Industrial Breakdown of the UK Innovation Survey 2001

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Introduction

This article is intended to accompany the "UK Innovation Survey 2001" report (on the UK element of the EU-wide Community Innovation Survey) published by DTI, providing greater depth in the form of industrial analyses.

Business innovation is a vital ingredient in raising the productivity, competitiveness and growth potential of modern economies. Providing the right economic conditions for, and using appropriate policy instruments to encourage innovation in the UK is a central objective for the Department of Trade and Industry (DTI). Measuring the level of innovation activity in the UK and identifying where policy might be best targeted contributes to the pursuit of that objective.

The Community Innovation Survey complements other indicators of innovativeness by providing a regular snapshot of innovation inputs and outputs and the constraints faced by UK businesses in their innovation efforts, across the range of UK industries and business enterprises. It has the additional benefit of providing the basis for some comparisons with other EU countries. The results in this paper provide comparisons of innovation activity across 12 major industrial groups in the UK, based on the Standard Industrial Classification (SIC) code of the business. More details on the industry groupings are provided in Annexe B.

Innovation Activity by Industry

Innovation takes place through a wide variety of business practices and a range of indicators can be used to measure its level within the enterprise or in the economy as a whole. These include the levels of effort employed (measured through resources allocated to innovation) and of achievement (the introduction of new or improved products and processes). This section reports on the types and levels of innovation activity over the three-year (1998-2000) sample period.

We define innovation activity here as whether enterprises:

- have introduced a new or significantly improved good, service or process;
- were engaged in innovation projects not yet complete or abandoned;
- engaged in longer-term innovation activity such as basic R&D or technology watch;

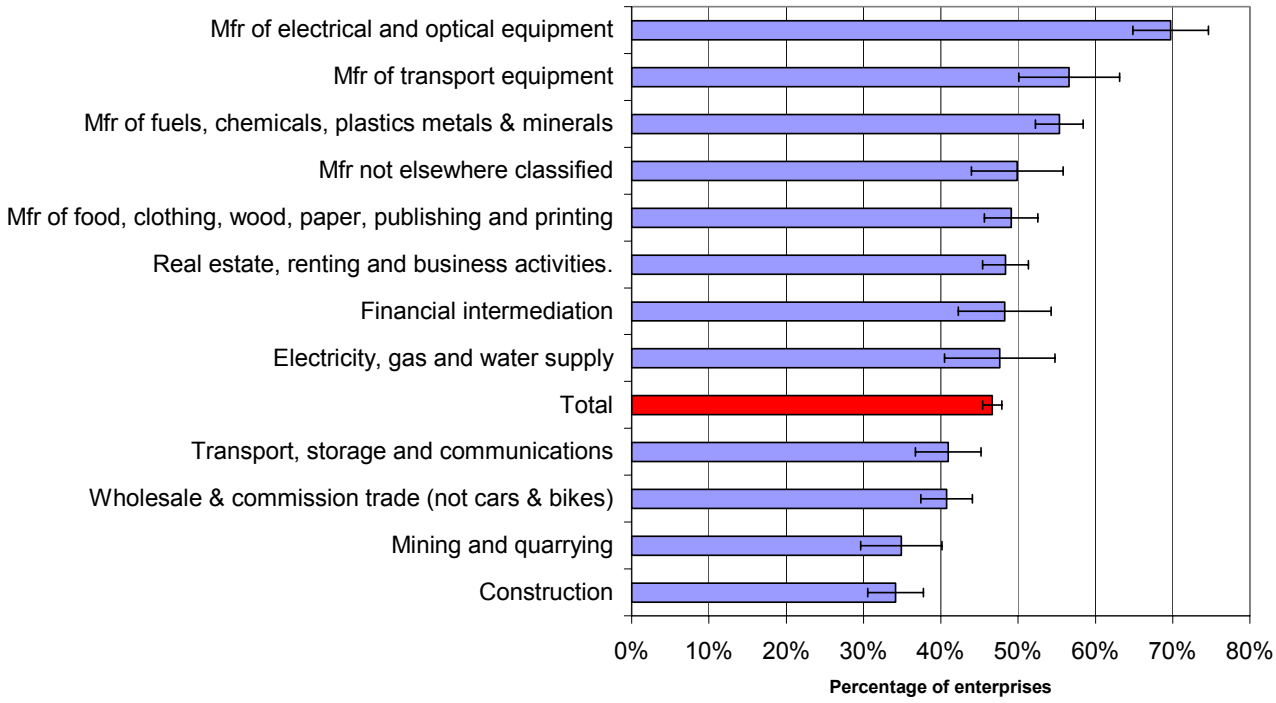
- had expenditure in areas such as internal research and development, training, acquisition of external knowledge or machinery and equipment linked to innovation activities;
- formally co-operated on innovation activities with other enterprises or institutions.

