South East England Development Agency, serving a region which enjoys a high international ranking on a number of key economic indicators, also seeks to compete on a ‘cluster’ ticket’; *‘Networks and clusters are key to increasing the extent to which businesses, especially smaller businesses, are able to access both innovative technologies and better business practices to increase their competitiveness’*. Pharmaceuticals and biotechnology, media and creative industries, tourism, and aerospace are named. The cluster/sector litany is replicated in the economic development strategies of the London DA, the East of England DA, and the South West of England DA.

Table 1 Regional Development Agencies - Priority Sectors

Organisation	Sectors identified
Scottish Enterprise DA { HYPERLINK "http://www.scottish-enterprise.com" }	Biotechnology, Food, Oil and gas, Opto-electronics, Semiconductors, Software including multimedia, Tourism
Northern Ireland DA “Invest Northern Ireland” www.investni.com	Contact centres, Hi-tech manufacturing, Life & health sciences, Software Telecoms/ electronics
East of England DA “EEDA” { HYPERLINK "http://www.eeda.org.uk" }	Key sectors: selected against a range of criteria including size, growth prospects, R&D base, markets and multiplier effects. ICT, Life sciences Media and cultural industries, Financial and business services, Agriculture and food processing, Tourism leisure and heritage, Automotive High-technology manufacture and advanced engineering, Transport gateways
South West of England RDA “SWERDA” { HYPERLINK http://www.southwestrda.org.uk }	Aerospace, Biotechnology, Creative Industries, Environmental Technologies Food and Drink, ICT, Marine, Tourism.

North East RDA “One NorthEast” { HYPERLINK "http://www.onenortheast.co.uk" }	Seeking to develop and support a strong portfolio of clusters in: Automotive & precision engineering, Bio-Science, Chemicals, Clothing & textiles, Culture, Digital/ Multimedia, Electronics, Environmental industries & energy, Food & Drink, Nanotechnology, Offshore/ Marine Engineering Tourism
South East England DA “SEEDA” { HYPERLINK http://www.seeda.co.uk }	Sector Groups have been established: Defence and aerospace, Media and creative industries, Transport and logistics
West Midlands RDA “Advantage West Midlands” { HYPERLINK "http://www.advantagewm.co.uk" }	Added value engineering, Automotive, Electronics & telecommunications Food & drink, Healthcare & pharmaceuticals, Logistics & e-fulfilment Rubber & plastics’ Services & e-business, Software
Yorkshire RDA “Yorkshire Forward” { HYPERLINK http://www.yorkshire-forward.com }	Advanced engineering, Bioscience, Chemicals, Digital industries, Food & drink
North West DA “NWDA” { HYPERLINK "http://www.nwda.co.uk" }	Automotive components, Financial services, Food & drink, ICT, Life sciences (pharmaceutical, biochemical centres), Software
East Midlands DA “EMDA” { HYPERLINK "http://www.emda.org.uk" }	Existing/ emerging clusters area seen to have a competitive advantage in & where there is potential for growth: clothing & textiles, creative industries food & drink (processing & technology), healthcare industries, high performance engineering
London DA “LDA” { HYPERLINK "http://www.lda.gov.uk" }	Setting up business-led advisory “sector commissions” in: Creative industries Manufacturing

Since devolution, Scotland and Wales have both published frameworks for economic development. Scotland’s document *The Way Forward; Framework for Economic Development in Scotland* (2000) embraces economic change and suggests that six considerations are paramount: knowledge intensity, letting go of uncompetitive enterprise, partnerships in enterprise, recognition of the increasing mobility of enterprise, lifelong learning and the importance of Scottish HQ. The document also suggests a shift away from sectoral focus (*‘in more slowly moving times, the focus of many governments was heavily on which products and sectors could be promoted to secure economic growth’*) to

achieving growth through across the board productivity gains, which it claims arise from innovation, human capital, resource use, entrepreneurship and infrastructure. However, the document later discusses where the public policy focus should lie and comments that it should be at ‘*the sectoral level; with a focus on particular sectors or clusters of enterprise, however defined*’ but that ‘*the nature of support needs further direction before specific initiatives can be considered*’. The framework then acknowledges that Scottish Enterprise has already established ‘cluster approaches’ with Action Plans in the semi-conductor, biotechnology and food and drink sectors.

While far from exhaustive, the above background demonstrates several points. There is a widely held acceptance of the imperative for knowledge creation in key sectors and clusters both on the part of academic commentators and the UK government and its advisors and informants. There is evidence to suggest that the source of this conviction is often anecdotal and heavily recycled, with a reliance on exemplar regions or localities usually outside the UK. Models held to provide the key to futures elsewhere are essentially historical success stories; often having complex origins reflecting structural peculiarities which may not be replicable elsewhere. Moreover, there is evidence that the direction of prescriptive influence is top-down, rather than bottom-up, reflecting the historical direction of institutional influence.

As a result economic strategies across the regions contain similar themes, and often encourage the development of similar sectors and industry groups. The prioritisation of industries for special attention is rarely subject to rigorous analysis, partly because of the absence of robust qualitative analytical tools. A further problem is the absence of good regional statistical data to inform policies. The corollary is that a sectoral or cluster focus is seldom subjected to on-the-ground reality checks, or to any genuine evaluation of the risks attached. The need for new tools to inform policy formulation, which are robust, timely and sufficiently refined to manage the new demands implicit in the new regionalist paradigm should be a priority.

