people:skills:jobs:

Department for
**Employment
and Learning**
www.delni.gov.uk

# Towards a Skills Assessment Framework for Northern Ireland:
# A Sectoral Performance Approach

A report prepared by the Priority Skills Unit,
Economic Research Institute of Northern Ireland

March 2008

**erini**
Economic Research Institute
of Northern Ireland

# Towards a Skills Assessment Framework for Northern Ireland:
# A Sectoral Performance Approach

March 2008

Seamus McGuinness* & Jessica Bennett
Priority Skills Unit
The Economic Research Institute of Northern Ireland (ERINI)
Floral Buildings
2-14 East Bridge Street
Belfast, BT1 3NQ


Tel: 028 90 727364
Email: seamus.mcguinness@esri.ie
j.bennett@erini.ac.uk
Web: www.erini.ac.uk


* Now based at The Economic and Social Research Institute, Dublin

# CONTENTS

## LIST OF TABLES

## LIST OF FIGURES

**EXECUTIVE SUMMARY**

- The aim of this report is to further develop an objective framework for identifying priority skill areas of the Northern Ireland (NI) economy.  It is a key input in the development of a Regional Skills and Employment Action Plan, to be delivered by the NI Skills Expert Group (SEG) by September 2007.

- The report profiles 38 sectors of the NI economy using a number of key performance indicators related to both economic significance and skills. It consists of two stages: in stage one, the sectors of the NI economy are assessed in terms of their economic significance; while in stage two, the extent of skill shortages and gaps within each industry is identified.  Given that we are working with historical data, it is impossible to say how each of these sectors will perform in the long term, however, we are able to assess, at least to some extent, the short to medium term outlooks by examining the trend in the data and, disregarding any unforeseen circumstances, we can only assume that this trend is likely to continue, at least in the short term.

- Each sector is ranked on a total score based on a weighted average of each indicator. To examine the sensitivity of the results to changes in weights, we examine three alternative ranking methods:  a 'neutral' approach whereby all indicators are attributed an equal weight; a 'subjective' approach where the weights are based on individual value judgments on the relative importance of each indicator (weights assigned within previous report); and an 'objective' approach where the weights are based on Principal Components Analysis (PCA).

- With regards to the top performing sectors of economic significance, there is a good deal of consistency across the three weighting strategies, with five sectors present amongst the top ten under each weighting scenario, and, a further four sectors in common to at least two of the weighting strategies;

- The top nine sectors of economic significance averaging across all three weighting scenarios were identified as: Manufacture of Radio, Television and Communication Equipment & Apparatus, Manufacture of Office Machinery and Computers (both major components of the Electronic Engineering sector), Research & Development, Manufacture of Chemicals and Chemical Products, Manufacture of Pulp, Paper and Paper Products, Other Business Activities, Computer and Related Activities, Manufacture of Rubber and Plastic Products, and, Manufacture of Machinery and Equipment N.E.C which also covers an element of the Mechanical Engineering sector.

- In terms of the sectors experiencing the highest level of skill shortages and skill gaps, with just four indicators encompassing just two measures of skill shortage we apply only the neutral and objective weighting scenarios in this instance.

- Once again, the results of both the neutral and objective scenarios generate very similar results with seven sectors identified as suffering from skill related problems under both weighting methods. These are Manufacture of Transport Equipment, Manufacture of Chemicals and Chemical Products, Manufacture of Radio, Television and Communication Equipment & Apparatus, Manufacture of Rubber and Plastic Products, Public Administration and Defence; Construction; and Real Estate Activities.

- Quite worryingly, three of the most economically significant sectors are amongst the top seven sectors suffering from the most significant skills shortages and gaps. These are; Manufacture of Chemicals and Chemical Products and the Manufacture of Rubber and Plastic Products and Manufacture of Radio, Television and Communication Equipment & Apparatus. The figure rises to four if we include Manufacture of Transport Equipment which ranked highly in terms of economic significance, under the objective assessment.

- Finally, it is also worth noting that a number of the sectors identified as having the greatest skill needs have been previously researched by the PSU – Manufacture of Transport Equipment in the study of the Mechanical Engineering sector (2002) and Manufacture of Radio, Television and Communication Equipment & Apparatus, as part of the Electronics Industry Study (2001). In addition, adding further credence to our results, we have produced results, some of which are consistent with those found in a RoI study which identified a number of sectors with specific growth opportunities in Ireland up to 2015, these include, ICT, Engineering, Education, Construction and Professional and Consultancy Services.

# 1    BACKGROUND AND INTRODUCTION

The aim of this report is to further develop an objective framework for identifying priority skill areas of the Northern Ireland (NI) economy.   It is a key input in the development of a Regional Skills and Employment Action Plan, to be delivered by the NI Skills Expert Group (SEG) by September 2007.

The importance of preventing skill shortages within key industries is now widely accepted and has become central to UK government policy with the identification of skills as one of the five drivers of productivity growth.   Further evidence of the importance of skills has come with the establishment of the Sector Skills Councils (SSCs) throughout the UK.   The SSCs, which have responsibility for the skills and development of all those employed in their sectors, are also responsible for developing action plans for improving skills and productivity within their specific sectors.   Thus, while the importance of skills is becoming increasingly evident, the whole idea of forecasting skill needs is still considered extremely difficult, and for some, an impossible task.   Lord Leitch (2006) stated "… we cannot be complacent and we cannot predict future economic conditions with certainty, but we do know that the demand for skills will grow inexorably".   Thus while the Leitch Review recommends an increase in adult skill levels across all levels – basic, intermediate and higher – and makes some recommendations about how to achieve this higher skills base, with regards to the specific type of skills required, the only recommendation is for a fully demand-led system which encourages "employers, through their SSCs to become more responsible for the control of vocational qualifications".   In the context of NI, the expectation is that this work will provide some indication of where the problems lie and help us to identify specific growth areas and the type of skills required for them.

The potential productivity costs associated with skills shortages have been well demonstrated within the international literature, for example; Daly et al, (1985), Mason et al, (1993), Haskel and Martin (1996), Nickell and Nicolitsas (1997) and, The Leitch Review of Skills (2005 & 2006).   Within the NI context, the costs arising from skill

problems have recently been highlighted by two studies focusing on very distinct regions of the labour market. Bennett & McGuinness (Forthcoming 2007) utilising data from three separate skill related surveys of firms in the high-tech industries of IT, Electronic Engineering and Mechanical Engineering, found that both hard-to-fill and unfilled vacancies had reduced output per worker levels by between 65 and 75 per cent in affected firms. Furthermore, the results suggest that the best performing firms within these sectors tended to be the most adversely effected, with the effects of skill shortages virtually wiping out the productivity advantage of these top performers. McGuinness, Bennett & McCausland, (Forthcoming 2007), looking at the demand for young people with basic skills amongst service sector SME's found that in instances where such skill shortages were due to a lack of basic literacy / numeracy skills, they exerted a negative impact on productivity performance. The studies demonstrate that skill shortages are likely to be costly to productivity no matter where they occur in the economy, nevertheless, it is reasonable to assume that the overall costs to the economy will be higher as a result of lost output and growth within high-tech, high value-added industries.

The report profiles sectors of the NI economy using a number of key performance indicators related to both economic significance and skills. The approach is based on the recommendations contained in our previous report which advocated using a more transparent, indicator based framework linked to the four NI specific productivity drivers established by the Economic Development Forum in 2004 to identify key sectors of the economy and assess their skills needs. We have data for 45 sectors, each represented by a 2-digit Standard Industrial Classification (SIC) code. The approach consists of two stages: in stage one, the sectors of the NI economy are assessed in terms of their economic significance; while in stage two, the extent of skill shortages and gaps within each industry is identified. This exercise provides a preliminary indication of the extent to which the top performing sectors of the economy are likely to be experiencing skill related constraints. The indicators adopted were those recommended in the previous report, they are:

*Indicators of Economic Significance*

- Total Employment Size  (Number)
- Job Creation / Loss (Number)
- R&D Expenditure per Employee in Employment   (£ per employee in employment)
- Proportion of NI Businesses that are Product and Process Innovators (%)
- Export Revenue per Employee in Employment (£ per employee in employment)
- Export Growth (% of sales)
- GVA per Employee in Employment (£ per employee in employment)
- Growth in GVA per Employee in Employment (%)
- No. of VAT Registrations Expressed as a Proportion of the Stock of Existing Businesses (%)
- Count of Foreign Owned Businesses expressed as a Percentage of the Total Stock of Businesses (%)

*Indicators of Skill Needs*

- Evidence of skill shortages – measured by 'hard to fill' vacancies
  - % of Establishments
  - % of All Vacancies
- Evidence of Skill Gaps – employer's views of their workforce's current skill levels and the skill levels required by the organisation.
  - % of Establishments
  - % of Employment

The data for the indicators of economic significance relates to 2003, the year for which we have the most complete observations at the 2-digit SIC level.  Although we are working with historical data, we are able to assess, at least to some extent, the short to medium term outlooks by examining the trend in the data which we can only assume will continue, at least in the short term.  The data for the indicators of skill needs however, refers to 2005 and is taken from the NI Skills Monitoring Survey, published by DEL in October 2006.  Missing data records a zero value for that indicator as the absence of data

is assumed to represent low or poor performance within that sector. Also, very small sectors were removed since they often record widely varying growth rates. We excluded sectors employing less than 1,000 persons (less in total than 0.1 per cent of overall employment), which left us with 38 sectors thus reducing the number of 2-digit SIC groupings by seven[1]. The full listing of 2-digit SIC categories is given in **Table 1**.

Within the previous report we had recommended that each sector would be ranked on a total score based on a weighted average of each indicator. This approach can be described as largely subjective as the weights are based on individual value judgments on the relative importance of each indicator. To examine the sensitivity of the results to changes in weights, we have also examined two other ranking methods: a 'neutral' approach whereby all indicators are attributed an equal weight; and an 'objective' approach where the weights are based on Principal Components Analysis (PCA).

---

[1] The sectors excluded from the analysis were Mining of Coal and Lignite etc. (10); Manufacture of Leather etc. (19); Manufacture of Coke etc. (23); Manufacture of Basic Metals (27); Recycling (37); Water Transport (61); and Air Transport (62).

**Table 1: UK Standard Industrial Classification of Economic Activities**

| 2-Digit SIC Division Group | Description |
|---|---|
| 1, 2 & 5 | Agriculture, Hunting, Forestry and Fishing |
| 14 | Other Mining and Quarrying |
| 15/16 | Manufacture of Food Products; Beverages and Tobacco |
| 17 | Manufacture of Textiles |
| 18 | Manufacture of Wearing Apparel; Dressing and Dyeing of Fur |
| 20 | Manufacture of Wood and Wood Products |
| 21 | Manufacture of Pulp, Paper and Paper Products |
| 22 | Publishing, Printing and Reproduction of Recorded Media |
| 24 | Manufacture of Chemicals and Chemical Products |
| 25 | Manufacture of Rubber and Plastic Products |
| 26 | Manufacture of Other Non-Metallic Mineral Products |
| 28 | Manufacture of Fabricated Metal Products, Except Machinery and Equipment |
| 29 | Manufacture of Machinery and Equipment N.E.C |
| 30 | Manufacture of Office Machinery and Computers |
| 31 | Manufacture of Electrical Machinery and Apparatus N.E.C |
| 32 | Manufacture of Radio, Television and Communication Equip. & Apparatus |
| 33 | Manufacture of Medical, Precision & Optical Instruments, Watches & Clocks |
| 34/35 | Manufacture of Transport Equipment |
| 36 | Manufacture of Furniture; Manufacturing N.E.C |
| 40/41 | Electricity, Gas and Water Supply |
| 45 | Construction |
| 50 | Sale, Maint. & Repair of Motor Vehicles & Cycles; Retail Sale of Auto. Fuel |
| 51 | Wholesale & Commission Trade, Except of Motor Vehicles & Motorcycles |
| 52 | Ret. Trade (Exc. Motor Vehicles & cycles); Repair of Pers. & Household Gds |
| 55 | Hotels and Restaurants |
| 60 | Land Transport; Transport via Pipelines |
| 63 | Supporting and Auxiliary Transport Activities; Activities of Travel Agencies |
| 64 | Post and Telecommunications |
| 65-67 | Financial Intermediation |
| 70 | Real Estate Activities |
| 71 | Renting of Machinery & Equipment & of Personal & Household Goods |
| 72 | Computer & Related Activities |
| 73 | Research & Development |
| 74 | Other Business Activities |
| 75 | Public Administration & Defense; Compulsory Social Security. |
| 80 | Education |
| 85 | Health & Social Work |
| 90-93 | Other Community, Social & Personal Service Activities. |

The report is structured as follows: In **Section 2** we give an overview of the top performing sectors within each indicator of economic significance; **Section 3** profiles

those sectors suffering from the most significant skill shortages and skill gaps; In **Section 4**, we discuss the various weighting strategies (a detailed discussion of PCA is included in **Appendix 2**). **Section 5** discusses and compares the top ten sectors of economic significance as generated by the various weighting strategies while **Section 6** identifies the sectors of the NI economy most likely to be experiencing skill shortages and gaps and assesses the extent to which the top performing industries are likely to be constrained by skill related problems. **Section 7** provides a summary of the main findings and some policy recommendations.

# 2    MEASURES OF ECONOMIC SIGNIFICANCE

This section of the report provides a brief profile of each indicator in terms of the top performing sectors in 2003 and, where data permits, the changes that have occurred over time.

## 2.1    *Employment Size*

**Table 2** ranks the ten largest industries in Northern Ireland in terms of employment size according to the NI Quarterly Employment Survey (2003). The complete listing of all industries is given in **Appendix 1** in **Table A1**. A total of 666,180 persons were employed within the 38 listed 2-digit SIC divisions in Northern Ireland in 2003. The Health & Social work sector was the largest single employer with over 100,000 employees and accounting for just over 15 per cent of the total employment. The next most significant industries were Retailing, Education, and Public Administration and Defence, all of which employ over 50,000 persons. The table emphasises the fact that the public sector remains a hugely important source of employment within the region. The industries ranked 5 to 10 are dominated by the service sector with Other Business Activities, Hotels & Restaurants, Other Community, Social & Personal Service Activities and Wholesale Trade and Commission Trade all employing between 23,000 and 43,000 persons. The Construction industry was identified as the seventh largest employer with Manufacture of Food, Beverages and Tobacco being the only manufacturing sector to make the top ten.

