8 Innovation Performance Indicators

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> *"A manager is responsible for the application and performance of knowledge."*
>
> PETER DRUCKER (1909–2005)

This chapter at a glance:

- Introduction: innovation performance indicators and small firms
- Innovation performance
- Framework for measuring innovation performance
- Regional Innovation Performance
- Conclusions

Introduction: innovation performance indicators and small firms

In the 1990s small firms were seen as a driving force for job creation, growth and global competitiveness through innovation (Feldman et al, 2002). According to Freudenberg (2003, p. 14) "innovation can be defined as the development, deployment and economic utilisation of new products, processes and services, and is an increasingly important contributor to sustained and sustainable economic growth, both at micro-economic and macro-economic levels". One of the main indicators cited in the literature used to measure innovation in small firms is research and development (R&D) (Mueller, 1967; Grabowski, 1968; Mansfield, 1968). Other measures include patents (Hall, Griliches and Hausman, 1986; Pakes and Griliches, 1980; Scherer, 1965; 1983; Schwalbach and Zimmermann, 1991), new product innovations (Acs and Audretsch, 1990; 1993; Audretsch, 1995) and the adoption of advanced manufacturing technologies (Dunne, 1994; Romeo, 1975; Siegel, 1999). With regard to these it has been found that large firms have a greater propensity to patent than small firms, small firms appear to be as innovative as large firms and large and small firm innovative activities appear to be complementary (Feldman et al, 2002). A summary of the findings from selected literature on firm size and innovation performance indicators is shown in Table 8.1.

The differences between large and small firms with regard to innovation can be explained through the model of the knowledge production function (Griliches, 1979). A simplified production function can be expanded to include the stock of knowledge as an input and an investment in knowledge that many firms will make will be R&D (Feldman et al, 2002). The OECD Frascati Manual (OECD, 1997) defines R&D as "creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of man, culture and society, and the use of this stock of knowledge to devise new applications". There will be other activities that generate knowledge and although many small firms will not undertake R&D they will still be innovative and these firms will depend on knowledge spillovers from external sources including universities (Audretsch and Feldman, 1996a&b; Link and Rees, 1990). In fact, small firms when compared with large firms will be better at absorbing knowledge from external sources (Feldman et al, 2002). Here new employees will be important and small firms will be able to exploit knowledge embodied in employees to a greater degree than large firms (Audretsch and Stephan, 1996). The reason for this is that small firms will provide an environment for their workers to develop ideas not apparent in large firms (Prevezer, 1997).

Innovation Performance Indicator	Selected Literature	Relationship to size of firm
R&D	Mueller (1967) Grabowksi (1968) Mansfield (1968)	R&D spending positively related to firm size
Patents	Hall, Griliches and Hausman (1986) Pakes and Griliches (1980) Scherer (1965; 1983) Schwalbach and Zimmermann (1991)	Patenting positively or proportionally related to firm size
New product innovations	Acs and Audretsch (1990) Audretsch (1995)	Parity across size of firm – differences according to industry
Adoption of advanced manufacturing technologies	Dunne (1994) Romeo (1975) Siegel (1999)	Positive relationship between firm size and probability of adopting an advanced manufacturing technology

Table 8.1: Summary of findings from selected literature on firm size and innovation performance indicators Source: Feldman et al (2002)

Recent work into innovation performance indicators, at national and regional levels, has shown that there is evidence of variability of such indicators to manipulation (Grupp, 2006). The robustness of such innovation scoreboards has been criticised empirically by heuristic types of analysis (Grupp and Mogee, 2004). This chapter reviews the current innovation performance indicators available and presents an approach that can be used to provide rigorous analysis of small firm innovation activity for comparison with other regions. It is clear that complex and qualitative interrelations within an innovative national environment cannot be measured in a simple sense (Schumpeter, 1934). It is therefore necessary to combine several indicators for innovation to form an aggregate measure (Grupp, 2006). In the area of small firm research in order to reach a broader audience it is necessary to develop simple measures and this is well established. A more complete compilation of such simple indicators has been undertaken by Freudenberg (2003). This chapter identifies those indicators of innovation performance that are relevant to small firm policy which enables comparison of innovation activity between regions/countries.