3. Selecting Key Sectors and Clusters: Identification Problems and Standard Tool-Kits

Policy developed around key regional sectors and clusters is obviously nothing new. Selection is often based on the presence of strong forward and/or backward linkages in a region. This also connects through to growth pole theory and the concept of key inter-linked lead firms (see Perroux, 1955; Erickson, 1974). However, care must be taken with these perspectives. Sectors featuring strong inter-industry linkage in a region are not necessarily those which make the most meaningful economic contribution (see Hewings, 1982), for example, in terms of job and income creation, or export generation. Generally, there is no *a priori* reason to expect that sector growth rates and the intensity of sector structural inter-relationships should be correlated. Indeed, fast growth industries could actually be the ones that trade with well-linked key sectors (see McGilvray, 1977, Hewings et al., 1984). Moreover, and returning to the ideas of Hirschman (1958) induced investment connected to expansion of a key sector depends on whether linked regional sectors can also expand. These basic issues are not always addressed by strategic policies outlined in the previous section. For example, the regional promotion of a defined key sector or cluster could give rise to inward investment, which could have the effect of damaging incumbent prospects where factor markets are tight.

The remaining key issue is one of identification. The previous section highlighted a concern that in the UK (and elsewhere) the current targeting of sectors with linkage or cluster potential is rarely supported by empirical research that shows precisely why such sectors are a focus of resources, and how far promotion of them might be linked to regional/national growth prospects and competitiveness. In this regard Feser and Bergman (2000), conclude that local cluster policies in the US have often involved the identification of current regional specialisations, and with the result that sector strategies have simply provided a means of focusing scarce resources, rather than represented an efficient means of developing longer term area advantage.

Aside from case study analysis an important tool for key sector identification and for identification of inter-linked clusters of activity have been Input-Output tables.

Interestingly, the UK DTI Cluster Survey, was also based on a location quotient approach, linked through to the national Input-Output framework. Whilst such tables provide some valuable perspectives they can foster tunnel vision. The focus on inter-industry technical relationships ignores the significance of social ties and networks in regional competitiveness (see Gordon and McCann, 2000). More fundamentally an ex-post framework based solely on Input-Output table decomposition may poorly represent new industries, or aggregate them together with other sectors. Hewings et al. (1984) make the important point that future key sectors could be those that are currently missing from the region, and hence not even be represented in an *ex post* Input-Output framework.

4. Multi-Sectoral Qualitative Analysis

Inadequate Tools?

In the preceding sections this paper has argued that policy promotion of key sectors and clusters of economic activity has been undertaken with a limited regard to regional contexts, and that where there has been analysis of key sectors, methods have been narrow such that there is a need for better tools to inform policy. In particular quantitative methodologies to identify ‘growth sectors’ may not accommodate qualitative data demands of the new knowledge paradigm, and their composition, generally reliant on historical data, can deliver only the haziest appreciation of future risk. Moreover, trends in ‘sectoral followership’ have resulted in a lack of appreciation of regional uniqueness which has led many policymakers to adopt policy prescriptions that have been found to work elsewhere as a central policy paradigm with little thought as to the necessity of adaptation.

The complementary approach highlighted in the case below draws from methods such as Multi-Criteria Analysis (MCA), Delphi and Foresight approaches, which may fulfil better the requirement to explore and predict the knowledge related (and untraded) components of sectoral development, whilst also treating with core competitiveness characteristics and local linkage potential.

Case Background

In 2002 the Welsh Development Agency commissioned the authors to produce a series of short briefing notes which examined sectors in the region whose future development pattern might redress inequalities between Wales and other regions. Inevitably this exercise was made difficult by the use of historical data to inform predictions, and difficulties of sectoral aggregation and definition. For example, standard aggregations along Standard Industrial Classifications (SICs) served to disguise significant intra-sectoral variations, and with the SIC framework dealing poorly with some faster growing activities such as tourism, arts and culture, and other business services.

An alternative methodology was then used in order to explore in greater depth the parameters surrounding the underlying strengths and weaknesses of a set of industries, which had either experienced fast growth, were large employers or had high value added attributes.

Multi-sectoral qualitative analysis (see Roberts and Stimson 1998) offered a means to '*explain the strength and importance of attributes that contribute to the phenomena of regional competitiveness*'. The MSQA technique combined quantitative and qualitative intelligence, and was considered to deliver greater flexibility, and be better placed to capture regional demands to understand the knowledge components underlying sectoral growth.

The MSQA methodology aims to provide various information about industries, together with analysis of the characteristics of the study area/region, that will aid policy-making. The advantage of such an approach is that the analysis is not restricted by the availability of quantitative information, and can therefore explore the relationships between a wide series of selected economic and other variables, and selected industries or sectors. The other benefit of MSQA is that choice of sectors for analysis can be extended to those industries or activities not adequately identified from SICs (e.g. bio-sciences/genetics), or those industries which are associated with many different SICs (such as tourism or the arts).

Finally, this approach makes maximum use of various ‘market intelligence’ and is outward and forward looking, anticipating trends in activities rather than looking to past economic data. Importantly, published economic and other data can be used to inform an MSQA but is not pivotal.