**Table 2: Top Ten Sectors in terms of Employment Size in NI in 2003**

| Rank | SIC | Sector Description | Employment | % Total Employment |
|------|-----|--------------------|-----------|--------------------|
| 1 | **85** | Health & Social Work | 101,960 | 15.3 |
| 2 | **52** | Retail Trade etc | 75,130 | 11.3 |
| 3 | **80** | Education | 70,870 | 10.6 |
| 4 | **75** | Public Administration etc. | 62,180 | 9.3 |
| 5 | **74** | Other Business Activities | 43,260 | 6.5 |
| 6 | **55** | Hotels and Restaurants | 40,580 | 6.1 |
| 7 | **45** | Construction | 35,400 | 5.3 |
| 8 | **90-93** | Other Community Activities etc | 30,550 | 4.6 |
| 9 | **51** | Wholesale & Commission Trade, | 23,210 | 3.5 |
| 10 | **15/16** | Manuf. of Food, Beverages & Tobacco | 18,760 | 2.8 |

Source: NI Quarterly Employment Survey (2003)

Between 1998 and 2003, overall employment grew by approximately 1.9 per cent per annum, a total of 59,420. The changing pattern of employment over the period 1998 to 2003 is discernable from **Figures 1** and **2** which plot total employment within each sector during both time periods. **Figure 1** shows total employment in those sectors employing less than 10,000 persons in 2003 with **Figure 2** showing those sectors employing greater than 10,000 persons in 2003. From looking at the graphs it is evident that employment, in the vast majority of industries, has remained relatively constant. However, some employment loss is apparent in the manufacturing sector and principally in the Manufacture of Textiles and Manufacture of Wearing Apparel industries (**Figure 1**), which have been particularly badly affected by the impacts of increased globalisation and the re-sourcing of manufacturing activities to companies located in the developing world. Despite the fact that most manufacturing industries managed to at least preserve their employment levels over the period, the manufacturing share of total employment will have fallen due to the growth of service industries such as Retailing, Hotels & Restaurants, and those related to Other Business Activities and the continued expansion of public sector related employment in Health & Social Work and Education.

**Figure 1: Numbers Employed by Sector  - 1998 & 2003 (<10,000)**
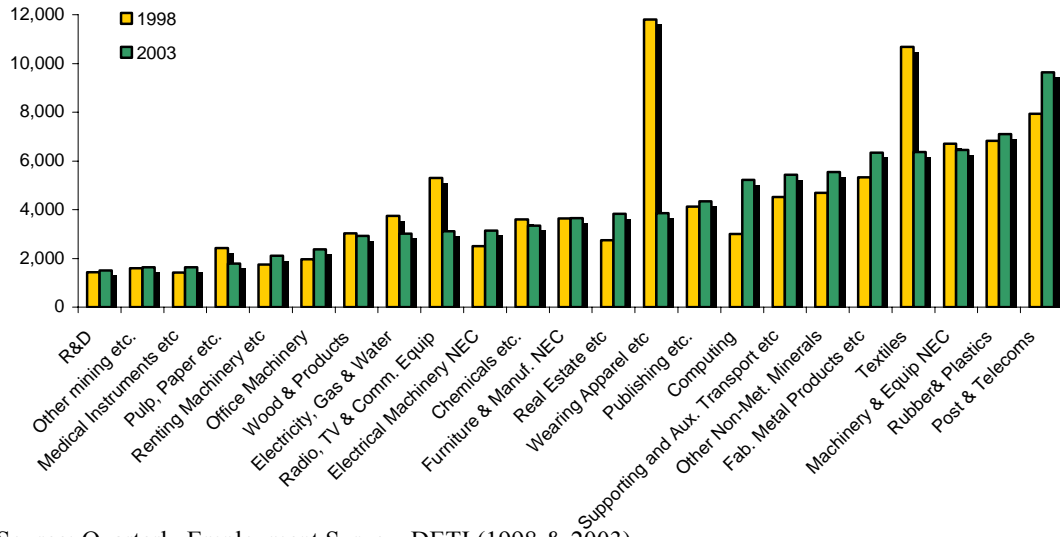


Source: Quarterly Employment Survey, DETI (1998 & 2003)

**Figure 2: Numbers Employed by Sector - 1998 & 2003 (>10,000)**
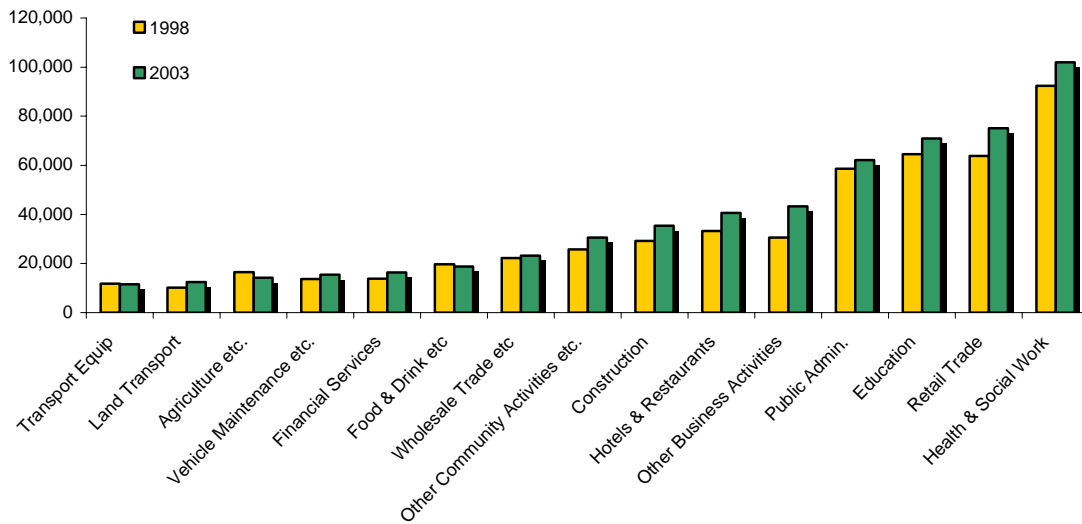


Source: Quarterly Employment Survey, DETI (1998 & 2003)

## 2.2 Job Creation / Loss

When constructing this indicator, we had the option of measuring employment growth / decline in either absolute or percentage terms. When considering percentage growth, small sectors invariably come out top by virtue of the fact that they are growing from a very small base. As a result, it was decided to adopt the indicator expressed in absolute terms, however, the overall results proved to be relatively insensitive to the indicator selected. The data used for this indicator is the NI Quarterly Employment Survey (QES) (2002 & 2003). The sectors experiencing the most significant increases in employment numbers during 2003 were all non-manufacturing sectors (**Table 3**). The sector experiencing the largest employment growth was Health and Social Work which saw 2,550 jobs created between 2002 and 2003. The other sectors experiencing relatively high levels of employment growth during the period were Education, Other Business Activities, Public Administration and Defence, Other Community, Social & Personal Service Activities, Retail Trade, and Hotels & Restaurants. We have chosen to measure only one years growth / decline as recent growth is more relevant to performance than historical growth, however, if we consider growth over the five year period 1998-2003, the pattern changes only slightly[2] indicating that the sectors identified tend to be consistent performers in terms of employment growth and that cyclical effects have only a relatively marginal impact on overall performance rankings.

The general pattern observed in **Table 3** is reinforced further by **Figures 3** and **4** which demonstrate that those industries experiencing employment growth between 2002 and 2003 were predominantly in the non-traded sectors (**Figure 3**) while those sectors within which employment was contracting were predominantly in manufacturing (**Figure 4**). However, it should be noted that, despite this, manufacturing employment levels within key NI manufacturing sectors have been declining at a slower rate that those in GB (McGuinness & Bonner, 2002), furthermore, while contracting employment is

---

[2] When comparing the five year growth period with one year growth, seven of the top ten sectors are the same. Those sectors performing better in the longer term are: Construction, Financial Intermediation and Computer & Related Activities.

synonymous with sectoral decline it can also be consistent with economic rationalisation and increased productivity.

**Table 3: Job Creation / Loss by SIC - 2003**

| Rank | SIC | Sector Description | No. |
|------|-------|-------------------------------------|-------|
| 1 | 85 | Health & Social Work | 2,550 |
| 2 | 80 | Education | 2,460 |
| 3 | 74 | Other Business Activities | 2,060 |
| 4 | 75 | Public Administration etc, | 1,960 |
| 5 | 90-93 | Other Community Activities etc | 1,410 |
| 6 | 52 | Retail Trade etc | 1,370 |
| 7 | 55 | Hotels and Restaurants | 1,200 |
| 8 | 60 | Land Transport; Transport via Pipelines | 370 |
| 9 | 51 | Wholesale & Commission Trade etc. | 360 |
| 10 | 70 | Real Estate Activities | 300 |

Source: NI Quarterly Employment Survey (2003)

**Figure 3: Job Creation by SIC (2002-2003)**



Source: Quarterly Employment Survey, DETI (2002, 2003)

11
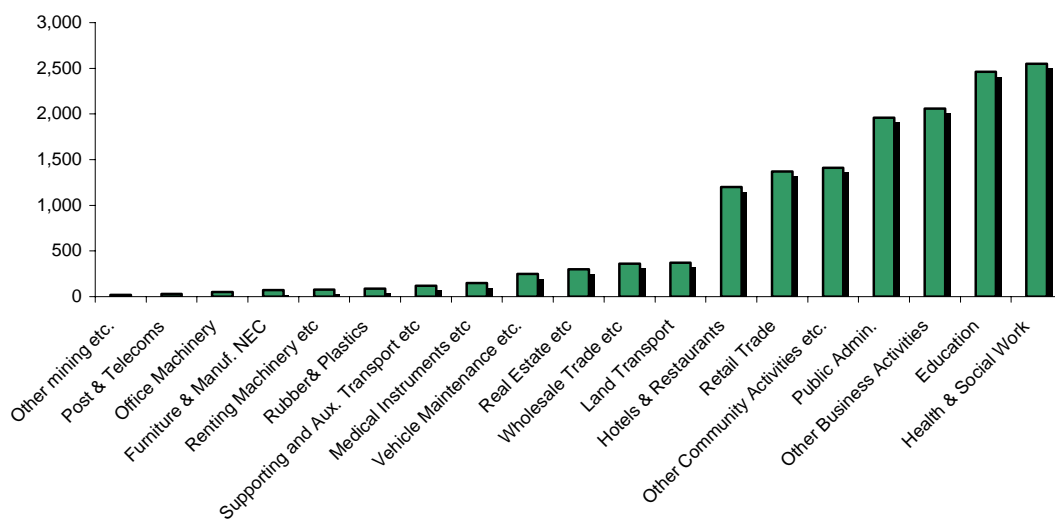
**Figure 4: Job Loss by SIC (2002-2003)**
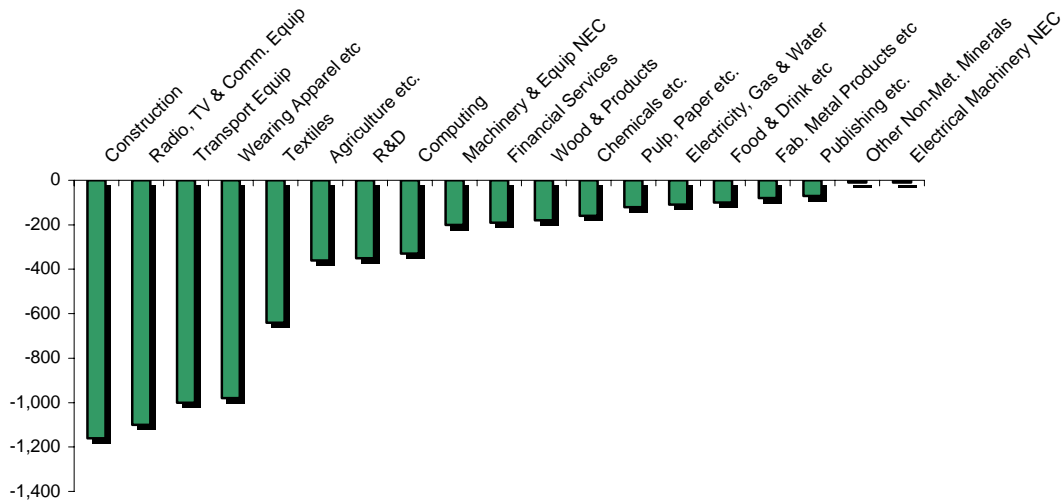


Source: Quarterly Employment Survey, DETI (2002, 2003)

## 2.3 R&D Expenditure per Employee in Employment

Sectoral measures of the level of innovation activity are given by two indicators. The first relates to the average spend on research and development per employee in employment which is derived from the 2003 (and 1999) Business Expenditure on R&D surveys.

The ranking of sectors by R&D expenditure per employee for 2003 is presented in **Table 4** and **Figure 5** (with a 1999 comparison). R&D data was not available for all 38 sectors; however, where data was missing we assume that this signifies little or no R&D expenditure within that particular sector. Not surprisingly, manufacturing sectors dominate this indicator with the R&D industry somewhat predictably taking the position of top performing sector followed by Manufacture of Chemicals and Chemical Products, Computer & Related Activities, Manufacture of Medical, Precision & Optical Instruments, Watches & Clocks and Manufacture of Office Machinery and Computers. The remainder of the top ten performing sectors incorporates elements of the Electronic and Mechanical Engineering Industries, Manufacture of Textiles, and Manufacture of Food, Beverages and Tobacco. Many of the sectors dominant within the 2003 data were

12

also prominent in 1999 with eight sectors recording a top ten position during both periods indicating a consistently high level of R&D investment within these areas over time.