Comparison of innovation performance with a set of countries and regions enables greater in-depth study with regard to small firm innovation policy. The identification of innovation and technology diffusion as a long term micro-driver of productivity and growth has been identified by the OECD (2001). The aim of the chapter is to seek to answer the question "what are the most appropriate innovation performance indicators for small firms to enable accurate comparison of innovation activity between countries and regions".

Innovation performance

The literature on innovation performance indicators considers the development of measures used to assess trends over time in order to compare the performance of countries at national, regional and industry levels. Grupp (2006) has described innovation indicators as "statistics that describe various aspects of innovation. Individual indicators are generally partial, that is, they do not measure innovation as a whole. Collections of selected indicators are used to measure innovation more broadly. Innovation indicators are often indirect because the underlying phenomenon of interest, innovation, is intangible or not directly observable." This chapter therefore provides a selective overview of the literature with regard to the different approaches adopted including the use of composite indicators with special reference to small firms. Veugelers (2005) has provided an analysis of appropriate indicators for the European Commission (EC) using the concept of national innovative capacity (NIC) (Table 8.2) which is defined as the "ability of a nation to not only produce ideas, but also to commercialise a flow of innovative technologies over the longer term" (Sharpe and Guilbaud, 2005). This approach cautions the use of individual statistical indicators to assess national innovation performance and suggests a systemic approach between indicators and socio economic development (Sharpe and Guilbaud, 2005).

Characteristic	Measure
Common innovation infrastructure – cross cutting institutions, resources and policies	Existing stock of technological know how
	Supporting basic research and higher education
	Overall science and technology policy
Technology Cluster Specific Conditions	Technology specific know how – specialised R&D personnel
	Incentives for innovation – lead users, intellectual property rights (IPR) and market competition
	Related supporting industries (clusters)
Quality of links between clusters and common factors	Industry-science relationships
	Efficient labour and capital markets

Table 8.2: National Innovation Capacity Source: Veugelers (2005, pp 8–9)

A European Innovation Scoreboard (EIS) (Table 8.3) has been developed with regard to the drivers and output of innovation and from this an industry dimension for many indicators can be developed (Sharpe and Guilbaud, 2005). The robustness of innovation scoreboards has been criticised empirically by heuristic type analysis (Grupp and Mogee, 2004). Further to this Veugelers notes that there needs to be care taken with inter industry comparisons of innovation indicators and since the systemic approach to innovation is at the technology sectoral level innovation performance should be analysed across sectors (the lack of data at the sectoral level is the challenge) (Veugelers, 2005).

Indicator	Measure	Source
Human Resources		
S&E graduates	% of 20–29 years age class	EUROSTAT
Population with tertiary education	% of 25–64 years age class	EUROSTAT
Participation in life-long learning	% of 25–64 years age class	EUROSTAT
Employment in medium-high and high tech manufacturing	% of total work force	EUROSTAT
Employment in high-tech services	% of total work force	EUROSTAT
Knowledge creation		
Public R&D expenditures (GERD-BERD)	% of GDP	OECD
Business expenditures on R&D (BERD)	% of GDP	OECD
High-tech patent applications	Per million population	EUROSTAT
High-tech patents granted	Per million population	EUROSTAT
Patent applications	Per million population	EUROSTAT
Patents granted	Per million population	EUROSTAT
Transmission and application of knowledge		
SMEs innovating in-house	% of all SMEs	EUROSTAT
SMEs involved in innovation cooperation	% of all SMEs	EUROSTAT
Innovation expenditures	% of total turnover	EUROSTAT
SMEs using non technological change	% of all SMEs	EUROSTAT
Innovation finance, output and markets		
Share of high-tech venture capital investment		EVCA
Share of early stage venture capital in GDP		EUROSTAT
Sales of 'new to market' products	% of total turnover	EUROSTAT
Sales of 'new to the firm but not new to the market' products	% of total turnover	EUROSTAT
Internet access		EUROSTAT
ICT expenditures	% of GDP	EUROSTAT
Share of manufacturing value-added in high-tech sectors		EUROSTAT

Table 8.3: European Innovation ScoreboardSources: EU Trend Chart (2004), Veugelers (2005, pp 15–16)