The approach taken was to develop a pilot MSQA for Wales based around the method developed by Stimson and Roberts, but adapted to specific regional needs. The MSQA method records information for selected industries on a range of factors, classified into various characteristics as follows:

- regional and sector core competencies
- economic linkage possibilities
- trade possibilities
- regional economic and industry risk

Regional and Sector Core Competencies

Industry core competency and resource competitiveness describes the tangible and intangible assets (i.e. physical infrastructure, skills, technology, and knowledge) that are one determinant of how well industry can organise resources to maximise new market opportunities. The examination of industry core competencies in the Welsh case involved an examination of 41 competence criteria under 9 headings:

- Economic strengths
- Trade orientation
- Technology and development
- Human resource development
- Management
- Finance
- Governance
- Infrastructure
- Environment

The individual criteria under each heading are shown in the first column of Table 2. There are links between some of the identified criteria. However, the objective is to give as full a picture as possible of the wide range of factors that could lead to strong sectoral competence. A few examples are given by means of illustration.

Under regional economic strengths the competency criteria include industry growth prospects, together with value added characteristics. A focus on higher value added sectors, and on those featuring higher relative earnings was noted in the Welsh Assembly Government economic strategy *A Winning Wales*, in the context of reducing disparities in GDP per capita between Wales and the UK.

Technology and development addresses another theme evident in *A Winning Wales* – that of the importance of promoting R&D within the region. Criteria address levels of R&D in Wales, and in the selected industry globally, and regional collaborations with higher education. Other criteria under this heading deal with how far the sector features agglomerations of expertise (i.e. as opposed to branch plant dependency characteristics), and importantly, whether development of the sector could be associated with productivity spillovers to other Welsh sectors, a key component of the clustering debate. Finally, criteria in this section relate to levels of new firm formation, and the technological absorptive capacity of the sector. For example, selected sectors may be so far behind global leaders in the field that they are unable to assimilate new innovations in product and process.

Table 2. Industry Core Competence and Resource Competitiveness

Competencies	Statement used in survey instrument to assess significance of the factor
<u>1. Regional economic strengths</u>	
1.1. Recent performance of the sector	Output in the industry at the UK level has grown strongly in the last five years
1.2. Future growth potential	The industry is expected to grow strongly in the UK in the next decade
1.3. Value adding activities (<i>i.e. low or high value added sector</i>)	The industry (locally) features high levels of gross value added compared to other Welsh industry
1.4. Earnings levels	The industry locally exhibits high wage levels compared to the Welsh average
<u>2. Trade orientation</u>	
2.1. How embedded is sector in Wales (<i>what proportion of intermediate products comes from inside</i>)	The industry (through its local purchasing links) supports significant activity elsewhere in Wales
2.2. Performance in trade and investment	The industry is a strong overseas exporter compared to other Welsh industries
2.3. Dependence on local markets (<i>i.e. proportion of industry sales in Wales – expectation is that participation in the national and international economy is a better thing than dependence on local markets</i>)	Industry development is not excessively dependent on Welsh markets for its output
2.4. Presence of strategic business alliances (<i>i.e. between Welsh based and global firms</i>)	The industry in Wales is characterised by regular ‘high level’ interactions and information exchange with global firms (e.g. strategic business alliances)
<u>3. Technology and development</u>	
3.1. Expenditure on R&D locally	The industry has a significant R&D spend, as a percentage of

	industry sales, compared to other Welsh industries (<i>average Welsh R&D is less than 1% of sales</i>)
3.2. Expenditure on R&D globally	The industry <i>globally</i> is characterised by significant expenditure on R&D compared to other industries
3.3. Agglomeration of expertise (<i>i.e. presence of expertise at all levels in the industry</i>)	The industry in Wales is characterised by extensive technical expertise at all levels
3.4. Productivity spillovers to other regional sectors	The development of the industry creates technical or productivity spillovers into other Welsh industries
3.5. Collaborative research in Wales	The industry has significant technical collaborations with the higher education sector in Wales
3.6. Collaborative research outside Wales	The industry has significant technical collaborations with the higher education sector <i>outside</i> Wales
3.7. New firm formation (<i>i.e. new firm formation rate, high medium, below average</i>)	Business start-up rates in the industry are high in Wales
3.8. Technology absorption rate	The industry has the ability to capitalise on new technologies as they arise.
<u>4. Human resource development</u>	
4.1. Regional education services (<i>i.e. what is the condition of training services for the sector</i>)	Training facilities/resources for the industry are adequate for its current needs
4.2. Regional skills base (<i>are there noticeable skills shortages in Welsh sector</i>)	It is easy to recruit suitably trained and qualified people in Wales, within a reasonable time-scale
4.3. Investment in skills	The industry generally invests in skills and training for its employees (e.g. has a high rate of adherence to Investors In People etc.)
4.4. Occupational structure (<i>i.e. does sector in Wales feature a diversified occup. base or is it very specialised</i>)	The industry features a well diversified range of occupations and activities, ranging from entrants to senior managers
4.5. Links to higher education (<i>use of graduates, education linkages</i>)	The industry makes extensive and appropriate use of university graduates and their educational capital on suitable career paths
4.6. Industrial relations practices	The industry is characterised by very good industrial relations practice
<u>5. Management</u>	
5.1. Customer service and product quality (<i>i.e. presence of strong record of quality and service</i>)	The industry has a strong record in customer satisfaction
5.2. Network linkages locally (<i>i.e. is there a strong network of formal/informal associations</i>)	The industry features a strong network of formal and informal associations <i>within</i> the region
5.3. Network linkages outside region	The industry features a strong network of formal and informal associations <i>outside</i> the region
5.4. Marketing capability (<i>i.e. is marketing management based regionally or nationally</i>)	The industry at the local level has a strong and autonomous marketing capability
5.5. Utilisation of IT (<i>does the sector make extensive use of IT facilities</i>)	The industry in Wales makes extensive and varied use of IT resources
<u>6. Finance</u>	
6.1. Finance availability (<i>presence of capital shortages</i>)	Industry players are easily able to access finance for investment from commercial sources
<u>7. Governance</u>	
7.1. Regulatory structure (<i>strongly or weakly regulated sector, argument here is that regulatory encumbrance is a factor adding to weakness</i>)	The industry suffers few undue regulatory constraints at a UK level which hinder growth
7.2. Local autonomy (<i>presence of decision making autonomy at local level</i>)	The industry in Wales is characterised by high levels of autonomy in decision making
7.3. Business support schemes	General public sector business support for the industry locally is strong and appropriate
7.4. Planning regulations	The future development of the industry in Wales is unlikely to be unduly affected by planning restrictions
<u>8. Infrastructure</u>	
8.1. Transport infrastructure	Transport facilities (roads & services etc.) are adequate in the region for the industry
8.2. Other physical infrastructure	Other physical facilities are adequate in the region for this industry (e.g. buildings, specialised physical resources etc.)
8.3. ICT infrastructure	The Telecoms and IT infrastructure regionally is adequate for

