GLOBAL INDEX OF REGIONAL KNOWLEDGE ECONOMIES:

Benchmarking South East England

SEEDA SOUTH EAST ENGLAND DEVELOPMENT AGENCY
Working for England's World Class Region

robert huggins ASSOCIATES

FINAL REPORT

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Contents

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SEEDA commissioned this study and broadly supports the approach adopted. Views expressed in this report are those of the authors and not necessarily SEEDA's.

Executive Summary

Introduction

South East England Development Agency (SEEDA) has commissioned this research in order to establish a set of key indicators, with a potential to be updated, from available data sources in order to measure the performance and understand the underlying structures of knowledge-based economies. The report also sets out to define and understand the term *knowledge-based* and its dynamics and implications for regional and local economic development.

The knowledge base of an economy was defined as: 'the capacity and capability to create and innovate new ideas, thoughts, processes and products, and to translate these into economic value and wealth'. In other words, knowledge is the ingredient that underlies the competitiveness of regions, nations, sectors or firms.

An analytical framework was developed to undertake the measurement of the South East's knowledge economy in comparison to the world's leading knowledge-based regional economies. The framework is based upon identifying the key factors driving regional knowledge-based development. A total of 19 variables were used to benchmark the top 40 regions across the globe. The framework generated three core factors for analysis: (1) *knowledge economy inputs;* (2) *knowledge economy outputs;* and (3) *knowledge economy sustainability*.

Knowledge Economy Inputs

The South East shows a strong performance in many of the areas representing *knowledge economy inputs*. It is ranked 17th in terms of economic activity and enjoys the 6th position in density of managers with a score 19.3% higher than the average of top 40 regions. The region has a solid employment base in key knowledge-based sectors. The region's employment in IT and High-Technology manufacturing is 33.6% higher than the average, being ranked 8th. In the biotechnology and chemical sectors, it exceeds the average by even higher 42.6%, occupying the 6th position.

The instrumentation and electrical machinery sectors is another area in which the South East performs well, with a score 26.4% above the average and a ranking of 10th. The region shows strength in high-tech services as well, 36.0% above the high-performing mean and ranked 8th. Furthermore, Government expenditure on R&D in the South East is 42.4% above the average of top 40 with a ranking of 9th although Business expenditure on R&D is somewhat weak with only 80.6% of the high performing average.

Knowledge Economy Outputs

The South East appears to be unable to fully convert its *knowledge economy inputs* into *knowledge economy outputs*. The region's patent registration lags behind with only 49.3% of the top 40 average and a ranking of 27th. It is situated in the middle of its UK counterparts, Eastern (54.7%) at 24th and London (23.1%) at 35th. The South East also shows a poor performance in per capita GDP with a score of 77.0% of the top 40 average and a ranking in 34th place. This is reflected in its below par showing in labour productivity (77.4% of the average and a ranking of 35th) and earnings (87.4% of the average and a ranking of 29th). The exception to its weak performance in this area is unemployment rate. The region is ranked 11th among the top 40 regions with a score of 101.9% of the average.

Knowledge Economy Sustainability

The region's investment in *knowledge economy sustainability* is also weak and significantly lower than the average of top 40 regions. The South East, along with Eastern and London, is ranked 25th with only 78.3% of the top 40 average for primary and secondary expenditure per capita. For Higher Education expenditure per capita the South East ranks slightly above Eastern and London but is still placed in 34th position with a score of 55.3% of the average.

Intra-Regional Disparities

There are significant disparities among the sub-regions of South East England. The knowledge powerhouses are clearly situated within the western and northern parts of the region, with Thames Valley, Surrey and Buckinghamshire all with Knowledge Economy scores of over 120. Along with the Isle of Wight, the worst performing sub-regions in terms of their Knowledge Economy score are East Sussex, Brighton and Hove and Kent.

Concluding Remarks

The above findings about the South East economy, i.e. its inability to transform strong *knowledge economy inputs* into *knowledge economy outputs* as well as its weak investment in *knowledge sustainability*, suggest that the workings of the South East's economy are currently less effective and efficient than they could be. This is best demonstrated by the relatively poor labour productivity achieved by the region. Although poor labour productivity is UK problem, it is accentuated when the South East is benchmarked with global comparator regions

The apparent lack of clusters has serious effects for the South East economy. Looking in more detail at the problems we can derive a number of more specific problems: (1) The lack of Knowledge Networks (Human), in particular the interface between industry and academia appears to be poorly developed; (2) The lack of Knowledge Networks (Infrastructural), such as the lack of access to broadband telecommunications networking; (3) The foreign ownership of firms means that innovation is often undertaken in the facilities in their home country; (4) The capital market structure – the decision making in the financial market is still largely orchestrated in London; (5) Many of the knowledge based firms in the South East are relatively large in employment size, and it is therefore unclear as to the extent which their employees are actually involved in value-added knowledge-based occupations.

1. Introduction

1.1 South East England Development Agency (SEEDA) has commissioned this research in order to establish a set of key indicators, with a potential to be updated, from available data sources in order to:

- Measure the performance and understand the underlying structures of knowledge-based economies.
- Define and understand the term knowledge-based and its dynamics and implications for regional and local economic development.
- Assess the implications for public intervention and determine the linkage between knowledge-based and more traditional business models.
- Provide a sub-regional analysis of South East England's knowledge-based economy.
- Generate comparative benchmarks with leading regional economies.

1.2 The sources of productivity and economic growth are increasingly based on the role that knowledge plays within and across economies. The concept of the knowledge-based economy has emerged from this increasing recognition of the requirement for the production, distribution and use of knowledge within modern economies. New Growth Theory, developed by the economist Paul Romer, proposes that knowledge has become the third factor of production, alongside labour and capital. Romer argues that knowledge is now in fact the basic form of capital and that economic growth is driven by its accumulation. Knowledge-driven economies are in which knowledge generation and exploitation are to the creation of wealth. The proposition of the evolution of economies into knowledge-bound entities results in learning and knowledge creation assuming paramount importance in the quest for prosperity.

1.3 The knowledge-based economy is not sector or industry-bound, although the intensity of knowledge creation and diffusion within sectors is undoubtedly highly variable and scattered. The importance of knowledge is increasing rapidly, with the OECD estimating that 50% of GDP in the major OECD economies is now knowledge-based, within output and employment expanding fastest in the most knowledge-intensive industries.

Defining the Knowledge-Based Economy

1.4 We need to be very clear at the outset as to what we are referring to when we use the term knowledge-based economy. At its most fundamental level, the knowledge-base of an economy can be defined as:

> ***'the capacity and capability to create and innovate new ideas, thoughts, processes and products, and to translate these into economic value and wealth.'***

1.5 In other words, knowledge is the ingredient that underlies the competitiveness of regions, nations, sectors or firms. The knowledge economy includes the skills of workers, the experience of firm managers and owners, as well as what the American economic geographer Edward Malecki terms the 'pulse of customers' needs and demands. However, the question can reasonably be asked: how can we 'see' the knowledge economy? The following are, perhaps, a number of examples of knowledge economy recognition:

- Where the processes of production and their products have become increasingly complex and sophisticated.
- Where increasingly advanced knowledge and skills are required in the production process.
- Where there is an increasing reliance on specialist and idiosyncratic skills.
- Where there is a more extensive use and transfer of information.

1.6 The capacity and capability to create and innovate is based on a highly complex web of variables involving:

- Education and human capital availability and quality,
- Knowledge communication networks, and
- Infrastructure for facilitating creation and innovation processes.

1.7 Knowledge is considered to be non-rivalrous, whereby utilisation by one nation, region or individual does not prevent its use by another actor. This leads us to the question, what is knowledge? An informative way of answering this question is to break the knowledge concept into a number of types, as follows:

- Know-what – referring to factual knowledge
- Know-why – referring to knowledge of the principles and laws of nature
- Know-how – referring to skills or capability required to undertake a task
- Know-who – referring to information on who knows what and who knows how to do what.

1.8 It is our aim in this report to explore the relative knowledge capacity and capability across the world's best performing regions. The series of benchmarks we establish identify the relative strengths and weaknesses of individual regional economies in terms of their knowledge capacity, capability and utilisation. Furthermore, the features of knowledge-based are far from remaining static but are evolving rapidly. Therefore, we aim to analyse some of the core factors that will underlie the future development of regional knowledge-based economies. The focus on a global study of regions is highly relevant, since there is an increasing appreciation that it is regions, rather than whole nations, that are competing in the new global economy. The globalisation and regionalisation of economies are developing in tandem.

1.9 The mode by which knowledge is produced has shifted for traditional linear processes of innovation to more complex incremental and iterative chain-link models based on the interactions between knowledge actors. The most prosaic example of this shift is the demise of large in-house assembly-line production to SME-based models of production. Within these SME supply-chains knowledge and information moves between firms in a non-linear manner, which is dependent on the development of the range of ever-changing products with which they are involved, i.e. a firm's position in the supply-chain will alter as requirements and demand shifts. The characteristics associated with these modes of knowledge production include: (1) a rapid rise in the number and types of sites where innovation occurs; (2) the stock of knowledge is an outcome of the intensity of interaction between knowledge actors; (3) the pattern and dynamics of these interactions are constantly shifting reflecting ever changing knowledge contexts; and (4) the density of interactions is increasingly rapidly, as is the number of knowledge actors. The links between knowledge creation and diffusion processes, through individuals, organisations and systems, is clearly required to as fully understood as possible, as knowledge becomes the key value creator in modern economies.

Measurement Issues

1.10 So far, a clear understanding of knowledge-based economic activity has been limited by the number, type and quality of existing indicators. These indicators fail to capture the new processes by which knowledge is created and diffused. Also, unlike other capital goods, knowledge has no limiting or fixed capacity. For instance, the generation of a new idea may have a massive impact or no impact at all. This mean that knowledge cannot be measured in simplistic quantitative terms, but must be evaluated as an overlapping mix of a wide array of variables, some of which are measurable, and some of which are currently not. Indeed, if knowledge is viewed in the same light as any other capital form this will limit the capacity for its understanding. Furthermore, the difficulties in establishing new indicators is a reflection of the uniqueness in character of the knowledge-based economy.

1.11 Some of the factors limiting the measurement of knowledge include factors such as:

- A lack of stable formulae for translating inputs into knowledge creation into outputs of knowledge.
- Difficulties in mapping the inputs of knowledge creation are there are no knowledge accounts.
- Lack of a systematic price system serving as a basis for aggregating essentially unique pieces of knowledge.
- New knowledge creation does not necessarily equate to an increase in the stock of knowledge.

This Report

1.12 The remainder of this report consists of the following:

Chapter 2- outlines the analytical framework developed for the study and the research design employed to operationalise this framework.

Chapter 3 – analyses the results of the global benchmarking of high-performing regions.

Chapter 4 – provides a sub-regional analysis of the knowledge economy of South East England based on the level of the 11 sub-regional economic partnership areas.

Chapter 5 – returns to the global analysis and assesses some of the high-performing regions that possess a degree of commonality with the

South East, and which could perform a core of useful comparator regions.

Chapter 6 – provides a review and further analysis of the findings in order to propose a set of policy recommendations.

Appendix 1 – short profiles of the benchmarked regions.

Appendix 2 – results of the factor analysis for the global benchmarking study.

Appendix 3 – results of the factor analysis for the sub-regional analysis.

Appendix 4 – a list of data sources.

2. Analytical Framework and Research Design

2.1 The objective of this chapter is to introduce the analytical framework that has been developed to undertake the measurement of the South East's knowledge economy in comparison to the world's leading knowledge-based regional economies.

2.2 This chapter consists of the following three sections:

- Section 1 – **Global Clusters of Knowledge**: introducing the core analytical concepts forming the basis of the analytical framework.
- Section 2 – **The Analytical Approach and Model**: outlining the analytical approach and model to be adopted.
- Section 3 – **Research Design**: accounting for the choice of regions studied and the variables measured, and reviewing the procedures of statistical analysis adopted.

Global Clusters of Knowledge

Competitiveness, Innovation and Knowledge

2.3 The prosperity of a nation is based upon the productivity gained from the utilisation of its labour force, capital and natural resources (Porter, 1990). The productivity of nations is a function of the interplay of three factors:

- The political, legal and macroeconomic context
- The quality of the microeconomic business environment
- The sophistication of the operations and strategies of its firms.

2.4 As illustrated by Figure 2.1, these three factors determine the capacity of a nation to produce internationally competitive firms and support rising prosperity.

2.5 The focus of the competitiveness challenge has clearly shifted towards the importance of innovation (Porter, 1999). Furthermore, from the 1990s onwards the competitiveness challenge facing advanced nations has been to adapt to the new environment of the global economy and to build a sound macro and micro-economic foundation. Many countries have moved forcefully towards reducing budget deficits, strengthening financial institutions and streamlining regulation. At the more micro-level, many firms have made great strides in

eliminating non-productive activities and resources (i.e. restructuring), renewing their market focus, and speeding up product and process improvement. There is no end in sight for these changes, and the competitiveness challenge is continually shifting. Michael Porter (1999) argues that 'in advanced nations, future prosperity will increasingly hinge on innovation - successfully developing and commercializing new technologies, new products and new processes.' In the global economy, within which firms have increasingly good access to cheap raw materials and low-wage manual labour around the world, the creation of high value-added rests on innovation, i.e. the ability to create and transform new ideas into commercially valued new products and processes.

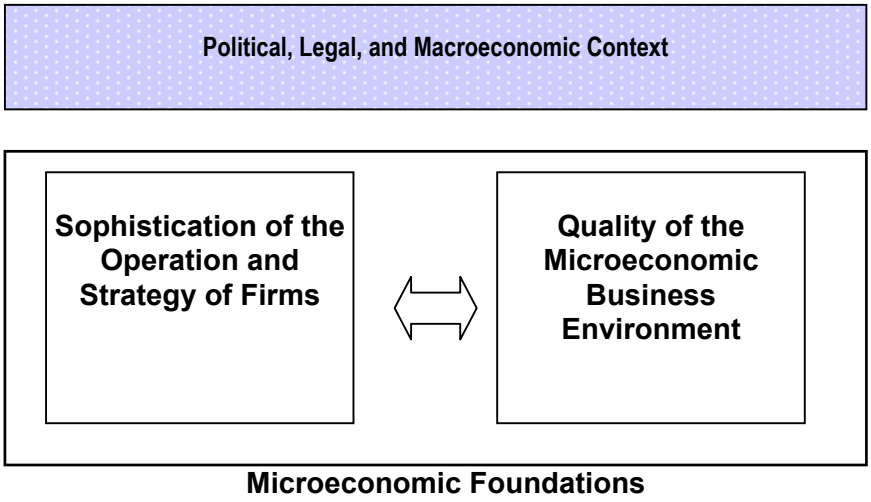


Figure 2.1: The Competitiveness Paradigm (Source: Porter,1990)

2.6 The OECD (1999) defines it as being 'directly based on the production, distribution and use of knowledge and information'. Knowledge refers to the cumulative stock of information and skills concerned with connecting new ideas with commercial values, developing new products and processes, and, therefore, 'doing business in a new way'. This may be called 'knowledge for innovation' or 'innovative knowledge'. While innovation is a process, knowledge consists of the process recipe and the ingredients to be processed. The knowledge-based economy can be defined as the sphere and nexus of activities and resources centred on and geared towards innovation. Therefore, as illustrated by Figure 2.2, the relationship between the concepts of knowledge, innovation and competitiveness are strongly associated and inter-linked.

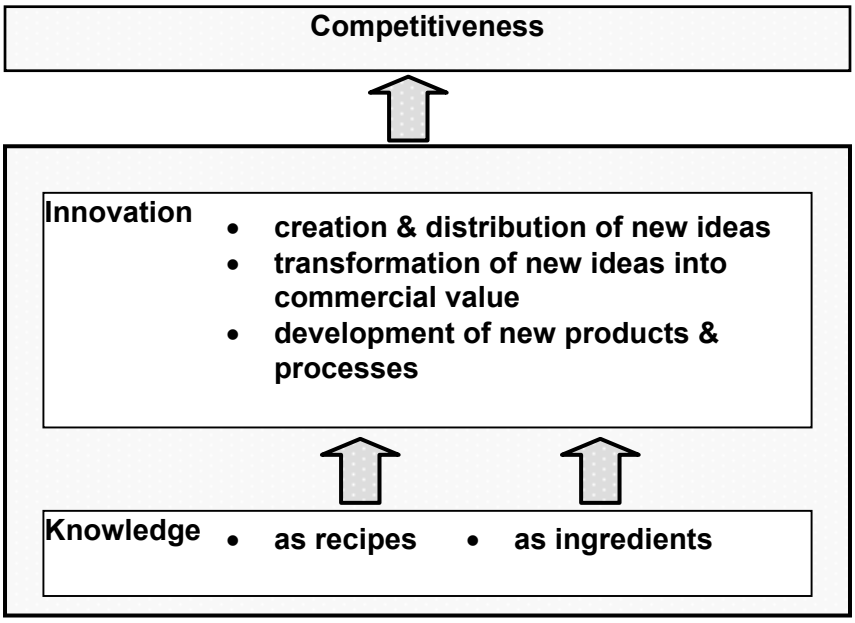


Figure 2.2 Relationships of competitiveness, innovation and knowledge

2.7 Such knowledge for innovation is not – as is sometimes presumed - necessarily confined within 'high technology' industries. Also, although scientific and technical knowledge created by scientists and technologists is a major source of innovation, it is only a part of the value creation process, and must be allied with the conversion of this knowledge into commercial value. Such conversion involves discerning and meeting the needs of customers. Porter (1999) argues that 'there are no "low tech" industries – only low technology companies that fail to incorporate new ideas and methods into their products and processes.' Hence, the utilisation of a dichotomy between high-technology industries and low-technology industries, based solely on the proportion of employees deemed to be R&D-based, is not a wholly appropriate analytical tool. Instead, we adopt another distinction: 'knowledge-based firms' and 'non knowledge-based firms'. While 'knowledge-based firms' actively pursue innovation, with a significantly high proportion of their employees involved in producing high value added, 'non knowledge-based firms' tend to lag behind in the knowledge creation, acquisition and transformation race.

Regional Clusters of Knowledge

2.8 In almost any nation, there is an unequal distribution of wealth among its regions. In the UK, this is manifested in the 'North-South Divide': while regions in the southern half of the country, and particularly London and South East England, are seen as the nation's

core economic drivers, northern regions have suffered higher unemployment rates and lower income levels (Robert Huggins Associates, 2000). Many studies relate these divides to the different industries located and functions performed in these regions, and differences in supporting environments. Such supporting environments consisting of, for example, universities and research establishments, service providers, and information and communication technologies (ICT) infrastructure. Therefore, it would appear logical to argue that the distribution of innovative knowledge, and the capacity of the knowledge economy, are also unequal among regions. Accordingly we need to base our analysis at the regional level.

2.9 The theoretical building block that gained currency in the 1990s in understanding the competitive performance of nations is the concept of 'clusters', which was developed by Michael Porter. The underlying tenet of this theory is that national competitiveness is determined by the strength of key concentrations of specific industries within the nation. Porter's (1998) definition of a cluster is that of a geographically proximate group of interconnected firms and associated institutions in a particular field, linked by commonalities and complementarities. These clusters possess a socio-economic business culture linking certain fundamental conditions that are the drivers of economic growth within nations. Porter (1990) groups these conditions into four distinct determinants of competitive advantage:

- **Factor conditions** – position in factors of production, such as the skilled workforce and infrastructural capacity, necessary to compete in a given industry.

- **Demand conditions** – nature of home-market demand.

- **Related and supporting industries** – the presence or absence of suppliers and other related industries that are internationally competitive.

- **Firm strategy, structure and rivalry** – the conditions governing how companies are created, organised, and managed, as well as the nature of domestic rivalry.

2.10 Clusters offer a vital means for upgrading and producing higher value-added by tapping into and distributing the potential of 'local strengths' as a whole, rather than as a series of fragmented firms. In particular, clusters can positively influence economic growth in three core ways: (1) by increasing the productivity of firms based in an area; (2) by driving the direction and pace of innovation, underpinning future productivity growth; and (3) by stimulating the formation of new businesses, expanding and strengthening the cluster itself. A cluster allows an individual actor (i.e. business) to benefit as if it had greater

scale or as if it had joined with others formally, without requiring it to sacrifice its flexibility.

2.11 Such clusters are more often than not regionally based and those currently emerging are apparently associated with knowledge-based industries and firms. Silicon Valley is by far the world's largest and best example of a functioning knowledge-based cluster, while San Francisco's 'Multimedia Gulch', for example personifies a new breed of smaller, yet fully integrated, clusters engaged in the service sector end of knowledge-based activities such as software and media applications. Evidence from the UK also identifies the importance of geographical concentrations of activities in the knowledge-based economy. A study undertaken by Baptista and Swann (1998) finds that the higher the level of the geographic concentration of production, the greater is the propensity towards catalysing innovative activity. Furthermore, strong clusters are far more likely to attract newly formed firms, resulting in strong clusters growing faster than non-clustered industrial locations

2.12 The manner in which knowledge is created, acquired and transformed helps understand why such clusters are regionally based, and are becoming more relevant to knowledge-based industries and firms. Furthermore, the new and global economy places paramount emphasis on knowledge as an input subject to increasing returns. At first glance it might be argued that advances in information and telecommunication technologies support the notion that knowledge is geographically ubiquitous, leading to the dissolution of regional clusters as an economic force. However, this proves to be a mistaken belief, particularly if utilising the conceptualisation of knowledge in terms of codified knowledge (explicit and readily transferable) and tacit knowledge (implicit and difficult to codify. Although the latter type is often deeply embedded within individuals, it is a vital component of a firm's competitive performance. Given the difficulty in transferring tacit knowledge, its movement across firm boundaries is highly reliant on the existence of trust-based interactions between individuals, as well as labour mobility between firms. Trust-based interactions are mobilised and facilitated, or hindered, by a region's socio-economic business culture. As for labour mobility, it tends to operate within local labour markets. Furthermore, labour markets for highly skilled workers are often anchored to universities and research institutes through spin-off and the employment of graduates, as well as knowledge exchange between industry and universities. These reinforce, rather than weaken, the clustering of knowledge-based economic activities at the regional level.

2.13 The formation and development, and in some cases decline, of clusters takes place in the complex local and global environment, which is summarised in Figure 2.3.