In a study for Industry Canada the Conference Board of Canada (CBC, 2004) published "Exploring Canada's Innovation Character: Benchmarking Against Global Best" as part of the innovation strategy for the federal government. The framework provided by the Conference Board for innovation benchmarking divides innovation into the four aspects of knowledge performance, skills performance, innovation environment and community based innovation (Sharpe and Guilbaud, 2005). The framework is composed of seventeen indicators including the indicator of business expenditure on R&D (BERD) as a % of GDP which allows a comparison of R&D activity for industries and countries and the R&D statistics follow definitions provided by the Frascati model (OECD, 1997). The measurement of patents also enables an understanding of innovation performance since they indicate the creation and transfer of knowledge (Sharpe and Guilbaud, 2005). If a patent is filed at the European Patent Office, Japanese Patent Office and the United States Patent Office at the same time it is considered to be a member of a triadic patent family (Stead, 2001). More generally the most common indicator of innovation is gross expenditure on R&D (GERD) as a % of GDP (Sharpe and Guilbaud, 2005).

At the level of the small and medium-sized enterprise (SME), or the individual project, management practices such as scoreboarding or benchmarking have been established (for industrial innovation patent scoreboards and R&D scoreboards are published) (Grupp, 2006). Furthermore, at national levels, approaches include common procedures to calculate composite indicators. According to Freudenberg (2003, p. 3) "composite indicators are synthetic indices of individual indicators and are increasingly being used to rank countries in various performance and policy areas". Moreover, Freudenberg (2003, p. 7), in developing a theoretical framework, notes that "composite indicators are generally used to summarise a number of underlying individual indicators or variables. An indicator is a quantitative or qualitative measure derived from a series of observed facts that can reveal relative position in a given area and, when measured over time, can point out the direction of change…. There are basically three levels of groupings: 1) Individual indicator sets represents a menu of separate indicators or statistics… 2) Thematic indicators are individual indicators which are grouped together around a specific area or theme… 3) Composite indicators are formed when thematic indicators are compiled into a synthetic index and presented as a single composite measure." This work is being led by the European Commission (EC, 2003) who are using composite indicators to aggregate the different indicators into "simpler constructs for the purpose of summarising multi-dimensional phenomena" (Grupp, 2006). Through aggregating different variables the "big picture" is summarised with regard to a many dimensional issue (EC, 2003). The European Innovation Scoreboard (EIS, 2009) has been published on a regular basis since 2000 using composite indicators (Grupp, 2006). In 2002 the EC Joint Research Centre published a report on composite indicator development (Saisana and Tarantola, 2002). This was followed by publication of the manual "Tools for Composite Indicators Building" (guidelines for the construction of composite indicators have been published by the European Commission and OECD) (Nardo et al., 2005a&b).

In 2001 the European Innovation Scoreboard (EC, 2001) presented eighteen indicators including R&D intensity, business expenditures on R&D, European and US patents, SMEs' innovation and co-operation and innovation intensity. A tentative Summary Innovation Index (SII) was constructed for the indicators within the UK (score 4.4) ranked fourth (Grupp, 2006). There have been further releases of the EIS (EC, 2003, 2005) with the methodology altered for the composite number. In relation to methodology Freudenberg (2003, pp. 9–10) notes the problem of data deletion, missing values and other indicator development problems (metric scales include "distance from the best and worst performers", "minimum-maximum approach", "leader and laggard", unreliability due to outliers and "re-scaling") (Grupp, 2006). More sophisticated procedures of weighting are randomly assigned weights although these do not solve the problem of arbitrariness (Freudenberg, 2003, p. 25). Problems when calculating composite indicators require a thorough investigation of robustness (Freudenberg, 2003, p. 13) and examples include heuristic approaches (Grupp and Mogee, 2004), linear and non-linear programming methods (Schubert, 2006) and Monte Carlo simulation methods (Freudenberg, 2003, p. 25). Grupp and Mogee (2004) have also noted "country tuning" with composition procedures intentionally placing certain countries in a better position than others. The problems of missing values also affect composite indicators (the range of composite indices for indicators of innovation performance can show considerable variation between countries) (Freudenberg, 2003, p. 9). It is anticipated that accuracy and quality of composite indicators will improve with advances in the collection of data and the development of indicators although it is suggested that there should be pragmatism with regard to the implementation of composites (Freudenberg, 2003).