Table 1: Innovation Activity by Industry

Per cent of all enterprises

	Size of enterprises			95% confidence interval
	SME	Large	All	All
Mining and quarrying	32	61	35	± 5
Mfr of food, clothing, wood, paper, publishing and printing	48	73	49	± 3
Mfr of fuels, chemicals, plastics, metals and minerals	54	80	55	± 3
Mfr of electrical and optical equipment	68	86	70	± 5
Mfr of transport equipment	51	89	57	± 7
Mfr not elsewhere classified	49	75	50	± 6
Electricity, gas and water supply	31	82	48	± 7
Construction	34	46	34	± 4
Wholesale and commission trade (not cars and bikes)	41	51	41	± 3
Transport, storage and communications	41	49	41	± 4
Financial intermediation	47	66	48	± 6
Real estate, renting and business activities	48	56	48	± 3
Total	46	67	47	± 1

Figure 1: Innovation Activity by Industry with 95% Confidence Intervals



Enterprises in the manufacture of electrical and optical equipment sector had the most innovation activity, significantly higher than all other sectors, followed by those in the manufacture of transport and the manufacture of fuels, chemicals, plastics, metals and minerals. Construction sector firms had the least innovation activity.

Across all the sectors large firms were more likely to engage in some form of innovation activity than their small and medium counterparts. This difference was the least pronounced in the real estate renting and business activities and transport, storage and communications sectors. The greatest difference was seen in the electricity, gas and water supply sector.

Note however, that since this is a sample survey the results are subject to sampling errors. The table and chart above show a 95% confidence interval for innovation activity by industry (confidence intervals are explained in more detail in Annexe B). Only where the confidence intervals do not overlap can we say that the results are statistically significantly different.

In this case we can say that the manufacturing of electrical and optical equipment sector has a significantly greater proportion of innovation active firms than any of our other industry groupings. Also we can say that the top three industry groupings are significantly more innovation active than the UK average while the bottom four industry groupings are significantly less innovation active.

Innovation active is a composite measure taking into account five different factors which we shall now look at individually (these results are tabulated in Annexe A.)

- The electrical and optical equipment manufacturing sector leads **product innovation** in the UK with 39 per cent of its firms introducing a new product compared to a national average of 18 per cent. Firms in the construction industry are the least likely to introduce new products, with only 6 per cent of firms doing so.
- Twenty-four per cent of enterprises in the transport equipment manufacturing sector introduced a **new process** compared to the national average of 15 per cent and the construction industry with 6 per cent.
- Firms in the electricity, gas and water supply sector were the most likely to have **co-operation agreements** regarding innovation at 27 per cent compared to the UK average of 8 per cent and construction, the least likely area for co-operation, with only 3 per cent.
- Thirty seven per cent of enterprises in the electrical and optical equipment manufacturing sector reported **innovation activities not yet completed or abandoned** compared to 16 per cent for the UK and 7 per cent for construction.
- Fifty-six per cent of enterprises in the electrical and optical equipment manufacturing sector reported **innovation related expenditure,** with the UK at 36 per cent and the mining and quarrying industry at 25 per cent.
- Electricity, gas and water supply firms were most likely to have **long-term innovation activities** at 21 per cent compared to a UK average of 9 per cent and the construction industry at 3 per cent.

Novel Innovation

The most potentially lucrative types of innovation are those which are not only new to the firm in question, but also new to the firms market thus giving the enterprise an advantage over its competitors.

Table 2: Percentage of firms carrying out novel innovation, by industry

	Novel Product Size of enterprise			Novel Process Size of enterprise		
	SME	Large	All	SME	Large	All
Mining and quarrying	3	14	4	2	19	4
Mfr of food, clothing, wood, paper, publishing & printing	7	16	8	5	15	6
Mfr of fuels, chemicals, plastics, metals & minerals	10	31	11	7	15	7
Mfr of electrical and optical equipment	19	30	20	6	11	6
Mfr of transport equipment	12	23	13	6	33	10
Mfr not elsewhere classified	7	15	7	5	10	5
Electricity, gas and water supply	0	0	0	10	10	10
Construction	2	12	2	1	8	1
Wholesale and commission trade (not cars & bikes)	7	15	8	3	3	3
Transport, storage and communications	3	7	3	3	7	3
Financial intermediation	7	18	8	6	15	7
Real estate, renting and business activities	8	11	8	5	8	5
Total	7	18	8	4	12	5

The electrical and optical equipment manufacturing sector leads the way in novel product innovation at 20 per cent, while the electricity, gas and water supply sector reported no novel product innovation. However, 10 per cent of firms in the electricity, gas and water supply and the transport equipment manufacturing sectors introduced a new process. Only 1 per cent of enterprises in the construction industry introduced a novel process.

Return on innovation

As well as the innovation itself, it is important to see how firms turn their new and novel (new to the market as well as new to the firm) products into revenue.