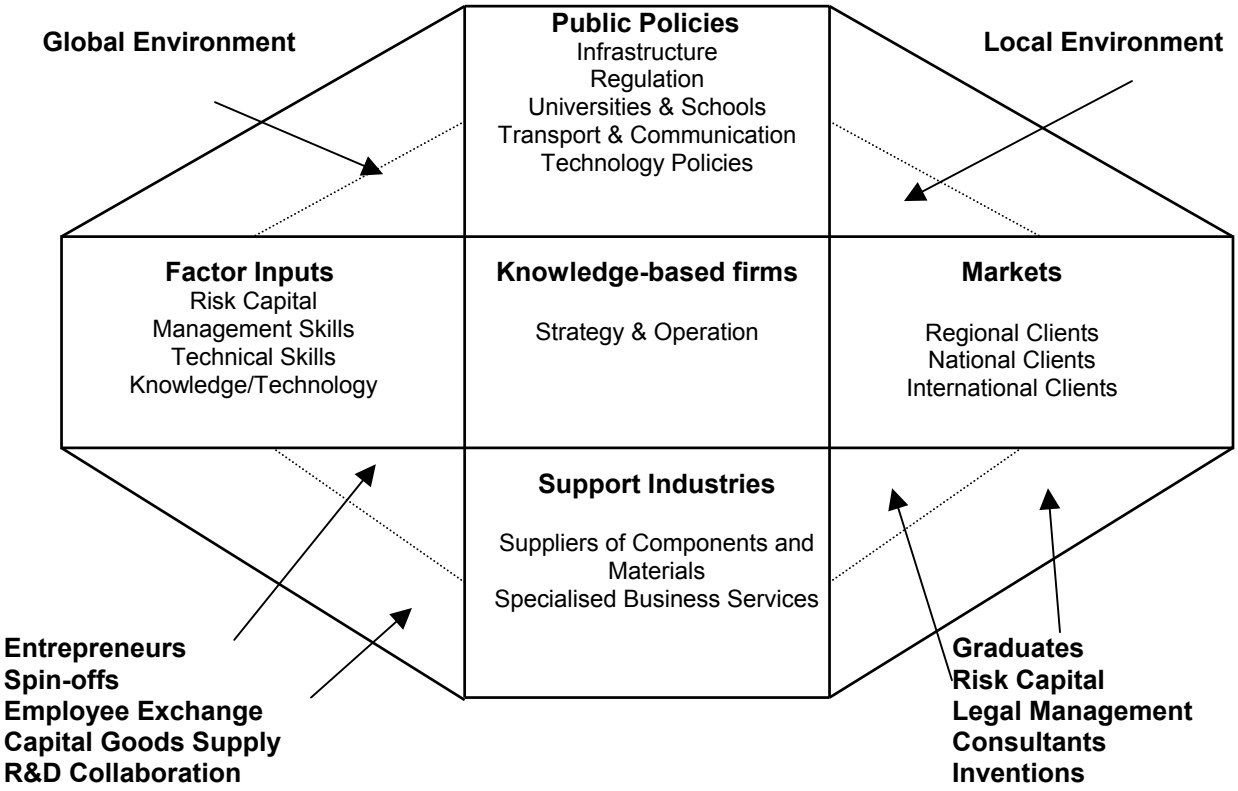


Figure 2.3 The Knowledge-based Firm and its Environment (Source: Developed from an earlier configuration by Todtling, 1994)

2.14 In general, the development of regional clusters is a long-term process dependent on an ever-changing balance in the relative importance of the underlying conditions. In particular, there is a shift away from cost factors, physical infrastructure and regulatory policies, towards the importance of non-physical knowledge-based infrastructure. This knowledge-based infrastructure is lubricated with a socio-economic business culture that provides feedback loops between actors in the cluster.

The Analytical Approach and Model

Approaches Taken in Previous Studies

2.15 In undertaking the present study, we reviewed a number of approaches adopted in major studies of the economic performance of nations and regions. Before we discuss our approach, we present the

strengths and weaknesses identified in those previous approaches. The previous approaches can be classified into a number of groups.

- *Approach that looks into a single aspect of an economy and produces a single index.*

2.16 When economists analyse the economic performance of nations and regions, the most typical approach they take is to account for a certain economic variable (called dependent variable), such as growth rates of gross domestic products or employment, by some other variables (called independent variable) expressed in monetary values. A well-known example of this is the studies undertaken by Abramovitz (1956) and Solow (1957) on the role of technology in wealth creation. In accounting for decades of the growth of gross domestic products in the United States, they find that capital and labour inputs alone produced an astonishing residual of approximately 85%. Both economists argue that most of the residual is a result of innovation, and particularly technological change. A theoretical issue with this approach is the choice of a dependent variable and independent variables to account for the degree of "knowledge-base". In the above case, the qualitative residual might be considered to represent the degree to which the economy is knowledge-based: the higher the residual, the more knowledge-based. However, the whole analysis hinges upon the assumption, which is never tested in the analysis. Another practical disadvantage of this approach is its hefty requirement for time series data for each region. If they are quarterly data, a decent result needs a ten-year set (i.e. forty inputs for each variable).

2.17 Similarly, some studies set a variable as a proxy of the degree to which economies are knowledge-based and attempt to account for it by other variables or to explore relationships between the variable and another. An example of the former is Porter and Stern's study of innovation index (1999) in which they set the number of patents registered as a proxy of the nation's "innovativeness" and attempt to account for it by other variables. The latter's example is Milken Institute's *America's High-Tech Economy* (1999) which presumes that high-tech activity is the most progressive stage of economic development to this date and looks into relationships between the concentration of high-tech activity and a region's economic growth. Again, the merit of these studies hinges upon the *a priori* choice of a variable as a proxy of the degree of "knowledge base".

2.18 On the whole, this approach has an advantage in operational ease of benchmarking by having a variable set beforehand as representing the degree of "knowledge base". At the same time, the choice of the variable leaves much room for subjectivity as to the relationship between the variable and the degree of "knowledge base".

- *Approach that looks into more than one aspects of an economy.*

2.19 Unlike the above approach, this looks into more than one aspects of an economy in understanding and defining the degree of "knowledge base". By doing so, the approach avoids the simplistic assumption that a single aspect of an economy represents the degree of "knowledge base". This approach is further classified into the following two sub-groups in their treatment of a composite index.

- *Approach that gives an index to each of those aspects but does not produce a single composite index*

2.20 Massachusetts Technology Collaborative's *Index of the Massachusetts Innovation Economy* (1998) and OECD *Science, Technology and Industry Scoreboard: Benchmarking Knowledge-based Economies* (1999) are examples of this. This approach provides a range of angles to look into the knowledge-based economy but does not offer a single index to benchmark nations and regions.

- *Approach that looks into more than one aspects of an economy and produces a single composite index*

2.21 While looking into more than one aspects of an economy in understanding the knowledge-based economy, this approach at the same time produces a single composite index for benchmarking. Studies taking this approach vary in the way in which they aggregate sub-indices derived from different aspects of an economy into a single composite index. For example, Milken Institute's *New Economy Index* measures the US states in a dozen of aspects and produces a single composite index by taking a mean of the scores for those original indices. Another example is *the Index of Regional Competitiveness* (2000) developed by Robert Huggins to measure the competitiveness of UK regions. Huggins employs six sub-indices and classifies them into three groups. In aggregation, each of the three groups receives the same weight, which is in turn distributed evenly to the sub-indices in the group. Because the number of sub-indices included varies between the three groups, the weight for a sub-index varies between them (i.e. 0.111 for business density, 0.111 for knowledge-based business, 0.111 for economic participation, 0.333 for productivity, 0.166 for earnings, and 0.166 for unemployment). Similarly, Atkinson and Gottlieb's *The Metropolitan New Economy Index* (2001) uses a set of weights that vary but are arbitrarily set.

2.22 These examples indicate some subjectivity or arbitrariness in arriving at weightings used in the aggregation. Some studies attempt to avoid this by employing more complex methods for the calculation of weights. An example is World Economic Forum's *The Global Competitiveness Report*. The Report employs both quantitative and qualitative figures and classifies them to eight groups. For each group, the Report calculates an average of quantitative sub-indices and an

average of qualitative sub-indices. Then it takes a weighted average of the quantitative index and the qualitative index with weights 3/4 and 1/4 respectively, to obtain an overall index for the factor. Finally, the Report takes a weighted average of the eight indices obtained from the eight groups. Here it assigns the following weights to the indices obtained from the eight groups: openness, 1/6; government, 1/6; finance, 1/6; infrastructure, 1/9; technology, 1/9; management, 1/18; labour, 1/6; and institutions, 1/18. The Report chooses the weights by undertaking regression analysis so that the composite index is highly correlated with per capita economic growth. Yet, by doing this, the Report ends up in the same situation as the first approach reviewed earlier (i.e. approach that looks into a single aspect of an economy): it ties the object under examination to a single aspect of an economy. This fails to identify other driving factors of an economy that are not closely associated with the aspect chosen.

2.23 The aggregation, a necessary step in this approach, also involves double counting of the same factors as well as subjectivity. For example, when a set of indices are derived by looking into more than one aspects of an economy, the indices are most likely to reflect some common factors driving an economy. The studies mentioned above fail to distinguish those common factors from the rest. Those common factors are counted in more than one indices, leading to their double counting in the composite index. Of those common factors, some are reflected in more indices, while others are reflected in less indices. When those indices are aggregated into a single composite index, the former group of factors are relatively over-represented. World Economic Forum's *The Global Competitiveness Report* attempts to avert the double counting problem to some extent. As noted above, it employs a predetermined set of groups, which it calls "factors of competitiveness", and chooses variables representing each of the groups. Nonetheless, the *a priori* selection and assignment of indices to "factors" does not eradicate the possibility that the "factors" are dependent on and overlap one another as indices in different "factors" could share what governs their variations (i.e. real factors underlying the behaviour of an economy). This would lead to double counting in a single composite indicator.

2.24 Another problem with the aggregation of indices is treatment of "specialist" regions against "all round" regions when a single set of weights (including the case of giving an equal weight to all indices) is applied in the aggregation process. Application of a single set of weightings necessarily means a particular viewpoint that "favours" some regions against others. For example, if an equal weight is given to indices in the aggregation process, it favours those "all round" regions that have modest scores for all indices. Yet, if multiple sets of weightings are used to avoid the problem with fixed weighting, an objective method has to be employed.

2.25 From the above review, the following objective is set:

- To identify key factors driving the knowledge-based regional economy. Those factors are independent from (i.e. uncorrelated with) one another, thus avoiding the above problem of double counting.

2.26 To achieve the above objectives, we have adopted the following methodology:

- We set a model of the knowledge-based regional economy that, with a good theoretical basis, represents its workings and dynamics.

- This normative model is then applied to over fifty best performing regions in the world. Through comparisons of these regions, we identify some underlying factors that account for a common part of their variations. Those factors are independent from (i.e. uncorrelated with) one another. In other words, this clarifies those dimensions by which those best performing regions develop. Given the use of the model of knowledge production and utilisation and its application to the world's best performing regions that have presumably entered the stage of knowledge-based development, it is fair to argue that the identified dimensions are those by which knowledge-based regional economies make progress.

Model

2.27 The model we employ to analyse the knowledge-based regional economies, as illustrated by Figure 2.4, is a multi-linked, cycle model representing knowledge creation and utilisation as well as capacity building. The model reflects the latest thinking of the innovation process that sees it as a process in which agents in different domains (e.g. universities, research laboratories, other functions of private firms, governments) interact with one another through feedback loops (e.g. Klein and Rosenberg, 1986). We extend this thinking to the regional level and add a component that reproduces and sustains the whole system's innovative capacity.

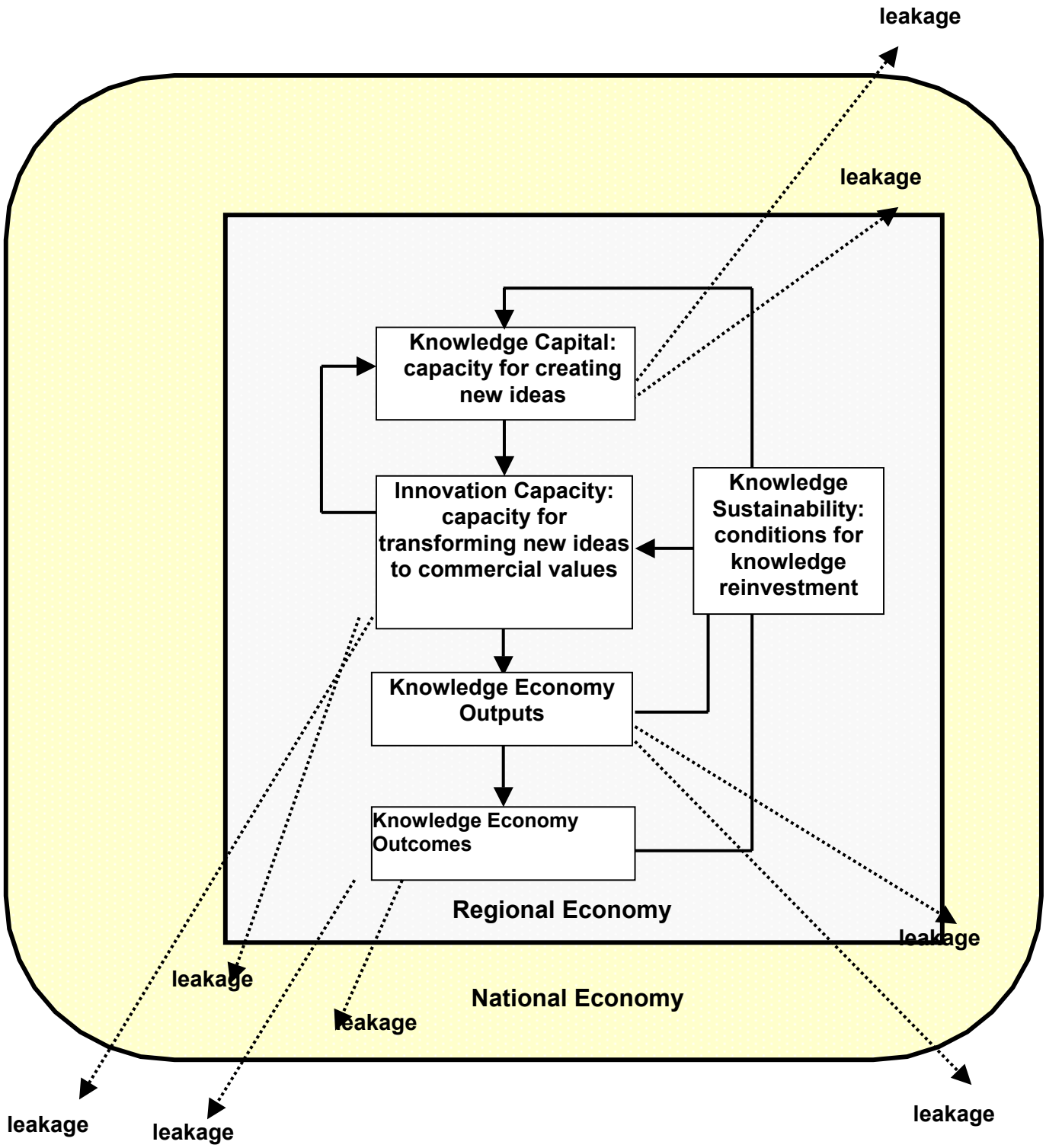


Figure 2.4 Model of the Regional Knowledge Economy

2.28 At the heart of the model's extension to the regional level is our understanding that regional clusters of various agents, embodying networks among them, constitute a key to innovative activity.

2.29 The model is made of six components, each of which includes representative variables.

2.30 *Knowledge Capital* consists of the raw material of the knowledge economy, referring to the region's capacity for creating new ideas. Ideas in this realm are not necessarily created with consideration to commercial applications, with the sources of such new ideas ranging from universities and research establishments to firms, individuals and other organisations.

2.31 The second component, *Innovation Capacity*, refers to the region's capacity for transforming such new ideas and creating commercial value. This transformation is most often undertaken by managerial, professional, and technical personnel within firms.

2.32 The combination of knowledge capital and innovation capacity results in knowledge-based goods and services that contain high value added. The outputs, called *Knowledge Economy Outputs*, are often measured by the number of patents and innovations.

2.33 This is likely to be reflected by the wealth the region creates, *Knowledge Economy Outcomes* (e.g. as measured by indicators such as GDP per capita). The distinction between *Knowledge Economy Outputs* and *Knowledge Economy Outcomes* lies in our assumption that innovative knowledge outputs embodied in goods and services are not always translated evenly into the wealth the region's inhabitants will enjoy.

2.34 The cycle is completed by the requirement for *Knowledge Sustainability*. Unless part of the wealth created is re-invested in knowledge capital and innovation capacity to support their reproduction and further development, the medium to long-term prosperity of the regional economy will be undermined.

2.35 It must also be recognised that regional knowledge systems are usually set within a *National Environment* over which the region has little control. This includes large-scale infrastructure projects (e.g. information and communication technologies infrastructure) and legal frameworks (e.g. intellectual property rights) decided at the national level. As the regional system is not closed, there is always some leakage from each component of the system to other regions, domestic or overseas.

2.36 Each component in the model is represented by some variables. The following are examples of the most generally utilised and standard variables representing each component of the above system:

- ***Knowledge Capital***
  - Working population
  - Personnel employed in managerial, professional and technical occupations
  - Personnel employed in R&D
  - Personnel employed in Higher Education (HE) establishments
  - Employment in knowledge-based sectors

- ***Innovation Capacity***
  - New business registration rates
  - Number of HQs
  - Number of businesses in knowledge-based sectors
  - R&D expenditures in Government
  - R&D expenditures in Business
  - R&D expenditures in HE establishments
  - Amount of venture capital

- ***Knowledge Economy Outputs***
  - Number of patents registered
  - GDP
  - Labour productivity per person employed
  - Value of exports

- ***Knowledge Economy Outcomes***
  - Weekly (monthly or annual) earnings
  - Unemployment rates
  - Household incomes

- ***Knowledge Sustainability***
  - Money spent in secondary and tertiary education
  - Participation in HE
  - Participation in HE in engineering & science (including medical) departments

- ***National Environment***
  - Telecommunication links
  - Internet hosts.

2.37 By using the above model, the study seeks to explore those underlying factors that drive the knowledge-based regional economy. In other words, observable variables in the model are viewed as reflective of the common drivers of regional economies. Such

identification of the drivers facilitates an understanding of the knowledge-based regional economy in the following three senses.

2.38 First, it helps to understand the dynamics of the knowledge-based economies. The identification of drivers reveals key dimensions with which knowledge-based regional economies are observed. This would be particularly useful when such a dimension would indicate how knowledge-based regional economies progress over time. While part of the model has more relevance to the previous to current performance, others represent the potential for producing prosperity in the future. Although the current performance of the innovative capacity can be represented by indices such as the number of patents registered per capita (Porter, 1999), the study could suggest directions the regional knowledge economy would take.

2.39 Second, the study demonstrates how policy objectives and/or policy variables are related with the dynamics of knowledge-based regional economies. A good understanding of the relationships facilitates appropriate capacity building towards the development of the knowledge-based economy.

2.40 Finally, the identification of key dimensions allows mapping of different types of regional economies. This achieves the main purpose of this study: benchmarking of the South East of England against best-performing regional economies around the globe.

Research Design

Choice of Regions

2.41 We initially included the following 56 high-performing regions in our analysis with a view to identifying the common drivers of knowledge-based economic development.

European regions (35)

- Brussels, Belgium
- Vlaams Gewest, Belgium
- Denmark
- Baden-Württemberg, Germany
- Bayern, Germany
- Berlin, Germany
- Bremen, Germany
- Hamburg, Germany
- Hessen, Germany
- Niedersachsen, Germany
- Nordrhein-Westfalen, Germany
- Saarland, Germany

- Schleswig-Holstein, Germany
- Comunidad de Madrid, Spain
- Île de France, France
- Ireland
- Nord Ovest, Italy
- Lombardia, Italy
- Nord Est, Italy
- Emilia-Romagna, Italy
- Centro, Italy
- Lazio, Italy
- Luxembourg
- Noord-Nederland, Netherlands
- West-Nederland, Netherlands
- Zuid-Nederland, Netherlands
- Ostösterreich, Austria
- Westösterreich, Austria
- Uusimaa, Finland
- Stockholm, Sweden
- Eastern, UK
- London, UK
- South East, UK
- Switzerland
- Norway

2.42 These regions are based on European Union's definition of regional units, NUTS-1. Because of the definition, some nations are included as regions (i.e. Denmark, Ireland, Luxembourg). Further, regions in Finland and Sweden are based on NUTS-2, a lower level of units. Of all regions in EU member countries, the study selected those regions with an average per capita GDP higher than the EU average in 1995-98. In addition, two non-EU member countries, Switzerland and Norway are included in the analysis. As with Denmark, Ireland and Luxembourg, these two small nations are treated as regions.

US regions (12)

- New York NY-NJ-CT-PA CMSA
- Los Angeles CA CMSA
- Chicago IL-IN-WI CMSA
- Washington, DC-MD-VA-WV CMSA
- San Francisco CA CMSA
- Philadelphia PA-NJ-DE-MD CMSA
- Boston MA-NH-ME-CT CMSA
- Atlanta GA MSA
- Seattle WA CMSA
- Austin TX MSA
- Raleigh-Durham NC MSA

- Hartford CT MSA

2.43 These 12 US regions are based on the units called consolidated metropolitan statistical areas (CMSAs) and metropolitan statistical areas (MSAs). MSAs, defined by the US Census Bureau, consist of a set of counties and represent a single labour market with a one- to two-hour commute from edge to edge. CMSAs, consisting of a set of Primary Metropolitan Statistical Areas (PMSAs), includes the county hinterlands of two or more large central cities that are adjacent to each other. Also as the suffix attached to each region suggests, some CMSAs extend over more than one state. Compared with counties, cities and states, both MSAs and CMSAs analysed in this study are better units for economic analysis as they well reflect the boundaries of clusters of firms in related industries.

Rest of the World (9)

- Tokyo, Japan
- Kanagawa, Japan
- Osaka, Japan
- Kyoto, Japan
- Ontario, Canada
- British Columbia, Canada
- New South Wales, Australia
- Singapore
- Hong Kong, China

2.44 For a similar region for some small countries in Europe, Singapore is included in the analysis as a region state.

Choice of Variables

2.45 Because of data availability and compatibility between regions in Europe, the US and the rest of the World, the following variables are selected for the global analysis:

- ***Knowledge Capital***
  - Economic Activity Rate
  - Employment per 1,000 inhabitants
  - Number of Managers per 1,000 inhabitants
  - Employment in IT and Computer Manufacturing per 1,000 inhabitants
  - Employment in Biotechnology and Chemicals per 1,000 inhabitants
  - Employment in Automotive and Mechanical Engineering per 1,000 inhabitants
  - Employment in Instrumentation and Electrical Machinery per 1,000 inhabitants

- Employment in High-Tech Services per 1,000 inhabitants

- ***Innovation Capacity***
  - Per Capita Expenditures on R&D performed by Government
  - Per Capita Expenditures on R&D performed by Business

- ***Knowledge Economy Outputs***
  - Number of Patents Registered per one million inhabitants
  - Per capita GDP
  - Labour productivity

- ***Knowledge Economy Outcomes***
  - Mean Gross Monthly Earnings
  - Unemployment Rates

- ***Knowledge Sustainability***
  - Per Capita Public Expenditures on Primary and Secondary Education
  - Per Capita Public Expenditures on Higher Education

- ***National Environment***
  - Secure Servers per one million inhabitants
  - Internet Hosts per 1,000 inhabitants

2.46 For the sub-regional analysis within the South East region, the following variables were adopted:

- ***Knowledge Capital***
  - Economic Activity Rate
  - Proportion of the Workforce Employed in Higher Education and R&D establishments
  - Proportion of Managerial, Professional and Technically Occupied Workers within the Employed Workforce

- ***Innovation Capacity***
  - Per Capita Number of Businesses
  - Proportion of Businesses Operating in Knowledge-Based Defined Sectors

- ***Knowledge Economy Outputs***
  - Per capita GDP
  - Labour productivity

- ***Knowledge Economy Outcomes***
  - Earnings

- Unemployment Rates

- ***Knowledge Sustainability***
  - Percentage of Pupils in Last Year of Compulsory Schooling with 5 or more A-Cs at GCSEs
  - Average A/AS Level Points Score

Analytical Techniques Adopted

2.47 All data are first converted so that the mean and variance of each variable are set at zero and one respectively. After the standardisation, a multivariate data reduction technique called factor analysis is applied to the data set. Factor analysis is used to simplify complex and diverse relationships that exist among a set of observed variables by uncovering common dimensions or factors that link together the seemingly unrelated variables, and consequently provide insight into the underlying structure of the data. In general, those dimensions are uncorrelated with one another. To extract the common part of variations among the original variables (i.e. commonalities), an extraction method called image factoring is employed. The dimensions obtained initially are then rotated. This aims to facilitate a better understanding of the dimensions. A rotation method called varimax is used with Kaiser normalisation. While identifying common dimensions of the underlying structure, factor analysis also shows the location of each case (i.e. region in this study) within the underlying structure by providing the case's scores for the dimensions identified. We use those scores for the dimensions as sub-composite indices.