From the literature a framework can be identified (Table 8.4) that develops a composite of innovation performance for selecting and placing indicators which combine three to five underlying variables predominantly derived from OECD databases (OECD, 2001).

Performance area	Generation of new knowledge	Industry-science linkages	Industrial innovation
Indicators	Basic research	Government or higher education R&D financed by business	Business enterprise R&D (BERD)
	R&D performance by non-business sector	Scientific papers cited in patents	Business researchers
	Non-business researchers	Publications in most industry-relevant scientific disciplines	Number of patents in "triadic" patent families
	PhD graduation rates in science, engineering and health		Firms with new or improved products or processes
	Scientific and technical articles		

Table 8.4: Framework for identifying indicators to measure innovation performanceSources: OECD (2001); Freudenberg (2003)

The first performance area (generation of new knowledge) includes basic research as a % of GDP, R&D performance by non-business sector, non-business researchers, PhD graduation rates, scientific and technical articles; the second (industry-science linkages) involves data concerning R&D, patents and publications; and the third (industrial innovation) concerns data regarding business research, patents, new products and processes (OECD, 2001; Freudenberg, 2003).

Framework for measuring innovation performance

In order to develop innovation performance indicators of relevance to small firms there are two principal stages. The first stage is developing a framework for selecting and placing indicators in three performance areas according to i) basic research and the production of new knowledge, ii) links between public and private research and iii) levels of industrial innovation (OECD, 2001). The second stage concerning the selection of variables and indicators involves investigation of the three performance areas outlined in stage 1. Variables are derived from databases including those of the EC and OECD. The core components include the generation of new knowledge (involving variables such as basic research as a percentage of GDP and non-business researchers in the labour force), industry-science linkages (business financed R&D performed by government and higher education as a percentage of GDP, patents and publications), and industrial innovation (business enterprise R&D (BERD) as a percentage of GDP, business researchers in the labour force, patents and new products and processes) (Freudenberg, 2003). Through categorisation and weighting, indicators can be determined to measure innovation performance.

By reviewing the current innovation performance indicators identified in the literature those that are relevant to small firms are illustrated. For this initial work the underlying variables for the three core components (Table 8.4) have been simplified according to the data available in order to undertake the initial analysis. Therefore, for the performance areas of 1) the generation of new knowledge, 2) industry-science linkages and 3) industrial innovation underlying variables include 1.1) basic research, 1.2) public R&D, 2.1) med/high tech employment in manufacturing, 2.2) high-tech patent applications, 3.1) business R&D and 3.2) patent applications (Table 8.5).

Performance area	Generation of new knowledge	Industry-science linkages	Industrial innovation
Indicators	Basic research Public R&D	Med/High tech employment in manufacturing High-tech patent applications	Business R&D Patent applications

Table 8.5: An initial framework for identifying indicators relevant to small firms

The approach used in this chapter to provide an analysis of innovation activity for comparison with other countries and regions, uses the initial framework (Table 8.5) and considers performance area and underlying variables (indicators) for a national/regional profile according to high, moderate and low levels of activity.

UK regional innovation indicator data has been considered in relation to the EU Regional Innovation Scoreboard (RIS) (EC, 2003). From this it has been possible to formulate regional innovation performance and to determine those indicators relevant to small firms.

Regional Innovation Performance

The development of innovation performance indicators to compare countries and regions involves standardising and weighting variables. The variables selected will have to be normalised to enable comparison. Although the influences of the standardisation method on the results of performance indicators are limited the weighting of variables strongly influence indicators. The results show how the three components described in stage 2 contribute to aggregated measures. This gives an idea to the overall innovation performance of small firms and shows the national strengths and weaknesses at the indicator level.