Table 3: Percentage of industry turnover from products new to the firm or significantly improved

	Of all product innovators		
	Size of enterprises		
	SME	Large	All
Mining and quarrying	18	29	28
Mfr of food, clothing, wood, paper, publishing & printing	16	13	14
Mfr of fuels, chemicals, plastics, metals & minerals	24	18	20
Mfr of electrical and optical equipment	43	30	32
Mfr of transport equipment	56	27	33
Mfr not elsewhere classified	38	31	35
Electricity, gas and water supply	-	-	-
Construction	30	11	28
Wholesale and commission trade (not cars & bikes)	26	24	25
Transport, storage and communications	54	34	41
Financial intermediation	17	53	50
Real estate, renting and business activities	41	17	25
Total	30	37	35

Table 4: Percentage of turnover from novel products

	Of all novel product innovators		
	Size of enterprises		
	SME	Large	All
Mining and quarrying	11	-	10
Mfr of food, clothing, wood, paper, publishing & printing	13	7	9
Mfr of fuels, chemicals, plastics, metals & minerals	13	11	11
Mfr of electrical and optical equipment	26	13	15
Mfr of transport equipment	15	17	17
Mfr not elsewhere classified	26	11	19
Electricity, gas and water supply	-	-	-
Construction	17	3	3
Wholesale and commission trade (not cars & bikes)	13	21	15
Transport, storage and communications	46	15	27
Financial intermediation	8	1	2
Real estate, renting and business activities	17	9	14
Total	15	6	8

- Estimate unreliable as less than 5 enterprises in sample.

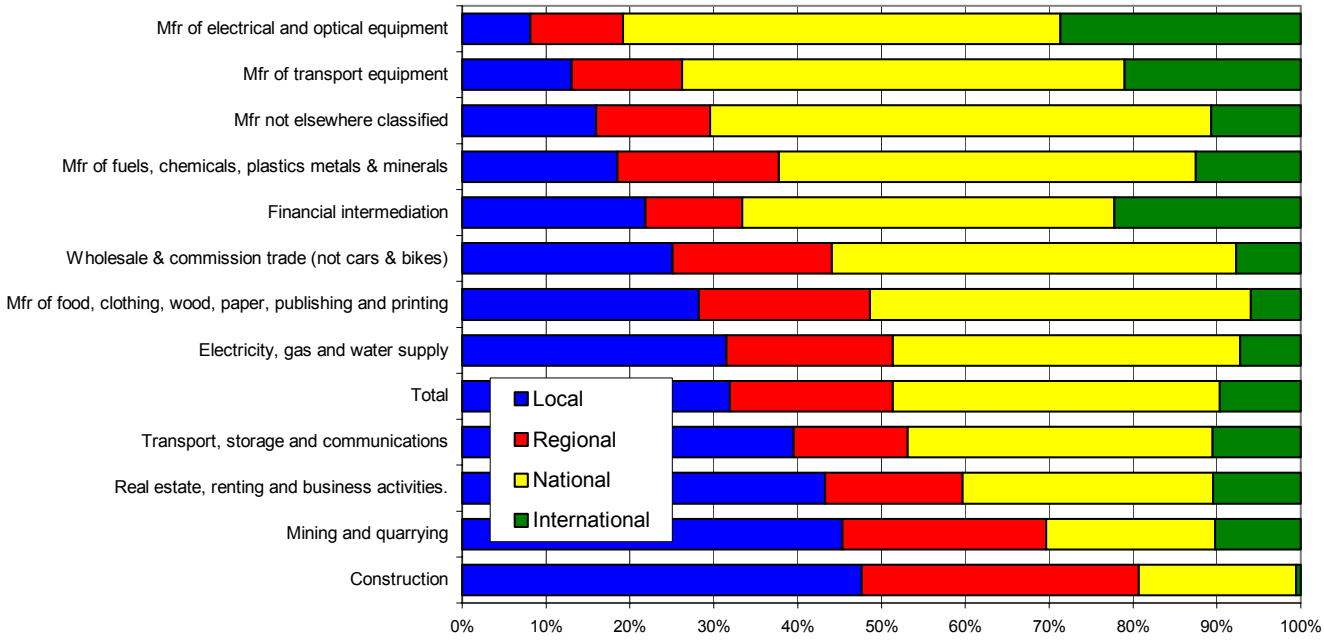
Interestingly, although large firms are always more likely to engage in innovation activity, many of those that did produce new or improved products generated a lesser percentage of their turnover from them than their SME counterparts. This is true across all sectors except mining and quarrying, financial intermediation and the UK average. Product innovating firms in the financial intermediation sector generated 50 per cent of their turnover from these new or improved products, well over the UK average of 35 per cent.

This scenario is more pronounced for novel products. Of those firms that introduced novel products SME's generated a much higher percentage of their turnover from these products than large firms. The only sectors where this was not true were the manufacture of transport equipment and the wholesale and commission trade. Novel innovators in the transport, storage and communications sector made the greatest percentage of turnover from novel products at 27 per cent, compared with the UK average of 8 per cent.

Most Important Market

One of the questions in the community innovation survey asks enterprises whether their largest market is local, regional, national or international. This helps to gauge how centralised regional markets are in comparison with each other.