2.48 In a sub-regional analysis of the South East of England, a quantitative analytical technique called Data Envelopment Analysis (DEA) is used to obtain a single composite index from the above sub-composite indices. DEA is a linear programming technique originally developed for the estimation of the relative efficiency of a set of units (called decision making units, DMUs) producing a set of outputs from common inputs. It neither assigns weights to variables with any dependent variable chosen *a priori* to account for, nor assigns weights set *a priori*. Instead, it seeks for a set of weights for each unit that maximises a weighted sum of variables with the constraints that no units have the weighted sum larger than one. As a result, each unit receives a score between 0 and 1. This process is repeated for all units in the data set, giving each unit a score unique to each iteration. Finally a geometric mean of all the scores is taken for each unit, providing a DEA score.

2.49 After we obtained a single composite index, we set a cut-off point at top 40 regions in its score. Sixteen regions that did not make the cut

are removed from the analysis from the next chapter. Those sixteen regions are as follows:

- Vlaams Gewest, Belgium
- Bremen, Germany
- Niedersachsen, Germany
- Nordrhein-Westfalen, Germany
- Saarland, Germany
- Schleswig-Holstein, Germany
- Comunidad de Madrid, Spain
- Ireland
- Nord Ovest, Italy
- Lombardia, Italy
- Nord Est, Italy
- Emilia-Romagna, Italy
- Centro, Italy
- Lazio, Italy
- Noord-Nederland, Netherlands
- Westösterreich, Austria

2.50 In the following analysis throughout this report, all scores are converted into the figures whose average is 100 to facilitate an intuitive understanding of the regions' positions in our league table.

2.51 The population of the top 40 benchmarked regions is shown by Table 2.1.

Table 2.1: Population of Top 40 Knowledge-based Benchmarked Regions

Region	Population
New York, US	21,199,865
Los Angeles, US	16,373,645
Bayern, Germany	12,086,500
Tokyo, Japan	12,059,237
Ontario, Canada	11,669,300
Ile de France, France	11,088,200
Baden-Wurttemberg, Germany	10,426,000
Chicago, US	9,157,540
Osaka, Japan	8,804,806
Kanagawa, Japan	8,489,932
South East, UK	**8,061,000**
Washington, US	7,608,070
West-Nederland, Netherlands	7,351,200
London, UK	7,274,900
Switzerland	7,262,372
Hong Kong, China	7,116,302
San Francisco, US	7,039,362
New South Wales, Australia	6,463,500
Philadelphia, US	6,188,463
Hessen, Germany	6,035,100
Boston, US	5,819,100
Eastern, UK	5,408,400
Denmark	5,313,600
Norway	4,481,162
Singapore	4,151,264
Atlanta, US	4,112,198
British Columbia, Canada	4,063,800
Seattle, US	3,554,760
Zuid-Nederland, Netherlands	3,477,000
Ostosterreich, Austria	3,413,500
Berlin, Germany	3,398,800
Kyoto, Japan	2,644,331
Stockholm, Sweden	1,783,400
Hamburg, Germany	1,700,100
Uusimaa, Finland	1,362,600
Austin, US	1,249,763
Raleigh-Durham, US	1,187,941
Hartford, US	1,183,110
Brussels, Belgium	954,500
Luxembourg	429,200

3. Global Analysis of High-Performing Regions

3.1 This chapter of the report displays and analyses the findings from the global benchmarking study of high-performing regions. Tables 3.1-3.13 highlight the indices of the 19 variables analysed, benchmarking the South East region within the top 40 knowledge-based regions around the world. The 19 variables are grouped under three main themes: Knowledge Economy inputs, Knowledge Economy outputs, and Knowledge Economy sustainability. Tables 3.14-3.16 are further indicators of the drivers and outputs of knowledge-based development, derived from the factor analysis. Each indicator is an important representation of how the South East region is performing when compared to its high-performing counterparts. The results should be viewed as a vital component of future knowledge development strategies for the region.

Knowledge Economy Inputs

3.2 Representing *Knowledge Capital* and *Innovation Capacity* in our model (Chapter 2), the following ten variables measure the availability of inputs for the production of knowledge within each regional economy.

Economic Activity and Knowledge Workers

- Economy Activity Rate
- Employment per 1,000 inhabitants
- Number of Managers per 1,000 inhabitants

Knowledge-Based Sectors and Employment

- Employment in IT and Computer Manufacturing per 1,000 inhabitants
- Employment in Biotechnology and Chemicals per 1,000 inhabitants
- Employment in Automotive and Mechanical Engineering per 1,000 inhabitants
- Employment in High-Tech Services per 1,000 inhabitants

R&D Expenditures

- Per Capita Expenditures on R&D performed by Government
- Per Capita Expenditures on R&D performed by Business

Economic Activity and Knowledge Workers

3.3 The level of economic participation within a region or nation is a fundamental indicator of its 'vibrancy' and knowledge capital capacity at the macro-level. With sufficient labour market engagement there is little opportunity for long-term and on-going knowledge investment. Indeed, high levels of economic participation are a prerequisite for a socially cohesive living and working environment, as well as an economy that is not over-dependent on its public welfare system. As the left-hand columns of Table 3.1 indicate economic activity rates vary considerably even among the globe's highest performing regions.

3.4 The highest levels of economic activity are amongst the regions of the United States, with highest ranking being Austin, with a participation rate 26.9% above the high-performing mean. The highest ranked European region is Finland's Uusimaa (108.0). The lowest ranked region is Hong Kong (74.9), followed by Brussels (80.1). This variation is necessarily based on opportunities to enter the labour market, the prevailing system of social security and welfare, age-related demographics, as well as a complex mix of social and cultural variables.

3.5 The South East is ranked 17th with an economic activity 2.6% above the high-performing mean, and is the 4th highest ranked European region. In general, this is a situation similar to comparisons of the UK as a whole against other leading nations. It highlights that although by European standards economic activity in the South East and the UK is relatively high, they do not compete with those of the US or the leading Nordic regions and nations.

3.6 The importance of the number of managers within firms in a region is that innovation – whether it is product, process or organisational - is usually stimulated and co-ordinated through those workers with management responsibilities. The pervasiveness of the global knowledge economy can, to some extent, be equated by the fact employment growth is largely occurring through the expansion of managerial and professional/technical occupations. These non-production employees are now more generally termed knowledge workers.

3.7 As shown by the right-hand columns of Table 3.1, the proportion of such knowledge workers is highest in the UK's Eastern region, covering the high-tech hub of Cambridge, with a score 28.3% above the average, followed by Raleigh-Durham (121.0) and Ontario (119.7). The lowest ranked region is Ostosterreich in Austria, followed by a cluster of German regions. The low ranking of the German regions reflects the continuance of organisational model of work that is still highly hierarchical, with many workers still classed as 'blue-collar'.

3.8 The South East is ranked 6th (119.3), alongside British Columbia and New South Wales. This is an indication of a significantly highly skilled workforce. However, an issue for both the South East and Eastern regions is that a highly qualified workforce demands a high quality-of-place and life, particularly since such workers have a higher than average propensity to relocate.

3.9 A further measure of the economic vibrancy underlying the potential for knowledge-based development are the levels of employment compared to population. Employment growth, which is strongly correlated with GDP, is fuelled by social and economic factors, including the rate of technological change.

3.10 As illustrated by Table 3.2 the highest levels of employment are again found in the United States, with Austin (123.0), Raleigh-Durham (114.9) and Atlanta (113.1) leading the way. The lowest ranked being the regions of Brussels (72.4), Luxembourg (84.7) and Berlin (86.8).

3.11 The South East is ranked 24th with 1.2% below the high-performing mean. Again, this reflects national trends and is an indication that neither the South East nor the UK is excelling in terms of a strong 'culture of work'. In particular, the shift from a dependency economy is not as marked as is often portrayed.

Table 3.1: Index of Economic Activity and Number of Managers (as a proportion of the population) by Region

Rank	Region	Economic Activity	Rank	Region	Number of Managers
1	Austin, US	126.9	1	Eastern, UK	128.3
2	Atlanta, US	116.5	2	Raleigh-Durham, US	121.0
3	Raleigh-Durham, US	114.8	3	Ontario, Canada	119.7
4	Stockholm, Sweden	113.8	4	Austin, US	119.6
5	Seattle, US	111.8	**5**	British Columbia, Canada	119.6
6	San Francisco, US	108.9	6	**South East, UK**	**119.3**
7	New South Wales, Australia	108.6	7	New South Wales, Australia	118.2
8	Chicago, US	108.6	8	Washington DC, US	118.0
9	Washington DC, US	108.4	9	Atlanta, US	115.9
10	Boston, US	108.0	10	Boston, US	114.2
11	Uusimaa, Finland	108.0	11	San Francisco, US	111.5
12	Ontario, Canada	105.1	12	Chicago, US	111.5
13	Los Angeles, US	103.2	13	Hartford, US	110.6
14	Denmark	103.0	14	Singapore	109.0
15	Philadelphia, US	102.8	15	Île de France, France	108.6
16	Hartford, US	102.8	16	Philadelphia, US	107.8
17	**South East, UK**	**102.6**	17	Tokyo, Japan	104.2
18	British Columbia, Canada	101.5	18	Los Angeles, US	101.1
19	Tokyo, Japan	101	19	New York, US	100.4
20	Eastern, UK	100.5	20	Seattle, US	100.3
21	London, UK	100.3	21	Kanagawa, Japan	99.4
22	Kanagawa, Japan	99.9	22	Osaka, Japan	95.3
23	New York, US	99.0	23	Kyoto, Japan	93.3
24	West-Nederland, Netherlands	98.3	24	Zuid-Nederland, Netherlands	91.2
25	Zuid-Nederland, Netherlands	98.0	25	West-Nederland, Netherlands	91.1
26	Osaka, Japan	97.5	26	Norway	85.2
27	Île de France, France	96.9	27	London, UK	82.8
28	Kyoto, Japan	96.2	28	Stockholm, Sweden	82.5
29	Bayern, Germany	95.1	29	Hong Kong, China	71.3
30	Norway	94.3	30	Switzerland	70.4
31	Berlin, Germany	93.4	31	Uusimaa, Finland	69.9
32	Baden-Württemberg, Germany	93.3	32	Denmark	61.0
33	Ostösterreich, Austria	92.8	33	Luxembourg	58.0
34	Hamburg, Germany	91.8	34	Brussels, Belgium	57.9
35	Hessen, Germany	90.8	35	Baden-Württemberg, Germany	52.9
36	Switzerland	85.1	36	Bayern, Germany	46.4
37	Singapore	83.7	37	Hessen, Germany	42.8
38	Luxembourg	82.0	38	Hamburg, Germany	39.5
39	Brussels, Belgium	80.1	39	Berlin, Germany	34.4
40	Hong Kong, China	74.9	40	Ostösterreich, Austria	15.9
	Global High-Performing Mean	100		Global High-Performing Mean	100

Table 3.2: Index of Employment by Region (per 1000 inhabitants)

Rank	Region	Index of Employment
1	Austin, US	123.0
2	Raleigh-Durham, US	114.9
3	Atlanta, US	113.1
4	Seattle, US	109.4
5	Tokyo, Japan	109.2
6	San Francisco, US	108.8
7	Uusimaa, Finland	107.7
8	Switzerland	107.6
9	Kanagawa, Japan	105.6
10	Washington DC, US	105.0
11	Denmark	104.2
12	Chicago, US	103.3
13	Hartford, US	103.0
14	Singapore	102.9
15	Ontario, Canada	102.6
16	Boston, US	102.5
17	Norway	102.3
18	Kyoto, Japan	102.0
19	Osaka, Japan	101.3
20	Zuid-Nederland, Netherlands	100.1
21	West-Nederland, Netherlands	99.9
22	Eastern, UK	99.6
23	Philadelphia, US	99.3
24	**South East, UK**	**98.8**
25	British Columbia, Canada	97.8
26	Bayern, Germany	97.8
27	Stockholm, Sweden	97.1
28	New York, US	96.7
29	Los Angeles, US	96.2
30	New South Wales, Australia	94.5
31	Baden-Württemberg, Germany	94.2
32	Hamburg, Germany	94.2
33	Ostösterreich, Austria	94.0
34	London, UK	93.6
35	Hong Kong, China	93.2
36	Hessen, Germany	90.7
37	Île de France, France	90.1
38	Berlin, Germany	86.8
39	Luxembourg	84.7
40	Brussels, Belgium	72.4
	Global High-Performing Mean	100.0

Knowledge-Based Sectors and Employment

3.12 The concept of knowledge-based and non-knowledge-based sectors is used to distinguish between industries with higher or lower levels of research and development activity. Knowledge-based sectors, therefore, clearly offer a high potential for innovation, and subsequently competitive advantage. Within the study we have created five broad groups of knowledge-based sectors, in order to undertake an analysis of employment. It is our hypothesis that some sectors have a higher propensity for developing a knowledge-driven economy. The five sectors consist of:

- IT and computer manufacturing – communication equipment, computer and office equipment, electronic components and accessories.

- Biotechnology and chemical sectors – pharmaceuticals, drugs, chemicals and chemical products.

- Automotive and high-tech mechanical engineering – motor vehicles and transport equipment, machine tools and equipment.

- Instrumentation and electrical machinery – precision and optical instruments, electrical transmission and distribution equipment lighting and wiring equipment.

- High-tech services – software and computer related services, telecommunications, research, development and testing services.

3.13 High-technology sectors, in particular IT and computer manufacturing, form an increasingly important component of international trade, and are generally more internationalised than traditional sectors. Throughout the world three regions dominate the field for IT and computer manufacturing - left-hand columns of Table 3.3 - as measured by employment density. The highest ranked is Austin (567.1), with more than five-fold the high-performing mean, which is the home of Dell Computers and the chip manufacturer Sematech. Second is San Francisco (372.3), which includes the famous Silicon Valley cluster of IT and computer firms such as Apple, Sun Microsystems, Intel, Hewlett-Packard and National Semiconductor. Third is the Kanagawa (228.4) region of Japan, the headquarters of companies such as NEC, Fujitsu and Toshiba. The lowest ranked regions are Luxembourg (15.0), Tokyo (15.1) and Washington DC (17.2).

3.14 The South East is ranked 8th with a score of 133.6, making it the third highest ranked European region. This highlights the significant strength of the region in these sectors, and its importance as a global player. Furthermore, the fact that London is 31st, with a score only 40.2, strengthens the identity of the South East as a region distinct from its important neighbour.

3.15 The right-hand columns of Table 3.3 indicate employment density in the biotechnology and chemical sectors, with the highest ranked being the German region of Hessen (305.4), followed by Philadelphia (230.0) and Raleigh-Durham (193.6). The lowest ranked are Seattle (16.2), Luxembourg (29.2) and Washington DC (35.8).

3.16 As with the IT and computer manufacturing sectors, the South East performs well, being ranked 6th with a score 42.6% above the high-performing mean. This suggests that the region possesses a fairly well diverse knowledge economy, which some commentators suggest is an important factor for economic sustainability.

3.17 Table 3.4 is a measure of employment density in more 'traditional' knowledge-based sectors. The left-hand columns indicate employment density in the automotive and high-tech mechanical engineering sectors, with the highest ranked region being Germany's Baden-Wurttemburg (295.8), the traditional European powerhouse of engineering and car manufacturing, in particular BMW, followed by Philadelphia (267.4). The lowest ranked region is Brussels (15.8).

3.18 The South East has an employment density for automotive and high-tech mechanical engineering below the high-performing mean at 91.8 and is ranked 19th of the 40 benchmark regions. The score is actually relatively healthy given that much of the UK's automotive activity is undertaken in the adjacent regions of the West Midlands and South West. It is buoyed by the existence of the motor sport cluster based around Oxfordshire.

3.19 The right-hand columns of Table 3.4 indicate employment density in the instrumentation and electrical machinery sectors, with the leading region's being Germany's Bayern (250.9) and Baden-Wurttemburg (236.1). The South East also has a significant concentration of activity in this sector, with a score 26.4% above the high-performing mean and a ranking of 10th, again highlighting the relative diversity of the economy.

Table 3.3: Index of Regional Employment in the IT/Computer Manufacturing and Biotechnology/Chemical Sectors (Employees per 1,000 inhabitants

Rank	Region	IT and Computer Manufacturing	Rank	Region	Biotechnology and Chemicals
1	Austin, US	567.1	1	Hessen, Germany	305.4
2	San Francisco, US	372.3	2	Philadelphia, US	230.0
3	Kanagawa, Japan	228.4	3	Raleigh-Durham, US	193.6
4	Zuid-Nederland, Netherlands	200.1	4	Zuid-Nederland, Netherlands	164.3
5	Boston, US	175.8	5	Hamburg, Germany	142.6
6	Stockholm, Sweden	152.5	**6**	**South East, UK**	**142.6**
7	Uusimaa, Finland	142.4	7	Switzerland	139.4
8	**South East, UK**	**133.6**	8	Osaka, Japan	135.6
9	Kyoto, Japan	122.9	9	Norway	132.5
10	Baden-Württemberg, Germany	119.2	10	Stockholm, Sweden	124.5
11	Singapore	115.0	11	Bayern, Germany	119.8
12	Hong Kong, China	104.1	12	Baden-Württemberg, Germany	117.8
13	Hessen, Germany	98.0	13	Ostösterreich, Austria	112.5
14	Ostösterreich, Austria	95.8	14	Île de France, France	112.4
15	Raleigh-Durham, US	93.5	15	Denmark	110.9
16	Eastern, UK	90.9	16	New York, US	110.5
17	New South Wales, Australia	90.4	17	Uusimaa, Finland	110.3
18	Switzerland	81.0	18	Chicago, US	108.1
19	Osaka, Japan	80.0	19	New South Wales, Australia	98.7
20	Norway	77.0	20	West-Nederland, Netherlands	98.5
21	Bayern, Germany	76.8	21	Eastern, UK	93.2
22	Île de France, France	76.7	22	Tokyo, Japan	90.2
23	Berlin, Germany	71.9	23	Singapore	85.2
24	Los Angeles, US	66.2	24	Berlin, Germany	81.7
25	Denmark	64.5	25	Brussels, Belgium	77.4
26	Chicago, US	54.8	26	Hong Kong, China	77.2
27	Hamburg, Germany	48.0	27	Kanagawa, Japan	75.9
28	Philadelphia, US	44.6	28	Ontario, Canada	69.5
29	Hartford, US	44.5	29	London, UK	58.3
30	Atlanta, US	40.8	30	Kyoto, Japan	57.6
31	London, UK	40.2	31	Boston, US	56.9
32	New York, US	38.1	32	Los Angeles, US	53.5
33	Seattle, US	38.0	33	San Francisco, US	52.7
34	Ontario, Canada	37.7	34	Atlanta, US	51.5
35	Brussels, Belgium	29.4	35	Hartford, US	47.2
36	British Columbia, Canada	21.2	36	Austin, US	41.6
37	West-Nederland, Netherlands	19.6	37	British Columbia, Canada	39.1
38	Washington DC, US	17.2	38	Washington DC, US	35.8
39	Tokyo, Japan	15.1	39	Luxembourg	29.2
40	Luxembourg	15.0	40	Seattle, US	16.2
	Global High-Performing Mean	100.0		Global High-Performing Mean	100.0

Table 3.4: Index of Regional Employment in the Automotive/High-Tech Mechanical Engineering and Instrumentation/Electrical Machinery Sectors (Employees per 1,000 inhabitants)

Rank	Region	Automotive and High-Tech Mechanical Engineering	Rank	Region	Instrumentation and Electrical Machinery
1	Baden-Württemberg, Germany	295.8	1	Bayern, Germany	250.9
2	Philadelphia, US	267.4	2	Baden-Württemberg, Germany	236.1
3	British Columbia, Canada	223.8	3	Boston, US	167.2
4	Bayern, Germany	202.2	4	San Francisco, US	158.7
5	Seattle, US	200.5	5	Uusimaa, Finland	152.4
6	Ontario, Canada	169.5	6	Kyoto, Japan	149.8
7	Hartford, US	158.9	7	Hessen, Germany	132.9
8	Hessen, Germany	149.2	8	Tokyo, Japan	129.6
9	Switzerland	119.0	9	Raleigh-Durham, US	128.2
10	Kanagawa, Japan	116.8	10	**South East, UK**	**126.4**
11	Eastern, UK	113.5	11	Hartford, US	117.2
12	Norway	113.1	12	Osaka, Japan	116.8
13	Austin, US	112.1	13	Kanagawa, Japan	113.0
14	Osaka, Japan	107.9	14	Eastern, UK	112.8
15	New South Wales, Australia	97.1	15	Berlin, Germany	110.1
16	San Francisco, US	96.5	16	Switzerland	110.0
17	Singapore	94.1	17	Singapore	109.6
18	Denmark	93.7	18	Los Angeles, US	109.3
19	**South East, UK**	**91.8**	19	Ostösterreich, Austria	105.3
20	Hong Kong, China	85.2	20	Norway	104.6
21	Hamburg, Germany	82.8	21	Hong Kong, China	99.3
22	Boston, US	79.4	22	Chicago, US	98.1
23	Uusimaa, Finland	76.5	23	New South Wales, Australia	91.3
24	Chicago, US	74.5	24	Austin, US	91.2
25	Île de France, France	74.1	25	Île de France, France	89.6
26	Kyoto, Japan	73.7	26	Hamburg, Germany	88.7
27	Zuid-Nederland, Netherlands	72.4	27	Denmark	87.6
28	Los Angeles, US	70.4	28	Stockholm, Sweden	69.9
29	Tokyo, Japan	67.5	29	Philadelphia, US	67.6
30	Berlin, Germany	65.0	30	Seattle, US	64.8
31	Ostösterreich, Austria	60.2	31	Atlanta, US	62.1
32	Atlanta, US	59.9	32	New York, US	60.6
33	West-Nederland, Netherlands	42.9	33	London, UK	52.8
34	Stockholm, Sweden	42.9	34	Zuid-Nederland, Netherlands	51.4
35	Raleigh-Durham, US	36.7	35	Ontario, Canada	45.7
36	London, UK	30.1	36	Washington DC, US	31.8
37	New York, US	24.2	37	Brussels, Belgium	30.7
38	Washington DC, US	22.7	38	West-Nederland, Netherlands	30.1
39	Luxembourg	20.2	39	British Columbia, Canada	25.7
40	Brussels, Belgium	15.8	40	Luxembourg	20.4
	Global High-Performing Mean	100.0		Global High-Performing Mean	100.0

3.20 It is crucial to recognise that high-value added service sectors are an increasingly important site for knowledge capital and innovation. Despite recent criticisms of the new economy concept and the 'dot.com crisis', it is clear that ICT and associated development is at the very heart of knowledge-driven economics. The growth of the Internet and enhanced telecommunications are the keys to creating a global knowledge community. In general, high-tech services provide the base for facilitating global communication, as well as being vitally important for mobilising cluster development within and across sectors.

3.21 Table 3.5 represents an index of employment density in high-tech service sectors. The top ranked regions are San Francisco (179.5) – including Silicon Valley the home of firms such as Cisco Systems and Oracle – followed by Washington DC (173.7) and Tokyo (170.8). The lowest ranked regions are Kyoto (34.1), Zuid-Nederland (58.2) and Brussels (64.4).