The results are based on the two Regional Innovation Scoreboards published in 2002 and 2003 under the European Commission's European Trend Chart on Innovation (EU Trend Chart, 2002; 2003). This is supplemented with findings from the 2006 European Regional Innovation Scoreboard (EU Trend Chart, 2006). In comparison with the European Innovation Scoreboard for the twenty five European Union states in 2006 the reports in 2002 and 2003 focused on regional innovation performance of the fifteen European Union states using a more limited number of indicators (EU Trend Chart, 2006). Whereas the number of regions increased from 173 in 2003 to 208 in 2006 there was a decrease from 13 to 7 in the number of indicators (EU Trend Chart, 2003; 2006). In order to determine the level of regional analysis the Nomenclature of Territorial Units for Statistics (NUTS) classification is used (OECD, 2007).

For the 2006 European Regional Innovation Scoreboard (EU Trend Chart, 2006) regional data are determined using two indexes one of which is the Regional National Summary Innovation Index (RNSII) which can be expressed:

$$RNSII = \sum_{j=1}^{m} x_{ijkt}^{n}$$

where x_{ijkt} is the value of indicator i for region j in country k and time t and m is the number of indicators for which regional data are available.

The Regional European Summary Innovation Index (REUSII) can be expressed:

$$REUSII = \sum_{j=1}^{m} x_{ijkt}^{eu}$$

The Revealed Regional Summary Innovation Index (RRSII) is calculated as the weighted average of the re-scaled values for RNSII and REUSII as follows:

$$RRSII = \tfrac{3}{4} * REUSII + \tfrac{1}{4} * RNSII$$

Using the measure of RRSII UK regional innovation performance is shown in Table 8.6.

Rank	UK Region	Average
12	South East	0.72
17	Eastern	0.69
35	London	0.59
37	South West	0.58
42	West Midlands	0.57
47	East Midlands	0.57
56	North West	0.54
72	Yorkshire and The Humber	0.49
78	North East	0.48
80	Wales	0.48
89	Scotland	0.45
113	Northern Ireland	0.41

Table 8.6: UK Regional Innovation Performance 2006 Source: EU Trend Chart (2006)

This shows the ranking for UK regions with the South East of England highest for the UK and Scotland and Northern Ireland below Wales. Table 8.7 shows the impact on UK regions' EU ranks from changes in methodology for calculating the composite innovation index between 2002 and 2006 (EU Trend Chart, 2006).

	RIS 2002		RIS 2003		RIS 2006			
Transformation	NO		NO		YES		YES	
Re-scaling	NO		YES		YES		YES	
National weight	1/2		1/2		1/2		1/4	
Region	RRSII	Rank	RRSII	Rank	RRSII	Rank	RRSII	Rank
East Midlands	107	52	0.36	55	0.53	50	0.57	47
Eastern	147	18	0.5	18	0.66	18	0.69	17
London	112	42	0.41	38	0.56	40	0.59	35
North East	86	94	0.29	85	0.44	89	0.48	78
North West	102	65	0.34	68	0.5	61	0.54	56
Northern Ireland	72	134	0.23	131	0.37	129	0.41	113
Scotland	92	85	0.33	73	0.4	107	0.45	89
South East	150	14	0.54	15	0.69	12	0.72	12
South West	109	46	0.38	48	0.54	42	0.58	37
Wales	86	96	0.3	82	0.43	91	0.48	80
West Midlands	108	48	0.38	47	0.54	47	0.57	42
Yorkshire and The Humber	90	87	0.3	83	0.45	83	0.49	72

Table 8.7: Impact on UK regions' EU ranks from changes in methodology
Source: EU Trend Chart (2006)

In 2002 a simple methodology was used with data not transformed or re-scaled and national and European components receiving equal weighting (EU Trend Chart, 2002). For 2003 re-scaling of indicators was introduced and five indicators from the 2nd Community Innovation Survey (CIS) were included (EU Trend Chart, 2003). 2006 introduced the transformation of data with square root transformation for five indicators and double square root transformation for two indicators (a smaller weight for the national component of ¼ instead of ½ is used in 2006) (EU Trend Chart, 2006). The EU Regional Innovation Scoreboard 2006 UK data are shown in Table 8.8 for T-2, T-1 and T.