Figure 2: Most Important Market by Industry



In construction, firms are very concentrated on their local and regional markets, while most electrical and optical manufacturing firms tend to rely more on the national and international markets.

Importance of the Science Base

A common criticism of the UK innovation system is that it fails to make full use of the science base. One of the main reasons for this is seen as the patchiness in links between higher education institutions and business.

In this extract from the results of the community innovation survey respondents were asked to rank the importance of several potential sources of information for innovation as being not used, low, medium or high. Here we have used institutional sources of information as our proxy for the science base. Institutional sources include:

- Universities or other higher education institutes
- Government research organisations
- Other public sector such as business links and government offices
- Private research institutes

Table 5: Percentage of enterprises grading institutional sources of information as being of some importance by industry

	Percentage of all respondents
Mining and quarrying	50%
Mfr of food, clothing, wood, paper, publishing & printing	36%
Mfr of fuels, chemicals, plastics, metals & minerals	50%
Mfr of electrical and optical equipment	53%
Mfr of transport equipment	49%
Mfr not elsewhere classified	35%
Electricity, gas and water supply	65%
Construction	40%
Wholesale and commission trade (not cars & bikes)	33%
Transport, storage and communications	31%
Financial intermediation	32%
Real estate, renting and business activities	45%
Total	42%

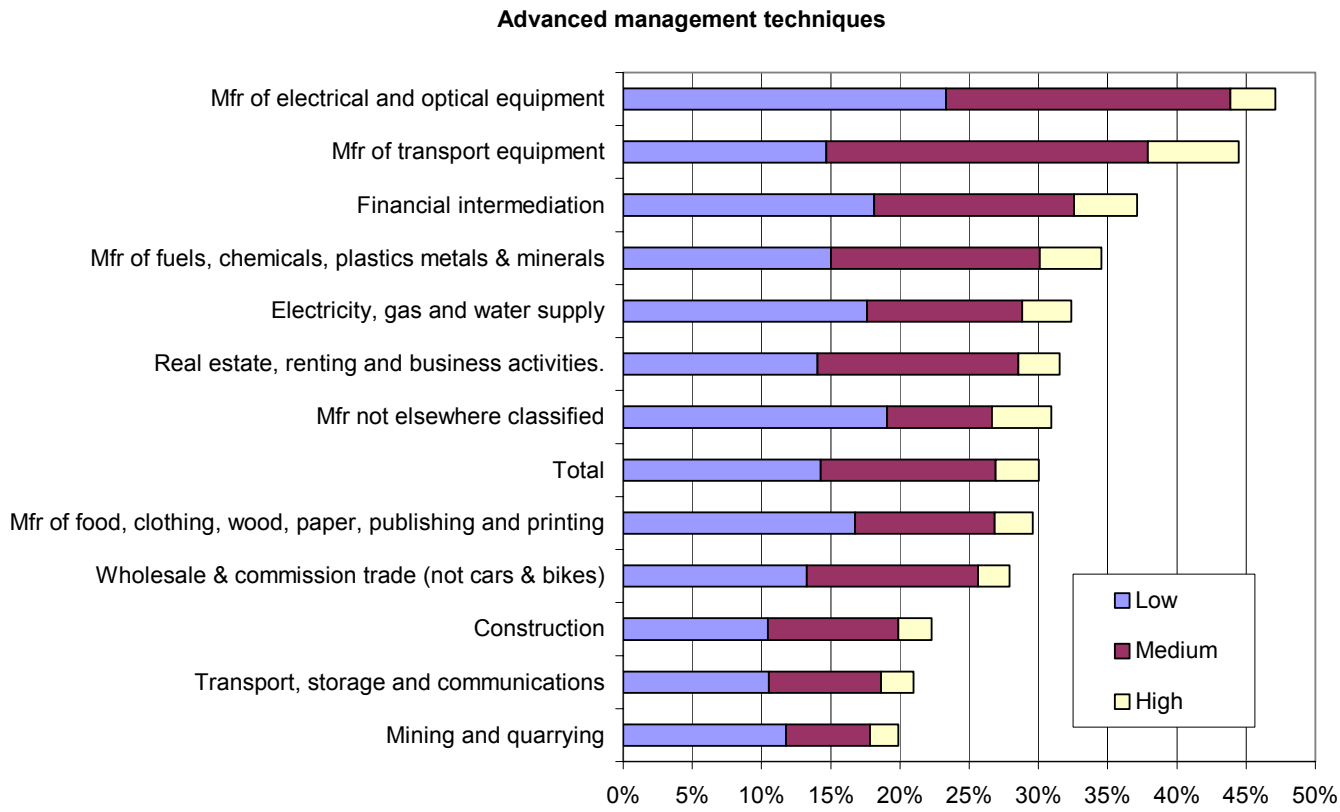
More firms in the electricity, gas and water supply industry (65%) regarded the science base, or in this case our proxy of institutional sources, as being of importance than in any other industry in the UK. Firms in transport, storage and communications (31%) attached the least importance to these institutional sources. It must be noted that this table does not indicate actual use of the science base, it simply measures industrial attitudes to its importance in the innovation system.