3.22 The South East has a very healthy employment density in high-tech services, 36.0% above the high-performing mean and ranked 8th. Once again, it is also the third highest ranked European region. The position of the other UK regions is also relatively good, with London (120.7) ranked 12th and Eastern (111.4) 14th. We consider it vital that all UK regions acquire a significant level of activity in these sectors.

Table 3.5: Index of Regional Employment in High-Tech Service Sectors (Employees per 1,000 inhabitants

Rank	Region	High-Tech Services
1	San Francisco, US	179.5
2	Washington DC, US	173.7
3	Tokyo, Japan	170.8
4	Uusimaa, Finland	169.0
5	Stockholm, Sweden	153.3
6	Atlanta, US	153.3
7	Raleigh-Durham, US	152.6
8	**South East, UK**	**136.0**
9	Boston, US	135.7
10	Seattle, US	126.1
11	Île de France, France	125.4
12	London, UK	120.7
13	Austin, US	118.8
14	Eastern, UK	111.4
15	Singapore	102.5
16	New York, US	102.2
17	Denmark	101.5
18	Chicago, US	100.9
19	Ontario, Canada	95.4
20	West-Nederland, Netherlands	95.2
21	New South Wales, Australia	92.9
22	Hong Kong, China	92.8
23	Switzerland	87.7
24	Philadelphia, US	84.1
25	Norway	83.4
26	Hartford, US	82.3
27	Berlin, Germany	78.2
28	Osaka, Japan	76.4
29	Kanagawa, Japan	74.9
30	British Columbia, Canada	72.2
31	Hessen, Germany	71.2
32	Hamburg, Germany	70.2
33	Ostösterreich, Austria	67.4
34	Los Angeles, US	67.2
35	Bayern, Germany	66.7
36	Luxembourg	65.7
37	Baden-Württemberg, Germany	65.5
38	Brussels, Belgium	64.6
39	Zuid-Nederland, Netherlands	58.2
40	Kyoto, Japan	34.1
	Global High-Performing Mean	100.0

R&D Expenditure

3.23 Research and development expenditure is an indication of attempts to enlarge the knowledge base and inputs to the process of searching for knowledge. In recent years government expenditure on research and development has decreased with the reduction in defence expenditure. This has prioritised the requirement for increased innovation expenditure by businesses, although public expenditure still represents an important lever for knowledge development.

3.24 The left hand columns of Table 3.6 ranks public/government expenditure per head of population. The rankings are dominated by three regions: Washington DC (598.2), Hong Kong (350.5) and Berlin (224.6). At the other end of the index are the four Japanese regions of Tokyo (5.2), Osaka (6.9), Kanagawa (8.8) and Kyoto (10.9), highlighting the dearth of government involvement in innovation in these regions.

3.25 Government expenditure on R&D in the South East is relatively high, 42.4% above the high-performing mean, with a ranking of 9th. This is particularly high given the position of the other two UK regions: Eastern (77.8) 19th and London (38.9) 31st.

3.26 Business expenditure on research and development highlights the intensity of efforts to innovate, particularly through technological process development. It is, therefore, an important indicator of innovation capability. At the head of the rankings are – as indicated by right-hand columns of Table 3.6 - the US high-tech hubs of Boston (278.7) and Seattle (236.1), followed by Stockholm (198.9). In a reversal to its lofty position in the index of government R&D expenditure, the lowest ranked region is Hong Kong with a score of a mere 1.9, followed by London (24.4) and New South Wales (28.0). The low ranking of London is an indication of a dependency on service sector activities where there is little measured research and development expenditure.

3.27 The South East is ranked 26th with only 80.6% of the mean expenditure by businesses on R&D. This is a very serious issue for the region and its long-term competitiveness, particularly when compared to the ranking of the Eastern region in 13th place with a score 20.4% above the mean. Data from the OECD finds that within the UK as a whole there is a relative reliance on R&D expenditure from foreign-owned, as opposed to indigenous, firms. For instance, only Sweden and Ireland has a higher proportional share of expenditure (compared to domestic product) by foreign affiliates, while Sweden, Finland, the United States, Japan, Germany, the Netherlands and France all have a higher proportion of R&D expenditure, as a share of domestic product, than the UK. Although all the necessary data does not currently exist at

a regional level, the situation would appear to be similar or even accentuated for the South East given the relatively high levels of foreign investment within the region.

Table 3.6: Index of Research and Development Expenditure by Region (per capita)

Rank	Region	R&D Expenditure by Government	Rank	Region	R&D Expenditure by Business
1	Washington DC, US	598.2	1	Boston, US	278.7
2	Hong Kong, China	350.5	2	Seattle, US	236.1
3	Berlin, Germany	224.6	3	Stockholm, Sweden	198.9
4	Boston, US	202.5	4	Los Angeles, US	195.0
5	Uusimaa, Finland	195.9	5	San Francisco, US	194.4
6	Île de France, France	157.6	6	Philadelphia, US	179.6
7	Los Angeles, US	154.5	7	Hartford, US	170.7
8	San Francisco, US	153.9	8	New York, US	155.9
9	**South East, UK**	**142.4**	9	Kanagawa, Japan	135.0
10	Hamburg, Germany	139.1	10	Baden-Württemberg, Germany	131.9
11	Norway	112.5	11	Île de France, France	131.7
12	Baden-Württemberg, Germany	112.5	12	Tokyo, Japan	122.4
13	Luxembourg	104.5	13	Eastern, UK	120.4
14	Singapore	103.3	14	Uusimaa, Finland	118.5
15	Zuid-Nederland, Netherlands	82.0	15	Chicago, US	101.0
16	West-Nederland, Netherlands	81.9	16	Bayern, Germany	95.8
17	Seattle, US	81.5	17	Brussels, Belgium	92.4
18	New South Wales, Australia	81.0	18	Switzerland	89.3
19	Eastern, UK	77.8	19	Osaka, Japan	88.4
20	Denmark	74.0	20	Hessen, Germany	87.3
21	Chicago, US	70.4	21	Raleigh-Durham, US	82.3
22	Ostösterreich, Austria	65.7	22	Hamburg, Germany	82.1
23	Bayern, Germany	63.9	23	Austin, US	81.8
24	Ontario, Canada	62.3	**24**	**South East, UK**	**80.6**
25	British Columbia, Canada	58.8	25	Luxembourg	78.3
26	Brussels, Belgium	50.5	26	Kyoto, Japan	78.2
27	Philadelphia, US	48.9	27	Ontario, Canada	78.1
28	Raleigh-Durham, US	46.3	28	Berlin, Germany	61.1
29	Hessen, Germany	42.3	29	Denmark	52.8
30	New York, US	42.2	30	Washington DC, US	50.0
31	London, UK	38.9	31	Ostösterreich, Austria	49.2
32	Austin, US	38.0	32	British Columbia, Canada	48.0
33	Switzerland	35.1	33	Zuid-Nederland, Netherlands	46.5
34	Atlanta, US	33.9	34	West-Nederland, Netherlands	46.4
35	Stockholm, Sweden	29.6	35	Singapore	36.9
36	Hartford, US	13.2	36	Norway	35.8
37	Kyoto, Japan	10.9	37	Atlanta, US	34.7
38	Kanagawa, Japan	8.8	38	New South Wales, Australia	28.0
39	Osaka, Japan	6.9	39	London, UK	24.4
40	Tokyo, Japan	5.2	40	Hong Kong, China	1.9
	Global High-Performing Mean	100.0		Global High-Performing Mean	100.0

Knowledge Economy Outputs

3.28 Highlighting *Knowledge Economy Outputs* and *Knowledge Economy Outcomes* in our model (Chapter 2), the following five variables measure the size of outputs of knowledge economy production in each region.

Patents

- Number of Patents Registered per one million inhabitants

Gross Domestic Product and Productivity

- Per capita GDP
- Labour Productivity

Earnings and Unemployment

- Mean Gross Monthly Earnings
- Unemployment Rates

Patents

3.29 Patent registrations are a representation the generation of new ideas and are the nearest proxy to direct indicators of knowledge formation, and are perhaps the best measure of knowledge economy outputs. A high level of patent activity is often a reflection of high levels of applied research and development activity. Also, patent registrations are a strong indicator of outputs derived from clustered relationships between both firms and other research institutions.

3.30 As Table 3.7 illustrates, patent registration is dominated by US regions, which hold the first five rankings led by Austin (449.5), and followed by San Francisco (448.7) and Raleigh-Durham (278.5). The lowest ranked regions are Singapore (12.0), New South Wales (14.0) and Norway (18.0). The spread of registrations across regions is very wide, and indicates that the top ranked regions in the US are undertaking patent activity at a rate far above the majority of other places.

3.31 The South East is ranked a lowly 27th with a score of only 49.3, lower than Eastern (54.7) at 24th but higher than London (23.1) 35th. Along with the low expenditure of businesses on R&D in the region, this finding raises considerable doubts concerning the amount and intensity of innovation undertaken by firms in the region. Indeed, it can be hypothesised that the region has a significant, yet so far undetermined, innovation gap when compared the top performing regions, lagging regions from North America, Europe and Asia.

Table 3.7: Index of Patent Registrations by Region (per capita)

Rank	Region	Index of Patent Registrations
1	Austin, US	449.5
2	San Francisco, US	448.7
3	Raleigh-Durham, US	278.5
4	Boston, US	211.5
5	Hartford, US	142.8
6	Baden-Württemberg, Germany	138.2
7	Stockholm, Sweden	136.8
8	Seattle, US	134.2
9	Uusimaa, Finland	133.1
10	New York, US	127.9
11	Philadelphia, US	127.2
12	Bayern, Germany	125.6
13	Zuid-Nederland, Netherlands	112.8
14	Chicago, US	112.6
15	Hessen, Germany	101.7
16	Tokyo, Japan	97.2
17	Los Angeles, US	92.0
18	Atlanta, US	88.8
19	Washington DC, US	87.7
20	Île de France, France	82.9
21	Osaka, Japan	63.1
22	Switzerland	62.8
23	Hamburg, Germany	56.6
24	Eastern, UK	54.7
25	Luxembourg	51.0
26	Ontario, Canada	50.4
27	**South East, UK**	**49.3**
28	British Columbia, Canada	47.8
29	Berlin, Germany	47.3
30	Denmark	44.2
31	Brussels, Belgium	40.3
32	Ostösterreich, Austria	34.4
33	West-Nederland, Netherlands	34.0
34	Kanagawa, Japan	27.5
35	London, UK	23.1
36	Kyoto, Japan	20.6
37	Hong Kong, China	19.0
38	Norway	18.0
39	New South Wales, Australia	14.0
40	Singapore	12.0
	Global High-Performing Mean	100.0

Gross Domestic Product and Productivity

3.32 GDP has been measured on a workplace basis, reflecting the product generated by those working in each region. It must be made clear that GDP does not equate to the available income within a region and is not a direct or overall measure of relative prosperity between regions. However, GDP is an indicator of a region's output, and therefore, to some extent, its level of economic development.

3.33 Table 3.8 highlights the GDP per capita of the 40 benchmarked regions indexed to mean average. The highest GDP per capita is found in the regions of Hartford (160.5), Tokyo (143.9) and San Francisco (131.4). The lowest ranked regions are Berlin (70.8), Kanagawa (71.6) and the Eastern region of the UK (72.4). Once again, the significant disparity highlights that even with these high-performing regions there are marked differences in the evolution of their economic development.

3.34 The South East performs particularly poorly on this measure with a score of only 77.0 and a ranking in 34th place. Poor GDP performance is a feature common to the UK as whole, when compared to most leading nations. However, it is interesting to note the performance of London which scores above the high-performing mean, with a score of 106.8 and a ranking of 16th.

3.35 Alongside GDP, productivity is a crucial measure of regional performance, as it is influenced by a wide range of factors such as sectoral make-up, workforce skills, investment in innovation, and market competition. Productivity varies from GDP per capita and is partly a function of respective economic activity and unemployment rates. Therefore, the prosperity of all economies is highly dependent on its productivity rates.

3.36 The highest productivity rates, as illustrated by Table 3.9, are within the regions of Brussels (161.2), Hartford (155.7) and Luxembourg (145.0). The high ranking of all three regions reflects the significant levels of high value-added service sector employment within their economies. The lowest ranked regions are Kanagawa (67.9), Kyoto (72.0) and the Eastern region of the UK (72.2).

3.37 The South East again performs very much below par with a score of only 77.4% of the high-performing mean and a ranking of 35th. London is again above the mean average with a score of 113.3 and a ranking of 11th. The low ranking of both the South East, Eastern and Kanagawa is interesting since they are regions all adjacent to centres of finance and business – London in the case of the South East and Eastern, Tokyo in the case of Kanagawa – and have little concentrations of such activities themselves. However, Hartford, which is adjacent to the financial centre of New York, has very high labour

productivity – even higher then New York. Importantly, Hartford has it own critical mass of financial and business service sector activity.

Table 3.8: Index of Gross Domestic Product by Region (per capita)

Rank	Region	Index of Gross Domestic Product
1	Hartford, US	160.5
2	Tokyo, Japan	143.9
3	San Francisco, US	131.4
4	Hamburg, Germany	128.7
5	New York, US	126.8
6	Boston, US	125.2
7	Luxembourg	123.8
8	Washington DC, US	118.7
9	Brussels, Belgium	117.5
10	Atlanta, US	116.1
11	Seattle, US	114.8
12	Austin, US	113.2
13	Chicago, US	112.7
14	Raleigh-Durham, US	112.7
15	Philadelphia, US	109.2
16	London, UK	106.8
17	Île de France, France	104.6
18	Los Angeles, US	104.0
19	Uusimaa, Finland	99.0
20	Ontario, Canada	95.9
21	Stockholm, Sweden	95.5
22	Hessen, Germany	91.4
23	Osaka, Japan	90.6
24	Switzerland	87.5
25	West-Nederland, Netherlands	87.4
26	New South Wales, Australia	86.1
27	Ostösterreich, Austria	85.6
28	Bayern, Germany	85.5
29	Baden-Württemberg, Germany	85.3
30	Denmark	82.8
31	British Columbia, Canada	82.1
32	Norway	81.1
33	Hong Kong, China	77.3
34	**South East, UK**	**77.0**
35	Singapore	76.2
36	Zuid-Nederland, Netherlands	74.6
37	Kyoto, Japan	73.9
38	Eastern, UK	72.4
39	Kanagawa, Japan	71.6
40	Berlin, Germany	70.8
	Global High-Performing Mean	100.0

Table 3.9: Index of Labour Productivity by Region

Rank	Region	Index of Labour Productivity
1	Brussels, Belgium	161.2
2	Hartford, US	155.7
3	Luxembourg	145.0
4	Hamburg, Germany	135.6
5	Tokyo, Japan	131.1
6	New York, US	131.0
7	San Francisco, US	121.7
8	Boston, US	121.3
9	Île de France, France	115.2
10	Washington DC, US	113.4
11	London, UK	113.3
12	Philadelphia, US	110.3
13	Chicago, US	109.9
14	Los Angeles, US	108.1
15	Seattle, US	104.2
16	Atlanta, US	101.9
17	Hessen, Germany	100.0
18	Raleigh-Durham, US	98.5
19	Stockholm, Sweden	97.7
20	Austin, US	92.2
21	Ontario, Canada	91.6
22	Uusimaa, Finland	91.2
23	New South Wales, Australia	90.5
24	Ostösterreich, Austria	90.4
25	Baden-Württemberg, Germany	89.8
26	Osaka, Japan	88.9
27	West-Nederland, Netherlands	86.9
28	Bayern, Germany	86.8
29	British Columbia, Canada	82.6
30	Berlin, Germany	81.0
31	Switzerland	80.8
32	Denmark	78.8
33	Hong Kong, China	78.6
34	Norway	77.9
35	**South East, UK**	**77.4**
36	Zuid-Nederland, Netherlands	74.0
37	Singapore	73.5
38	Eastern, UK	72.2
39	Kyoto, Japan	72.0
40	Kanagawa, Japan	67.9
	Global High-Performing Mean	100.0

Earnings and Unemployment

3.38 Earning levels are an indicator of the relative wealth and the standards of living within an economy, particularly the value-added generated from economic activity. It is also a strong proxy of the relative quality of jobs within an economy. The regions with the highest average earnings are predominately in the US with their regions occupying 11 of the highest 12 rankings. The top three regions are New York (151.3), San Francisco (142.0) and Hartford (138.5). The three lowest ranked regions are Hong Kong (63.5), Stockholm (64.6) and Uusimaa (68.0).

3.39 Earnings in the South East are below the high-performing mean with a score of 87.4 and a ranking of 29th. This is compared to London which is ranked 13th with a score of 108.7. From this we begin to see a correlation between earnings and labour productivity.

3.40 Table 3.11 illustrates the levels of unemployment within the regions, reverse ranked so that a high score indicates a lower level of unemployment. The majority of the US regions perform well, with them occupying the first eight positions of the rankings, led by Raleigh-Durham (103.4), Austin (103.2) and Hartford (102.8). The lowest ranked are the European regions of Brussels (90.6), Berlin (90.9) and Ile de France (94.5).

3.41 The South East is the third highest performing European region – behind West-Nederland and Zuid-Nederland – ranked in 11th position with a score of 101.9, confirming that unemployment is not at present a serious issue for region.

Table 3.10: Index of Earnings by Region (Mean Gross Monthly Earnings)

Rank	Region	Index of Earnings
1	New York, US	151.3
2	San Francisco, US	142.0
3	Hartford, US	138.5
4	Washington DC, US	136.4
5	Boston, US	135.1
6	Chicago, US	128.5
7	Atlanta, US	123.9
8	Philadelphia, US	123.5
9	Seattle, US	120.8
10	Tokyo, Japan	119.0
11	Los Angeles, US	118.0
12	Raleigh-Durham, US	116.6
13	London, UK	108.1
14	Hamburg, Germany	108.1
15	Kanagawa, Japan	101.2
16	Baden-Württemberg, Germany	99.0
17	Hessen, Germany	97.6
18	Ontario, Canada	96.8
19	Osaka, Japan	96.0
20	Austin, US	95.4
21	Brussels, Belgium	94.1
22	Bayern, Germany	93.5
23	British Columbia, Canada	90.5
24	West-Nederland, Netherlands	89.7
25	Luxembourg	88.8
26	Denmark	88.6
27	Berlin, Germany	88.5
28	Switzerland	88.2
29	**South East, UK**	**87.4**
30	Norway	87.2
31	Kyoto, Japan	85.6
32	Eastern, UK	82.2
33	Zuid-Nederland, Netherlands	82.0
34	Ostösterreich, Austria	78.5
35	Île de France, France	75.9
36	New South Wales, Australia	74.1
37	Singapore	73.5
38	Uusimaa, Finland	68.0
39	Stockholm, Sweden	64.6
40	Hong Kong, China	63.5
	Global High-Performing Mean	100.0

Table 3.11: Index of Unemployment Rates by Region (reversed rankings)

Rank	Region	Index of Employment
1	Raleigh-Durham, US	103.4
2	Austin, US	103.2
3	Hartford, US	102.8
4	Luxembourg	102.8
5	Boston, US	102.7
6	San Francisco, US	102.6
7	Atlanta, US	102.2
8	Washington DC, US	102.1
9	West-Nederland, Netherlands	102.1
10	Zuid-Nederland, Netherlands	102.1
11	**South East, UK**	**101.9**
12	Singapore	101.9
13	Norway	101.4
14	Eastern, UK	101.2
15	Switzerland	101.2
16	New York, US	101.0
17	Seattle, US	101.0
18	Chicago, US	100.9
19	Philadelphia, US	100.9
20	Kyoto, Japan	100.7
21	Ostösterreich, Austria	100.6
22	Kanagawa, Japan	100.5
23	Los Angeles, US	100.3
24	Tokyo, Japan	100.2
25	Bayern, Germany	100.1
26	Hong Kong, China	100.1
27	Baden-Württemberg, Germany	99.9
28	Stockholm, Sweden	99.8
29	Denmark	99.4
30	Ontario, Canada	99.3
31	New South Wales, Australia	99.0
32	Osaka, Japan	98.8
33	Hessen, Germany	98.3
34	Uusimaa, Finland	97.9
35	British Columbia, Canada	97.8
36	London, UK	97.1
37	Hamburg, Germany	97.0
38	Île de France, France	94.5
39	Berlin, Germany	90.9
40	Brussels, Belgium	90.6
	Global High-Performing Mean	100.0

Knowledge Economy Sustainability

3.42 The last of the three key themes is *Knowledge Economy Sustainability*. This represents each region's capacity for sustaining its long-term health of knowledge creation and commercial exploitation. In this report, this is represented by investment in future generations of knowledge workers and investment in Information and Telecommunication Technology (ICT) infrastructure. The following four variables are included.

Investment in Future Knowledge

- Per Capita Public Expenditures on Primary and Secondary Education
- Per Capita Public Expenditures on Higher Education

National ICT Infrastructure

- Secure Servers per one million inhabitants
- Internet Hosts per 1,000 inhabitants

Investment in Future Knowledge

3.43 It is highly obvious that future knowledge capital is currently embodied within those individuals undertaking education and training. Therefore, the resources dedicated to such education and training are an important source of knowledge investment. Much of the expenditure on education is set by national budgets, particularly in Europe for compulsory primary and secondary education, while higher education expenditure is a reflection of the number and type of institutions within a region. Table 3.12 analyses regional expenditure of primary, secondary and higher education on a per capita basis.

3.44 The left-hand columns of Table 3.12 highlight primary and secondary expenditure per capita, with the scores for Europe and Japan based on national data. The top of the rankings is again dominated by regions from the United States, led by New York (174.9) and Hartford (170.7), although Luxembourg is placed third with a score of 165.4. The lowest ranked is Singapore (26.5) followed by the German regions with a score of 69.9.

3.45 The South East, Eastern and London are ranked 25th with only 78.3% of the high-performing mean. This highlights that within Europe the UK's expenditure on compulsory education is near the average, but is well below average when compared against the leading regions in the United States it is under-performing.

3.46 The right-hand columns of Table 3.12 highlight expenditure on higher education by region. The dominance of the United States is

once again profound, with the leading regions being Seattle (181.0), Raleigh-Durham (172.0) and Austin (158.9). The lowest performing regions are Luxembourg (12.5), the UK's Eastern region (27.5), Singapore (32.2) and London (41.5).

3.47 Although the South East ranks slightly above Eastern and London it is still placed in only 34th position with the lowly score of 55.3. This highlights that despite the existence of universities such as Oxford and Cambridge within the UK's core regions, overall expenditure on higher education is lower than most high-performing regions. Coupled with the lack of strength on compulsory schooling expenditure, this calls into questions the investments being made in future knowledge capital.