Relative to EU	HRSTC			LIFE-LONG			MED/HI-TEC			HI-TECH			PUB R&D			BUS R&D			PATENTS		
	T-2	T-1	T	T-2	T-1	T	T-2	T-1	T	T-2	T-1	T	T-2	T-1	T	T-2	T-1	T	T-2	T-1	T
United Kingdom	121	119	119	281	277	266	98	103	105	138	145	142	89	89	93	98	103	103	95	97	94
East Midlands	101	99	99	266	254	257	116	124	117	122	123	112	61	61	58	127	121	122	73	87	90
Eastern	114	109	109	286	281	269	111	110	109	165	179	174	91	91	99	274	272	276	178	189	174
London	161	155	155	325	327	308	36	39	40	192	215	188	89	89	90	35	35	34	122	120	117
North East	88	96	96	254	248	230	129	131	135	97	143	108	56	56	55	42	45	52	48	49	65
North West	105	114	114	267	276	259	105	118	117	111	105	130	52	52	51	124	133	121	71	73	74
Northern Ireland	119	101	101	187	182	162	84	78	79	80	82	86	56	56	54	53	40	36	26	26	19
Scotland	132	126	126	270	255	240	84	89	91	101	112	118	123	123	128	41	44	51	0	0	0
South East	136	130	130	306	296	290	106	110	114	193	202	200	121	121	134	172	183	178	196	184	181
South West	120	121	121	291	298	293	102	105	119	127	120	113	88	88	101	96	106	119	62	65	56
Wales	114	117	117	262	231	228	96	97	114	83	87	95	77	77	72	33	49	33	19	19	16
West Midlands	104	103	103	268	276	263	153	165	156	132	121	122	71	71	72	61	81	86	95	99	105
Yorkshire/Humber	105	103	103	273	266	255	82	83	89	98	104	104	71	71	66	36	38	39	81	89	78

Table 8.8: EU Regional Innovation Scoreboard 2006 UK data
Source: EU Trend Chart (2006)

Key: HRSTC – Knowledge workers, LIFE-LONG – Life-long learning, MED/HI-TEC – Med/Hi-tech manufacturing, HI-TECH – Hi-tech services, PUB R&D – Public R&D, BUS R&D – Business R&D, Patents.

The EU Regional Innovation Scoreboard 2006 UK composite indicator scores are shown in Table 8.9 for RNSII, REUSII and RRSII T-4, T-3, T-2, T-1 and T.

	RNSII					REUSII					RRSII				
	T-4	T-3	T-2	T-1	T	T-4	T-3	T-2	T-1	T	T-4	T-3	T-2	T-1	T
United Kingdom	0.55	0.52	0.52	0.48	0.49	0.65	0.68	0.66	0.64	0.63					
East Midlands	0.48	0.46	0.46	0.41	0.45	0.6	0.64	0.62	0.59	0.6	0.57	0.59	0.58	0.54	0.57
Eastern	0.69	0.66	0.67	0.58	0.59	0.75	0.78	0.77	0.73	0.72	0.73	0.75	0.74	0.7	0.69
London	0.53	0.53	0.52	0.46	0.48	0.64	0.69	0.66	0.63	0.63	0.61	0.65	0.63	0.59	0.59
North East	0.41	0.4	0.34	0.32	0.36	0.54	0.59	0.53	0.52	0.52	0.51	0.54	0.48	0.47	0.48
North West	0.5	0.46	0.43	0.41	0.42	0.62	0.64	0.6	0.6	0.58	0.59	0.59	0.56	0.55	0.54
Northern Ireland	0.23	0.22	0.26	0.24	0.27	0.43	0.47	0.49	0.47	0.46	0.38	0.41	0.44	0.41	0.41
Scotland	0.35	0.3	0.29	0.3	0.31	0.52	0.53	0.52	0.52	0.5	0.48	0.48	0.46	0.47	0.45
South East	0.75	0.7	0.71	0.65	0.63	0.78	0.81	0.79	0.78	0.75	0.77	0.78	0.77	0.75	0.72
South West	0.55	0.5	0.49	0.47	0.47	0.64	0.66	0.64	0.64	0.62	0.62	0.62	0.6	0.6	0.58
Wales	0.35	0.32	0.31	0.3	0.35	0.51	0.54	0.52	0.51	0.52	0.47	0.48	0.46	0.46	0.48
West Midlands	0.53	0.51	0.49	0.45	0.47	0.63	0.66	0.63	0.61	0.61	0.6	0.62	0.6	0.57	0.57
Yorkshire/ Humber	0.39	0.37	0.36	0.35	0.37	0.53	0.56	0.55	0.54	0.53	0.5	0.52	0.5	0.49	0.49

Table 8.9: EU Regional Innovation Scoreboard 2006 UK composite indicator scores
Source: EU Trend Chart (2006)
Key: RNSII – Regional National Summary Innovation Index, REUSII – Regional European Summary Innovation Index, RRSII – Revealed Regional Summary Innovation index (RRSII).