Wider Innovation

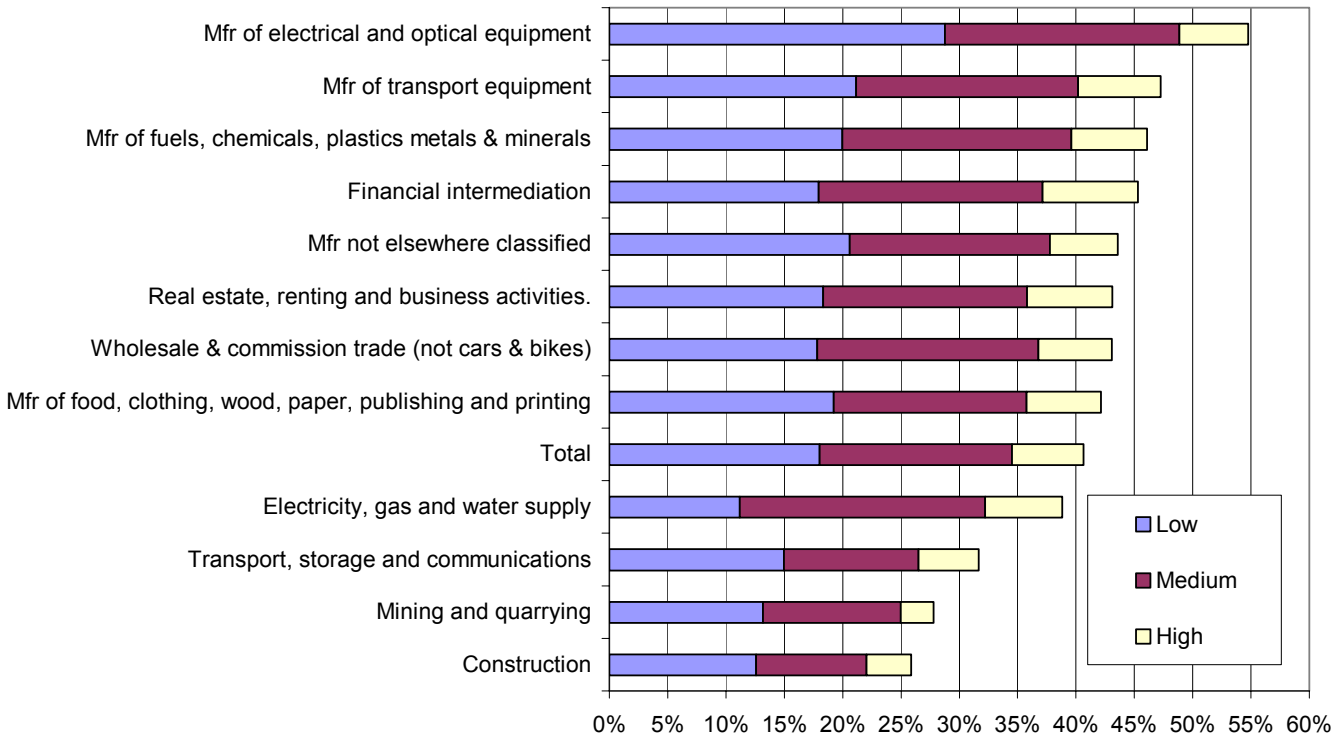
Innovation is not wholly about the development or use of technology. Enterprises can also change their behaviour or business strategies to make themselves more competitive, often in conjunction with technological change.

Enterprises were asked whether they have made major changes to their business structure and practices in the three-year period 1998-2000 and to rank their importance (see figures 8-11 for detailed results). As would be expected, a far greater proportion of large firms engaged in some sort of wider innovation than SMEs.