Table 3.12: Index of Public Expenditure on Primary, Secondary and Higher Education (per capita)

Rank	Region	Primary & Secondary Education	Rank	Region	Higher Education
1	New York, US	174.9	1	Seattle, US	181.0
2	Hartford, US	170.7	2	Raleigh-Durham, US	172.0
3	Luxembourg	165.4	3	Austin, US	158.9
4	Austin, US	149.8	4	Los Angeles, US	157.7
5	Philadelphia, US	146.4	5	San Francisco, US	157.0
6	Seattle, US	135.1	6	Brussels, Belgium	152.0
7	Chicago, US	131.4	7	Ostösterreich, Austria	141.5
8	Atlanta, US	129.3	8	Philadelphia, US	138.9
9	Boston, US	125.1	9	Berlin, Germany	137.8
10	Los Angeles, US	122.5	10	Atlanta, US	136.7
11	San Francisco, US	122.0	11	Chicago, US	131.7
12	Denmark	114.9	12	New York, US	125.7
13	Raleigh-Durham, US	114.7	13	Stockholm, Sweden	124.3
14	Norway	113.2	14	Hamburg, Germany	122.7
15	Switzerland	112.7	15	Hartford, US	119.5
16	Stockholm, Sweden	107.7	16	Norway	104.1
17	Ostösterreich, Austria	105.0	17	Zuid-Nederland, Netherlands	103.9
=18	Ontario, Canada	104.8	18	Ontario, Canada	103.4
=18	British Columbia, Canada	104.8	19	Tokyo, Japan	103.3
20	Île de France, France	93.3	20	Kyoto, Japan	101.9
21	Uusimaa, Finland	86.7	21	Île de France, France	101.1
22	New South Wales, Australia	86.3	22	Washington DC, US	100.4
23	Washington DC, US	83.6	23	Switzerland	96.4
24	Brussels, Belgium	82.4	24	Denmark	91.4
=25	Eastern, UK	78.3	25	Boston, US	91.3
=25	London, UK	78.3	26	West-Nederland, Netherlands	84.9
=25	**South East, UK**	78.3	27	Hessen, Germany	83.2
28	West-Nederland, Netherlands	74.0	28	New South Wales, Australia	81.4
=28	Zuid-Nederland, Netherlands	74.0	29	Baden-Württemberg, Germany	74.3
30	Hong Kong, China	73.7	30	Bayern, Germany	73.7
=31	Tokyo, Japan	71.2	31	British Columbia, Canada	68.6
=31	Kanagawa, Japan	71.2	32	Hong Kong, China	63.7
=31	Kyoto, Japan	71.2	33	Uusimaa, Finland	56.6
=31	Osaka, Japan	71.2	**34**	**South East, UK**	**55.3**
=35	Berlin, Germany	69.9	35	Osaka, Japan	47.7
=35	Hamburg, Germany	69.9	36	Kanagawa, Japan	42.3
=35	Bayern, Germany	69.9	37	London, UK	41.5
=35	Baden-Württemberg, Germany	69.9	38	Singapore	32.2
=35	Hessen, Germany	69.9	39	Eastern, UK	27.5
40	Singapore	26.5	40	Luxembourg	12.5
	Global High-Performing Mean	100.0		Global High-Performing Mean	100.0

National ICT Infrastructure

3.48 A well developed ICT infrastructure is a prerequisite for moving knowledge effectively and efficiently within and across regions. In particular, access to fast broadband telecommunications services. Although broadband penetration data is unavailable for all our benchmark regions and nations, the OECD has collected certain data at the national level for its member states. The figures make very disappointing reading as far the UK is concerned with UK penetration equating to only 7% of the OECD mean average, ranked only 21st out of 30 surveyed countries. Furthermore, figures from Oftel indicate that only 0.6% of Internet users have a fast connection via a telephone line.

3.49 In order to look in more detail at the ICT infrastructure we have analysed the number of secure servers and Internet hosts per capita in the nations covering the benchmarked regions (since regional data is unavailable for the majority of regions). Secure servers utilise encrypted software for e-commerce transactions, and therefore the number of such servers within a nation gives a strong indication of the level of e-business undertaken. The left-hand columns of Table 3.13 indicate that the highest proportion of secure servers per capita are in the United States (326.7), Australia (202.7) and Canada (173.7). The lowest proportions are within Hong Kong (12.2), France (29.8) and Japan (31.1). The UK proportion of secure servers is just above the mean average with a score of 100.6 and a ranking of 7th out of 18 regions.

3.50 The Internet is by far the most rapidly growing feature of ICT infrastructure, with it becoming an ever more important and powerful tool for the movement and diffusion of knowledge. The proportion of Internet hosts within a nation is a representation of the degree to which it is developing its 'wired economy'. The right-hand columns of Table 3.13 illustrate the number of Internet hosts per capita with the nations. The highest ranked nations are the United States (292.1), Finland (198.4) and Canada (158.6). The lowest ranked are France (23.9), Luxembourg (38.0) and Germany (39.5). The UK is ranked in 13th place with a score of only 65.5, and is the lowest ranked English-speaking nation.

Overall, the position of the UK, and therefore its regions, within the global information society is not strong. However, as both national and regional innovation systems increasingly function through their ICT infrastructure, this becomes a vital component of knowledge-based development.

Table 3.13: Index of National ICT Infrastructure – Secure Servers and Internet Hosts per Capita

Rank	Nation	Secure Servers	Rank	Nation	Internet Hosts
1	United States	326.7	1	United States	292.1
2	Australia	202.7	2	Finland	198.4
3	Canada	173.7	3	Canada	158.6
4	Switzerland	162.6	4	Norway	145.3
5	Luxembourg	138.3	5	Sweden	132.6
6	Sweden	124.5	6	Netherlands	101.8
7	**United Kingdom**	**100.6**	7	Hong Kong, China	96.4
8	Finland	90.1	8	Australia	93.5
9	Norway	83.2	9	Denmark	90.4
10	Austria	75.0	10	Singapore	83.0
11	Denmark	73.8	11	Switzerland	79.2
12	Germany	62.3	12	Austria	71.8
13	Netherlands	46.5	**13**	**United Kingdom**	**65.5**
14	Belgium	35.6	14	Belgium	49.5
15	Singapore	31.3	15	Japan	40.5
16	Japan	31.1	16	Germany	39.5
17	France	29.8	17	Luxembourg	38.0
18	Hong Kong, China	12.2	18	France	23.9
	Global High-Performing Mean	100.0		Global High-Performing Mean	100.0

3.4 Three Key Dimensions of the Knowledge Economy Development

The 19 variables analysed above are interlinked with one another, forming a web of complex and diverse relationships. For the purpose of benchmarking the position of the South East of England and setting policy goals, it is of critical importance to simplify the relationships among the 19 variables and uncover common dimensions through which the world's high performing regions move forward. Through the factor analysis, we have identified the following three key dimensions of the knowledge economy development: (1) *Principal Driver Strengths*; (2) *Regional Knowledge Economy Outputs*; and (3) *Weightless Economy Attributes*.

Principal Driver Strengths

Principal Driver Strengths are the key 'common' variables that have underlined the progress of regional knowledge economies, with the Index of Principal Driver Strengths ranking those economies that possess the highest and weakest sets of these core knowledge variables. The Principal Driver Strengths of knowledge-based regional economies represent a part of the chain in our original model from Knowledge Economy Outcomes to Knowledge Capital. This suggests close association among those components within the part of the chain, which may be called the *Sustainability Path*, whereby high levels of Knowledge Economy Outcomes are reinvested in Knowledge Capital, in an environment supported by a strong compulsory education and ICT infrastructure. This represents a principal dimension knowledge-based regional economies move through as they make progress.

The analysis found *Principal Driver Strengths* of high knowledge economy performance to be closely associated with:

- A strong ICT infrastructure – as measured by the density of secure servers and Internet hosts.
- High levels of economic participation – as measured by economic activity and employment rates.
- A strong compulsory schooling infrastructure – as measured by expenditure on primary and secondary schooling.
- A strong pool of knowledge workers – as measured by the proportion of employees in a management position.

- High levels of economic outcomes – as measured by earnings and unemployment rates

As might be anticipated, the strongest principal driver strengths are found in the US regional economies, with all their regions scoring far higher than any other non-US region (Table 3.14). The top strengths are found in Austin (171.1), San Francisco (167.5) and Boston (154.0). The highest performing non-US region is Canada's Ontario with a score of 103.6. The lowest strengths are found in Brussels (49.7), Berlin (53.9) and Hong Kong (57.9).

The South East is ranked mid-table at 20th position, with a score lower than the high-performing mean at 92.2, compared to the highest ranked European region, Stockholm, which ranked 14th with a score of 101.8. Slightly above the South East region is Eastern, ranked in 19th place with a score 93.3. London trails in 28th place, scoring only 78.6. The findings confirm that both the South East and the UK do not currently possess a strong enough capacity of the key drivers of knowledge-based development.

Table 3.14: Index of Principal Driver Strengths of Knowledge Development

Rank	Region	Index of Principal Drivers
1	Austin, US	171.1
2	San Francisco, US	167.5
3	Boston, US	154.0
4	Hartford, US	150.2
5	Raleigh-Durham, US	148.8
6	Seattle, US	146.7
7	Atlanta, US	143.3
8	Washington DC, US	138.9
9	New York, US	138.6
10	Chicago, US	133.8
11	Philadelphia, US	131.7
12	Los Angeles, US	125.5
13	Ontario, Canada	103.6
14	Stockholm, Sweden	103.2
15	Tokyo, Japan	101.8
16	Uusimaa, Finland	99.8
17	British Columbia, Canada	94.2
18	New South Wales, Australia	94.0
19	Eastern, UK	93.3
20	**South East, UK**	**92.2**
21	Norway	85.2
22	Denmark	85.1
23	Luxembourg	84.4
24	Switzelarnd	83.4
25	Kanagawa, Japan	83.2
26	West-Nederland, Netherlands	80.2
27	Zuid-Nederland, Netherlands	78.9
28	London, UK	78.6
29	Baden-Wurttemberg, Germany	76.3
30	Ile de France, France	76.2
31	Osaka, Japan	75.2
32	Bayern, Germany	73.7
33	Hamburg, Germany	72.0
34	Ostosterreich, Austria	71.6
35	Kyoto, Japan	71.1
36	Singapore	67.6
37	Hessen, Germany	63.7
38	Hong Kong, China	57.9
39	Berlin, Germany	53.9
40	Brussels, Belgium	49.7
	Global High-Performing Mean	100.0

Regional Knowledge Economy Outputs

Regional Knowledge Economy Outputs highlight the output and production efficiency of knowledge-based regional economies. This dimension has a strong association with:

- Per capita GDP
- Labour productivity

Though weaker than with the above, the dimension is also associated with:

- R&D by Business
- Earnings
- Public expenditures on compulsory education

This dimension represents the part of the link in our model that complements the part that *Principal Driver Strengths* embody. The identification of these two parts, which complete our model's cycle, as independent dimensions is of significant importance. It suggests that high levels of *Principal Driver Strengths* do not necessarily produce high levels of *Regional Knowledge Economy Outputs*. Viewed in an opposite way, regions enjoying high levels of *Knowledge Economy Outputs* do not always have strong *Principal Drivers*. These two dimensions are to some extent tied together by the R&D undertaken by businesses. In other words, the strong presence of R&D undertaken by business tends to correlate with both high levels of *Principal Driver Strengths* to produce high levels of *Knowledge Economy Outputs*, although this is not the case across all of the benchmarked regions. As will be discussed later, this in some degree accounts for the situation of the South East region as well as the UK as a whole: while they have good *Principal Drivers*, they do not enjoy the same levels of *Knowledge Economy Outputs*.

As illustrated by Table 3.15, the highest knowledge economy outputs are Hartford (192.9), New York (171.0) and San Francisco (170.1). The lowest ranked regions are the Asian areas of Singapore (40.5), Hong Kong (49.2) and Kyoto (51.6). The South East is well down the table in 34th place with a score of 62.7; London is placed 19th with a score of 99.3 and Eastern in 35th place, scoring 59.3. From these figures it is clear that within the South East there is a break in the chain from knowledge inputs to knowledge outputs, and this is an issue we discuss in more detail in the concluding chapter.

Table 3.15: Index of Regional Knowledge Economy Outputs

Rank	Region	Index of Knowledge Economy Outputs
1	Hartford, US	192.9
2	New York, US	171.0
3	San Francisco, US	170.1
4	Boston, US	162.6
5	Seattle, US	145.3
6	Luxembourg	136.7
7	Philadelphia, US	135.4
8	Chicago, US	134.7
9	Brussels, Belgium	133.6
10	Tokyo, Japan	133.5
11	Los Angeles, US	133.5
12	Washington DC, US	132.6
13	Atlanta, US	128.3
14	Raleigh-Durham, US	128.1
15	Austin, US	126.8
16	Hamburg, Germany	119.3
17	Stockholm, Sweden	102.3
18	Ile de France, France	101.4
19	London, UK	99.3
20	Ontario, Canada	90.3
21	Uusimaa, Finland	89.0
22	Hessen, Germany	77.5
23	British Columbia, Canada	74.8
24	Ostosterreich, Austria	74.7
25	Baden-Wurttemberg, Germany	73.7
26	Switzerland	72.7
27	New South Wales, Australia	72.2
28	Denmark	72.0
29	Osaka, Japan	71.7
30	West-Nederland, Netherlands	71.3
31	Bayern, Germany	69.6
32	Norway	67.7
33	Berlin, Germany	63.3
34	**South East, UK**	**62.7**
35	Eastern, UK	59.3
36	Zuid-Nederland, Netherlands	54.7
37	Kanagawa, Japan	54.1
38	Kyoto, Japan	51.6
39	Hong Kong, China	49.2
40	Singapore	40.5
	Global High-Performing Mean	100.0

Weightless Economy Attributes

Weightlessness Economy Attributes are the last, but not least, of the underlying dimensions of knowledge-based regional economies. Fundamentally, it represents the development of regional economies away from traditional manufacturing and low value-added service sector activities to a high-tech and high-valued ICT-based economy. In other words, it is an indication of the dematerialisation of production from a dependence on traditional, goods-producing sectors to those based on knowledge and information as core outputs.

This dimension has a positive association with:

- Employment in computer services and R&D
- R&D performed by Government.

while the dimension is negatively associated with:

- Employment in Automotive and Mechanical Engineering
- Employment in Electrical Engineering and Instruments.

In this particular dimension of the knowledge-based economic development, regions move away from activities such as automotive and mechanical engineering to ICT-related services and R&D activities. Given the fact that the employment base of major developed economies shifted away from manufacturing to services during the last century, the weightlessness of economy represents an evolutionary path of knowledge-based economies. In other words, the weightlessness of economy is a temporal path: all knowledge-based economies soon or later go down this route.

Table 3.16 below represents the extent to which each regional economy has shifted from traditional to knowledge-based sectors. The top-performers are predictably the US regions – led by Washington DC (234.5), Atlanta (144.3) and San Francisco (142.4). London is ranked in a high 6th position with a score of 129.2, highlighting the prevalence of a relatively strong high value-added service sector. The lowest rank region is Baden-Wurttemberg (13.8), which illustrates that so far the region has failed to significantly evolve from its core manufacturing sector, follow by two other German regions: Bayern (24.6) and Hessen (41.3).

The South East is ranked 23rd, performing above the high-performing average with a score of 102.5, above Eastern which is ranked 25th with a score of 93.3. From this we can see that the South East does possess significant weightless attributes, and that its current sector make-up is fairly well balanced to compete within the prevailing conditions of the global economy.

Table 3.16: Index of Weightless Economy Attributes

Rank	Region	Weightless Economy Index
1	Washington DC, US	234.5
2	Atlanta, US	144.3
3	San Francisco, US	142.4
4	Boston, US	136.7
5	New York, US	129.7
6	London, UK	129.2
7	Brussels, Belgium	127.4
8	Ile de France, France	125.5
9	Raleigh-Durham, US	125.1
10	Tokyo, Japan	124.1
11	Uusimaa, Finland	122.7
12	Chicago, US	118.8
13	Los Angeles, US	115.5
14	Stockholm, Sweden	113.8
15	Austin, US	113.7
16	Luxembourg	113.4
17	New South Wales, Australia	110.5
18	Berlin, Germany	109.3
19	Seattle, US	108.4
20	West-Nederland, Netherlands	106.8
21	Hong Kong, China	106.6
22	Hamburg, Germany	103.1
23	**South East, UK**	**102.5**
24	Hartford, US	101.0
25	Eastern, UK	93.3
26	Ontario, Canada	89.4
27	Singapore	86.7
28	Denmark	84.3
29	British Columbia, Canada	77.3
30	Zuid-Nederland, Netherlands	75.1
31	Norway	73.4
32	Ostosterreich, Austria	72.3
33	Osaka, Japan	68.3
34	Kanagawa, Japan	63.2
35	Philadelphia, US	60.8
36	Switzerland	57.0
37	Kyoto, Japan	54.4
38	Hessen, Germany	41.3
39	Bayern, Germany	24.6
40	Baden-Wurttemberg, Germany	13.8
	Global High-Performing Mean	100.0

4. Sub-Regional Analysis of South East England's Knowledge Economy

The focus of this chapter of the report is to benchmark the local knowledge economies within South East England. This benchmarking analysis has been undertaken at the level of the eleven Economic Partnerships within South East England. This required the building and aggregating of some data from local authority boundary levels. The eleven Economic Partnerships consist of:

- Thames Valley Economic Partnership (incorporating the local authorities of West Berkshire, Reading, Wokingham, Windsor and Maidenhead, Bracknell Forest and Slough).
- West Sussex Economic Forum.
- Buckinghamshire Economic Partnership.
- Surrey Economic Partnership.
- East Sussex Economic Partnership.
- Isle of Wight Partnership.
- Milton Keynes Economic Partnership.
- Oxfordshire Economic Partnership.
- Kent Economic Forum (includes Medway Towns).
- Hampshire Economic Partnership (incorporating the local authorities of Hampshire, Southampton and Portsmouth).
- Brighton and Hove Regeneration Partnership.

The benchmarking draws together eleven indicators available at the local level that are appropriate measures of the core concepts representing the model of the regional knowledge economy established within the analytical framework. The core concepts consisting of: (1) knowledge capital – the capacity for creating new ideas; (2) innovation capacity – the capacity for transforming new ideas into commercial values; (3) knowledge sustainability – the conditions for knowledge reinvestment; (4) knowledge economy outputs; and (5) knowledge economy outcomes. The eleven indicators consist of the following:

- **Economic Activity** – percentage of economically active individuals.

- **Unemployment** - ILO unemployment rates.
- **Gross Domestic Product** – GDP per capita.
- **Earnings** – Average gross weekly full-time earnings.
- **Business Density** – Number of business per capita.
- **Knowledge-based Businesses** – Proportion of businesses operating in knowledge-based defined sectors.
- **Knowledge Workers** – Proportion of managerial, professional and technically occupied workers within the employed workforce.
- **Research and Development and Higher Education Workers** – Proportion of the workforce employed in higher education and R&D establishments.
- **Productivity** – Proportion of domestic product per employee.
- **Compulsory Educational Attainment** – Percentage of pupils in last year of compulsory schooling with 5 or more A*-Cs at GCSEs.
- **Advanced Educational Attainment** – Average A/AS level points score.

The representation of this data for analysis consists of: (1) the creation of a series of indices for each of the individual factors; (2) an index, based on the mean average of the relevant factors for each of the five knowledge economy core concepts listed above; (3) an index of the overall knowledge economy within each locality; and (4) a series of three indices produced through factor analysis that highlight the key conditions underlying knowledge-based growth and development, and their relative strength within each Economic Partnership area. The following sections analyse these findings. In each case the indices have been calculated from a base of the UK as a whole equating to a score of 100.

Knowledge Capital

Knowledge capital – or the capacity to generate new ideas – has been analysed through an assessment of three core variables. Firstly, levels of economic participation as measured by the economic activity rate. Second, the proportion of employees situated within higher education and research and development establishments. Finally, the proportion of knowledge workers, measured by the proportion of managerial, professional and technically occupied workers within the employed workforce.

The Index of Knowledge Capital highlights, as shown by Table 4.1, that the South East as a whole has a capacity 20.5% above the UK average. The highest performing localities within the South East consist of Oxfordshire (180.8), Brighton and Hove (137.7), Thames Valley (131.4) and Surrey (122.4). The weakest performing areas - all of which under-perform the UK average - consist of the Isle of Wight (71.5), East Sussex (95.3) and West Sussex (99.5). There is a clear correlation between the positioning a major higher education establishment in an area and the levels of knowledge capital. However, what is less clear is how, if at all, this is transferred into tangible knowledge economy outputs and outcomes. This is an issue, particularly important for areas such as Brighton and Hove, which will be discussed later when we analyse the conditions for the knowledge-based growth.

There are clearly issues of low economic participation, relative to the rest of the region, within Kent and the Isle of Wight. Also, East and West Sussex, Buckinghamshire, and the Isle of Wight have levels of employment in higher education and R&D establishments that are below the UK average, although all – with the exception of the Isle of Wight – have above average levels of knowledge workers. This strongly suggests that these local economies are supported more by the private sector, than by publicly-funded 'knowledge establishments' such as universities and research laboratories.

Table 4.1: Index of Knowledge Capital within the Economic Partnership Areas of South East England

Rank	Economic Partnership Area	Economic Activity	Employment in HE and R&D	Knowledge Workers	Index of Knowledge Capital
1	Oxfordshire EP	108.9	310.6	122.8	180.8
2	Brighton and Hove EP	104.4	183.9	124.8	137.7
3	Thames Valley EP	106.8	161.3	126.1	131.4
4	Surrey EP	106.9	128.6	131.8	122.4
5	Hampshire EP	105.1	130.0	114.6	116.6
6	Milton Keynes EP	110.4	133.2	101.9	115.2
7	Kent EP	103.7	118.9	114.1	112.3
8	Buckinghamshire EP	105.8	93.1	134.1	111.0
9	West Sussex EP	105.0	75.6	118.1	99.5
10	East Sussex EP	106.4	68.2	111.3	95.3
11	Isle of Wight EP	102.2	27.6	84.6	71.5
	South East	105.7	134.1	121.8	120.5
	United Kingdom	100.0	100.0	100.0	100.0

Innovation Capacity

Innovation capacity – or the capacity for transforming new ideas to commercial values - has been measured by analysing the business strength of an area, in terms of the actual levels of businesses operating within an area – business density – and the number of these firms situated within knowledge-based sectors. We are obviously aware that innovation capacity may equally exist within more traditional sectors. However, in this case we consider that the mass of knowledge-sectored firms within an area does provide an interesting measure of the potential capacity to undertake innovation. These knowledge-based sectors have been drawn from the current Standard Industrial Classification (not the best means of identifying such firms, but currently the only accessible framework) and consist of:

- Pharmaceuticals
- Office machinery and computers
- Aerospace
- Precision instruments
- Electrical/Electronic engineering
- Telecommunications
- Financial intermediation, except insurance and pension funding
- Insurance and pension funding, except compulsory social security
- Activities auxiliary to financial intermediation
- Computer & related activities
- R&D

- Other business activities
- Motion picture and video activities
- Radio & television activities.

The highest performing area in terms of innovation capacity are Buckinghamshire (148.1), Surrey (145.8), Thames Valley (141.2) and Milton Keynes (124.0), all of which perform above the South East average (Table 4.2). As a whole, the South East region's innovation capacity measures 18.1% higher than the average for the UK. Interestingly, we can already begin to see a strong association between: the number of businesses in area; the number operating in knowledge-based sectors; and the proportion of knowledge workers. This begins to indicate that firms based in more traditional sectors do not, in many cases, have the same proportion of knowledge workers as firms operating in knowledge-defined sectors. The hypothesis, therefore, is that traditional sector firms in the South East do not usually possess the same levels of knowledge capital as their counterparts in the knowledge-defined sectors.

Table 4.2 indicates that the Isle of Wight, Brighton and Hove, Kent and Hampshire have a density of businesses less than the UK average. Furthermore, the Isle of Wight, Kent and East Sussex have below average levels of knowledge-based businesses. These figures highlight the dislocation of the eastern end of the region – Kent and East Sussex, and to a lesser extent Brighton and Hove – from the powerhouse of knowledge-based economic activity.