	industry needs currently, and will not hinder growth in the immediate future
8.4. Energy costs (<i>are energy costs for sector in Wales appreciably higher than elsewhere</i>)	Energy costs for the sector in Wales are not significantly higher than elsewhere in the UK
<u>9. Environment</u>	
9.1. Environmental and waste management facilities	Environmental and waste management facilities for the industry locally are good
9.2. Greenhouse gas emissions (<i>is sector a large creator of such emissions</i>)	The industry in Wales produces relatively small amounts of greenhouse gases
9.3. Water pollution (<i>does sector create major water emissions</i>)	The industry creates no water-borne emissions in Wales
9.4. Other environmental damage	The industry is associated with relatively small environmental effects generally
9.5. Environmental planning restrictions	Planning restrictions on this industry are imposed for identifiable social or environmental reasons, even where industry players may disagree with those reasons

The approach taken was to construct a survey instrument through which each of the criteria for each sector could be scored. For each of the criteria a statement was developed in an expert questionnaire (see later) and shown in the second column of Table 2. For example, under economic strengths the second criteria relates to industry growth potential. The statement in the survey instrument (1.2) was then “*the industry is expected to grow strongly in the UK in the next decade*”. Respondents were asked to rate how accurate this statement was for the selected sector on a scale moving from 5=strongly agree to 1=strongly disagree. As a means of weighting the importance of given criteria respondents were also asked to rate how important the given factor was to the future development and success of the sector. So, for example, a respondent answering 5 on accuracy, and 5 on importance, would be showing that in their opinion, for this sector, output growth is expected to be strong, and this is an important factor in long run development of the sector.

The scores for each criteria were transformed to provide a score for the sector for the given heading. So, for example, for regional economic strengths, the scores for criteria 1.1-1.4 were combined to create a score for the sector under this heading.

Assessing Industry and Regional Risk

Some assessment of risk is necessary to inform regional developmental policy and strategic planning. The causes of risk vary from industry to industry. The approach taken here was to specify different types of risk under 4 separate headings:

- External risk factors

- Specific industry risks
- Governance risks
- Environmental risks

Under these headings there were a total of 25 risk factors identified (Table 3). The progress of the Welsh industrial economy is tightly interwoven with a series of external factors over which the regional assembly has very little control. Welsh industries are generally prone to macro-economic instability and global recession. However, industries might vary in their proneness to exchange rate movements and tariff barriers in key overseas markets.

Table 3. Risk Factors in Welsh MSQA

1. External risks	2. Industry risks
1.1 UK Macro-economic instability	2.1 Lack of security in critical physical supplies, or recurrent logistical supply problems
1.2 Movements in exchange rates	2.2 General skills shortages
1.3 Global economic downturn	2.3 Managerial and technical skills shortages
1.4 Tariff barriers in key industry export markets	2.4 Capital shortages
1.5 Political instability abroad	2.5 Industrial relations difficulties
1.6 Price instability in input markets	2.6 Specific industry taxes and regulation
1.7 Price instability for industry outputs	2.7 Excessive monopoly power in downstream markets
1.8 Short-run technological change at the global level	
1.9 Internationally-based cost competition	
1.10 Internationally-based quality competition	
3. Governance risks	4. Environmental risks
3.1 Instability in industry-government relations	4.1 Environmental changes
3.2 Legislative changes at regional or national level	4.2 Natural resource depletion
3.3 Legislative changes at international level	4.3 Regional community group pressures
3.4 Loss of single important contractor or customer	4.4 Impact of national or international pressure groups

There are also a series of more specific industry, governance and environment risk factors which could potentially damage one industry whilst leaving another unscathed. Industry factors include security of physical supplies, skills shortages, and capital shortages. Industry in Wales may also be subject to a series of governance risks. These include instability in industry-government relations, but would more likely include legislative changes affecting market prospects or industry activity. Although legislative changes relating to the environment are examined in the governance section, there are also a series of environmental factors affecting Welsh industry but not linked to regulation. These include factors such as environmental changes (i.e. global warming), and natural resource depletion, but also pressures from regional and international groups. The last decade has seen the expansion plans of several industry groups in Wales adversely affected by the

actions of various pressure groups. Open-cast mining, and waste incineration are good examples.