**Table 4: Top Ten Sectors in terms of R&D Expenditure per Employee in Employment – 2003**

| Rank | SIC | Sector Description | R&D Exp Per EE |
|---|---|---|---|
| 1 | 73 | Research & Development | 6569 |
| 2 | 24 | Manufacture of Chemicals etc. | 4611 |
| 3 | 72 | Computer & Related Activities | 3934 |
| 4 | 33 | Manufacture of Medical Instruments etc. | 2865 |
| 5 | 30 | Manufacture of Office Machinery etc. | 2379 |
| 6 | 31 | Manufacture of Electrical Machinery etc. | 1675 |
| 7 | 29 | Manufacture of Machinery & Equip. N.E.C | 1176 |
| 8 | 15/16 | Manufacture of Food; Beverages & Tobacco | 532 |
| 9 | 28 | Manufacture of Fabricated Metal Products etc. | 520 |
| 10 | 17 | Manufacture of Textiles | 455 |

Source: Business Expenditure on Research & Development, R&D Survey, 2003

**Figure 5: R&D Expenditure per Employee in Employment - 1999 & 2003**
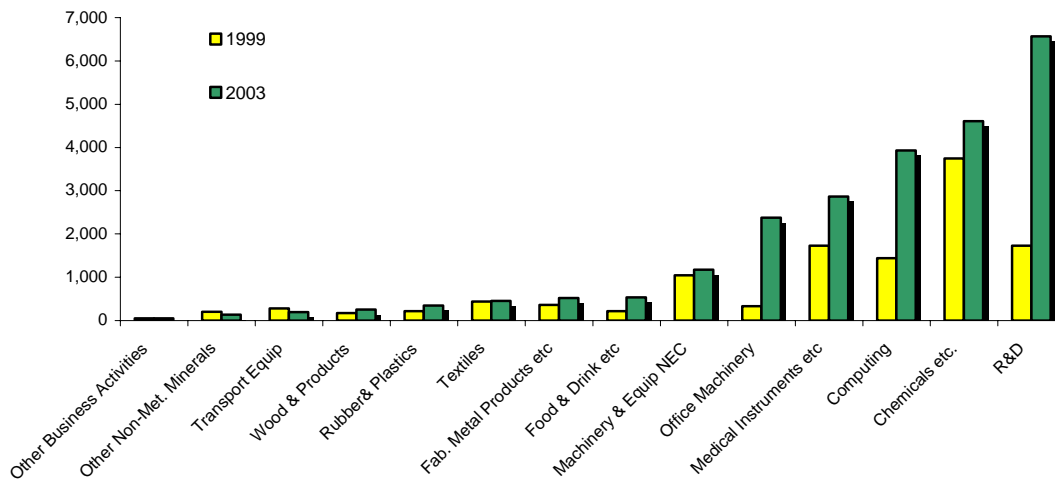


Source: Business Expenditure on Research & Development Survey, DETI, 1999 & 2003

Note: Several SIC groups have been excluded from the chart as their R&D expenditure per employee was too small to be detected or there was no comparative data for 1999 / 2003. For the 2003 figures, these SICs are Construction with R&D expenditure per EE of £1.30 and Wholesale Trade and Commission Trade - £13.50, Manufacture of Furniture etc. - £37.3, Post & Telecoms - £77.8, Other Mining etc. - £259.5, Manufacture of Electrical Machinery n.e.c. - £1674.9. For the 1999 figures, these SICs are Retail Trade etc with R&D expenditure per EE of £2.50, Construction - £10.90, Electricity, Gas & Water - £12.40, and Wholesale Trade & Commission Trade - £16.70, Manufacture of Wearing Apparel etc. - £181.9, Manufacture of Radio, TV etc. - £8767.9.

## 2.4 Proportion of NI Businesses that are Product and Process Innovators

This is our second measure of the level of innovation activity and relates to the average percentage of firms within each sector successfully implementing either product or process innovations. The data for this indicator comes from the 2005 Community Innovation Survey (CIS) and is a simple average of the percentage of firms engaging in product innovations and the percentage engaging in process innovation. This gives an indication of the intensity of innovation activity with sectors.

The pattern with respect to product and process innovations, while highly correlated with that relating to R&D expenditure per employee also contains some distinct differences, largely due to the fact that the aggregate incorporates process innovations and therefore will more fully reflect innovative activity in service sector industries. Four of the top ten performing sectors with respect to R&D investment are also among the top ten product and process innovators. Turning specifically to product and process innovations, the Manufacture of Transport Equipment is the top sector followed by Manufacture of Radio, Television & Communication Equipment and Apparatus, Research & Development, Computer & Related Activities, Post & Telecommunications and Financial Intermediation (**Table 5** & **Figure 6**). The remainder of the top ten grouping is dominated by manufacturing sectors; however, one of the largest service industries, Other Business Activities, received a ranking of six in this aggregate which is further evidence of substantial innovation levels within the NI business and corporate sectors.

**Table 5: Top Ten Sectors in terms of the Proportion of Product and Process Innovators - 2003**

| Rank | SIC | Sector Description | % P&P Innovators |
|------|-----|--------------------|------------------|
| 1 | 32 | Manufacture of Radio, TV Equip. etc. | 64.7 |
| 2 | 73 | Research & Development | 60.4 |
| 3 | 72 | Computer & Related Activities | 51.4 |
| 4 | 64 | Post and Telecommunications | 50.0 |
| 5 | 65-67 | Financial Intermediation | 40.7 |
| 6 | 74 | Other Business Activities | 38.8 |
| 7 | 29 | Manufacture of Machinery etc. | 37.5 |
| 8 | 33 | Manuf. of Medical Instruments etc. | 37.2 |
| 9 | 34/35 | Manufacture of Transport Equipment | 35.0 |
| 10 | 36 | Manufacture of Furniture etc. | 34.0 |

Source: Community Innovation Survey, 2005

**Figure 6: % of NI Enterprises that are Product and Process Innovators (2002-2004)**
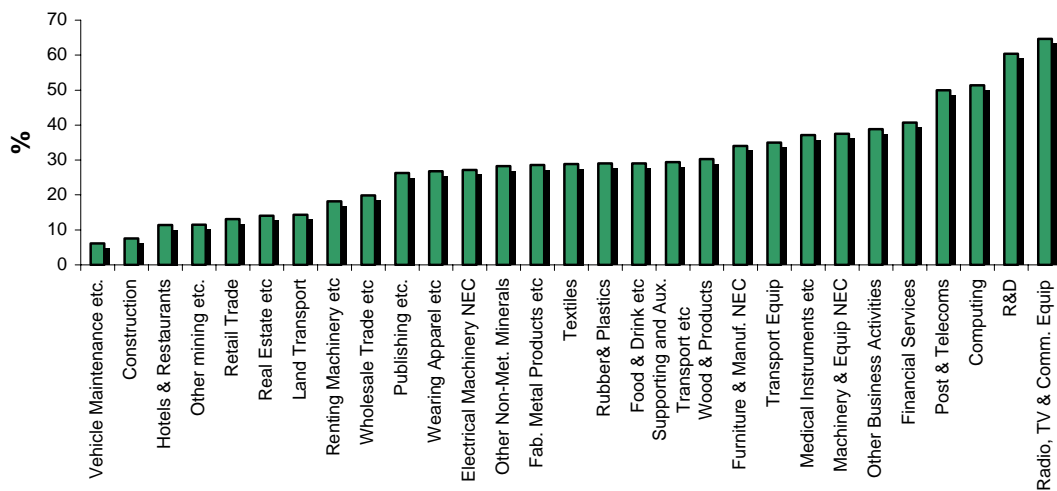


Source: Community Innovation Survey, 2005

## 2.5　Export Revenue per Employee in Employment

The level of export intensity is an important aspect of sectoral performance as it demonstrates an ability to compete internationally in terms of both quality and cost. Obviously data on export activity, as measured by export revenue per employee, will be observed almost exclusively for manufacturing firms, however, data on externally traded services has also been incorporated within the analysis using data from the 2006 Exporting Northern Ireland Services Study 2004 (DETI, 2006), Measuring Service Sector Exports from Northern Ireland (NIERC, 2004), and the Northern Ireland Tourist Board. The NIERC study (2004) highlighted the fact that almost all services are potentially tradeable, however, given that the service sector is so much larger than the manufacturing sector and the tradeable component of it is much harder to identify, studies of this nature tend to survey only those sectors identified as having high export potential (and sometimes those with medium export potential). It is generally agreed that the bulk of traded services are concentrated in the Financial and Business Services sectors, consequently, the Exporting NI Services Study 2004 (DETI, 2006) provides service export information for just four 2-digit SIC groupings (72, 73, 74 & 92). Export information on Education and Tourism was obtained from Measuring Service Sector Exports from Northern Ireland (NIERC, 2004), and the Northern Ireland Tourist Board. For those sectors with no export information available we have to assume that export sales are either very small or zero and record a zero figure. As a result, the absence of export data for most service industries will tend to boost exporting manufacturing sectors in the rankings framework and we believe this should be the case. The importance of exports to regional performance is often put on a par with technical progress and proponents of 'export-led' growth theory argue that exports act as an "engine for growth" in the economy. On these grounds, it seems only plausible that success in external markets is reflected within the ranking framework.

Information on the most export intensive sectors is provided in **Table 6** and **Figure 7**. Sectors falling within the area of Electronic Engineering, the Manufacture of Radio, Television & Communication Equipment and Apparatus, and Manufacture of Office

Machinery & Computers, occupy the first two positions. This is closely followed by the Manufacture of Chemicals and Chemical Products, and then two elements of the Mechanical Engineering area i.e. Manufacture of Machinery & Equipment N.E.C and the Manufacture of Transport Equipment. The sectors ranked from six to ten all also belong to manufacturing; however, no particular area dominates. One point of note is the presence of the Manufacture of Food, Beverages and Tobacco sector which suggests that it has recovered well despite being badly affected by the BSE crises in the late 1990's.

**Figure 8** demonstrates that those sectors with the highest export revenue per employee in **Table 6** were also among the most dominant in 1998 demonstrating that the sectoral pattern of export performance is relatively stable over time. However, there are some notable exceptions, in particular a very rapid increase appears to have taken place in the export intensity levels in the Manufacture of Radio, Television & Communication Equipment and Apparatus, which has resulted in a export per worker level twice that of its next nearest rival in 2003 (**Table 6**). Rapid swings have also occurred in the Manufacture of Office Machinery and Computers and the Manufacture of Electrical Machinery and Apparatus N.E.C sectors. Export intensity levels in the Manufacture of Radio, Television and Communication Equipment increased by almost 83 per cent with the Manufacture of Office Machinery and Computers rising by just under 400 per cent (DETI, 2006). In contrast, the Manufacture of Electrical Machinery and Apparatus N.E.C has seen its export sales fall dramatically since 1998 by around 95 per cent. However, apart from these few dramatic changes the pattern has been one of steady growth in sectoral export intensity levels. It should also be noted that service export data was available only for more recent years so we are unable to comment on earlier patterns of export growth in services.

**Table 6: Top Ten Sectors in terms of Export Revenue per Employee – 2003**

| Rank | SIC | Sector Description | Export Rev PE (£000's) |
|---|---|---|---|
| 1 | 32 | Manufacture of Radio, TV Equip. etc | 227.9 |
| 2 | 30 | Manufacture of Office Machinery etc | 104.4 |
| 3 | 24 | Manufacture of Chemicals etc | 100.0 |
| 4 | 29 | Manufacture of Machinery & Equip. N.E.C | 63.7 |
| 5 | 34/35 | Manufacture of Transport Equipment | 55.0 |
| 6 | 21 | Manufacture of Pulp, Paper etc | 51.6 |
| 7 | 25 | Manufacture of Rubber and Plastic Products | 46.9 |
| 8 | 15/16 | Manuf. of Food; Beverages & Tobacco | 41.4 |
| 9 | 36 | Manufacture of Furniture; Manufacturing N.E.C | 32.1 |
| 10 | 20 | Manufacture of Wood and Wood Products | 30.4 |

Source: Manufacturing, Sales and Exports Survey, DETI, 2003

**Figure 7: Export Revenue Per Employee in Employment - 2003**
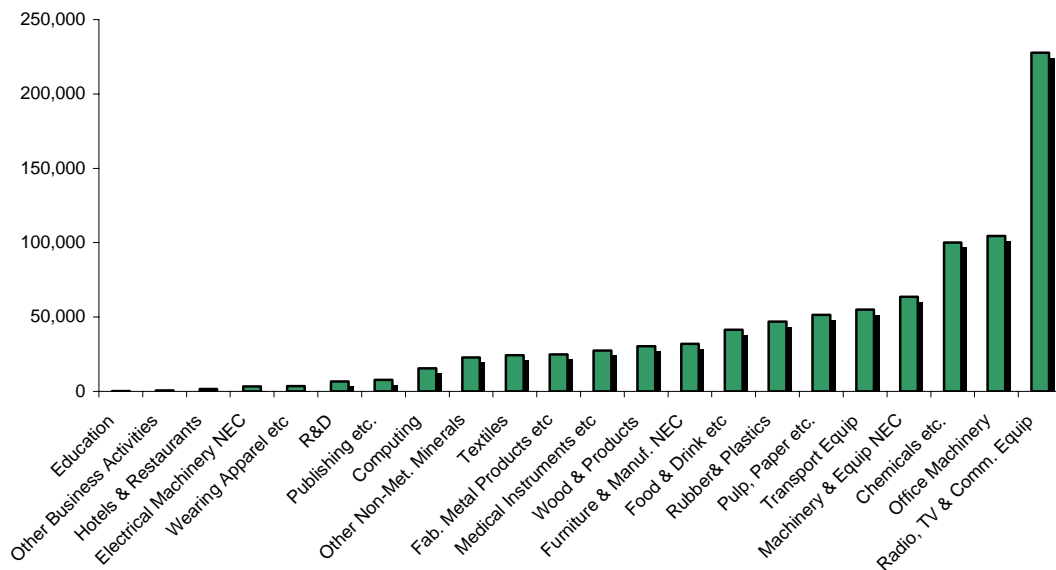


Source: Manufacturing, Sales and Exports Survey, DETI (2003); Exporting NI Services Study 2004, DETI (2006); Measuring Service Sector Exports from NI, NIERC (2004) ; NITB (2006)

**Figure 8: Export Revenue per Employee in Employment - 1998 &
2003**
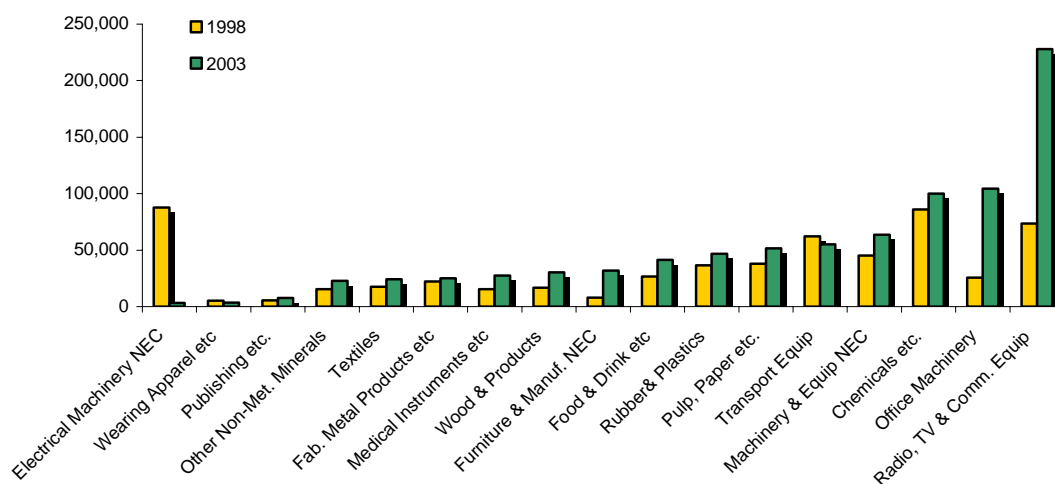


Source: Manufacturing, Sales and Exports Survey, DETI, 1998 & 2003

### 2.6    *Export Growth (computed at 2003 constant prices)*

Limitations relating to a lack of export data for service sector industries were more
pronounced with respect to export growth as the aggregate could not be constructed for
these sectors due to a lack of historical data. On the grounds that such exclusions could
potentially disadvantage service sectors within the analysis, the ranking procedures were
conducted to assess the sensitivity of the results to the inclusion \ exclusion of the export
growth variable. The results changed little, demonstrating that data limitations in this area
was not imposing any disadvantage on service industries with respect to the ranking
framework.