Table 4.2: Index of Innovation Capacity within the Economic Partnership Areas of South East England

Rank	Economic Partnership	Knowledge-based Business	Business Density	Index of Innovation Capacity
1	Buckinghamshire EP	137.4	158.9	148.1
2	Surrey EP	148.3	143.3	145.8
3	Thames Valley EP	154.2	128.3	141.2
4	Milton Keynes EP	141.9	106.1	124.0
5	Oxfordshire EP	111.5	119.6	115.6
6	West Sussex EP	116.9	109.0	113.0
7	Hampshire EP	121.7	98.6	110.1
8	Brighton and Hove EP	119.8	91.1	105.5
9	East Sussex EP	92.7	107.1	99.9
10	Kent EP	93.0	95.2	94.1
11	Isle of Wight EP	59.9	89.0	74.5
	South East	122.8	113.4	118.1
	United Kingdom	100.0	100.0	100.0

Knowledge Economy Outputs

This dislocation is shown to be even more profound when analysing the outputs of the knowledge economy, as measured by GDP per capita and labour productivity. As shown by Table 4.3, East Sussex (65.2), Brighton and Hove (79.5) and Kent (91.6) all have an output index below the UK average. However, by far the most worrying figures for the region are those concerning labour productivity. It is quite staggering that, given the relative strength of the region within the UK, labour productivity is a mere 1.8% higher than the UK average. Furthermore, even western areas such as Oxfordshire (97.0) and Buckinghamshire (97.5) have productivity levels below the UK average.

The three most productive areas - Thames Valley, Milton Keynes and Surrey – also all figure in the top four of the Index of Innovation Capacity (Table 4.2), confirming the link between a strong knowledge-based business sector and overall economic performance. The outlier is Buckinghamshire whose lack of productivity, along with Oxfordshire, should be further explored. This exploration should involve a detailed analysis of the sector make-up of the areas, as well as the travel-to-work patterns of residing employees and links with economy of London. Nevertheless, it can be reiterated that productivity performance is an issue for the region as a whole.

Table 4.3: Index of Knowledge Economy Outputs within the Economic Partnership Areas of South East England

Rank	Economic Partnership	GPD/capita	Labour Productivity	Index of Knowledge Economy Outputs
1	Thames Valley EP	151.0	130.7	140.9
2	Milton Keynes EP	140.0	129.1	134.5
3	Surrey EP	127.0	114.0	120.5
4	West Sussex EP	109.0	104.5	106.7
5	Hampshire EP	111.0	102.1	106.5
6	Oxfordshire EP	111.0	97.0	104.0
7	Buckinghamshire EP	110.0	97.5	103.7
8	Kent EP	93.0	90.2	91.6
9	Brighton and Hove EP	81.0	77.9	79.5
10	Isle of Wight EP	67.0	75.9	71.4
11	East Sussex EP	63.0	67.3	65.2
	South East	109.0	101.8	105.4
	United Kingdom	100.0	100.0	100.0

Knowledge Economy Outcomes

The Index of Knowledge Economy Outcomes (Table 4.4) - based levels of employment and earnings – to a large extent mirrors the index of outputs, although there are a number of interesting differences. In particular, while Milton Keynes is ranked second for outputs, it is ranked only 5th for outcomes. Conversely, Buckinghamshire is ranked 3rd for outcomes, but only 7th for outputs. The key difference between the two indices is that while output measures the performance individuals employed in an area, outcomes are a measure of the economic situation of individuals residing within these areas. Therefore, once again we suggest the requirement for further research to analyse the movement of workers within the region (and their links with London), as well as exploration of new graduates and their propensity to either stay within or move from a particular locality.

In general, Table 4.4 finds that for the South East as a whole socio-economic performance, in terms relative earnings and levels of employment, is not massively higher (4.2%) than the UK average. However, the key dampening effect within the South East is the internal west-east divide. This divide will only be overcome if the region operates – at both a public, private and individual level – with a coherent and holistic identity. It is clear that the South East is far from immune to issues of social exclusion and economic bipolorisation.

Table 4.4: Index of Knowledge Economy Outcomes within the Economic Partnership Areas of South East England

Rank	Economic Partnership	Unemployment	Earnings	Index of Knowledge Economy Outcomes
1	Thames Valley EP	104.2	124.5	114.3
2	Surrey EP	103.8	119.4	111.6
3	Buckinghamshire EP	102.2	117.1	109.7
4	Oxfordshire EP	104.3	102.9	103.6
5	Milton Keynes EP	103.5	103.4	103.5
6	West Sussex EP	102.9	103.0	102.9
7	Hampshire EP	102.3	103.4	102.9
8	Kent EP	100.6	95.9	98.2
9	East Sussex EP	101.0	89.0	95.0
10	Brighton and Hove EP	98.4	88.4	93.4
11	Isle of Wight EP	94.0	81.0	87.5
	South East	102.3	106.1	104.2
	United Kingdom	100.0	100.0	100.0

Knowledge Sustainability

To some extent the issue of social exclusion is reflected by Table 4.5, which illustrates the Index of Knowledge Sustainability - or the conditions for knowledge reinvestment. This has been based on school performance at GCSE and Advanced-level. The hypothesis being that those areas with higher level of achievers from the school system will have a higher probability of sustaining and enhancing the available knowledge capital. Once again, the South East outperforms the UK average by a mere 4.1%. Buckinghamshire is the highest performer with an indexed figure of 122.9, followed by Surrey and Thames Valley. The 4th ranked area is Kent, the most eastern area of the region. This relatively high figure for Kent suggests a lack of local opportunities for 'new workers' and/or a movement of human capital out of the area.

The issue of social exclusion within particular areas can be witnessed by the ranking of Oxfordshire (8th), Milton Keynes (10th) and Brighton and Hove (11th), all of which under-perform compared to the regional and UK average. Particularly in the cases of Oxfordshire and Brighton and Hove, it seems that connection between schools education and local university education is weak, with the movement of human capital along this chain less than integrated. This could be due to a number reasons, such as the current weakness of regional identity and/or the significance of London as an external, yet adjacent force.

Table 4.5: Index of Knowledge Sustainability within the Economic Partnership Areas of South East England

Rank	Economic Partnership	Compulsory Educational Attainment	Advanced Level Educational Attainment	Index of Knowledge Sustainability
1	Buckinghamshire EP	129.0	116.9	122.9
2	Surrey EP	119.7	98.9	109.3
3	Thames Valley EP	109.7	100.1	104.9
4	Kent EP	105.8	102.6	104.2
5	West Sussex EP	113.5	91.6	102.6
6	Hampshire EP	103.6	99.9	101.8
7	East Sussex EP	104.9	88.8	96.8
8	Oxfordshire EP	101.3	90.4	95.9
9	Isle of Wight EP	94.3	94.9	94.6
10	Milton Keynes EP	83.5	89.3	86.4
11	Brighton and Hove EP	89.0	82.0	85.5
	South East	108.2	100.0	104.1
	United Kingdom	100.0	100.0	100.0

Index of the Knowledge Economy within South East England

Table 4.6 illustrates the overall Index of the Knowledge Economy within South East England. It shows that the overall knowledge economy of the South East is almost 12% stronger than the UK average. However, within the region there are significant disparities; although with the exception of the Isle of Wight all perform above the UK average. The knowledge powerhouses are clearly situated within the western and northern parts of the region (see Figure 4.1) – those areas performing above the regional average consisting of: Thames Valley (121.82); Surrey (121.45), Buckinghamshire (120.68) and Oxfordshire (116.22). The remaining localities all perform relatively worse than the regional average (111.67), with this most accentuated by the Isle of Wight (85.80), East Sussex (100.41), Brighton and Hove (102.86), and Kent (103.16).

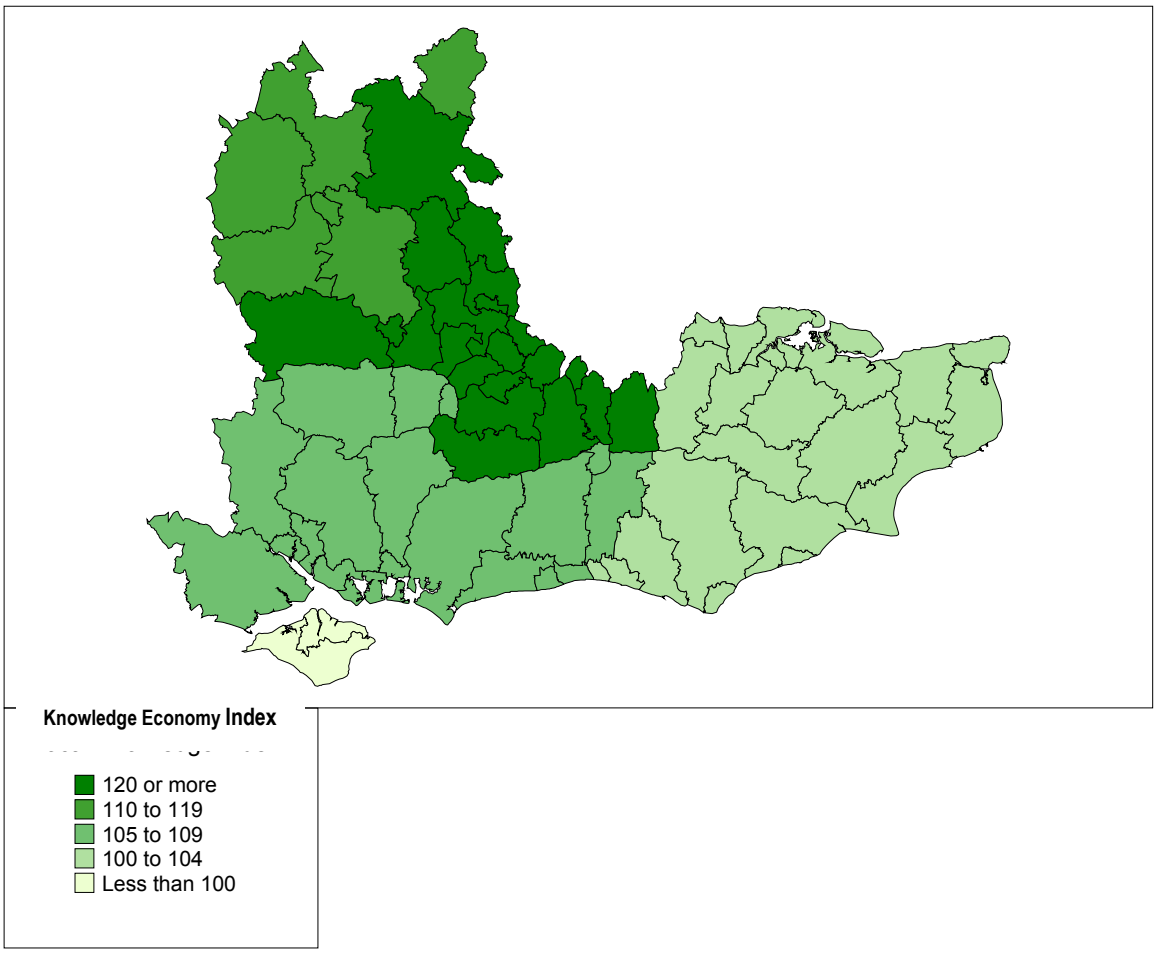
Overall, Table 4.6 is an important barometer of knowledge-based development across the South East region, and one that should be tracked and monitored. However, if policymakers are to make a difference to the future scores within this Index there must be a clear understanding of the conditions underlying knowledge-based growth and development. Interestingly, the top three knowledge economy rankings mirror the current rankings for forecast growth in GDP between 2000-2010 in the South East region (Thames Valley 4%; Surrey 3.5; and Buckinghamshire 3.4%). From the econometric analysis we have undertaken three core conditions have emerged, with indices available to understand each areas current standing with regard to these conditions. These conditions for knowledge-based growth, which are explored in the following sections of this report, consist of:

- Business Conditions
- Human Capital Conditions
- Institutional Conditions.

Table 4.6: Index of the Knowledge Economy within the Economic Partnership Areas of South East England

Rank	Economic Partnership Area	Knowledge Economy Index
1	Thames Valley EP	121.82
2	Surrey EP	121.45
3	Buckinghamshire EP	120.68
4	Oxfordshire EP	116.22
5	Milton Keynes EP	110.35
6	West Sussex EP	108.77
7	Hampshire EP	108.50
8	Kent EP	103.16
9	Brighton and Hove EP	102.86
10	East Sussex EP	100.41
11	Isle of Wight EP	85.80
	South East	111.67
	UK	100.00

Figure 4.1: The Location of Knowledge within South East England



Business Conditions

The econometric analysis of the South East region indicates that by far the most important factors related to achieving economic growth and sustainability are the establishment of a core of relatively highly productive companies, the majority of whom operate in knowledge-based sectors. As shown by Table 4.7, there is clear divide in business conditions between the western and eastern parts of the region. The fact that business conditions for four Economic Partnership areas are below the UK average is obviously disturbing. The variance in business conditions may, as already pointed out, be partly due to each areas connection with the capital region – a factor requiring further exploration.

Table 4.7: Index of Business Conditions for Knowledge-Based Growth within the Economic Partnership Areas of South East England

Rank	Economic Partnership Area	Business Conditions
1	Thames Valley EP	122.0
2	Surrey EP	117.1
3	Milton Keynes EP	115.8
4	Buckinghamshire EP	112.9
5	Oxfordshire EP	109.4
6	Hampshire EP	106.6
7	West Sussex EP	106.3
8	Kent EP	99.3
9	Brighton and Hove EP	95.7
10	East Sussex EP	93.1
11	Isle of Wight EP	84.9
	South East	108.0
	UK	100.0

Human Capital Conditions

From the analysis we find a strong link between business density and what we refer to as human capital conditions. These human capital conditions incorporate high achievers at school level, as well the existing numbers of knowledge workers. Indeed, there appears to be a strong link between human capital and knowledge-based entrepreneurship. This linked is undoubtedly hugely embedded within both regions and localities, and difficult to calculate. However, it does seem plausible that higher-educated workers, particularly those in

knowledge professions, have a higher propensity to establish their own business, especially in knowledge-based sectors.

At present, the best human capital conditions are clustered in western areas, particularly Buckinghamshire, Surrey and Thames Valley (Table 4.8). Although areas such as Kent and Brighton and Hove have certain human capital strengths – Kent in the form of relatively high achievers at school level, and Brighton and Hove in the form of the knowledge capital residing within the higher education establishments – these are not currently being transformed into strong localised business conditions for knowledge growth.

Table 4.8: Index of Human Capital Conditions for Knowledge-Based Growth within the Economic Partnership Areas of South East England

Rank	Economic Partnership Area	Human Capital Conditions
1	Buckinghamshire EP	125.8
2	Surrey EP	119.5
3	Thames Valley EP	116.6
4	West Sussex EP	106.9
5	Hampshire EP	104.8
6	Oxfordshire EP	104.6
7	Kent EP	102.2
8	Milton Keynes EP	99.3
9	East Sussex EP	98.6
10	Brighton and Hove EP	93.7
11	Isle of Wight EP	87.7
	South East	108.7
	UK	100.0

Institutional Conditions

Institutional conditions are a reflection of the vibrancy and opportunities for knowledge-based growth with an economy. Although less tangible than business and human capital conditions, they are an important contributor towards providing an 'atmosphere' for knowledge creation, transformation and innovation. From our available indicators, high levels of economic activity, high-skilled employment opportunities, and a range of 'innovation establishments' (such as higher education institutions and laboratories) all combine to provide varying levels of knowledge embeddedness.

From Table 9 we can see that the South East has a score for institutional conditions significantly above the UK average (14.6%). Within the region we almost see a list of the 'usual suspects' at the top of the index, with a very strong correlation with the overall Knowledge Economy Index at the local level in the South East (Table 4.6). This reiterates the significance of institutional factors for knowledge development, as well as the relative paucity of strong prevailing conditions in the eastern parts of the region.

Table 4.9: Index of Institutional Conditions for Knowledge-Based Growth within the Economic Partnership Areas of South East England

Rank	Economic Partnership Area	Institutional Conditions
1	Oxfordshire EP	127.8
2	Thames Valley EP	124.7
3	Surrey EP	122.6
4	Milton Keynes EP	120.1
5	Buckinghamshire EP	115.6
6	Brighton and Hove EP	112.9
7	Hampshire EP	111.9
8	West Sussex EP	111.1
9	Kent EP	105.0
10	East Sussex EP	104.9
11	Isle of Wight EP	86.3
	South East	114.6
	UK	100.0

5. Comparator Regions for South East England

This chapter compares the South East of England with those overseas regions that have similar spatial structures in terms of the same indices reviewed in the global analysis. The key objective of this exercise is to examine whether the spatial structures of South East have a decisive impact upon the region's performance in knowledge-based economic development. By comparing the region with its comparator regions, we seek to understand the degree to which South East's performance is influenced by its spatial structures.

A contentious issue of South East's economic development is its geographical position next to London, the country's prime metropolis, and its polycentric structure. It is often argued that the region's economic development has been hampered by London's power to attract high value added activities and, as a result, skilled knowledge workers from its hinterland regions. In addition, the region's polycentric structure containing centres of varied natures makes it difficult to implement co-ordinated economic development policy within the region. Our question is whether the spatial structures decide the pattern of the region's knowledge-based economic development.

As comparator regions for South East, we have selected the following regions:

- Raleigh-Durham, US: the region, known for its Research Triangle, is highly polycentric.
- Hartford, US: its location next to New York is similar to South East's situation.
- Los Angeles, US: its economic activity is highly spread within the region, being a giant suburb without a clear nucleus.
- Ontario, Canada: the region has a polycentric structure.
- Hamburg and Bayern, Germany: regions with a polycentric structure.
- West Nederland and Zuid Nederland, Netherlands: regions with a polycentric structure.
- Kanagawa, Japan: Japanese equivalent of South East in its relation to Tokyo.

Tables 5.1 to 5.10 present the ten regions' scores for the indices reviewed in Chapter 3.

Our findings from the comparisons are both positive and negative. First of all, those regions with spatial structures similar to those of South East are a minority in our league table. As noted in Chapter 2, we initially had 56 regions to look into and dropped 16 of them as under-achievers from our subsequent analysis. Many of those under-

achieving regions are polycentric in their spatial structure (e.g. Vlaams Gewest, Belgium; Niedersachsen, Nordrhein-Westfalen, Germany; Nord Ovest,Nord Est, Emilia Romagna, Centro, Italy). This suggests that polycentric structures tend to have adverse effects upon knowledge-based economic development.

Nonetheless, we have also found that the spatial structures like those of South East do not necessarily determine the pattern of knowledge-based economic development. This is clearly seen in Table 5.10 showing the scores of South East and its comparators in Principal Knowledge Economy Driver Strengths, Weightless Economy Attributes, and Regional Knowledge Economy Outputs. The distinctive pattern of the South East – i.e. its weakness in Knowledge Economy Outcomes, relative to other indices - is not shared by all comparator regions in the table. A similar pattern is only found in Kanagawa, Japan and Zuid-Nederland, Netherlands. This suggests that South East's weak capability of translating its abundant Knowledge Capital into high levels of Knowledge Economy Outputs is not explained by its spatial structures alone.

The examination of South East and its comparator regions demonstrates a complex nature of the knowledge-based economic development dynamics.

Table 5.1: Index of Economic Activity Rate, Employment and Number of Managers

Region	Economic Activity Rate	Employment	Number of managers
Raleigh-Durham, US	114.8	114.9	192.8
Kanagawa, Japan	99.9	105.6	96.0
Hartford, US	102.8	103.0	137.7
Ontario, Canada	105.1	102.6	184.5
Zuid-Nederland, Netherlands	98.0	100.1	73.9
West-Nederland, Netherlands	98.3	99.9	73.5
South East, UK	**102.6**	**98.8**	**182.4**
Bayern, Germany	95.1	97.8	17.5
Los Angeles, US	103.2	96.2	101.4
Hamburg, Germany	91.8	94.2	14.0

Table 5.2: Index of Employment in IT and Computer Manufacturing, and Biotechnology and Chemicals

Region	Employment in IT and Computer Manufacturing	Employment in Biotechnology and Chemicals
Kanagawa, Japan	228.4	75.9
Zuid-Nederland, Netherlands	200.1	164.3
South East, UK	**133.6**	**142.6**
Raleigh-Durham, US	93.5	193.6
Bayern, Germany	76.8	119.8
Los Angeles, US	66.2	53.5
Hamburg, Germany	48.0	142.6
Hartford, US	44.5	47.2
Ontario, Canada	37.7	69.5
West-Nederland, Netherlands	19.6	98.5

Table 5.3: Index of Employment in Automotive and Mechanical Engineering, and Instrumentation and Electrical Machinery

Region	Employment in Automotive and mechanical engineering	Employment in Instrumentation and Electrical machinery
Bayern, Germany	202.2	250.9
Ontario, Canada	169.5	45.7
Hartford, US	158.9	117.2
Kanagawa, Japan	116.8	113.0
South East, UK	**91.8**	**126.4**
Hamburg, Germany	82.8	88.7
Zuid-Nederland, Netherlands	72.4	51.4
Los Angeles, US	70.4	109.3
West-Nederland, Netherlands	42.9	30.1
Raleigh-Durham, US	36.7	128.2

Table 5.4: Index of Employment in High-Tech Services

Region	Employment in High-Tech Services
Raleigh-Durham, US	149.6
South East, UK	**133.3**
Ontario, Canada	93.6
West-Nederland, Netherlands	93.3
Hartford, US	80.7
Kanagawa, Japan	73.4
Hamburg, Germany	68.8
Los Angeles, US	65.9
Bayern, Germany	65.4
Zuid-Nederland, Netherlands	57.1

Table 5.5: Index of Expenditures on R&D Performed by Government and Business

Region	R&D expenditure by Government	R&D expenditure by Business
Los Angeles, US	154.5	195.0
Hartford, US	13.2	170.7
Kanagawa, Japan	8.8	135.0
Bayern, Germany	63.9	95.8
Raleigh-Durham, US	46.3	82.3
Hamburg, Germany	139.1	82.1
South East, UK	**142.4**	**80.6**
Ontario, Canada	62.3	78.1
Zuid-Nederland, Netherlands	82.0	46.5
West-Nederland, Netherlands	81.9	46.4

Table 5.6: Index of Patent Registrations

Region	Patents Registrations
Raleigh-Durham, US	278.5
Hartford, US	142.8
Bayern, Germany	125.6
Zuid-Nederland, Netherlands	112.8
Los Angeles, US	92.0
Hamburg, Germany	56.6
Ontario, Canada	50.4
South East, UK	**49.3**
West-Nederland, Netherlands	34.0
Kanagawa, Japan	27.5

Table 5.7: Index of Gross Domestic Product and Labour Productivity

Region	Gross Domestic Product	Labour Productivity
Hartford, US	160.5	155.7
Hamburg, Germany	128.7	135.6
Raleigh-Durham, US	112.7	98.5
Los Angeles, US	104.0	108.1
Ontario, Canada	95.9	91.6
West-Nederland, Netherlands	87.4	86.9
Bayern, Germany	85.5	86.8
South East, UK	**77.0**	**77.4**
Zuid-Nederland, Netherlands	74.6	74.0
Kanagawa, Japan	71.6	67.9

Table 5.8: Index of Earnings and Unemployment Rates

Region	Earnings	Unemployment Rates
Hartford, US	138.5	102.8

Los Angeles, US	118.0	100.3
Raleigh-Durham, US	116.6	103.4
Hamburg, Germany	108.1	97.0
Kanagawa, Japan	101.2	100.5
Ontario, Canada	96.8	99.3
Bayern, Germany	93.5	100.1
West-Nederland, Netherlands	89.7	102.1
South East, UK	**87.4**	**101.9**
Zuid-Nederland, Netherlands	82.0	102.1

Table 5.9: Index of Public Expenditures on Primary and Secondary Education and Higher Education

Region	Primary & Secondary Education	Higher Education
Raleigh-Durham, US	114.7	172.0
Los Angeles, US	122.5	157.7
Hamburg, Germany	69.9	122.7
Hartford, US	170.7	119.5
Zuid-Nederland, Netherlands	74.0	103.9
Ontario, Canada	104.8	103.4
West-Nederland, Netherlands	74.0	84.9
Bayern, Germany	69.9	73.7
South East, UK	**78.3**	**55.3**
Kanagawa, Japan	71.2	42.3

Table 5.10: Index of 5 Dimensions in Knowledge-Based Economic Development Dynamics

Region	Principal Knowledge Economy Driver Strengths	Weightless Economy Attributes	Regional Knowledge Economy Outputs
Hartford, US	150.2	101.0	192.9
Los Angeles, US	125.5	115.5	133.5
Raleigh-Durham, US	148.8	125.1	128.1
Hamburg, Germany	72.0	103.1	119.3
Ontario, Canada	103.6	89.4	90.3
West-Nederland, Netherlands	80.2	106.8	71.3
Bayern, Germany	73.7	24.6	69.6
South East, UK	**92.2**	**102.5**	**62.7**
Zuid-Nederland, Netherlands	78.9	75.1	54.7
Kanagawa, Japan	83.2	63.2	54.1

6. Conclusions

The benchmarking of the South East region against the globe's high performing regions clearly indicates the existence of high levels of knowledge capital and knowledge-based industrial sector activity within the region. In particular the South East performs above the global high-forming mean for the following indicators:

- Economic activity –2.6% higher
- Knowledge workers – 19.3% higher
- Employment in IT and computer manufacturing – 33.6% higher
- Employment in biotechnology and chemicals – 42.6% higher
- Employment in instrumentation and electrical machinery – 26.4% higher.