In the developed expert questionnaire (see below) respondents were asked to consider how far prospects for the selected Welsh industry could potentially be affected by each of the factors listed in Table 3. They were asked to first rate the impact of the individual factor on a scale of 1-5 (no impact to very significant impact). In a second column they were asked to assess likelihood of the selected risk attribute affecting the progress of the selected sector in the short to medium term - again on a scale of 1-5 (very unlikely to very likely). The scores for impact and likelihood were transformed to create a measure of the risk facing the sector under each of the four general headings. Further manipulation of the weighted risk scores for all the selected industries allowed conclusions to be made on the main risk factors facing the region as a whole.

Trade Potential

An important component of Welsh development is success in overseas and UK trade. Whilst exporting activity overseas is normally associated with manufacturing, selected Welsh services also sell overseas. Traditional markets for Welsh exports are Western Europe. During 2000, total Welsh exports to the EU were an estimated £4.57bn. However, Wales also exports extensively outside of the EU with £1.85bn of exports to non-EU states in 2000 (i.e. some 29% of total exports – see HMCE, 2002). There are numerous opportunities for new trade in developing Asia, south America, central and eastern Europe.

In assessing trade potential for selected sectors the approach was similar to that used in the assessment of risk. Expert respondents for the selected sectors were presented in the survey tool with a list of 16 trading regions. This included rest of the UK in order to provide some assessment of the balance between UK and overseas opportunities. Respondents were asked to assess on a scale 1-5 (irrelevant to very important) the current importance for the sector's goods or services of each of the export markets. They were then asked for each export market to assess future trade potential on a scale 1-5 (no potential to very high). This format was used to identify regions such as perhaps China or South America, which whilst

being of little importance currently might have strong future potential from some sectors and hence be a possible avenue for future trade promotion policy or other actions.

Scores for current trading importance and trade potential were transformed to create the measure of future trade potential for each sector. As was the case with the risk matrix, further manipulation of the weighted trade potential scores for all the selected industries allowed conclusions to be made on the selected areas of greatest trade potential for the region as a whole.

Assessing Inter-Industry Linkage Potential

The MSQA technique also permits the inclusion of more traditional parameters of key sector identification within mechanical approaches. Clearly the structure of financial interconnections between sectors can be an important indicator of the strengths and diversity of a given regional economy. Ideally a cross sectoral development opportunities matrix would be based on input-output transactions table data, combined with more qualitative information which describes the potential for sectors to share common networks, infrastructure etc. The development of a survey tool to account for the structure of formal and informal networks in the selected sectors was beyond the scope of the pilot research. For this pilot project, the approach taken was to focus on quantifiable interconnections between sectors. Welsh Input-Output tables were used to show how selected sectors were linked financially to other regional industry groups. In this way it would be possible to summarise how far growth of output in one selected sector would impact on growth of output in other Welsh sectors as measured by the size of output multipliers.

Selection of MSQA Sectors

The selection of sectors for inclusion in the pilot MSQA was informed by prior analysis undertaken for the Welsh Development Agency which had developed a suite of economic data on some 122 defined Welsh industry sectors (defined in terms of UK Input-Output groups which correspond to SIC 92 classifications). The report provided information on historical growth, size, earnings, trade potential, and a measure of Welsh specialisation in

the sector. This suite of data is not ideal but the objective in the pilot study was to show the potential of the technique, particularly in providing a reality check on sectors where resources were already being targeted. Sectors and activities selected for the pilot are shown in Table 4.

As highlighted earlier, the MSQA allowed an investigation of industrial groups which are not specifically defined by standard industry classifications, or that are encompassed within a series of dispersed industry classes. For the purposes of the pilot analysis the focus was upon six satellite themes largely by way of illustration. These were Bio-technology (sub-set of bio-sciences which includes medical devices and pharmaceuticals); ICT divided into ICT content, and ICT software/hardware; Major events; Aerospace; Optronics and Tourism.

Table 4. Selected Industry Sectors

Reporting Industry Group	Individual sectors and SIC classes Sector description
Final/Intermediate Electrical and Electronic goods	Office machinery & computers (30) Word processing machines, cash registers, auto banknote dispensers
	Electric motors and generators etc (311-312) Switches, fuses, plugs, sockets, electric control boards
	Electrical equipment nec (314-316) Lamps & light fittings, engine ignition equipment, rail/ road/ airport signalling
	Electronic components (321) Mnfr of tv picture tubes, integrated circuits, diodes, transistors
	Transmitters for TV, radio and phone (322) Telephones, fax machines, switchboards, tv cameras, relay + tv transmitters
	Receivers for TV and radio (323) Video projectors, camcorders, cassette-recorders, CD players, tv decoders
	Medical and precision instruments
Chemical products	Organic chemicals (241) Mnfr organic chemicals (charcoal, synthetic ethyl alcohol/ aromatic products)
	Pharmaceuticals (244) Investigation & prodn of medicines, vaccines, dental fillings cement
	Other chemical products (246) Explosives, glues, photographic film, unrecorded sound/ video/ computer discs
Machinery	General purpose machinery (292) Furnaces, lifts, vending machines, cranes, air-con machines, industrial freezing equipment,
	Machine tools (294) Lathes, drills, toolholders, forging machines (non-mining/ quarrying machines)
	Special purpose machinery (295) Mining, bulldozers, concrete mixers, food processing (wine presses), textile machine (sewing) paper making
Motor vehicles	Motor vehicles (34) Includes trailers, caravans, parts/ accessories