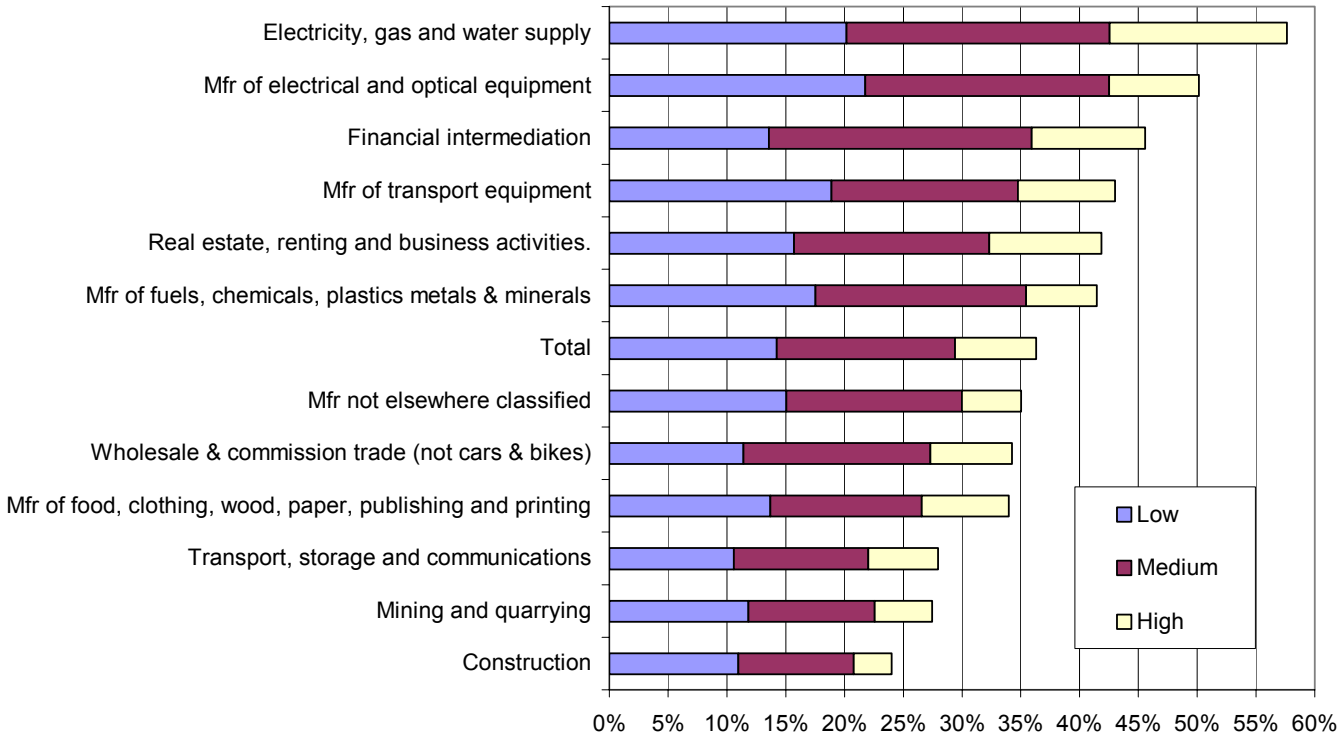
Figures 3 – 6: The Importance of Wider Innovation