Concentrating on recent export growth, the pattern observed in **Table 6** alters slightly
although eight of the top ten overall performers are amongst the ten fastest growing
sectors over the 2002 to 2003 period.   The Manufacture of Furniture and Other
Manufacturing N.E.C. experienced exceptionally strong growth in export sales between
2002 and 2003; rising by over 50 per cent (**Table 7**).  On the other hand, export growth of
firms in the Manufacture of Radio, Television & Communication Equipment and

Apparatus appears to have eased considerably and Manufacture of Office Machinery and Computers, which was the other dominant Electronic Engineering representative in **Table 6**, did not make the list of fastest growing sectors. Similarly, the Mechanical Engineering sectors that were ranked 3 and 4 in terms of overall export intensity performed less well with respect to recent export growth. The extent to which these disparities represent short-run changes in demand as opposed to a long-run trend is impossible to discern from the data. **Figure 9** demonstrates that the majority of sectors experienced some growth in export activity during 2002 to 2003, the exceptions being Manufacture of Electrical Machinery and Apparatus N.E.C, Manufacture of Wearing Apparel, Manufacture of Medical, Precision & Optical Instruments, Watches & Clocks, and, Manufacture of Textiles, all of which experienced slight declines. Once again it should be noted that export data was available for only two service sectors.

**Table 7: Fastest Growing Sectors in terms of Exports - 2003**

| Rank | SIC | Sector Description | % Growth |
|------|-------|-------------------------------------------------|----------|
| 1 | 36 | Manufacture of Furniture; Manufacturing N.E.C | 51.0 |
| 2 | 25 | Manufacture of Rubber and Plastic Products | 37.6 |
| 3 | 28 | Manufacture of Fabricated Metal Products etc. | 21.8 |
| 4 | 15/16 | Manuf. of Food Products; Beverages & Tobacco | 16.2 |
| 5 | 26 | Manuf. of Other Non-Metallic Mineral Prod. etc | 15.5 |
| 6 | 29 | Manufacture of Machinery and Equipment N.E.C | 14.2 |
| 7 | 20 | Manufacture of Wood and Wood Products | 12.7 |
| 8 | 32 | Manufacture of Radio, TV Equip. etc. | 12.5 |
| 9 | 21 | Manufacture of Pulp, Paper and Paper Products | 12.4 |
| 10 | 34/35 | Manufacture of Transport Equipment | 11.5 |

Source: Manufacturing, Sales and Exports Survey, DETI, 2002 & 2003

**Figure 9: Percentage Growth in Exports from 2002-2003**
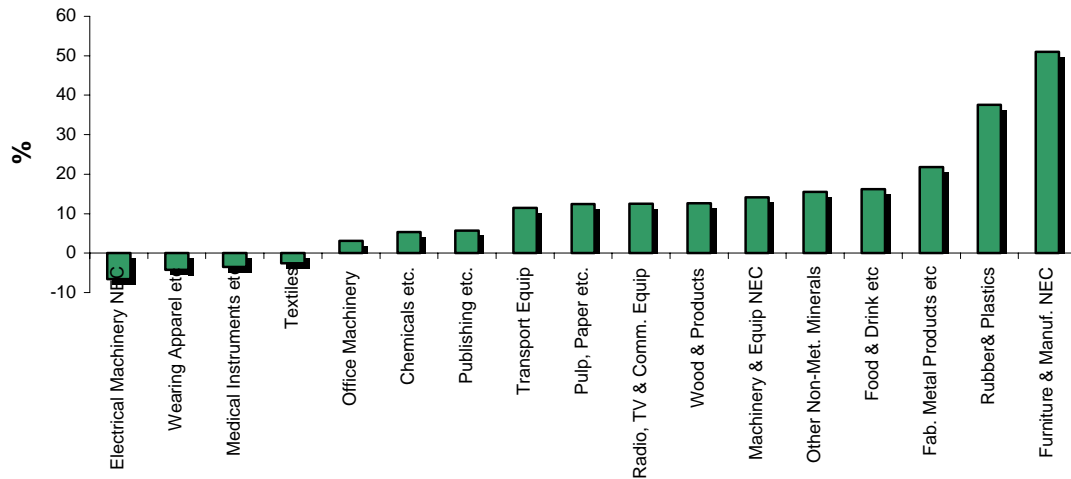


Source: Manufacturing, Sales and Exports Survey, DETI, 2002 & 2003

## 2.7 GVA per Employee in Employment

GVA per employee is a key measure of economic efficiency and a widely used proxy for overall productivity. It represents the difference between the value of goods and services produced per employee and the cost of raw materials and other inputs which are used up in production. GVA per employee is the UK Government's preferred method for measuring productivity performance and higher levels of this variable will generally reflect a more efficient workforce with higher sectoral value added. **Table 8** and **Figure 11** present the top performing sectors under this aggregate and, as we can see, no clear patterns emerge with the utility, manufacturing and service industries all represented amongst the top ten sectors. Electricity, Gas and Water Supply comes out top followed by Real Estate activities, Manufacture of Chemicals and Chemical Products, Manufacture of Office Machinery and Computers and Financial Intermediation. The dominant position of Real Estate Activities reflects the rapid growth in house prices experienced within NI over recent years. Among the sectors ranked from six to ten, three belong to manufacturing, one to Post and Telecommunications and one to Other Mining and Quarrying. Relative to other indicators, industries connected to Electronic and

21

Mechanical Engineering are not well represented among the top sectors. The distribution of GVA per employee outside the top ten is illustrated in **Figure 10**. Again, no strong pattern emerges, with service and public sector industries intertwined with manufacturing sectors as we move down the scale. Quite surprisingly, the R&D sector was amongst the lowest performers. From **Figures 12** and **13** it is evident that the sectoral pattern of GVA performance has remained relatively stable over time with the same sectors dominant in 1998 as in 2003.

**Table 8: Top Ten Sectors in terms of GVA per Employee – 2003**

| Rank | SIC | Sector Description | GVA per EE (£000's) |
|------|-------|------------------------------------------------|---------------------|
| 1 | 40/41 | Electricity, Gas and Water Supply | 142.9 |
| 2 | 70 | Real Estate Activities | 69.9 |
| 3 | 24 | Manufacture of Chemicals etc. | 64.7 |
| 4 | 30 | Manufacture of Office Machinery etc. | 62.3 |
| 5 | 65-67 | Financial Intermediation | 61.5 |
| 6 | 14 | Other Mining and Quarrying | 56.4 |
| 7 | 64 | Post and Telecommunications | 56.2 |
| 8 | 21 | Manufacture of Pulp, Paper and Paper Products | 55.1 |
| 9 | 15/16 | Manufacture of Food; Beverages and Tobacco | 52.8 |
| 10 | 71 | Renting of Machinery & Equipment etc. | 51.8 |

Source: Regional Accounts, RFL, 2003; DETI, RFL, 2003

**Figure 10: GVA Per Employee < £50,000 - 2003**
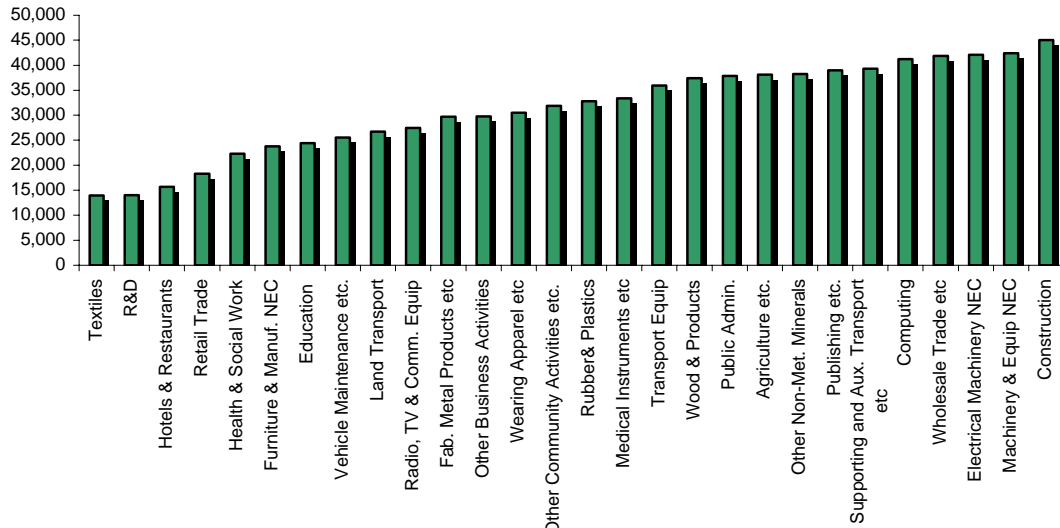


Source: Regional Accounts,RFL, 2003; DETI, RFL, 2003

**Figure 11: GVA Per Employee >£50,000 - 2003**
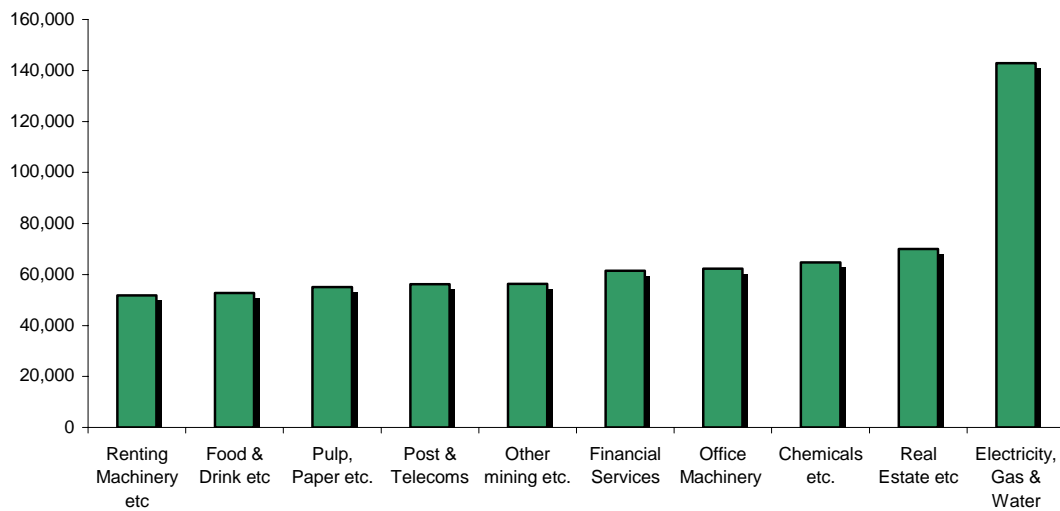


Source: Regional Accounts, RFL, 2003; DETI, RFL, 2003

**Figure 12: GVA Per Employee <£50,000 - 1998**
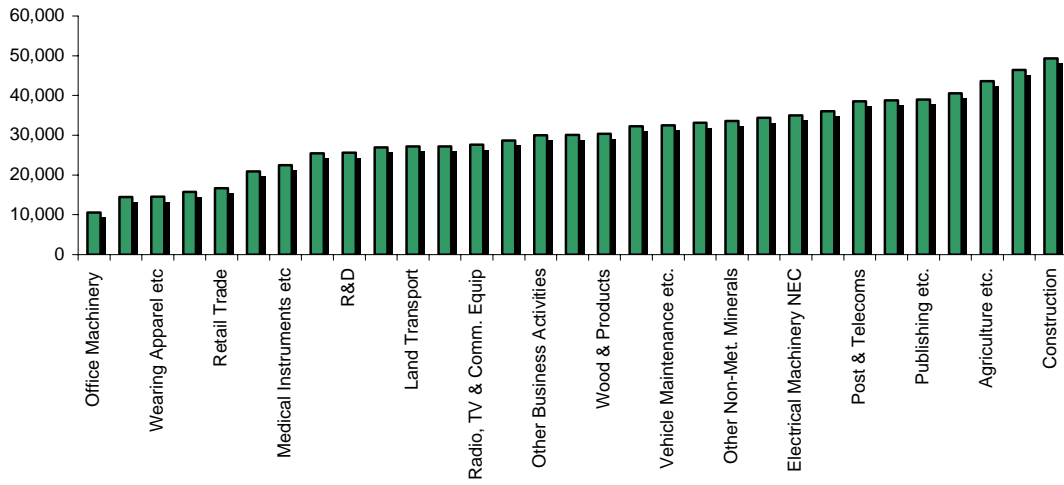
**Figure 13: GVA Per Employee >£50,000 - 1998**
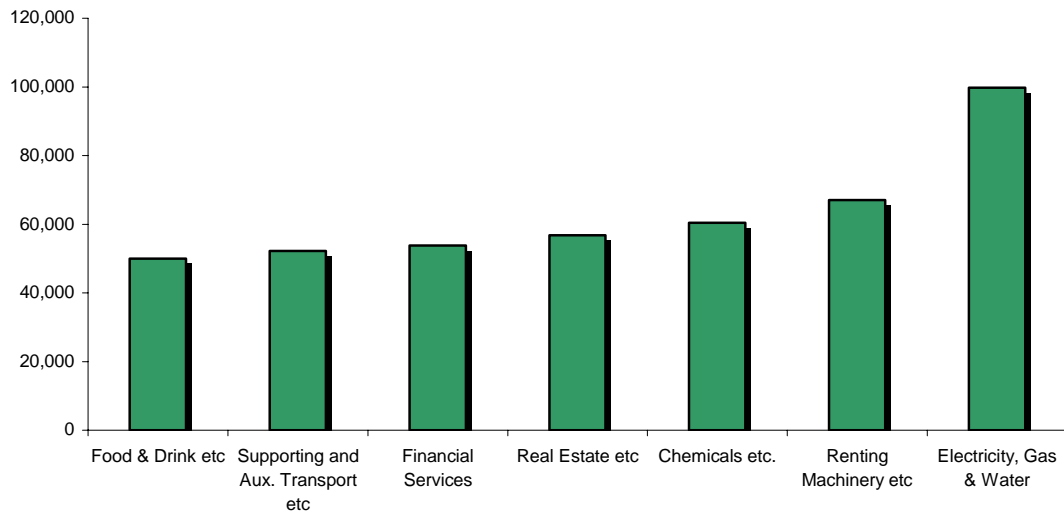
*2.8 Growth in GVA per Employee*

Growth in GVA per employee usually represents an improvement in firm's production techniques in that they have found better ways to create more output from given inputs, for example, by the introduction of new technologies. Such growth may improve the firm's competitiveness in the market place. **Table 9** and **Figure 14** detail the sectoral pattern of growth in GVA per employee in NI for the 2002 to 2003 period. Manufacturing industries account for six of the top ten performing industries with Manufacture of Electrical Machinery and Apparatus N.E.C and Manufacture of Pulp, Paper and Paper Products ranking first and second with growth between 35 and 41 per cent. Computer & Related Activities and Post and Telecommunications are ranked third and fourth, a sign that these sectors are again improving following some well documented closures in the first few years of the new millennium. Three manufacturing sectors are accompanied by Wholesale Trade & Commission Trade etc and Other Business Activities among the sectors ranked six to ten.