Printing and publishing	Printing and publishing (22) Newspapers, books etc., bookbinding & finishing, recorded media reproduction (sound, video)
Transportation	Shipbuilding and repair (351) Includes construction of floating structures (docks, buoys, pontoons)
	Aircraft and related (353) Includes mnfr of ground flying trainers
	Other land transport (602-3) taxi operation, road freight transport
	Water transport (61)
	Air transport (62)
	Ancillary transport services (63) Cargo handling & storage, travel agencies, tour guides
Pulp, paper and paperboard	Pulp, paper and paperboard (211) Manufacturer of paper, cellulose wadding, etc.
Materials	Plastic products (251) Manufacture of tubes, bags, containers, floor tiles, insulated fitting etc.
	Structural metal products (281) Prefab buildings of metal (construction site), doors, windows
	Glass products (261) Mirrors, bottles, inners for vacuum flasks,
Sports products	Sports goods and toys (364-5) Sports equipment, professional and arcade games and toys, electronic games.
Other business services	Market research, management consultancy (7413-7415)
	Architectural activities and technical consultancy (742-743)
	Advertising (744)
Accountancy	Accountancy services (7412): Book-keeping, auditing, tax consultancy
Legal activities	Legal activities (7411)
Higher education	Activities of H.E institutions (80)
Insurance and pension funds	Mainly activities relating personal, home, travel and life insurance (66)

The sectors identified above are fairly broad in terms of goods and services produced. Whilst a more detailed MSQA could be carried out at the level of individual commodity groups rather than industrial classes, it is unlikely that policy development can be this finely disaggregated.

Presentation and Interpretation of Results and Score Generation

The data was assembled into a matrix comprising 21 sector columns, (containing the sector aggregate/average) by 82 criteria rows, with each cell containing a value score weighted for importance (the Appendix provides details of the scoring method). This matrix provided a number of analytical and presentational possibilities, depending upon the user group.

Three methods for developing the scores were considered. The first, focus groups of specialist individuals for broad industry categories would require the development of consensus scores, through the intervention of a specialist amateur. An extensive industry survey raised issues of response bias, low return rates, and project costs beyond the scope of a pilot exercise. The third option of using a targeted survey of small numbers of identified industry experts was chosen, which focused the initial weight of resources upon defining senior directors from Welsh organisations, academic experts, Welsh Development Agency sector specialists and representatives from special regional development forums. Over 60 experts (Table 5) assisted in the generation of scores. The survey instrument used covered trade, risk and regional/industry competencies. The evaluation of linkages was undertaken by the research team separately and the results are not reported here..

Sample of Results

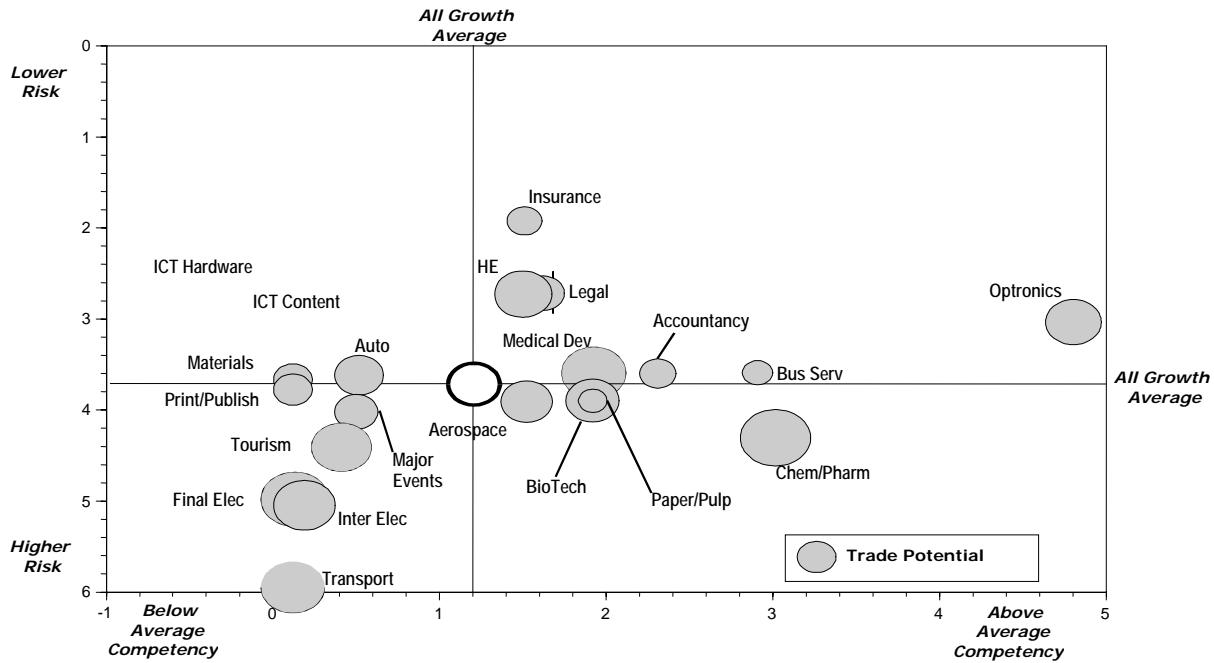
Figure 1 summarises results of the pilot Wales MSQA study. Risk is measured on the *y-axis*, sector core competency on the *x-axis*, while the *surface* of each circle is proportional to the degree of trade potential. Risk and incompetence are maximised at the *origin*. The combined all sector average is shown by the *cross* with Aerospace occupying the average ground on trade, competency and risk, and used as an example here.