The composite indicator scores in Table 8.9 take the average for RNSII, REUSII and RRSII T-4, T-3, T-2, T-1 and T (consistent with the findings Table 8.6).

Table 8.10 shows nine UK Regional Innovation Indicators for the 12 regions compared with those for the EU.

REGION	INDICATOR																	
	1		2		3		4		5		6		7		8		9	
European Union	21.78	a	8.52	a	7.41	a	3.57	a	0.68	b	1.3	b	31.6	b	161.1	b	22603	c
United Kingdom	29.36	a	22.29	a	6.72	a	4.47	a	0.6	d	1.28	b	35.6	b	133.5	b	26096	c
East Midlands	24.29	a	21.12	a	7.93	a	3.96	a	0.38	d	1.45	b	13.5	b	108.9	b	24411	c
Eastern	26.96	a	23.04	a	7.6	a	5.35	a	0.55	d	3.11	b	94.2	b	261.3	b	27031	c
London	41.66	a	25.2	a	2.45	a	6.23	a	0.64	d	0.41	b	41	b	112.5	b	38230	c
North East	22.41	a	20.43	a	8.82	a	3.14	a	0.38	d	0.35	b	6	b	64.6	b	20136	c
North West	24.8	a	21.22	a	7.22	a	3.59	a	0.34	d	1.52	b	12.2	b	103.4	b	22670	c
Northern Ireland	25.23	a	14.69	a	5.75	a	2.6	a	0.38	d	0.69	b	7.7	b	42.5	b	20224	c
Scotland	32.83	a	21.88	a	5.75	a	3.28	a	0.82	d	0.62	b	18	b	91.2	b	25290	c
South East	33.78	a	24.11	a	7.28	a	6.25	a	0.78	d	2.49	b	74.6	b	233.2	b	28754	c
South West	29.34	a	22.98	a	6.98	a	4.1	a	0.6	d	1.37	b	49.6	b	145.4	b	23675	c
Wales	26.13	a	19.94	a	6.58	a	2.69	a	0.49	d	0.34	b	10.4	b	69.9	b	20959	c
West Midlands	25.45	a	21.41	a	10.49	a	4.28	a	0.46	d	0.78	b	11.8	b	97.3	b	23919	c
Yorkshire/ Humber	25.09	a	21.76	a	5.59	a	3.16	a	0.46	d	0.4	b	15.3	b	86.9	b	22927	c
Key:	Year		a 2002 b 2001 c 2000 d 1999															
Indicator	1 Tertiary education 2 Lifelong learning 3 Med/hi-tech employment in manufacturing 4 High-tech employment in services 5 Public R&D 6 Business R&D 7 High-tech patent applications 8 Patent applications 9 GDP per capita																	

Table 8.10: UK Regional Innovation Indicators Source: EC (2003)

Using the initial framework for identifying indicators relevant to small firms (Table 8.5) for the three performance areas of generation of new knowledge (public R&D), industry-science linkages (med/high tech employment in manufacturing and high-tech patent applications) and industrial innovation (business R&D and patent applications) a comparison of regional profiles can be made.

Conclusions

The chapter has reviewed the current innovation performance indicators relevant to small firms and has presented an approach that can be used to provide analysis of innovation activity for the comparison of countries and regions. A framework for selecting and placing indicators in three performance areas has been explored. Results according to the performance areas have been derived from databases including the EC and OECD. The chapter identifies those indicators useful to entrepreneurs, policy makers, practitioners, researchers and educators and these include public R&D, med/high tech employment in manufacturing, high tech patent applications, business R&D and patent applications.

Recommended Reading

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