**Figures 14** and **15** demonstrate that the majority of industries experienced some level of growth in GVA per employee over the 2002 to 2003 period. Only thirteen sectors experienced falling levels of GVA per employee with the most severe fall experienced in the R&D sector which declined by almost 80 per cent during the period thus explaining its position among the low value added sectors in **Figure 10**. The exact causes of this rapid decline in productivity are not known. Six of the twelve sectors experiencing a decline in GVA per employee throughout the year 2002-2003 were in manufacturing. **Figures 16** and **17** show those sectors experiencing rising, and, falling GVA per employee levels in 1999. Only four of the fastest growing sectors between 2002 and 2003 also experienced growth between 1998 and 1999. Just under half of those sectors experiencing rising GVA per employee levels were in manufacturing. If we consider growth over the five year period, the sectoral pattern again changes slightly with only five of the top ten identified in **Table 9** experiencing significant growth between 1998 and 2003, these are Manufacture of Pulp, Paper and Paper Products, Post & Telecommunications, Manufacture of Wearing Apparel etc., Manufacture of Machinery

and Equipment N.E.C, and Wholesale Trade & Commission Trade.  Manufacture of Electrical Machinery and Apparatus N.E.C and Manufacture of Wood and Wood Products were listed in the top twelve. The data would suggest that this particular aggregate is more susceptible to business cycle changes.

**Table 9: Fastest Growing Sectors in terms of GVA per Employee - 2003**

| Rank | SIC | Sector Description | % Growth GVA per EE |
|------|-----|--------------------|---------------------|
| 1 | 31 | Manufacture of Electrical Machinery etc. | 40.7 |
| 2 | 21 | Manufacture of Pulp, Paper etc. | 35.6 |
| 3 | 72 | Computer & Related Activities | 26.0 |
| 4 | 64 | Post and Telecommunications | 23.0 |
| 5 | 18 | Manufacture of Wearing Apparel etc. | 22.8 |
| 6 | 29 | Manufacture of Machinery & Equip. N.E.C | 13.7 |
| 7 | 51 | Wholesale & Commission Trade etc. | 12.0 |
| 8 | 74 | Other Business Activities | 11.9 |
| 9 | 20 | Manufacture of Wood and Wood Products | 11.8 |
| 10 | 26 | Manufacture of Other Non-Metallic etc. | 11.1 |

**Figure 14: Sectors Experiencing a Rise in GVA per Employee Levels - 2003**
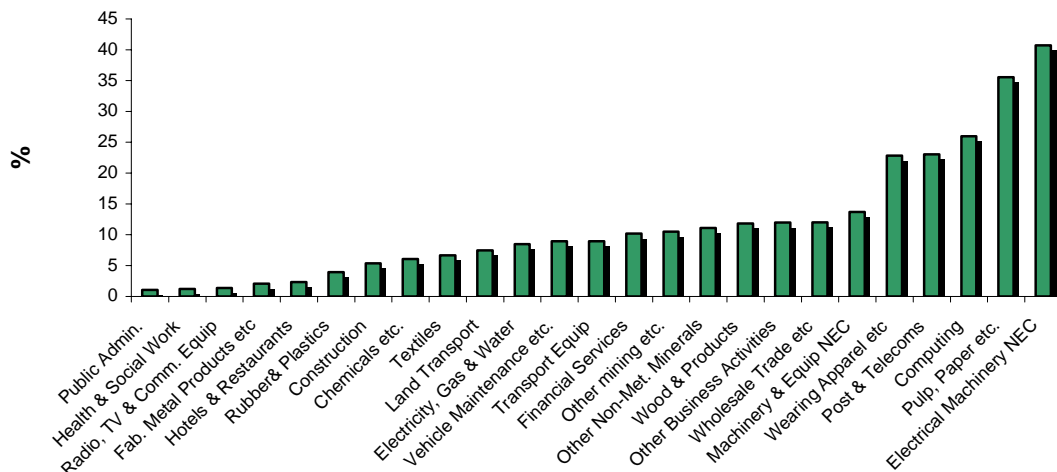


Source: Regional Accounts, RFL, 2002, 2003; DETI, RFL, 2002, 2003

**Figure 15: Sectors Experiencing a Fall in GVA per Employee Levels - 2003**
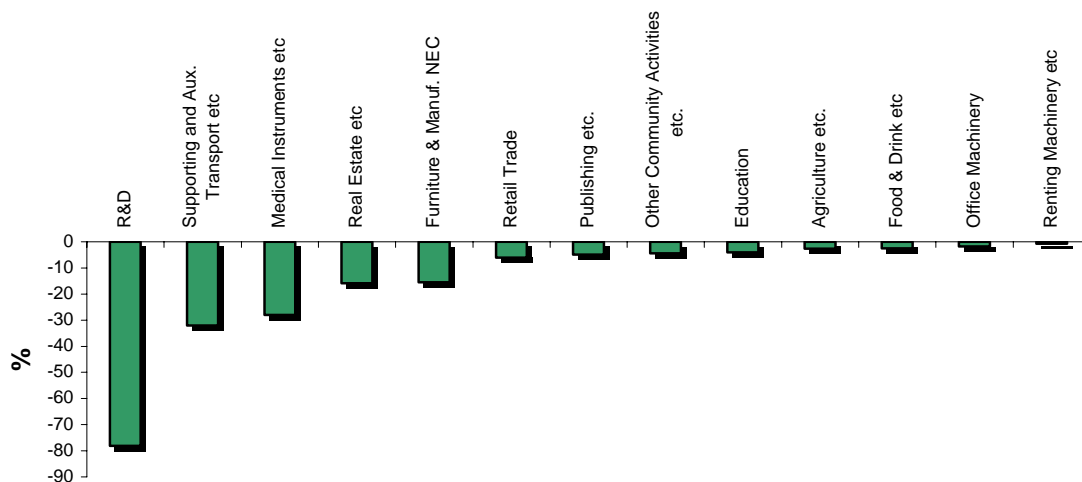


Source: Regional Accounts, RFL, 2002, 2003; DETI, RFL, 2002, 2003

**Figure 16: Sectors Experiencing a Rise in GVA per Employee Levels - 1999**



Source: Regional Accounts, RFL, 1998, 1999; DETI, RFL, 1998, 1999

27
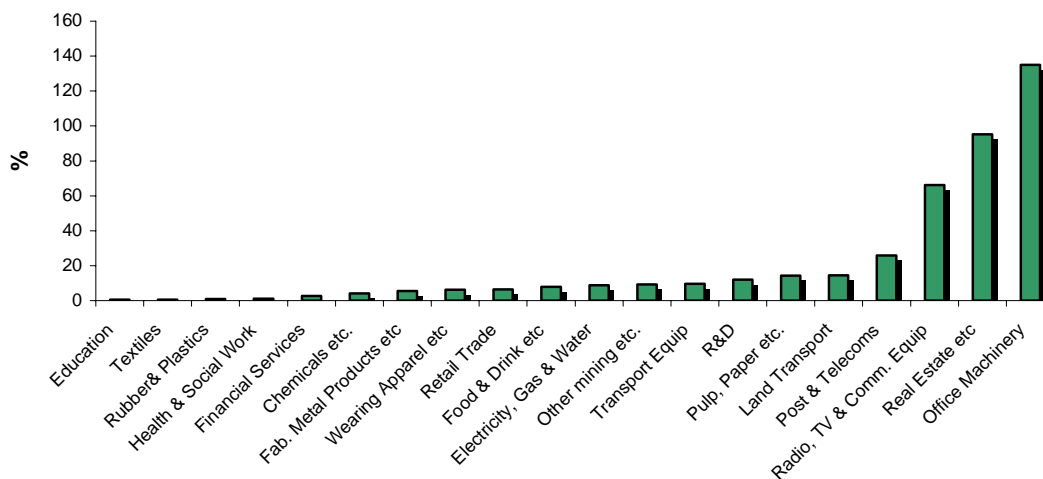
**Figure 17: Sectors Experiencing a Fall in GVA per Employee Levels - 1999**
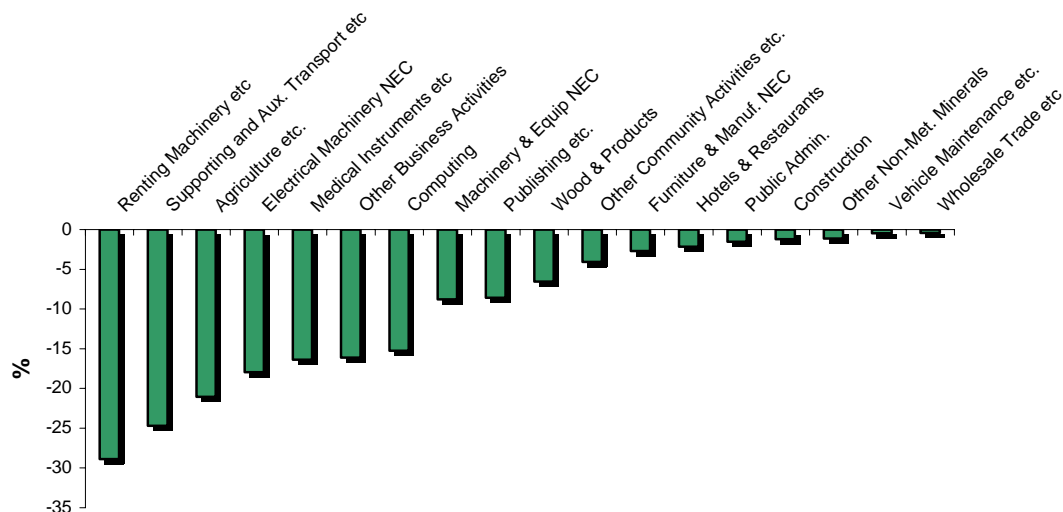


Source: Regional Accounts, RFL, 1998, 1999 DETI, RFL, 1998, 1999

## 2.9 No. VAT Registrations expressed as a Percentage of the Stock of Existing Businesses

The number of VAT registrations is the best official guide to the pattern of business start-ups in each industry and therefore acts as a key indicator of the level of entrepreneurship in that particular sector. The sectoral pattern of new firm formation, as measured by VAT registrations, expressed as a percentage of the total stock of businesses, is given in **Table 10** and **Figure 18**. The rate of new firm formation within the R&D sector during 2003 was more than twice that of any other industry with the total stock of businesses increasing by over 50 per cent in that year. VAT registration rates, while well below that of the R&D industry, were also high within Manufacture of Office Machinery and Computers, Manufacture of Transport Equipment and Manufacture of Radio, Television and Communication Equipment & Apparatus. The remaining top ten sectors consist of elements of the Public Sector, Service industries, Telecommunication and IT. From **Figure 18** it is apparent that the sectors identified in **Table 10** stand out as top performers within the context of the overall economy. Furthermore, **Figures 19** and **20** confirm that the sectoral pattern of VAT registrations observed in 2003 is relatively consistent over

time although in overall terms, the sectoral rates of new firm formation are generally lower in 2003 than they were in 1998.