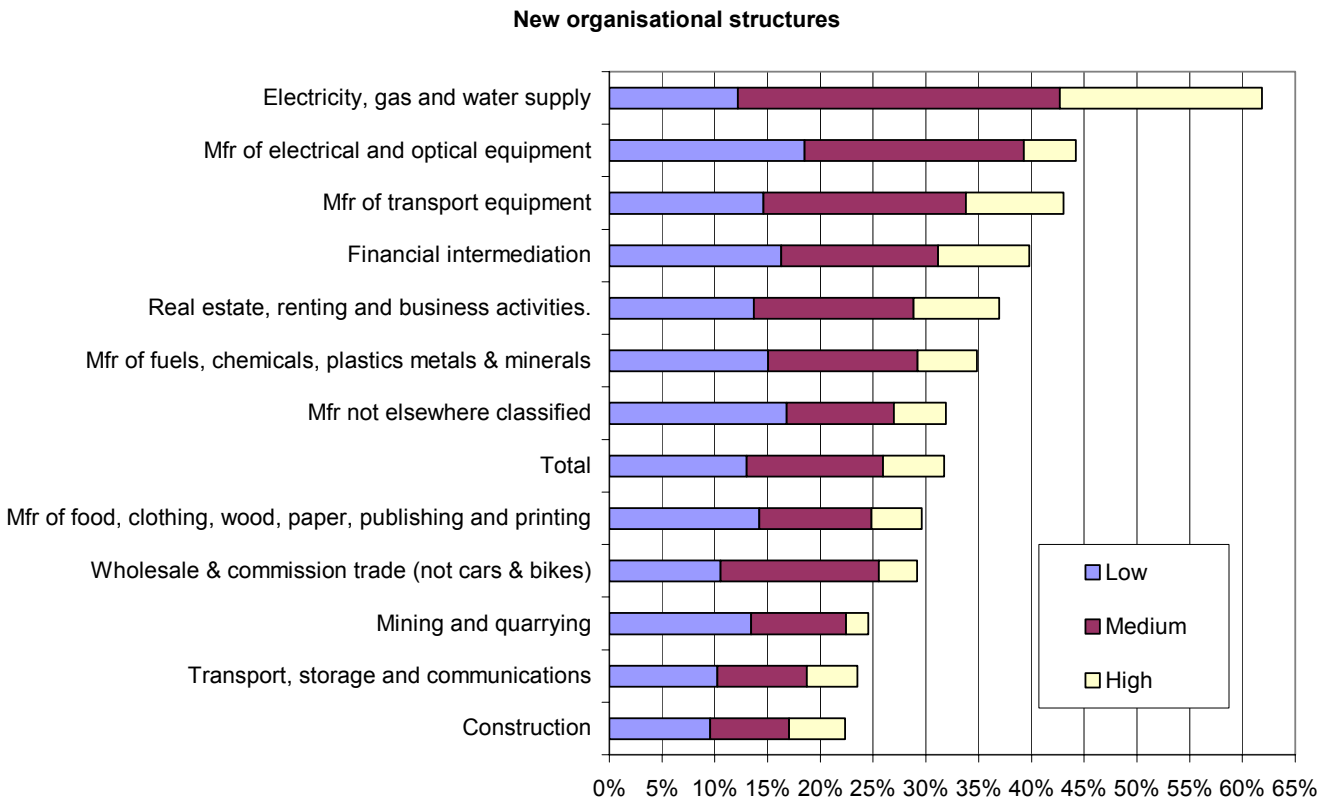


Change in marketing strategy



Change in corporate strategy





The implementation of advanced management techniques and significantly changed marketing strategies were most commonly quoted as having an impact on performance by businesses in the manufacturing of electrical and optical equipment sector. Changes in corporate strategy and new organisational structures were most commonly attributed to improvements in performance by firms in the electricity, gas and water supply sector. Firms in the construction and mining and quarrying sectors were the least likely to quote areas of wider innovation activity as having an impact on their performance.

ANNEX A – Innovation by Industry (details)

Table 6 – 11: Type of Innovation by Industry

	Product Innovation Size of enterprise			Process Innovation Size of enterprise		
	SME	Large	All	SME	Large	All
Mining and quarrying	10	31	12	10	27	12
Mfr of food, clothing, wood, paper, publishing & printing	16	37	17	20	41	21
Mfr of fuels, chemicals, plastics, metals & minerals	23	51	24	18	42	19
Mfr of electrical and optical equipment	38	60	39	21	53	23
Mfr of transport equipment	23	47	27	18	54	24
Mfr not elsewhere classified	16	34	17	17	29	17
Electricity, gas and water supply	3	15	7	14	26	18
Construction	6	18	6	6	24	6
Wholesale and commission trade (not cars & bikes)	16	29	17	10	17	10
Transport, storage and communications	12	18	12	9	18	9
Financial intermediation	15	42	18	19	43	21
Real estate, renting and business activities	21	32	21	16	25	16
Total	17	38	18	14	35	15

	Long term activity Size of enterprise			Co-operation Size of enterprise		
	SME	Large	All	SME	Large	All
Mining and quarrying	5	29	8	7	25	9
Mfr of food, clothing, wood, paper, publishing & printing	8	23	9	6	16	7
Mfr of fuels, chemicals, plastics, metals & minerals	13	35	15	10	32	11
Mfr of electrical and optical equipment	17	42	19	18	38	20
Mfr of transport equipment	13	33	16	12	42	17
Mfr not elsewhere classified	9	32	10	4	14	5
Electricity, gas and water supply	13	38	21	13	56	27
Construction	3	12	3	2	24	3
Wholesale and commission trade (not cars & bikes)	6	14	7	7	11	7
Transport, storage and communications	6	17	6	3	12	4
Financial intermediation	10	30	12	8	26	10
Real estate, renting and business activities	10	18	10	8	22	9
Total	9	26	9	7	24	8

	Not yet completed or abandoned Size of enterprise			Innovation related expenditure Size of enterprise		
	SME	Large	All	SME	Large	All
Mining and quarrying	10	19	11	24	37	25
Mfr of food, clothing, wood, paper, publishing & printing	15	25	16	37	55	38
Mfr of fuels, chemicals, plastics, metals & minerals	19	46	21	44	68	45
Mfr of electrical and optical equipment	35	57	37	55	68	56
Mfr of transport equipment	20	34	23	38	64	42
Mfr not elsewhere classified	18	25	18	41	63	42
Electricity, gas and water supply	5	46	18	19	56	31
Construction	7	21	7	27	34	27
Wholesale and commission trade (not cars & bikes)	14	15	14	29	35	30
Transport, storage and communications	14	16	14	31	30	31
Financial intermediation	20	39	22	34	47	35
Real estate, renting and business activities	16	23	16	38	44	38
Total	15	31	16	36	51	36

ANNEX B

Industry Groupings

The industry groupings used in this report are based on the UK Standard Industrial Classification of Economic Activities. These industry groupings also provided one of the stratification criteria for the survey. The UK Standard Industrial Classification of Economic Activities is used to classify business establishments and other statistical units into the type of economic activities they are engaged in. More detailed information on this classification system can be found at http://www.statistics.gov.uk/methods_quality/sic/contents.asp. The table below gives the respective SIC codes of the twelve industry groupings used in this report.