However, as already indicated, these knowledge 'inputs' are not being mobilised into the creation of high-level knowledge economic outputs and outcomes, nor does there seem to adequate sustainability in terms of educational expenditure. In particular the South East performs lower than the global high-forming mean for the following indicators:

- R&D expenditure by businesses – 19.4% lower
- Patent registration – 50.7% lower
- GDP per capita – 23.0% lower
- Labour productivity – 22.6% lower
- Average earnings – 12.6% lower
- Expenditure on primary and secondary education – 21.7% lower
- Expenditure of higher education – 44.7% lower.

The Productivity Problem

These findings strongly suggest that the workings of the South East's economy are currently less effective and efficient than a number of high-performing regions. This is best demonstrated by the relatively poor labour productivity achieved by the region. In many respects, the South East's productivity problem is a reflections of the UK's own weak levels of productivity. A report by the McKinsey Global Institute in 1998 ('*Driving Productivity and Growth in the UK Economy*') points to four root causes of this low productivity:

- Low levels of competitive intensity have limited the pressure on management to improve.

- Product market and land use regulations prevent the most productive companies from expanding, and conversely have allowed less productive companies to remain in business.

- Spillover effects have meant that low productivity in one sector has led to low productivity in another.

- Managerial practices in the UK have dictated companies pursuing under-performing business strategies.

The extent of these deficiencies across the UK has resulted in competitiveness being impeded by low capital investment, low skills and sub-scale operation. Furthermore, it is clear that higher levels of productivity would be translated into an increase in real disposable incomes, larger government receipts, and improved employment opportunities.

It is obvious that the extent of the four problems varies across the UK, being most acute and accentuated in peripheral regions. However, it is equally obvious that not only is this the national economic context within which the South East has to operate, but also that when regional comparisons are made against comparator regions these problems are also valid for the South East.

Bipolarisation - within the South East economy there is a significant bipolarisation of work and occupations. While a relatively small portion of knowledge-based, high-paying jobs (approximately one-seventh of all jobs are considered high-tech manufacturing and service jobs) exist, the vast majority are low-skill, low-paying service jobs. This has created a situation within which any surplus generated by knowledge-based jobs are too thinly spread across average GDP/capita or (earnings) and more than cancelled out by below-average figures of the greater majority of low-paying jobs.

The bipolarisation is due to a number of factors. First, a significant proportion of manufacturing jobs have been displaced by service-sector jobs during the last two decades within the South East (as well as in the UK as a whole). Manufacturing jobs tend to produce a more even distribution of income as (1) collective negotiation of wages are in place in many large-scale corporations and (2) a higher percentage are full-time jobs. In contrast, many employees in service sectors work on a part-time basis, which are not under the protection of collective bodies. A large proportion of service sector jobs are also concentrated in retail and wholesale, and restaurants and hotels, generating low income.

Education and Training - also, the lack of education and training for employees in service sectors exacerbate the situation, lowering labour productivity. This has been created by a surge of so-called 'fexible' part-time employees for whom training opportunities are lacking, due to the lack of incentives on the part of their employers. Deregulation of labour markets since the 1980s has increased flexibility, but failed to create a condition for better education and training, which had been a weakness in the UK economy since the 1950s.

Social System - Within the UK there is a lack of a 'social system' that distributes income across different occupations. In the UK, a relatively small number of high-ranking managers earn a disproportionately high income relative to the rest of the employees. This tendency is to some extent pronounced in "New Economy" sectors such as software and multimedia in every major advanced economy. Nonetheless, the "winner-take-it-all" tendency is socially less accepted in other European countries. This has facilitated them to achieve a more even distribution of income and avoid a 'class society', which in turn encourages participation in education and training across various groups of the society.

The bipolarisation of jobs is to some extent inevitable. Under these circumstances, policy intervention needs to be aimed at increasing the proportion of high-value knowledge-based jobs in the whole regional economy. This should take place both in manufacturing sectors and service sectors. Particularly, given their large relative proportion, the need for upgrading service sector jobs is utmost and urgent. This has to be achieved from all fronts including education and training policy, as well industrial policy targeting knowledge-based sectors.

Clusters – Little Evidence of their Prevalence

Despite the existence of a high concentration of knowledge-based employment, the findings present little evidence of the presence of clusters in the sense outlined in chapter – i.e. a critical mass of firms that interact with each other or other related firms and institutions producing high levels of innovation. Indeed, it is apparent that levels of innovation in the South East do not match those of many high-performing regions, as witnessed by the relatively low level of patent applications. Despite possessing a strong stock of knowledge capital, the actual undertaking of effective and efficient innovation is currently relatively weak. Analysing the reasoning behind the existence of this innovation gap is necessarily a complex task. However, it can hypothesised that this is precisely due to the lack of effective clusters and the networks they necessarily consist of, for instance:

- **Knowledge Networks (Human)** - despite discussions concerning the existence of high-tech clustering in the South

East, there is no current evidence that the concentration of activity within, for example, the biotechnology and ICT sectors is anything more than simple agglomeration. The interaction and connections between firms and also with support organisations, synonymous with cluster activity, are not known to exist in the South East on a widespread level. In particular, the interface between industry and academia appears to be poorly developed, along with business engagement within civic activities. Indeed, there is undoubtedly a lack of regional identity within the region as a whole.

- **Knowledge Networks (Infrastructural)** - the lack of access to broadband telecommunications networking in the UK is a serious issue for a region such as the South East which is at the forefront of creating the UK's knowledge-based economy.

- **The Ownership of Firms** – many of the knowledge-based firms in the region are foreign-owned and may still undertake much of their innovation at their indigenous facilities.

- **Capital Market Structure** - the financing of the South East's knowledge economy still lies in a capital market structure that is largely orchestrated from the neighbouring region of London, which as numerous reports over the recent years has shown to still operate on an agenda based on short-term gains, which are contrary to the requirements of creating an environment of innovation. In particular, the localised access to venture capital prevalent in a number of knowledge-based clusters is largely absent in the South East.

- **The Size of Firms** – many of the knowledge-based firms in the South East are relatively large in terms of number of employees, and it is therefore unclear as to the extent which these employees are actually involved in value-added knowledge-based occupations.

The Policy Framework

As part of the review of the Regional Economic Strategy and preparation of the Regional Business Plan, partners will need to reflect on the benchmarking study and consider how best to respond. The challenge for SEEDA and its partners is to support, develop and implement a programme of action to ensure the region captures the full benefits of its knowledge economy base. It was not the aim of the original brief, nor is it our intention here, to present a co-ordinated programme of actions. However, we do consider that in defining policy interventions there some key elements that should influence a future agenda for action. These include: (1) Existing initiatives; (2) Changing

policy agenda; (3) Intra-regional variation and responses; (4) Social cohesion; and (5) the 'London' factor.

Existing Initiatives

SEEDA, in partnership with other key stakeholders, is already progressing a comprehensive programme of activities to support Enterprise Development, for example the Enterprise Hub initiative, Innovative Cluster Fund, support towards restructuring the business support infrastructure. The critical question for the region is to consider whether these resources are being harnessed effectively.

Changing Policy Agenda

Since October 2000, there have been a number of key policy changes and announcements at UK and EU level that will shape future interventions. New arrangements for the Learning and Skills Council (LSC) areas in the region together with the new Small Business Service franchises create a new institutional structure to deliver education, skills and training as well as business support.

The regional knowledge development agenda will be required to be integrated across economic, business, education and social policy measures, some of which necessarily require co-ordinating at a national level.

Central Government has emphasised the importance of business clusters as a key regional and national economic development tool to improve competitiveness. The recent Science and Innovation White Paper emphasised the process of developing clusters of innovation by improving links between universities, other research institutes and businesses.

The UK Government's 1998 Competitiveness White Paper identified three broad themes for policy action:

- Investing in capabilities
- Catalysing collaboration
- Promoting competition.

Intra-Regional Variations and Responses

The sub-regional analysis has found a significant west-east divide in the evolution of the knowledge-driven economy in the South East. This should come as no surprise given that SEEDA's Business Plan states an "overall assessment of regional economic performances belies the extent of internal diversity within the South East". Furthermore, per capita GDP ranges from over 30% above the UK average (in Berkshire) to over 20% below in both East Sussex and the Isle of Wight. The important differences between the sub regions of the South East, in terms of overall economic performance and prospects, will mean variations in levels of interventions to support the development of the knowledge economy.

The challenge will be to develop agreement and consensus as to the hierarchy of public sector interventions, for example:

- Regional
- Sub-regional
- Region-wide sector partnerships
- Key thematic partnerships
- Prospective delivery partners.

Social Cohesion

Related to intra-regional variation is the issue of knowledge and social cohesion. High levels of social cohesion facilitate a wider involvement in the knowledge economy, particularly if there is a greater parity in income levels and therefore purchasing power. However, to some extent we are left with the cause-effect conundrum, whereby greater social cohesion may be only achieved through engagement with the knowledge economy. The role of public intervention, therefore, is to seek engagement with the knowledge economy through improvements and the resources available to the education system, with wider access itself acting as a catalyst of social cohesion.

The "London" factor

Any analysis of the South East economy has to take into account the London factor. The capital sucks in a net 600,000 workers daily, with a significant number from the GOSE region. This does have an impact on some indicators, particularly the prosperity and productivity indicators.

Scope for Intervention

SEEDA and its economic development partnerships have direct responsibility for creating the right environment for improving productivity in key (knowledge) sectors, including factors such as transport, education and training, regulation, planning etc. As the regional development agency, SEEDA is charged with developing a strategy and then ensuring it is implemented. However, SEEDA's role is not to lead or fund all, or the majority, of programmes and initiatives. An important consideration in terms of coordinating action to support the knowledge sectors will be clarifying roles and responsibilities as well as the areas of activities.

To address some of the findings of the benchmarking report, the "areas for intervention" will include:

- **Policy direction**: the implications of the benchmarking study will have policy implications, which need to be discussed and presented within the Regional Economic Strategy and sub-regional strategies

- **External advocacy**: as well as securing funding and investment and to influence national / European policy, at a practical level, pressure and influence will need to exerted to define common European indicators to assess and benchmark regional economies at a European level

- **Shaper, influencer and facilitator**: using funding and strategic overview, to ensure that the strategies and programmes of others address the barriers of promoting and securing high-value knowledge sectors. This is particularly the case in helping to shape the direction and delivery of the new Learning and Skills Councils and Small Business Service to ensure the needs of the region's businesses are met.

There are a number of "policy intervention areas", which need to be considered to help the South East region's economy realise its opportunities and potential to support, attract and develop the knowledge economy. These are discussed below.

Enterprise Development

A key strategic priority identified within the Regional Economic Strategy (RES) is to ensure that support networks for ambitious businesses are both world class and accessible. Future strategies will need to be developed and implemented, in partnership with the Small Business Service/Business Link to create and sustain globally competitive knowledge sectors. Further collaboration between firms across key

sectors will be essential to develop supply chains and the critical mass of smaller firms needed to encourage future competitiveness. Also, it is paramount that the number of high-performing and knowledge-based businesses in the east of the region be increased through indigenous creation or attraction from elsewhere.

Further support is needed to develop the Enterprise hubs into regional knowledge sharing networks between HEIs, research centres and critically the business community. SEEDA will need to ensure that a full suite of financial support is in place for SMEs, including possible new capital markets for knowledge-based start-ups.

Inward Investment

The South East is already a major beneficiary of inward investment, which has continued to aid the diversification of the regional economy. In many instances, the concentration of knowledge-based businesses is mainly an imported phenomenon, which has been brought about primarily by the influx of high-powered overseas firms. This is especially the case for the Thames Valley, which could be seen as a westward extension of the West London economy, where foreign firms have been attracted by the presence of Heathrow, proximity to London, good communications, availability of sites and premises etc.

Clearly, all sub-regions within the South East cannot offer the same inward investment product offer. In terms of supporting knowledge base businesses, the priority in some sub region will be to retain strategic and growing firms that contribute to current and future prosperity. The 'trick' for many areas in the future will be to try and encourage more indigenous growth.

Furthermore, with the exception of Ireland, the UK has the highest share among OECD nations of foreign-owned firms involved in some form of R&D within the host nation. This is possibly not the profitable activity for the host nation as is often argued. It is unclear where the revenue from these activities is directed, or the nature of the R&D undertaken.

Creating a Culture of Entrepreneurship

The key point of departure for any policies responses proactively encouraged to think and act beyond the current conventions of regeneration policy is to acknowledge it is no longer mainstream economic development practices, based on public sector pump-priming of either structural or hard infrastructure projects (usually at a standardised regional level) that are pushing forward the new growth geographic areas of the global economy. In short, new processes of ***economic gardening*** have replaced standard economic development

models as the driver of regeneration in those industrialised areas of the world that are most successfully reconverting and growing their economies. The emphasis on gardening, as opposed to development, represents a major recognition of new growth and increased competitiveness being best served by a policy environment allowing both individuals and businesses to 'sow-seeds' nurtured over a significant period of time.

Economic gardening, through the application of long-term business formation and growth initiatives (as well as associated development supplying the 'raw materials', in terms of new entrepreneurs and skilled workforces) lies at the very heart of the most innovative and successful models within most localities and regions achieving growth that is robust enough, and detached enough from long-term public subsidy or other concessions, to weather political, recessionary or other global fluctuations and shocks.

Embedding entrepreneurship, including entrepreneurial education throughout the whole educational process, will be a key strand activity to ensure the effective exploitation of knowledge research and new business formation. The South East region needs to support and develop both practical and theoretical entrepreneurial skills together with an entrepreneurial mindset to create, contribute towards and grow indigenous businesses, particularly in embryonic clusters, which are small at present but have the potential to grow rapidly, e.g. interactive media for education and entertainment, medical technologies etc.

Skills and Workforce Development

Closely allied to creating a culture of entrepreneurship is the priority to improve skills and competitiveness of the region's businesses. The Skills Development Fund is an important programme to support projects for addressing priority skills needs and gaps identified by labour market information. An important policy consideration is to understand and map current, and future, skills development needs in knowledge-based sectors. The policy objective will be to create a region-wide fully business focused skills development programmes in within each of SEEDA's Sector Groups.

Clearly, a particular focus in policy terms will be to ensure better linking of need and opportunity to ensure, where possible, that the benefits of the high-value knowledge sectors are spread throughout the region.

Stimulating Regional Buy-in and Engagement

The development of knowledge indicators is an important tool and a prerequisite for generating information and analysis that can be used to initiate a shift in mindset, paving the way for meaningful leadership

cultivation, broader engagement, and regional action. We consider that some form of 'community' participation is further required to create "public buy-in", as well as possibly serve as a catalyst in the creation of political will necessary to champion the report's findings and to assess public perception in three broad areas: regional identity, regional attitudes toward innovation and entrepreneurship, and regional values about economic growth and development.

In a number of US regions sample adult population surveys have been conducted, from which important and unexpected information has emerged that has helped to change the mindset of those decision makers and opinion leaders who participate in the strategic planning and decision making process for those regions. Such a process in the South East could be used to:

- **Initiate** an engagement process--building and motivating a core team to lead a strategic planning process based on this baseline of facts-driven information about the region.

- **Visualize** the desired future people want for the region using the innovation indicator assessment as a way to provide insight into the region's current reality (its performance and capacity for innovation-led development); and

- **Frame** strategic opportunities and challenges, identifying focus areas for action.

In innovative regions, this process can produce far more than a vision and a strategy for change. Through the teamwork of regional leaders, volunteers, and staff, the process also produces a common sense of purpose, new and stronger relationships, mutual trust, and commitment to action. The process can be consciously structured to produce these benefits over the longer term. For instance, US regions such as Austin and Seattle are examples of knowledge-based regions that have considered environmental quality and amenities to be elements of the knowledge economy policy planning. Quality-of-place is undoubtedly becoming a vital factor in sustaining economic competitiveness, and can only be achieved through strong regional governance.

Reflecting on the Study: Data Limitations

During the course of this study we faced a number of problems concerning the lack of reliable data, that would have aided our analysis, for many of the regions we wishes to benchmark, particularly non-UK European regions. For instance, a lack of regional data on:

- Occupational classifications of workers.

- Employment in education.
- Disaggregated employment figures by SIC or NACE codes.
- R&D performed by higher education.
- Value of exports.
- Venture capital financing.
- Household income.
- Participation in high education.

Given the importance of regional policy within Europe this lack of intelligence must begin to be alleviated. For instance, there is currently a dearth of knowledge in Europe compared to the United States on regional venture capital capacity, despite cursory evidence that access to such capital is not uniform across national or supra-regional economies. Given the proximity relationship between the South East and London it is vital that further work is undertaken to explore the capital investment market in the region. Within the UK, there is also little data on the role of business angels and their prevalence, or the nature by which public intervention can facilitate in making new knowledge firms 'ready for investment'.

Furthermore, there is little knowledge of the innovative intensity of and within sectors. In other words, we do not currently know where or how innovation is occurring with firms and sectors, and hypotheses are far to embedded in speculation rather than fact. The role of policy intervention is not to pick winners, but should be focused on identifying externality-generating innovations. However, this is a difficult enough task in itself, but is made impossible by a lack of any useful data.

Knowledge is undoubtedly very difficult to map, quantify or price, since some knowledge – we do not how much – is implicit and uncodified, residing only in the minds of individuals. We agree with the OECD that far more data concerning measures of the following need to be collected and disseminated:

- Knowledge inputs
- Knowledge stocks and flows
- Knowledge outputs
- Knowledge networks

- Knowledge and learning.

Appendix 1: The Benchmarked Regions

San Francisco, United States

San Francisco, covering Silicon Valley is home to a representative facility of many top US high-tech companies. Silicon Valley was given a cluster rating of 16 out of 16 in Wired Magazine's rating of knowledge-based economies, with San Francisco scoring an excellent 13. The main industry sectors are software, e-commerce, hardware, biosience, multimedia, finance - especially venture capital - and semiconductors. The region has earned a reputation as a centre for innovation, a status which is no doubt greatly supported by world-class research universities including Berkeley and Stanford. Lack of office space and rising costs has led some companies to locate elsewhere, but this did not prevent San Francisco from rating highest in the Regional Knowledge Index.

Austin, United States

Austin has seen an economy boom in recent years thanks to the growing high-technology industry. This has earned the area its nickname 'the Silicon Hills'. The last seven years have seen more than 5% employment growth per year. Other key industries for the area are housing and construction, manufacturing and healthcare.

Boston, United States

The Milken Institute rates Massachusetts as the region most likely to benefit from the new economy. Massachusetts itself enjoys the highest concentration of universities in the US including the Massachusetts Institute of technology (MIT), which is rated as the best technology university in the world (MIT related companies provide 1 in 170 jobs in the US). The main industry sectors are Telecommunications, Software and Internet related, Computers and electronics, Biotechnology & Pharmaceuticals, Finance and Manufacturing. Boston is a key centre of finance and trade for New England. Due to the influence of universities and federal research projects, Route 128 surrounding Boston has become home to a cluster of high technology companies.

Washington DC, United States

Washington DC commands attention due to it's global competitiveness in its main industry sectors of telecommunications, Internet Service Providers, Biotechnology and hardware and software. Most of the world's top telecomm and infrastructure companies have facilities in the

area, creating what is now regarded as one of the world's most vital information technology clusters. Washington DC's Biotechnology cluster is the world leader in Genomics research and is the third largest in the US. Knowledge-based companies provide much employment, leaving labour shortages in the non-high tech sectors.

Raleigh-Durham, United States

While Raleigh-Durham used to specialise in agriculture and manufacturing, it's key industries are now medicine, research and high technology. The leading industry sector in the metropolitan area is the service sector, with government and trade coming close behind. One of the America's best known research centres, Research Triangle Park, is situated in the area, housing firms specialising in pharmaceuticals and electronics and employing over 40,000 workers.

Hartford, United States

Hartford's main industry sectors are state government, insurance, manufacturing, and health care. Initiatives from both the city and the state have boosted economic development in recent years. Hartford, along with Connecticut has developed a very strong economic base and appears to have a healthy and profitable 'relationship' with both its East coast neighbours, New York and Boston.

Atlanta, United States

Atlanta benefits from a flow of venture capital to the sum of $6 million per week. Technology is the driving sector, in particular medical technology. Atlanta boasts an ideal technology infrastructure for supporting new technology companies. Advanced telecommunications and distribution systems and a superior air service are some of the reasons given to explain why more than 200 companies relocate or expand into the area each year. The main manufactures include textiles, furniture, food and beverages, telecommunications hardware, steel, paper, and chemicals.

Seattle, United States

Seattle's software industry boasts such big names as Boeing and Microsoft and indeed software is one of the area's key industry sectors, along with biotechnology and aerospace. Sales from Boeing, the state's largest employer, certainly boost the revenue from exports, with Seattle ranking as America's biggest exporter. Seattle has proved popular for large businesses as a result of its favourable environment for business development and attractive personal tax climate.

New York, United States

The largest percentage of New York's jobs lie in the service sector, however, manufacturing still provides many jobs, with the major goods being printed materials, apparel, food products, machinery, chemicals, paper, electrical equipment, computer equipment, optical instruments and cameras, sporting goods, and transportation equipment. The region has seen an explosive growth in it's new media industry over recent years and has also become a major centre for mass communication, advertising and entertainment, as well as earning a considerable revenue from the tourist trade. The effects of the recent destruction of the World Trade Centre and it surrounds will necessarily have a major effect on the knowledge economy of the region.

Chicago, United States

Chicago's economy benefits from an extensive transportation and distribution network. The region is a significant port for both domestic and international trade. The largest employer is the food products industry, followed by the printing and publishing, metal fabrication, electronic equipment, chemical, machinery, and transportation-equipment industries. Manufacturing employs about one-fifth of the metropolitan area's workers.

Tokyo, Japan

Tokyo is notable for its role as headquarters for most private companies in Japan, as well as being the nation's center for finance, government, communications, and education. The region houses approximately 800,000 businesses and 8 million workers. The largest sector of Tokyo's economy is made up of service industries, including wholesale and retail trade, finance, and insurance. The largest category of manufacturing in Tokyo is printing and publishing, accounting for about 20% of all factories in the metropolis and nearly 22% of the sector's labour force. The region is also known for the manufacture of electronic apparatus, transport equipment, automobiles, cameras and optical goods, furniture, textiles, and a wide variety of consumer items.