Table 5 Selected Industry Sectors and Expert Consulted in Pilot

Reporting Industry Group	Ind. Experts	Academic Experts Consulted	Public Sector Experts	Total Consulted
Electrical & Electronic Gds- Final	0	0	2	2
Electrical & Electronic Gds- Intermediate	1	0	2	3
Medical and precision instruments	1	0	0	1
Chemical products & Pharmaceuticals	1	0	1	2
Automotive	1	2	1	4
Printing and publishing	1	0	1	2
Transportation	3	0	0	3
Pulp and Paper	1	1	0	2
Materials (<i>inc Plastics & Structural Metals products</i>)	2	1	0	3
Other business services	2	1	0	3
Accountancy	2	0	0	2
Legal activities	9	3	3	15
Higher education	0	4	0	4
Insurance and pension funds	1	1	0	2
SATELLITE GROUPS				
Bio-technology	0	0	1	1

Sports and Cultural Events	0	1	1	2
ICT- Hardware	1	0	2	3
ICT- Software	1	0	2	3
Aerospace	1	1	1	3
Tourism	0	0	1	1
Optronics	1	0	0	1
TOTAL	29	15	18	62

Fig. 1: MSQA Sector Results: Competency, Risk & Trade



Around 7000 people are employed in aircraft manufacture, repairs and maintenance, most split between BAE Systems in Broughton, North Wales and the defence ministry’s repair and maintenance facility outside Cardiff. Aerospace scores, generated by public and private sector respondents, were average in sector core competency, risk and trade potential measures. The sector’s strengths were a highly skilled workforce, an absence of current labour constraints, and a high industry R&D spend. However, local physical infrastructure was held to be constraining to future development and the industry itself had not developed extensive local institutional linkages within Wales. Moreover, risks were perceived from technological change and international cost and quality competition, and the industry was over-dependent on a single customer. More importantly, the MSQA provided little justification for claims that the sector could be identified as a ‘cluster’ (NAfW, 2002). For example, there was little evidence of soft infrastructures such as informal, collaborative links between it and other related sectors; moreover, technology links between higher

education and aerospace were considered poorly developed, and the range of occupations within the sector was also considered narrow, with few opportunities for skill spillovers. The regional government's view that this is a strong sector appears to have been derived from observations relating to the *global* competency and R&D characteristics of the industry rather than the nature of its activities within the region.

Leading sectors on competency criteria were optronics, chemical, other business services, accountancy and paper and pulp, while among the weakest were ICT content and hardware and materials and final electronics. Interestingly, those higher ranking sectors derived their strengths from a diverse suite of competencies, so for example, of the top five sectors, accountancy, optronics, and paper/pulp shared competency in human resource development (industry training, recruitment, skills, occupational diversity, industrial relations and graduate absorption), while chemicals and other business services derived their high competence ranking from Technology and Development (global and local R&D spend, technical and productivity spillovers, technical collaborations with the HE sector within and out of Wales and new technology absorption), yet were weakest in areas where their peers were strongest. The same picture emerged in those sectors performing least well on this measure, also manifesting a diversity of strengths and weaknesses. The methodology produced a convincing demonstration that cross-cutting policies to reduce market failure or bolster resource provision should be subject to specific sectoral focus.

Table 6 Leading Sectors on Competency

Sectors	Strongest industry competencies	Weakest factors
Optronics	Management, human resource development, economic strengths	governance, environment, infrastructure
Chemicals	Technology and development, economic strengths, environment	infrastructure, governance, human resource development
Other business services	Trade orientation, finance, technology and development	management, human resource development, infrastructure
Accountancy	Human resource development, management, governance	trade, finance, technology and development
Paper and pulp etc.	Human resource development, infrastructure, finance	technology and development, trade, environment

Sectors ranked according to their risk scores revealed that services-orientated activities such as Insurance, Higher Education, Legal Services, ICT Hardware and Content were least risk sensitive, while the highest ranking risk sectors were Chemicals, Pharmaceuticals, Tourism, Final and Intermediate Electronics, and Transport. Analysis of first and second uppermost risk factors for those sectors showed the prevalence of external factors, then offering little latitude for policy intervention, but highlighting where intervention may be focused, for example, industry-based risks denominated in terms of capital and skills shortages for which lobbying or instituting measures might be appropriate. MSQA revealed that regional scope for mitigating the main elements of risk is limited. Furthermore, the method exposed the need for a balanced portfolio of sectors for regional development to mediate exposure to a variation of risk categories. MSQA showed that firms in final and intermediate electronics (of which a high proportion are foreign investors absorbing significant public resources) face high levels of external risks. Regional over exposure has already caused problems as larger firms have rationalised production Wales and exported capacity to cheaper locations in Central and Eastern Europe.

Table 7 Sectors and Risk

<i>Lowest ranking sectors on risk</i>	First and second uppermost risk factors
Insurance	Industry, external
Higher education	External, governance
Legal services	Governance, industry
ICT hardware	External, industry
ICT content	External, industry
<i>Highest ranking sectors on risk</i>	
Chemicals and pharmaceuticals	Governance, industry
Tourism	External, industry
Final electronics	External, governance
Intermediate electronics	External, industry
Transport	Governance, industry

Finally, here it is worth noting that the aggregation of scores for each of the selected sectors and for each criterion yielded an all-sector score, providing an indication of core competency, risk and trade measures for the region as a whole. The findings suggested that, underlying the broad success of prominent sectors were serious perceived deficiencies in terms of high level strategic interactions with the global economy, despite an outward orientation. All-sector Technology and Development indicators for the Wales MSQA revealed inherent dangers in assuming that industries associated with high R&D spend,

necessarily exhibited that strength within all regions where they are active, reflecting weaknesses in local strategic architecture.