Table 12: SIC Codes of Industry Groupings

SIC Code	Industry Grouping
10-14	Mining and quarrying
15-22	Manufacture of food, clothing, wood, paper, publishing and printing
23-29	Manufacture of fuels, chemicals, plastics, metals and minerals
30-33	Manufacture of electrical and optical equipment
34-35	Manufacture of transport equipment
36-37	Manufacture not elsewhere classified
40-41	Electricity, gas and water supply
45	Construction
51	Wholesale and commission trade (not cars and bikes)
60-64	Transport, storage and communications
65-67	Financial intermediation
70-74	Real estate, renting and business activities

Methodology

The UK Innovation Survey is funded by the Department of Trade and Industry (DTI). The survey was conducted on behalf of the DTI by the Office for National Statistics (ONS), with assistance from the Northern Ireland Department of Enterprise, Trade and Investment (DETI).

The UK Innovation Survey is part of a wider Community Innovation Survey (CIS) covering the EU. The survey is based on a core questionnaire developed by the European Commission (EuroStat) and Member States. This is the third iteration of the survey – CIS 2 was carried out in 1997 and the results form part of various EU benchmarking exercises (see www.cordis.lu/innovation-smes/scoreboard/home.htm).

The UK Innovation Survey 2001 was carried out in two parts. The first sampled 13,340 enterprises and covered the whole of the UK whilst the second was an England-only top up (of 6,287 enterprises) to allow the construction of regional indicators.

The survey was voluntary and conducted by means of a postal questionnaire. A copy of the questionnaire used can be found on www.dti.gov.uk/tese/science.htm.

Coverage

The survey covered enterprises with 10 or more employees in sections C-K of the Standard Industrial Classification (SIC) 1992. All SIC production and construction divisions are included i.e. sections C (mining and quarrying), D (manufacturing), E (electricity, gas and water supply) and F (construction). In distribution and services only SIC 51 (wholesale trade except of motor vehicles) is included from section G (wholesale and retail trade; repair of motor vehicles and personal and household goods) with section H (hotels and restaurants) excluded completely. Sections I (transport, storage and communication), J (financial intermediation) and K (real estate, renting and business activities) are included in their entirety.

Sampling

The first sample was drawn from the ONS Inter-Departmental Business Register (IDBR) on 16 March 2001 with the top up following on 30 October. The unit of analysis was the enterprise – for larger firms this is usually a business unit (which must be a legal entity and have a certain degree of autonomy), for smaller firms it is often the whole company.

The survey was stratified by Government Office Region in England, and by Scotland, Wales and Northern Ireland. Each of these regions contained the 12 industry SIC groupings and 5 employment sizebands. The sample was drawn using optimal allocation (based on the proportion of innovators from CIS 2) with a minimum cell size (which varied by the population in each region). Almost 16 per cent of the targeted 126,775 enterprises in the population were sampled.

Response and weighting

The questionnaires from the initial survey were distributed on 2 April 2001. Enterprises not responding received written reminders in mid-May and mid-June with the second reminder also including a copy of the questionnaire. Finally, around 1,000 non-responding enterprises were contacted by telephone in an effort to further boost response rates.

The top up survey was distributed on 9 November with only one reminder sent. The data collection was closed at the end of February.

Of the 19,602 enterprises selected, 8,172 valid responses were received (along with a small number of returned questionnaires from enterprises which had ceased trading) to give a response rate of 42 per cent. The population and achieved sample are summarised below.

Table 13: Summary of sampling frame

	Population			Achieved sample		
	Size of enterprise			Size of enterprise		
	SME	Large	All	SME	Large	All
Mining and quarrying	419	52	471	111	16	127
Mfr of food, clothing, wood, paper, publishing and printing	14196	880	15076	768	237	1005
Mfr of fuels, chemicals, plastics metals & minerals	19022	955	19977	904	217	1121
Mfr of electrical and optical equipment	4381	375	4756	422	105	527
Mfr of transport equipment	1552	283	1835	285	59	344
Mfr not elsewhere classified	3224	118	3342	388	55	443
Electricity, gas and water supply	80	39	119	33	20	53
Construction	17842	331	18173	829	118	947
Wholesale & commission trade (not cars & bikes)	18569	414	18983	918	123	1041
Transport, storage and communications	10171	480	10651	601	172	773
Financial intermediation	3765	372	4137	331	74	405
Real estate, renting and business activities.	28591	664	29255	1194	192	1386
Total	121812	4963	126775	6784	1388	8172

The results in this article are based on weighted data in order to be representative of the population of firms. The responses were weighted back to the population using the inverse sampling proportion in each stratum i.e. the weight attributed to each enterprise was the number of enterprises in the population divided by the number of responses in that stratum. On average each respondent represents 23 enterprises in the population.

Confidence Intervals

A confidence interval gives an estimated range of values which is likely to include an unknown population parameter, the estimated range being calculated from a given set of sample data.
If independent samples are taken repeatedly from the same population, and a confidence interval calculated for each sample, then a certain percentage (confidence level) of the intervals will include the unknown population parameter. Confidence intervals are usually calculated so that this percentage is 95%, but we can produce 90%, 99%, 99.9% (or whatever) confidence intervals for the unknown parameter.