Los Angeles, United States

Long established as the financial, commercial, and industrial capital of southern California, the sprawling Los Angeles metropolitan area is among the nations leading urban industrial complexes. The size of its population alone makes the Los Angeles metropolitan area California's biggest economic centre, employing 30 percent of the state's workforce. It generates nearly one-third of the value of goods

manufactured in the state and accounts for more than one quarter of all retail and wholesale sales. The city also is a financial centre for the western United States and a principal importer and exporter of international trade goods

Stockholm, Sweden

Stockholm has the highest level of expenditure on innovation in manufacturing throughout Sweden. This, along with a highly skilled workforce, make the region a potentially strong contender in the list of high-performing knowledge-economies. However, the Office of Regional Planning and Urban Transportation in Stockholm claims that Stockholm's rapid population growth is not supported by the necessary transport, housing and education systems. Key industries for the region are high-technology, information technology and communications.

Uusimaa, Finland

Finland's economy as a whole has become increasingly based on service and knowledge, depending less on the traditional industries of forestry and farming. Uusimaa, the region covering Helsinki, has key industries in pharmaceuticals, electronics and electrical products, IT, food and drink, general manufacturing, telecommunications, bio-technology and logistics. Uusimaa boasts the highest rate of internet usage in the world, both for personal and corporate usage, and also has the highest telephone penetration in the world.

Philadelphia, United States

Like in other so-called 'Rust Belt' cities in Northeast and Midwest America, hundreds of thousands of jobs were lost in Philadelphia through the 1970s and 80s. However, the area has recently seen a recovery facilitated by investment in the knowledge economy. A strong group of venture capital funds is fuelling the growth of high-tech companies in the Philadelphia region. A record $475 million in venture capital was invested in Philadelphia-area companies in the year 2000, a 50 percent increase from the previous year. A biotechnology cluster has been rapidly developing in the Philadelphia area. It is claimed that eighty percent of the largest pharmaceutical companies in the world are now within a 50-mile radius of Philadelphia

Ile de France, France

With over 5 million workers, Ile-de-France – covering Paris- houses Europe's largest workforce and also enjoys one of the highest regional GDPs in Europe. Banking and finance is one of the main industry sectors for the area, with approximately 96% of French banks and 70% of French insurance companies based in the area. 41.3% of French high tech production facilities are stationed in the region. Biotechnology is also one of the key industry sectors, with food and drink, metal, agriculture, paper and the automobile industry featuring solidly in the Ile-de-France economy.

Ontario, Canada

Ontario is Canada's most productive region, with 40% of the national GDP being generated there. Ontario's competitive advantages include its natural resources, a large, well-educated labour force, relatively inexpensive electrical power, and proximity to key U.S. markets. Over $10 billion is spent on Tourism, making it the province's third-largest industry. The high technology sector in the sub-region of Ottawa has enjoyed significant growth recently which has been attributed to 'the ability of the local economy to spin off and nurture new innovative firms. Federal government restructuring has put an end to an era where the federal government was the main driver of the region's economy.

New South Wales, Australia

New South Wales accounts for one third of Australia's workforce, with a particular concentration of jobs provided by finance, Information Technology, Telecommunications, Call Centres, Manufacturing, Biotechnology and Pharmaceutical sectors. Sydney, in particular, enjoys a highly skilled and well-educated workforce and contains almost half the Australian IT and telecoms industry. Sydney also boasts Australia's largest financial services sector, which employs almost 45% of the workforce. New South Wales' service industries generates a large portion of capital, with the sector accounting for 80% of state production.

Hamburg, Germany

As Germany's second most highly populated city-region, with one of the 9 most important ports in the world, Hamburg has become the self-claimed 'service and distribution metropolis of Northern Europe' Hamburg's key industries are media, banking, insurance companies, manufacturing and trading. Hamburg's institutes and companies place an emphasis on analytical technology, with their pharmaceutical and bio-technological research becoming well respected with in the industry. The younger academic institutions pride themselves on their

partnership with Hamburg's business, industrial and service sectors, using innovative research and highly educated personnel to maintain a vibrant economy.

Luxembourg

The recent decline in Luxembourg's steel industry has been compensated for by a substantial growth in the region's finance sector. Banking and finance have thus become one of Luxembourg's main industry sectors, along with insurance, telecommunications and agriculture. Luxembourg enjoys a stable economy with low inflation and low unemployment. In 2000, Luxembourg had the highest Personal Computer-density world-wide.

Denmark

Denmark's economy depends highly on foreign trade, due to the amount of food exports from the area. After food exports, the country's main industrial sectors are machinery and equipment, textiles and clothing, chemical products, electronics, construction, shipbuilding, furniture and other wood products. The coalition government has increased research and development funds and has also attempted to enhance industrial competitiveness by initiating reforms for both taxes and the labour market. Denmark enjoys Europe's most flexible labour laws.

West-Nederland, Netherlands

West-Nederland, including Amsterdam, is one of the most highly developed countries of Europe and the world. The population density is one of the highest in the world. The main export destinations for West-Nederland are Germany, Belgium and Luxembourg, France, UK, Italy and the US.

Norway

Norway's main industry sectors are petroleum and gas, food processing, shipbuilding, pulp and paper products, metals, chemicals, timber, mining, textiles and fishing. The country's economy relies heavily on Norway's natural resources, especially the vital petroleum sector which is controlled by the government through large-scale state enterprises.

Kanagawa

Located next to Tokyo, Kanagawa Prefecture is the fifth smallest prefecture in Japan. However, the region's gross product is almost equal to the GDP of Switzerland., accounting for 6.0% of Japan's GDP. The eastern coastal area is the nucleus of the Keihin Industrial Belt, the largest industrial complex in Japan. Manufacturing is Kanagawa's main industry, which accounts for about 30% of the gross prefectural product. Kanagawa Prefecture has more than 1100 research and development institutes and 62 colleges, universities and graduate schools. This greatly contributes to Kanagawa's esteemed role as 'Japan's brain centre'.

Brussels, Belgium

Belgium as a whole relies heavily on the import of raw materials, having itself a restricted supply of natural resources. This makes the country's economy dependant on the condition of world markets. Brussels accounts for about 15% of the GDP of Belgium and has a relatively high unemployment rate of 9.7%. The main industry sectors of Brussels are predominantly knowledge-based, with IT, chemicals, communications, pharmaceuticals and finance being the key contributors. Telecommunications, especially have seen a rapid growth, especially in cellular services, internet use and data transmission

Zuid-Nederland

The Netherlands is one of the most highly developed and densely populated countries of Europe and the world. With its advanced infrastructure for transport of goods, services and communications, The Netherlands has become an important hub of international commerce. Logistical advantages have contributed highly to make the port of Rotterdam, in Zuid-Nederland, the distribution gateway of Europe and the largest port in the world in terms of total tonnage. While the Port of Rotterdam remains the most notable feature of Zuid-Nederland's economy, the city of Rotterdam is also contributing to the area's competitiveness by focussing on the development of non-port-related industries. Efforts have been concentrated on growth of the telecom, multimedia, film, audiovisual, ICT and meditech/biotechnology sectors.

Switzerland

Switzerland's key industries are machinery, chemicals, watches, textiles and precision instruments. To improve the country's competitiveness on an international level Switzerland have been

bringing their economic practices in line with the EU and now enjoy a GDP per capita 20% above that of the big Western European countries. So far the decision to remain outside the European single market structure does not appear to have harmed Swiss interests.

Osaka, Japan

Osaka is the self-titled 'nucleus of the Japanese economy' with its main industries including the manufacture of steel, machinery, textiles, ships, automobiles, and electrical equipment. 99.4% of Osaka's manufacturers (with four or more employees) fall into the category of small and medium- sized enterprises. The manufacturing industries of Osaka are diverse in type, engaging in production of electric and electronic goods, metals, pharmaceuticals, plastics, textiles and foodstuffs. Osaka has many leading companies in each of these areas. According to Fortune magazine, of the world's top 500 companies ranked by manufacturing sales in 1996, 26 were based in Osaka. Recent years have seen a steady rise in the number of foreign-affiliated companies.

Ostosterreich, Austria

With its well-developed market economy and high standard of living, Ostosterreich is closely tied to other EU economies, especially Germany's. In the coming years Austria, which has been a member of the European Union itself since 1995, will use this experience to help achieve a successful enlargement of the EU in Eastern Europe. Overall, Austria has brought it's total public sector deficit down to 2.1% of GDP in 1999 and public debt – at 63.1% of GDP in 1998 - more or less in line with the 60% of GDP required by the EMU's Maastricht criteria.

British Columbia, Canada

British Columbia's economy is based on great natural resources, including forest covering 56% of the region. Tourism is also an important economic sector for the area, with approximately 5million people visiting the area each year. ICT, aerospace and sub-sea sectors of British Columbia are diversifying the economy, encouraging future economic growth for the area.

Bayern, Germany

Bavaria is a hub for West – East and North – South trade and is the number one growth region in Germany. The Bavarian economy is not only characterised by global players, but also by a dense net of small

and medium sized industry, trade and service enterprises. "New products, new firms, new markets", this is the leitmotiv of the Bavarian economic policy. As a partner for the economy it relies on a clear forward strategy in the globalisation of competition and markets.

Baden-Württemberg, Germany

The German state of Baden-Württemberg is responsible for the production of 10 per cent of all capital exports within the EU. Baden-Württemberg is Germany's most industrialised state, with cars, electronic products and machine tools, and manufacturing industries providing about 40 per cent of the state's GDP. Services account for more than a third of Baden-Württemberg's GDP, yet the state remains heavily dependent on the automotive sector and associated industries and tourism is an increasingly important part of the state's economy.

Singapore

Singapore's main industry sectors are Financial Services, Information Technology, Electronics, Petroleum Refining / Petrochemicals, Engineering, Pharmaceuticals, Transport, Biotechnology and Semiconductors. The Singapore government has introduced a wide range of initiatives in key areas to ensure an emphasis on becoming a globally recognised hi-tech centre.

Kyoto

Industrialised manufacturing is a growth industry in the area and textiles and machinery now comprise about half of the city's industrial production. A number of important global, technology-related companies have now been established in Kyoto, such as Nintendo and Kyocera Camera. Kyoto City has initiated various schemes to support venture businesses.

Berlin, Germany

Berlin, capital and largest city of the Federal Republic of Germany, has quickly developed into one of Europe's major industrial and cultural centres and become the single most important city in Germany. Following the division of the city of Berlin in 1949, the economies of the two halves of the city were re-integrated into their respective municipal and national economic systems. Although East Berlin constitutes only a third of the unified city and its population, it became the hub of East Germany's commercial, financial, and transportation systems, and a huge manufacturing centre.

Hessen, Germany

Hessen has one of the highest GDP of the German states, at 50,000 DM per capita. Tourism is a major generator of local economy, along with international conference and exhibition facilities. Hessen's manufacturing industry specialises in machinery and metal goods, textiles, pharmaceuticals, chemicals and cement. Hessen houses the stock exchange and over 400 banks, including Germany's central bank in Frankfurt which settles interest rates and controls money supply, making the state the most important financial centre in the country.

Hong Kong, China

Hong Kong's main industry sectors are banking, telecommunications, information technology, transport services, tourism and the manufacture of electrical/electronic goods and automotive parts and components. Hong Kong's world-class universities place a strong emphasis on high impact research and development and knowledge transfer. The Government's Digital 21 policy has ensured a strong emphasis in investment within the high-tech sector and the new cyberport, a high-tech, IT and multimedia hub, is hoping to attract more high-tech investment and create more opportunities in the future. After suffering economic difficulties since 1998, Hong Kong is showing signs of recovery.

Appendix 2: Factor Analysis for Global Benchmarking

Descriptive Statistics

	Mean	Std. Deviation	Analysis N
Economic Activity	-5.4916E-16	1.0000	56
Employment	-1.6515E-15	1.0000	56
Biotech & Chemicals	-7.4345E-17	1.0000	56
Computers and IT devices	-5.2438E-16	1.0000	56
Automotive and mechanical	-1.7199E-16	1.0000	56
Electrical and Instruments	-5.8881E-16	1.0000	56
Computer services and R&D	3.688E-16	1.0000	56
MANAGERS	1.784E-17	1.0000	56
R&D by Government	7.682E-17	1.0000	56
R&D by Business	-1.4274E-16	1.0000	56
PATENTS	3.985E-16	1.0000	56
GDP	1.269E-16	1.0000	56
Labor Productivity	6.344E-16	1.0000	56
EARNINGS	1.227E-15	1.0000	56
Employment rate		1.0000	56
Elementary eudcation	1.039E-15	1.0000	56
Higher Education	-2.0420E-16	1.0000	56
Secure Servers	1.209E-16	1.0000	56
Internet Hosts	9.149E-16	1.0000	56

Communalities

	Initial	
Economic Activity	.848	.794
Employment	.966	.953
Biotech & Chemicals	.227	9.650E-02
Computers and IT devices	.776	.697
Automotive and mechanical	.548	.299
Electrical and Instruments	.500	.320
Computer services and R&D	.772	
MANAGERS	.668	.535
R&D by Government	.453	.253
R&D by Business	.647	.462
PATENTS	.860	.822
GDP	.991	.986
Labor Productivity	.989	.984
EARNINGS	.758	
Employment rate	.710	.577
Elementary eudcation	.797	.698
Higher Education	.509	.279
Secure Servers	.942	.926
Internet Hosts	.911	.892

Extraction Method: Image Factoring.

Total Variance Explained

	Initial Eigenvalues			Loadings			Rotation Sums of Squared Loadings		
Fact	Total	% of	Cumulativ	Total	% of	Cumulativ	Total	% of	Cumulativ

or		Variance	e %		Variance	e %		Variance	e %
1	7.435	39.129	39.129	4.801	25.270	25.270	5.094		26.810
2	2.439		51.968		22.637	47.907	2.663		40.827
	1.702		60.926		5.138	53.045		9.235	50.062
4	1.351	7.113	68.039	.874	4.600	57.645	1.260	6.629	56.691
5	1.166	6.137	74.176	.943	4.961	62.606	1.124	5.915	62.606
	.977	5.143	79.319						
7	.897	4.722	84.040						
8	.707	3.720	87.760						
9	.523	2.755	90.515						
10	.449	2.362	92.877						
11	.323	1.701	94.578						
12	.298	1.571	96.149						
13	.243	1.276	97.425						
14	.165	.869	98.295						
15	.126	.662	98.957						
16	02	.491	99.448						
17	6.310E-02	.332	99.780						
18	3.717E-02	.196	99.975						
19	4.679E-03	2.463E-02	100.000						
Extraction Method: Image Factoring.									

Factor Matrix(a)

	Factor				
	1	2	3	4	5
	.405	.782	2.998E-02	1.516E-02	-.130
	.296	.901	-.220	-6.701E-02	1.986E-02
	-.209	-8.838E-02	-8.701E-02	.108	.160
	3.690E-02	.522	-.103	.639	-6.791E-02
	-.151	.119	6.414E-02	6.955E-02	.503
	-3.106E-02	.238	-.339	.281	.263
	.480	.483	-.161	5.105E-02	-.439
	.314	.606	.113	-.121	-.205
	9.587E-02	3.348E-02	.156	-5.392E-02	-.465
	.568	.305	7.243E-02	.173	.105
	.503	.531	3.630E-02	.534	2.447E-02
	.987	6.604E-02	-8.799E-02	-2.585E-02	1.158E-02
	.893	-.429	2.347E-02	2.505E-02	-8.637E-03
	.703	.326	.167	-8.970E-02	2.114E-02
	.214	.671	-7.425E-02	-.109	.252
	.648		.374	-1.599E-02	.211
Higher Education	.217		-.424	-8.550E-02	3.165E-02
Secure Servers	.648		.449	-2.495E-02	7.321E-03
Internet Hosts	.606		.398	-3.063E-02	-2.948E-02
Extraction Method: Image Factoring.					
a 5 factors extracted.					

Rotated Factor Matrix(a)

	Factor				
	1	2	3	4	5
	.745	2.192E-02	.331	.316	.168
	.710	-.105	.313	.582	-2.517E-03
	-.201	-.109	5.012E-02	-1.970E-02	-.204
	.197	-.102	.798	.101	-1.727E-02
	8.591E-02	-9.724E-02	3.673E-02	-5.243E-02	-.527
Electrical and Instruments	-3.677E-02	-3.708E-02	.359	.300	-.313
Computer services and R&D	.426	.173	.317	.375	.483
	.643	-1.892E-02	.135	.202	.249
R&D by Government	.109	-1.169E-02	-2.825E-03	-9.926E-02	.481
R&D by Business	.448	.417	.276	9.709E-02	-3.324E-02
PATENTS	.481	.304	.699	9.492E-02	-1.260E-02
	.396	.851	5.734E-02	.280	.154
Labor Productivity	2.344E-02	.971	-9.630E-02	-2.349E-02	.174
EARNINGS	.618	.479	4.641E-02	.118	.103
Employment rate	.602	-5.719E-02	.141	.375	-.226
	.675	.471	5.480E-02	-9.744E-02	-9.230E-02
Higher Education	6.969E-02	.113	6.376E-02	.508	-8.089E-03
Secure Servers	.880	.337	.149	-7.693E-02	.102
Internet Hosts	.878	.272	.173	-1.937E-02	.128

Rotation Method: Varimax with Kaiser Normalization.

a Rotation converged in 14 iterations.

Factor Transformation Matrix

Factor	1	2	3	4	5
1	.384	.889	.047	.175	.170
2	.755	-.409	.369	.354	-.036
3	.463	-.028	-.135	-.875	.037
4	-.246	.134	.912	-.280	-.105
5	.083	.154	-.109	.015	-.978

Extraction Method: Image Factoring.
Rotation Method: Varimax with Kaiser Normalization.

Appendix 3: Factor Analysis for Sub-regional Assessment

Communalities

	Initial	
per capita GDP	.999	.998
Index of Knowledge-based Busines	.993	.885
Employment rate (=1 - unemployme	.962	.772
Economic Activity	.951	.525
Business Density	.975	.834
EARNINGS	.990	.979
Productivity	.999	
Compulsory Educational Attainmen	.990	.955
Employment in Higher Education a		.828
Knowledge Workers (%)	.986	.943
Advanced Level Educational Attai	.855	.629
Extraction Method: Image Factoring.		

Total Variance Explained

	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
Factor	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	Variance	Cumulative %
1		56.080	56.080	5.038	45.796	45.796		33.548	33.548
2	2.282	20.746	76.827		23.968	69.764	3.352	30.474	64.022
3	1.193	10.844	87.671	1.671	15.195	84.959	2.303	20.937	84.959
4	.533	4.843	92.514						
5	.375	3.408							
6	.239	2.173	98.095						
7	.136	1.236	99.331						
8	5.724E-02	.520	99.852						
9	1.210E-02	.110	99.962						
10	3.796E-03	3.451E-02	99.996						
11	04	3.930E-03	100.000						
Extraction Method: Image Factoring.									

Image Covariance Matrix

	per capita GDP	Index of Knowledge-based Busines	Employment rate (=1 - unemployme	Economic Activity	ness Density	EARNINGS	Productivity	Compulsory Educational Attainmen	nt in Higher Educationa	Knowledge Workers (%)	Advanced Level Educational Attai
per capita GDP	.999	.854	.777		.513	.856	.980	.188	.371	.410	.247
Knowledge-based Busines	.854	.993	.783	.609	.648	.864	.786	.338	.371	.708	
Employment rate (=1 - unemployme	.777	.783	.962	.650	.618	.782	.693	.374	.481		.132
Economic Activity	.537	.609	.650	.951	.381	.415	.469	-1.076E-02		.387	-.148
Business Density	.513		.618	.381	.975	.813	.410	.778	.121	.723	.574
EARNINGS	.856	.864	.782	.415	.813	.990	.795	.633	.256	.684	.558
Productivity	.980	.786	.693	.469	.410	95	.999	.120	.246	.256	.238
Compulsory Educational Attainmen	.188	.338	.374	-1.076E-02	.778	.633	0	.990	-.146	.634	.742
Employment in Higher Educationa	.371	.371	.481	.523	.121	.256	.246	-.146	.982	.445	-.224
Knowledge Workers (%)	.410	.708	.667	.387	.723	.684	.256	.634	.445	.986	.270
Advanced Level Educational Attai	.247	.215	.132	-.148	.574	.558	.238	.742	-.224		.855

Extraction Method: Image Factoring.

Factor Matrix(a)

	Factor		
	1	2	3
per capita GDP	.998	-1.829E-02	2.820E-02
Index of Knowledge-based Busines	.864	.318	.192
Employment rate (=1 - unemployme	.778	.328	.244
Economic Activity	.533	7.941E-02	.484
Business Density	.526	.736	-.123
EARNINGS	.868		-.116
Productivity	.983	-.151	-9.654E-02
Compulsory Educational Attainmen	.214	.865	-.400
Employment in Higher Education a	.343	6.433E-02	.840
Knowledge Workers (%)	.417	.806	.346
Advanced Level Educational Attai	.266	.492	-.562
Extraction Method: Image Factoring.			
a 3 factors extracted.			

Rotated Factor Matrix(a)

	Factor		
	1	2	3
per capita GDP	.953	.167	.250
Index of Knowledge-based Busines	.713		.471
Employment rate (=1 - unemployme	.620	.369	.502
Economic Activity	.414	9.773E-03	.595
Business Density	.330	.821	.227
EARNINGS	.727	.630	.229
Productivity	.991	8.497E-02	9.097E-02
Compulsory Educational Attainmen	4.147E-02	.974	-6.352E-02
Employment in Higher Education a	.182	-.163	.876
Knowledge Workers (%)	.137	.702	.656
	.213	.697	-.313
Extraction Method: Image Factoring. Rotation Method: Varimax with Kaiser Normalization.			

Factor Transformation Matrix

Factor	1	2	3
1	.954	.194	.229
2	-.258	.919	.298
3	-.153	-.344	.927
Extraction Method: Image Factoring. Rotation Method: Varimax with Kaiser Normalization.			

Appendix 4: Data Sources

Data for European regions were assembled in conjunction with Eurostat (http://europa.eu.int/comm/eurostat/).

For regions in the US, the sources include:

- US Census Bureau (http://www.census.gov/),
- Bureau of Labor Statistics (http://www.stats.bls.gov/),
- US Patent and Trademark Office (http://www.uspto.gov/),
- US Conference of Mayors (http://www.usmayors.org/),
- Bureau of Economic Analysis (http://www.bea.doc.gov/),
- and Department of Education (http://www.ed.gov/).

As for regions in the rest of the world, the following sources are used:

- Statistics Bureau and Statistics Center, Government of Japan (http://www.stat.go.jp/), Japan Patent Office (http://www.jpo.go.jp/), Economic and Social Research Institute, and the Cabinet Office of Government of Japan (http://www.esri.cao.go.jp/) (for regions in Japan);
- Statistics Canada (http://www.statcan.ca/) (for regions in Canada);
- Australian Bureau of Statistics (http://www.abs.gov.au/) and New South Wales Department of State and Regional Development (http://www.business.nsw.gov.au/) (for New South Wales, Australia);
- Census and Statistics Department, the Government of the Hong Kong (http://www.info.gov.hk/) (for Hong Kong);
- Swiss Federal Statistics Office (http://www.statistik.admin.ch/) (for Switzerland);
- Statistics Singapore (http://www.singstat.gov.sg/) (for Singapore);
- and Statistics Norway (http://www.ssb.no/) (for Norway).

Data for international comparisons of education are available from Institute for Statistics, UNESCO (http://www.unescostat.unesco.org/).

Figures of purchasing power parities used to harmonise monetary value are available from OECD (http://www.oecd.org/).

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