**Table 10: Top Ten Sectors in terms of the Number VAT Registrations expressed as a Percentage of the Stock of Existing Businesses - 2003**

| Rank | SIC | Sector Description | VAT Reg. |
|------|-------|-------------------------------------------|----------|
| 1 | 73 | Research & Development | 52.8 |
| 2 | 30 | Manufacture of Office Machinery and Computers | 21.9 |
| 3 | 34/35 | Manufacture of Transport Equipment | 18.2 |
| 4 | 32 | Manufacture of Radio, TV Equip. etc | 17.9 |
| 5 | 64 | Post and Telecommunications | 17.0 |
| 6 | 75 | Public Administration & Defence etc. | 16.8 |
| 7 | 74 | Other Business Activities | 15.7 |
| 8 | 72 | Computer & Related Activities | 11.6 |
| 9 | 18 | Manufacture of Wearing Apparel etc. | 9.3 |
| 10 | 55 | Hotels and Restaurants | 9.2 |

Source: Small Business Service, DTI, 1998-2003; ONS, 1998-2003

**Figure 18: No. VAT Registrations Expressed as a Percentage of the Stock of Existing Businesses - 2003**



Source: Small Business Service, DTI, 1998-2003; ONS, 1998-2003

29
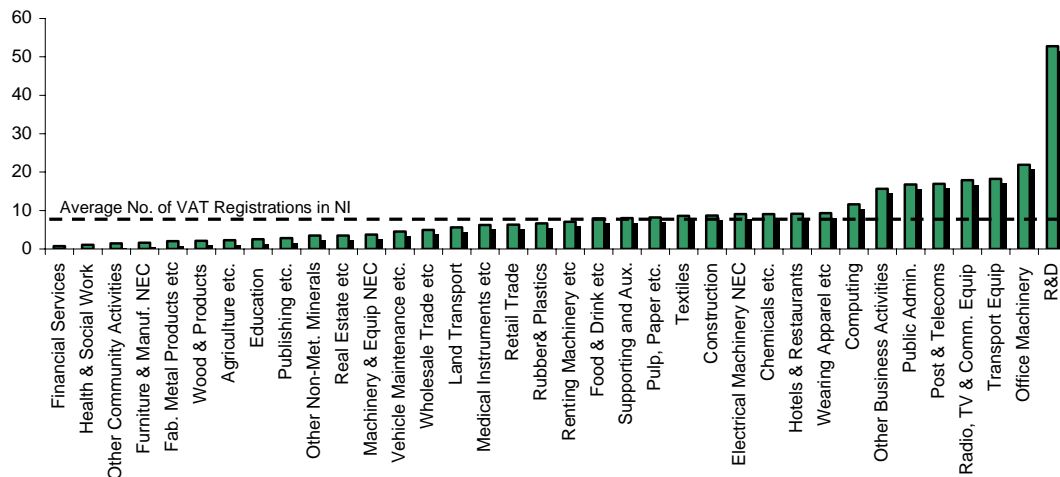
**Figure 19: No. VAT Registrations expressed as a Proportion of the Stock of Existing Businesses (1-7) - 1998 & 2003**
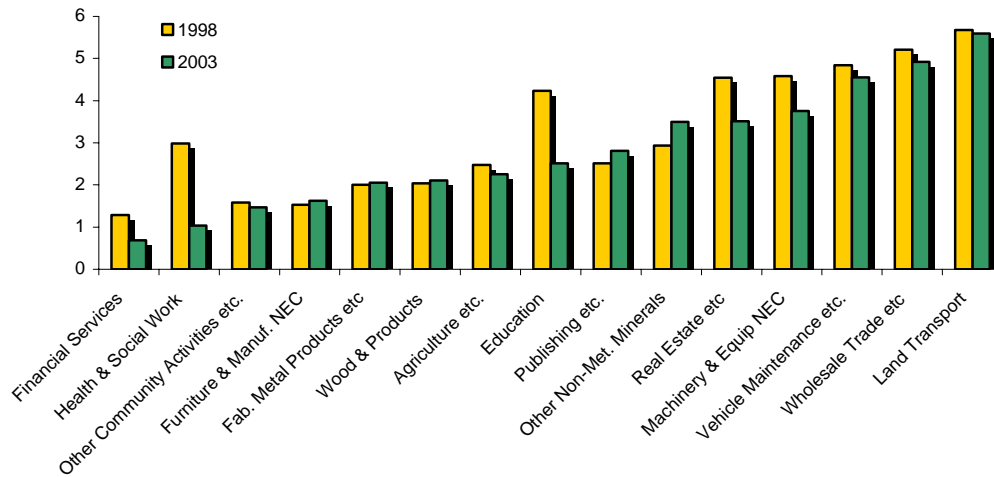


Source: Small Business Service, DTI, 1998-2003; ONS, 1998-2003

**Figure 20: No. VAT Registrations expressed as a Proportion of the Stock of Existing Businesses (7+) - 1998 & 2003**
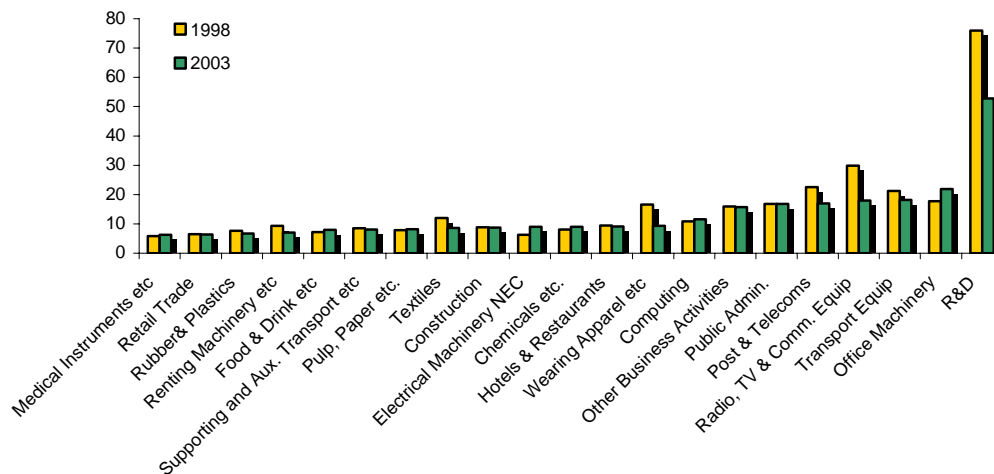


Source: Small Business Service, DTI, 1998-2003; ONS, 1998-2003

## 2.10 Count of Foreign Owned Businesses in Northern Ireland expressed as a Percentage of the Total Stock of Businesses

In addition to representing a key source of employment growth within the economy, Foreign Direct Investment (FDI) is also a key indicator of regional comparative advantage. While total sectoral FDI employment is arguably the most effective measure of inward investment, unfortunately, this data was not available and the count of foreign owned businesses expressed as a percentage of the total stock of businesses is used in its place.

Reported in **Table 11** are the ten industries with the highest share of foreign owned businesses, with the economy wide pattern of foreign owned businesses by sector available in **Figures 21** and **22**. Manufacturing industries dominate the top ten in this area (**Table 11**), with Manufacture of Radio, Television & Communication Equipment and Apparatus having 30 per cent of its businesses under foreign ownership. This is closely followed by Manufacture of Office Machinery and Computers in which 24 per cent of the businesses are foreign owned. Manufacture of Medical Instruments etc, Manufacture of Chemicals and Chemical Products and Manufacture of Pulp, Paper and Paper Products are ranked at four, five and six with the foreign owned component of the total number of businesses in their sector accounting for 16.7 per cent, 16.5 per cent and 16 per cent respectively. Only two non-manufacturing industries are listed in the top ten, Research and Development at number six with 13.3 per cent of the businesses foreign owned, and, Electricity, Gas and Water Supply at number nine with 6.7 per cent foreign owned. The Manufacture of Electrical Machinery and Apparatus NEC, Manufacture of Transport Equipment, and Manufacture of Rubber and Plastics are also listed in the top ten.

31

**Table 11: Top Ten Sectors in terms of the Number of Foreign Owned Businesses expressed as a Percentage of the Total Stock of Businesses - 2003**

| Rank | SIC | Sector Description | % |
|------|-------|---------------------------------------------------|------|
| 1 | 32 | Manuf. of Radio, TV & Communication Equip etc. | 30.0 |
| 2 | 30 | Manufacture of Office Machinery and Computers | 24.0 |
| 3 | 33 | Manufacture of Medical Instruments etc | 16.7 |
| 4 | 24 | Manufacture of Chemicals and Chemical Products. | 16.5 |
| 5 | 21 | Manufacture of Pulp, Paper and Paper Products. | 16.0 |
| 6 | 73 | Research & Development | 13.3 |
| 7 | 31 | Manuf. of Electrical Machinery & Apparatus NEC | 7.5 |
| 8 | 34/35 | Manufacture of Transport Equipment | 6.9 |
| 9 | 40/41 | Electricity, Gas & Water Supply | 6.7 |
| 10 | 25 | Manufacture of Rubber & Plastics | 6.1 |

Source: IDBR, 2003

**Figure 21: No. of Foriegn Owned Businesses as a Percentage of the Total Stock of Businesses < 3%**
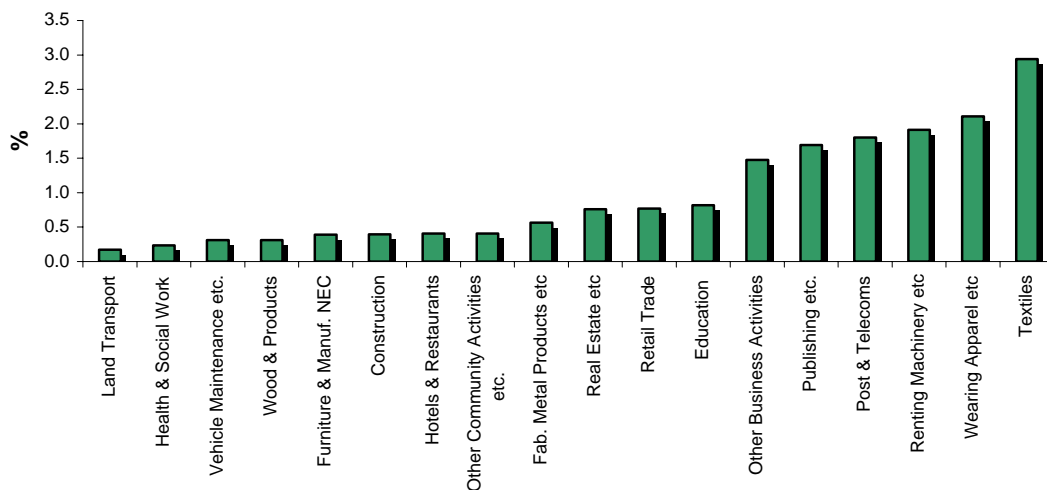


Source: IDBR, 2003; ONS, 2003

Note: Public Administration and Defence (SIC 75) and Other Mining and Quarrying (SIC 14) have zero foreign owned businesses operating in NI. Agriculture, Hunting, Forestry & Fishing has just 2 foreign owned companies but at just 0.01% of the total stock of businesses, this figure was too small to be detected in **Figure 20**.

**Figure 22: No. of Foreign Owned Businesses as a Percentage of the Total Stock of Businesses  > 3%**
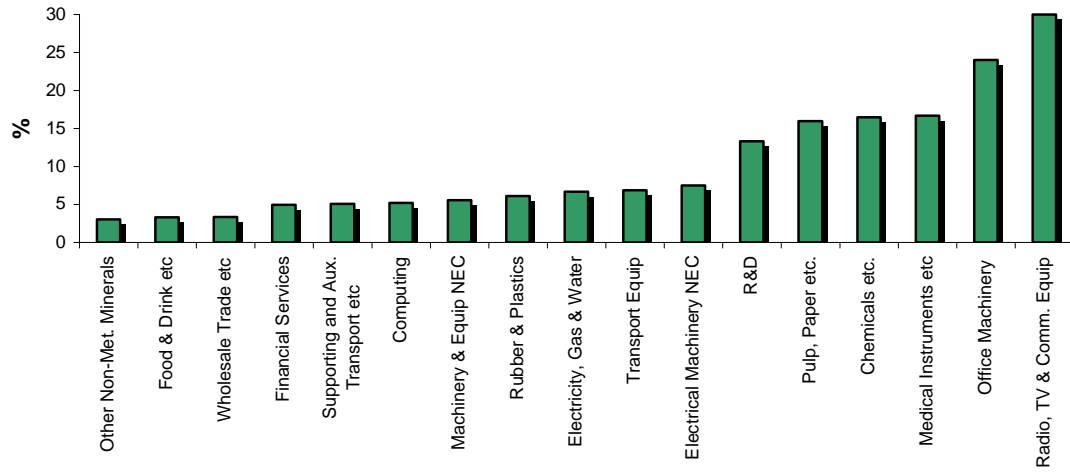


Source: IDBR, 2003; ONS, 2003

# 3 MEASURES OF SKILL NEEDS

This section of the report considers those sectors most heavily affected by skill shortages and skill gaps. The data used in this analysis refers to 2005 and was taken from the Northern Ireland Skills Monitoring Survey (SMS)[3] (DEL, October 2006). Data on skill shortages provides us with a measure of the extent to which posts are remaining unfilled because of a lack of qualified staff whereas data on skills gaps gives an indication of the extent to which the competencies of existing workers are not sufficient to meet the needs of employers.

## 3.1 Skill Shortages

The data on skill shortages relates to hard-to-fill vacancies[4] and is expressed in two forms, firstly, hard-to-fill vacancies as a percentage of all vacancies and secondly, the percentage of establishments affected by hard-to-fill vacancies. While both measures are likely to be correlated to some extent, the position of sectors within the rankings can potentially differ substantially, for instance, hard-to-fill vacancies within a sector may relate exclusively to skill shortages, thus generating a high rank, however, only a small proportion of establishments may have such skill related hard-to-fill vacancies, which would imply a low rank position.

The results, in terms of the extent to which vacancy problems are driven by hard-to-fill vacancies, are reported in **Table 12**. The Manufacture of Transport Equipment sector tops the rankings with just under 95 per cent of hard-to-fill vacancies being due to external skill shortages, however, the skills problems within this sector are well established having been the subject of a previous PSU report published in 2002. The Post and Telecommunications sector also has a very high proportion of hard-to-fill vacancies

---

[3] It is important to note that some sample sizes are small (less than 100) and as such, numbers should be treated with caution.
[4] Firms are considered to be experiencing hard-to-fill (referred to as difficult-to-fill in the SMS) vacancies when suffering from 'external skill shortages' as measured by a lack of skills the company demands, lack of work experience the company demands or a lack of qualifications the company demands (NI Skills Monitoring Survey, 2005).

at just over 70 per cent.  As we move further down the rankings, the intensity of skill related vacancies drops off considerably, levelling off at just over a third for those sectors ranked from fifth to tenth. While half of the sectors suffering from the most severe skill related vacancies are again found in manufacturing, other dominant sectors include Post & Telecommunications, Construction, Real Estate, Public Administration and Defence, and Other Business Activities.  Referring to **Figure 23**, and moving beyond the ten sectors with the most hard-to-fill vacancies, it is difficult to identify any strong industry patterns as elements of the service and manufacturing industries are relatively intertwined as we move down the rankings.