5. Discussion: Analysis using MSQA

While the MSQA technique was used to examine core competencies, trade and risk for selected growth sectors, it was sufficiently flexible and innovative to handle the wide range of interrogations which the new regional paradigm will increasingly invite. For example, the methodology could be used to refine understanding on specific constraints arising from a sustainable environment focus, pinpointing key risks in certain sectors. It presents further possibilities with regard to identifying knowledge networks and innovative capacity within clusters of activity, or isolating weaknesses in skills and occupational and technological spillovers and transfers; especially in the context of activities which do not sit easily within the traditional industrial classifications.

Traditional quantitative applications to sector performance evaluation do not normally provide an appreciation of future risk, and although individual investment projects may be subjected to some risk analysis these enquiries may not be informed by actors within the industry but rather be conducted by executives working in the public arena. By accessing expert opinion, the methodology can play a significant role in validating a number of potential policy outcomes. The Wales study identified a number of ex ante risks in the transport, tourism, major events and electronics sectors, which might call for policy modification in the event of future one-off inward investment proposals.

Scarce public resources point to the need for policies which can efficiently target and mitigate well-defined structural weaknesses. Clearly, quantitative techniques while of continuing use, even in knowledge-driven economies, still lack the capacity to capture intangibles. Meanwhile, the current alternatives including; transmission of external impressions from a national hierarchy down to the locale, ad hoc qualitative enquiries, or lobbyists or sector focus groups anecdote, together producing influential but fragmented intelligence of either broad or finely focused regional needs, cannot deliver objective, coherent and unbiased consistency.

The capability of MSQA to provide a central resource for regional policy formulation is likely to depend upon its ability to legitimise among policy makers, opinion originating outside established elites. Acquisition of legitimacy is a process not an event, involving compromise. The Wales MSQA accessed a greater number of experts than would normally be the case for a Delphi exercise, many of whom had not hitherto contributed to policy intelligence. The MSQA process then demonstrated possibilities to access new conduits of information.

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Appendix 1 Scoring System and Sample of Outputs

It was important to transform the information from the survey into a usable format, which also allowed efficient visual representation. As demonstrated in the paper for each of the core industry competence criteria a statement was developed in the expert questionnaire (and shown in the second column of Table 2). For example, under economic strengths one statement was “*the industry is expected to grow strongly in the UK in the next decade*”. Respondents were asked to rate how accurate this statement was for the selected sector on a scale moving from 5=strongly agree to 1=strongly disagree. As a means of weighting the importance of given criteria respondents were also asked to rate how important the given factor was to the future development and success of the sector. So, for example, a respondent answering 5 on accuracy, and 5 on importance, would be showing that in their opinion, for this sector, output growth is expected to be strong, and this is an important factor in long run development of the sector.

However, in the context of the sector core competencies negative scores would be useful to indicate where industry weaknesses existed. Therefore, in transforming the data the responses regarding the “accuracy” of a given statement were transposed from +1 to +5 to –2 to +2 via simple subtraction, and multiplied by the “importance” criteria to give an overall score for that statement. Hence, a score of –10 indicates an industry is very weak in a given area, and that this is very important to industry development; a score of +10 is the maximum possible and reflects industry strength. Negative scores therefore reflect industry weakness on the relevant criteria.

The scores for sector competencies were reported at the level of the nine broad themes rather than at the level of each of the 41 individual criteria, and for the average of all respondents for that sector, providing useful information without undue complexity, and reducing the potentially destabilising impact of reporting individual responses.

The analysis of sector risk proceeded in a slightly different manner. In the survey respondents considered how far prospects for the selected Welsh industry could potentially be affected by a number of risk factors (see Table 2.2). They were asked to first rate the impact of the individual factor on a scale of 1-5 (no impact to very significant impact). In a second column they were asked to assess likelihood of the selected risk attribute affecting the progress of the selected sector in the short to medium term - again on a scale of 1-5 (very unlikely to very likely).

The scores for the impact of a given risk factor, and its likelihood were multiplied to give an overall score for that individual facet. The scores were re-scaled to provide a “risk index” from 0 to 10, with a score of 10 indicating an industry most subject to damage from that risk, and where that risk was likely to occur. Again, risks were reported at the level of the four broad risk themes (external, specific industry, governance and environmental), and as an average of all respondents. However, as for the reporting of sector competency, salient points are noted in the text with respect to individual risk facets.

The survey results for trade potential are dealt within a similar manner. Expert respondents for the selected sectors were presented in the survey tool with a list of 16 trading regions and asked to assess on a scale 1-5 (irrelevant to very important) the current importance for the sector’s goods or services of each of the export markets. They were then asked for each export market to assess future trade potential on a scale 1-5 (no potential to very high). For reporting purposes these scores were averaged across respondents for that industry, and the multiplicand of these numbers provided a final “score” reflecting overall

potential; again this score was re-scaled to between 1 and 10, with 10 indicating a region where there was a high current level of interaction, and where great potential for expansion existed.

¹ 'Your Region, Your Choice: Revitalising the English Regions' (2002) Government White Paper, Department of Transport, Local Government and the Regions. Page

² Ob cit, Page

³ Ob cit, Page 20