**Table 12: Sectors with the Highest Percentage of Vacancies due to Skill Shortages**

| Rank | SIC | Sector Description | % Vacancies |
|------|-----|--------------------|-------------|
| 1 | 34/35* | Manufacture of Transport Equipment | 94.7 |
| 2 | 64* | Post and Telecommunications | 70.7 |
| 3 | 24* | Manufacture of Chemicals and Chemical Products | 57.1 |
| 4 | 45 | Construction | 42.7 |
| 5 | 36* | Manufacture of Furniture; Manufacturing N.E.C | 41.5 |
| 6 | 25* | Manufacture of Rubber and Plastic Products | 37.5 |
| 7 | 70 | Real Estate Activities | 36.6 |
| 8 | 75* | Public Administration & Defence etc. | 33.7 |
| 9 | 32* | Manufacture of Radio, TV Equipment etc. | 32.4 |
| 10 | 74 | Other Business Activities | 31.5 |

* Caution small numbers
Source: NI Skills Monitoring Survey, 2005

**Figure 23: Evidence of Skill Shortages - % of All Vacancies**
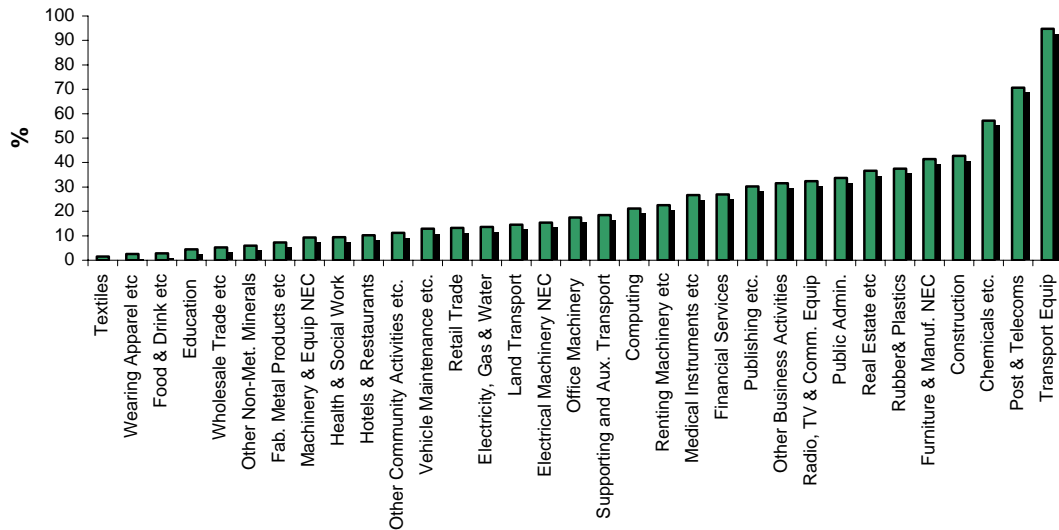


Source: NI Skills Monitoring Survey, 2005

**Table 13** presents the results from our second measure of skill shortage, the percentage of firms affected by skill related hard-to-fill vacancies. The Manufacture of Transport Equipment sector again emerges at the top with the highest proportion of establishments experiencing hard-to-fill vacancies. The pattern is similar to that reported in **Table 12** with six sectors scoring highly under both measures of skill shortage. The percentage of firms affected ranges from just over 17 per cent in Manufacture of Transport Equipment to just over 3 per cent in Other Business Activities. **Figure 24** indicates that in the vast majority of sectors, less than 3 per cent of establishments experience skill related hard-to-fill vacancies.

**Table 13: Sectors with the Highest Percentage of Establishments experiencing Skill Shortages**

| Rank | SIC | Sector Description | % Establishments |
|------|-----|--------------------|------------------|
| 1 | 34/35* | Manufacture of Transport Equipment | 17.4 |
| 2 | 24* | Manufacture of Chemicals and Chemical Products | 11.6 |
| 3 | 32* | Manufacture of Radio, TV Equipment etc. | 9.5 |
| 4 | 40/41* | Electricity, Gas and Water Supply | 7.7 |
| 5 | 25* | Manufacture of Rubber and Plastic Products | 6.9 |
| 6 | 75* | Public Administration & Defence etc. | 6.4 |
| 7 | 29* | Manufacture of Machinery and Equipment N.E.C | 4.7 |
| 8 | 22* | Publishing, Printing etc. | 4.2 |
| 9 | 72* | Computer & Related Activities | 3.7 |
| 10 | 74 | Other Business Activities | 3.6 |

* Caution small numbers
Source: NI Skills Monitoring Survey, 2005

**Figure 24: Evidence of Skill Shortages - % of Establishments (2003)**
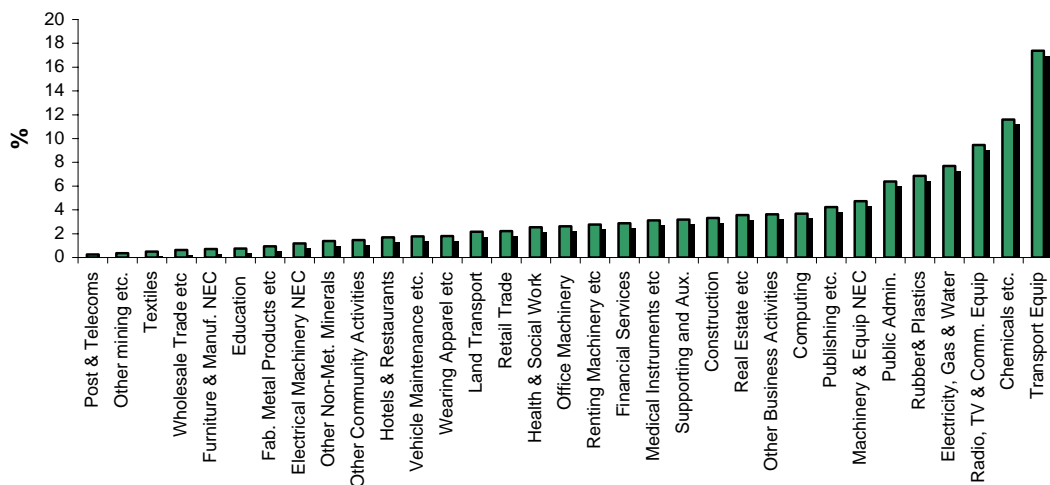


Source: NI Skills Monitoring Survey, 2005

### 3.2    Skill Gaps

The information on skill gaps is again presented in two forms; in the first instance, as a percentage of all employees and, secondly, as a percentage of all establishments. Again, while we would expect both methods to produce outcomes that are highly correlated, the

37

correlation will not be perfect.  For instance, we may have an industry with many firms but just a few accounting for the majority of employment leaving open the possibility that skill gaps could be found amongst the majority of the workforce and yet the majority of establishments could remain unaffected. Thus, outcomes may differ depending on the sectoral distribution of employment.

**Table 14** reports the ten sectors containing the highest percentage of employees with skill gaps.   As with the skill shortage data, manufacturing sectors again dominate the top five places, however, the composition of the manufacturing component is somewhat changed. For instance, firms involved in the Manufacture of Pulp, Paper and Paper Products were found to have the greatest proportion of employees with skills gaps with 22.2 per cent of existing employees reported to have skill deficiencies, however, this sector did not prove prominent in the hard-to-fill vacancy data. Conversely, the Manufacture of Transport Equipment sector which was found to have both the highest proportion of vacancies resulting from skill shortages, and the highest proportion of establishments affected by skill shortages, does not appear to have been badly affected by skill deficiencies amongst existing employees.  Referring to **Figure 25**, the distribution of skill gaps across sectors is much more pervasive relative to skill related vacancies, with over 5 per cent of employees reported to have some level of skill deficiencies in the majority of sectors.

**Table 14: Ten Sectors with the Highest Percentage of Employees with Skill Gaps**

| Rank | SIC | Sector Description | % Establishments |
|------|-------|----------------------------------------------|------------------|
| 1 | 21* | Manufacture of Pulp, Paper and Paper Products | 22.2 |
| 2 | 25* | Manufacture of Rubber and Plastic Products | 19.2 |
| 3 | 32* | Manufacture of Radio, TV Equipment etc. | 17.6 |
| 4 | 65-67 | Financial Intermediation | 16.2 |
| 5 | 30* | Manufacture of Office Machinery and Computers | 14.1 |
| 6 | 75* | Public Administration & Defence etc. | 13.0 |
| 7 | 36* | Manufacture of Furniture; Manufacturing N.E.C | 12.4 |
| 8 | 52 | Retail Trade etc. | 12.3 |
| 9 | 72* | Computer & Related Activities | 11.6 |
| 10 | 50 | Sale, Maintenance, Repair Motor Vehicles etc. | 10.9 |

* Caution small numbers
Source: NI Skills Monitoring Survey, 2005

**Figure 25: Evidence of Skill Gaps - % of Employment**
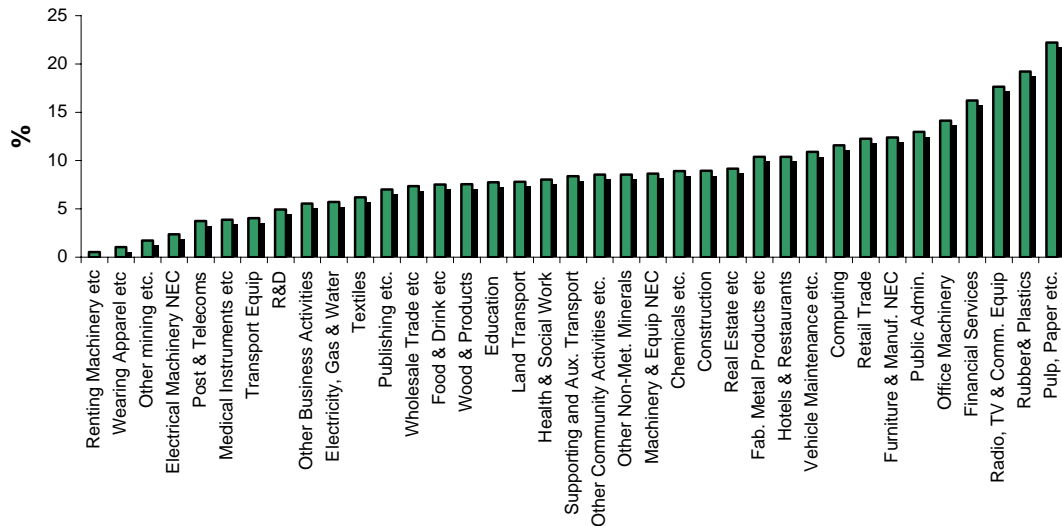
With regards to the second measure of skill gaps, the data on the percentage of establishments affected by skill gaps is presented in **Table 15**.  It is immediately obvious that this is not well correlated with the results presented in **Table 14** as there are just two sectors scoring highly under both methods of calculation.  The Research & Development sector is ranked number one with exactly 50 per cent of establishments reporting skill gaps amongst their staff.  Thereafter, the incidence of establishment level skill gaps falls off considerably with Public Administration & Defence ranking in second place with just over 20 per cent of establishments reporting deficiencies in the skill levels of their workforce. The service sector and public sector are much more dominant under this measure with non-traded sectors accounting for five of the ten sectors with the highest proportion of establishments experiencing skill gaps. The distribution of skill gaps by establishment across all sectors is given in **Figure 26** and, excluding Research & Development, the incidence is relatively low with between 5 and 15 per cent of establishments reporting skill gaps amongst their staff in the majority of sectors.

**Table 15: Sectors with the Highest Percentage of Establishments Experiencing Skill Gaps**

| Rank | SIC | Sector Description | % Establishments |
|------|------|--------------------|------------------|
| 1 | 73* | Research & Development | 50.0 |
| 2 | 75* | Public Administration & Defence etc. | 21.6 |
| 3 | 29* | Manufacture of Machinery and Equipment N.E.C | 18.3 |
| 4 | 28* | Manufacture of Fabricated Metal Products etc. | 17.2 |
| 5 | 90-93 | Other Community & Social Activities etc. | 14.1 |
| 6 | 85 | Health & Social Work | 14.1 |
| 7 | 65-67 | Financial Intermediation | 13.9 |
| 8 | 40/41* | Electricity, Gas and Water Supply | 12.8 |
| 9 | 80 | Education | 12.2 |
| 10 | 18* | Manufacture of Wearing Apparel etc. | 11.7 |

* Caution, small numbers
Source: NI Skills Monitoring Survey, 2005

**Figure 26: Evidence of Skill Gaps - % of Establishments**
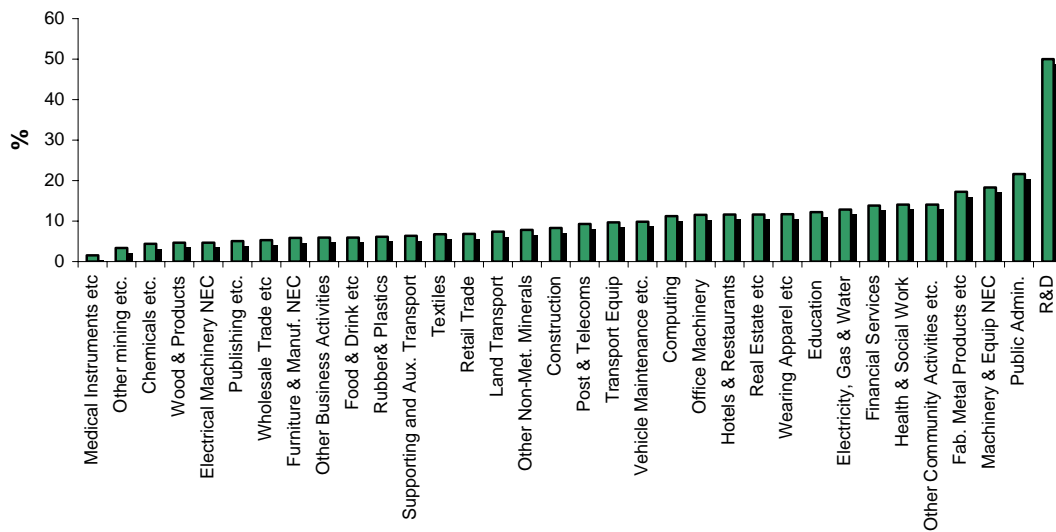


Source: NI Skills Monitoring Survey, 2005

# 4    THE WEIGHTING STRATEGIES

As previously stated, the framework adopted is indicator based and linked to the four NI specific productivity drivers.  It is essentially a two-stage approach; in stage one the sectors of the economy are assessed in terms of their economic significance; while in stage two, the extent of skill shortages and gaps within each industry is identified.  The data used in the analysis is for 2003, the year for which we have the most complete observations at the 2-digit SIC level[5].

In the previous report we recommended a subjective based weighting scenario with the weights based on our own value judgements on the relative importance of each indicator. The indicators of economic significance, on which sectors will be ranked according to their performance, are listed below with the subjective weights given in brackets.

- Total Employment Size  (0.12)
- Job Creation / Loss (0.12)
- R&D Expenditure per Employee in Employment  (0.055)
- Proportion of NI Businesses that are Product and Process Innovators (0.055)
- Export Revenue per Employee in Employment (0.12)
- Export Growth (0.12)
- GVA per Employee in Employment (0.12)
- Growth in GVA per Employee in Employment (0.12)
- No. of VAT Registrations Expressed as a Proportion of the Stock of Existing Businesses (0.05)
- Count of Foreign Owned Businesses expressed as a Percentage of the Total Stock of Businesses (0.12)

---

[5] In order to remove scale effects, the data for each sector was standardised. Standardizing returns a normalized value from a distribution characterized by a zero mean and a standard deviation of one.  It is achieved by applying the formula $(x - xm) / \sigma$ where x is the value of the sectors economic indicator, xm is the mean value of the indicator across all sectors and $\sigma$ is the standard deviation on the indicator across all sectors.

Under the subjective weighting scenario the sectors are ranked by multiplying the standardised value of each indicator by the subjective weight and summing the total. To examine the sensitivity of the results to changes in the weights, we have adopted two other ranking methods – a neutral and objective approach. The neutral methodology is similar to the subjective approach although all indicators are attributed an equal weight. The objective methodology, however, is somewhat more complicated in that the weights are derived through the application of varimax rotated Principal Components Analysis (PCA) which requires some further discussion (See **Appendix 2**, Page 59).

# 5 TOP PERFORMING SECTORS IN TERMS OF ECONOMIC SIGNIFICANCE

The top performing sectors in terms of economic significance, as identified by the neutral, subjective and objective weighting methodologies are reported below in **Tables 16, 17** and **18**. There is a good deal of consistency across the three weighting strategies, with five sectors present amongst the top ten under each weighting scenario. These are, Manufacture of Radio, Television and Communication Equipment & Apparatus, Manufacture of Office Machinery and Computers, Manufacture of Chemicals and Chemical Products, Manufacture of Machinery and Equipment N.E.C and, Manufacture of Rubber and Plastic Products. A further four sectors were found in common to at least two of the weighting strategies; Research & Development and Computer and Related Activities, in both the neutral and objective weighting scenarios; and, Other Business Activities, and, Manufacture of Pulp, Paper and Paper Products in both the neutral and subjective weighting strategies. The neutral and subjective approaches generate the most similar results with a total of seven sectors in common. While the three approaches certainly generate very similar results, from a methodological perspective, one would tend to favour the objective approach on the grounds that the assumption underlying the neutral strategy i.e. that each indicator is of equal importance in terms of a sectors contribution to the economy, is somewhat unrealistic. Similarly, the subjective methodology is based on value judgments which may, or may not be correct. The objective approach however, is free from any such criticisms as it assigns weights to each variable based on the most significant correlations evident in the data. Nevertheless, while the subjective method may be slightly preferred from a technical perspective the alternatives are of value as they provide a benchmark against which the consistency of the objective approach can be assessed and certainly any industry appearing in any two of the three ranking methods must be considered to be of importance. Thus, within this context, **Table 19** presents the nine sectors which are common to at least two of the weighting methodologies. These sectors are ordered according to their average rank position under each of the weighting scenarios in which they receive a top ten ranking. With regards to these results, the Manufacture of Radio, Television and Communication

Equipment & Apparatus was ranked highest on performance, followed by, Manufacture of Office Machinery and Computers, Research & Development, Manufacture of Chemicals and Chemical Products, and Manufacture of Pulp, Paper and Paper Products. However, while manufacturing industries tend to dominate the list, non-traded industries such as, Other Business Activities and Computer and Related Activities, are also represented. A final point worth noting is the fact that previously identified priority industries are heavily represented in the analysis, with major components of the IT (SIC 72), Electronic Engineering (SIC 30 & 32) and Mechanical Engineering industries (SIC 29 & 34/35) appearing under each of the weighting scenarios (see NIERC 2003, 2002, 2001).

**Table 16: Top Ten Sectors of Economic Significance under the Neutral Weighting Scenario**

| Rank | SIC | Sector Description |
|------|-----|--------------------|
| 1 | 32 | Manufacture of Radio, Television and Communication Equip. & Apparatus |
| 2 | 30 | Manufacture of Office Machinery and Computers |
| 3 | 24 | Manufacture of Chemicals and Chemical Products |
| 4 | 73 | Research & Development |
| 5 | 72 | Computer & Related Activities |
| 6 | 74 | Other Business Activities |
| 7 | 25 | Manufacture of Rubber and Plastic Products |
| 8 | 21 | Manufacture of Pulp, Paper and Paper Products |
| 9 | 29 | Manufacture of Machinery and Equipment N.E.C |
| 10 | 64 | Post and Telecommunications |

**Table 17: Top Ten Sectors of Economic Significance under the Subjective Weighting Scenario**

| Rank | SIC | Sector Description |
|------|-----|--------------------|
| 1 | 32 | Manufacture of Radio, Television and Communication Equip. & Apparatus |
| 2 | 30 | Manufacture of Office Machinery and Computers |
| 3 | 24 | Manufacture of Chemicals and Chemical Products |
| 4 | 21 | Manufacture of Pulp, Paper and Paper Products |
| 5 | 85 | Health & Social Work |
| 6 | 25 | Manufacture of Rubber and Plastic Products |
| 7 | 74 | Other Business Activities |
| 8 | 80 | Education |
| 9 | 40/41 | Electricity, Gas and Water Supply |
| 10 | 29 | Manufacture of Machinery and Equipment N.E.C |

**Table 18: Top Ten Sectors of Economic Significance under the Objective Weighting Scenario (Principal Components Analysis)**

| Rank | SIC | Sector Description |
|------|-------|--------------------|
| 1 | 73 | Research & Development |
| 2 | 32 | Manufacture of Radio, Television and Communication Equip. & Apparatus |
| 3 | 30 | Manufacture of Office Machinery and Computers |
| 4 | 33 | Manufacture of Medical, Precision & Optical Instruments, Watches & Clocks |
| 5 | 24 | Manufacture of Chemicals and Chemical Products |
| 6 | 34/35 | Manufacture of Transport Equipment |
| 7 | 25 | Manufacture of Rubber and Plastic Products |
| 8 | 72 | Computer & Related Activities |
| 9 | 36 | Manufacture of Furniture; Manufacturing N.E.C |
| 10 | 29 | Manufacture of Machinery and Equipment N.E.C |

**Table 19: Top Nine Sectors of Economic Significance Averaging across all Weighting Scenarios**

| Rank | SIC | Sector Description |
|------|-----|--------------------|
| 1 | 32 | Manufacture of Radio, Television and Communication Equip. & Apparatus |
| 2 | 30 | Manufacture of Office Machinery and Computers |
| 3 | 73 | Research & Development |
| 4 | 24 | Manufacture of Chemicals and Chemical Products |
| 5 | 21 | Manufacture of Pulp, Paper and Paper Products |
| 6 | 74 | Other Business Activities |
| 7 | 72 | Computer & Related Activities |
| 8 | 25 | Manufacture of Rubber and Plastic Products |
| 9 | 29 | Manufacture of Machinery and Equipment N.E.C |

# 6    SECTORS EXPERIENCING MOST SIGNIFICANT SKILL SHORTAGES AND SKILL GAPS

Using a similar approach to the identification of key industries of economic significance, we then sought to identify those sectors within the economy experiencing the highest level of skill shortages and skill gaps.  This gives us a preliminary indication of the extent to which the top performing sectors of the economy, as identified in **Table 19**, are likely to be experiencing skill related constraints. As previously stated, the data on skill shortages, as proxied by hard-to-fill vacancies, reflects the extent to which firms are experiencing difficulty in recruiting new labour, while the data on skill gaps gives us an indication of the extent to which the competencies of existing staff are not sufficient to meet the needs of employers.

As before, we have three possible weighting scenarios, however, given that in this instance, we have just four indicators encompassing what is essentially just two measures of skill shortage, it was not feasible to apply any subjective weights on the grounds that there is nothing to suggest, apiori, that firms are more adversely affected by either hard-to-fill vacancies or skill gaps. Consequently, only the neutral and objective[6] weighting scenarios are considered in this instance.   The PCA analyses (objective weighting scenario) reduced the data to just one component, identifying hard-to-fill vacancies as the principal component and thus attributing it a much higher overall weighting.   With respect to the two measures of vacancy intensity, both were given an equal weight within the PCA framework.   Turning then to the results of both the neutral and objective scenarios, presented below in **Tables 20** and **21**, we can see that both generate very similar results with seven sectors identified as suffering from skill related problems under both weighting methods.  To get a clearer sense of the data, **Table 22** adopts the same approach as in the previous section and orders the seven sectors with a top ten position under both weighting scenarios by their average rank position.   Under this approach, three of the top nine sectors in terms of economic significance, identified in **Table 19**, (Manufacture of Chemicals and Chemical Products, Manufacture of Radio, Television

---

[6] Results from the PCA are presented in the Appendix.

and Communication Equipment & Apparatus, and Manufacture of Rubber and Plastic Products), are amongst those most constrained by skill shortages. If we extend the analysis further, we find another sector, identified in the top ten under the objective approach (**Table 18**), Manufacture of Transport Equipment, also has significant skill needs.  Thus there are certainly some grounds for concern with respect to the possibility that key sectors may be potentially subject to labour market related growth constraints. There is a clear positive relationship at the industry level between the skill shortages and economic significance indicators and this is illustrated in **Figure 27** which plots the linear relationship derived under the PCA framework.

**Table 20: Top Ten Sectors with greatest Skill Needs under the Neutral Weighting Scenario**

| Rank | SIC | Sector Description |
|------|------|--------------------|
| 1 | 34/35 | Manufacture of Transport Equipment |
| 2 | 75 | Public Administration & Defense; Compulsory Social Security |
| 3 | 24 | Manufacture of Chemicals and Chemical Products |
| 4 | 25 | Manufacture of Rubber and Plastic Products |
| 5 | 32 | Manufacture of Radio, Television and Communication Equip. & Apparatus |
| 6 | 73 | Research & Development |
| 7 | 65-67 | Financial Intermediation |
| 8 | 70 | Real Estate Activities |
| 9 | 45 | Construction |
| 10 | 29 | Manufacture of Machinery and Equipment N.E.C |

**Table 21: Top Ten Sectors with greatest Skill Needs under the Objective Weighting Scenario (Principal Components Analysis)**

| Rank | SIC | Sector Description |
|------|------|--------------------|
| 1 | 34/35 | Manufacture of Transport Equipment |
| 2 | 24 | Manufacture of Chemicals and Chemical Products |
| 3 | 32 | Manufacture of Radio, Television and Communication Equip. & Apparatus |
| 4 | 25 | Manufacture of Rubber and Plastic Products |
| 5 | 64 | Post and Telecommunications |
| 6 | 75 | Public Administration & Defense; Compulsory Social Security. |
| 7 | 45 | Construction |
| 8 | 70 | Real Estate Activities |
| 9 | 22 | Publishing, Printing and Reproduction of Recorded Media |
| 10 | 40/41 | Electricity, Gas and Water Supply |

**Table 22: Top Seven Sectors with greatest Skill Needs Averaging across all Weighting Scenarios**

| Rank | SIC | Sector Description |
|---|---|---|
| 1 | 34/35 | Manufacture of Transport Equipment |
| 2 | 24 | Manufacture of Chemicals and Chemical Products |
| 3 | 32 | Manufacture of Radio, Television and Communication Equip. & Apparatus |
| 4 | 25 | Manufacture of Rubber and Plastic Products |
| 5 | 75 | Public Administration & Defense; Compulsory Social Security. |
| 6 | 45 | Construction |
| 7 | 70 | Real Estate Activities |

Concentrating on the sectors within **Table 22**, the industry identified as having the greatest skill needs (Manufacture of Transport Equipment), represents a major component of the Mechanical Engineering sector. Also identified is an element of the Electronic Engineering sector (Manufacture of Radio, Television and Communication Equipment & Apparatus) and the Construction industry. As previously indicated, the skills problems and issues within these industries have been previously researched by the PSU. With respect to the mechanical engineering sector, it was found that while the graduate aspect of the labour market was broadly in balance, there was the potential of imbalances at the technician level (NVQ level 3); there were also some skills gaps evident with respect to the basic numeracy and literacy levels of operator level staff. With regards to Electronic Engineering we identified potential shortfalls at both the graduate and technician levels under forecast growth scenarios, however, the industry did experience a substantial slow down following the analyses and it is unclear to what extent these risk factors remain. With respect to skill gaps, problems were identified with the business awareness, IT and the basic literacy / numeracy competencies of level 3 and 4 technician staff. In terms of the Construction industry, there was a clear need for a more multi-skilled approach to training to accommodate the rise in modular building techniques with some potential shortfalls also identified within some traditional craft areas at the Modern Apprenticeship level. The extent to which policy reacted to addressing these issues following publication of these reports is unknown. However, the SSCs which, have been established to give employers more responsibility in identifying their skill needs, work with, and take advice from, all types of organisations and stakeholders with an interest in skills and productivity, as they develop a forward looking

skills and productivity agenda and action plan for the sector which will help deliver skill based productivity improvements. All sectoral issues previously raised by the PSU should help inform this work. The top performing sectors exhibiting evidence of skill shortages and gaps that have yet to be researched are Manufacture of Chemicals and Chemical Products, and the Manufacture of Rubber and Plastic Products (the R&D sector may also warrant attention despite not being consistently identified within the study). Again, the work of the SSCs will be crucial in supporting any decisions regarding those sectors of highest priority. Finally, it is worth noting that a number of industries from the non-traded sector also appear to be suffering from skill related problems. However, it is possible that the causes of hard-to-fill vacancies in these industries may differ substantially from those occurring in the manufacturing industries i.e. it is quite possible that they could be more a product of low wages than genuine skill shortage.

# 7 SUMMARY

This report outlines the principal findings of our analysis in terms of the extent to which the sectors making the most substantial contribution to the NI economy are likely to be constrained by skills shortages and gaps. The results suggest that the sectors related to Other Business Activities, Research & Development, IT, Wholesale and Commission Trade, and Retail Trade, and those related to the Electronic, Mechanical and Chemical Engineering sectors are amongst the top performers on the indicators available. Although our analysis is based on historical data, we can only assume that those sectors scoring highest under each weighting scenario are hugely significant to the NI economy, and will be for some years. In this respect, our analysis produces results consistent with a number of those found in a RoI study which identifies a number of areas with specific growth opportunities in Ireland up until 2015, including ICT, Engineering, Consumer goods, Food, Education, Financial Services, Construction, and Professional and Consultancy Services (Enterprise Strategy Group, 2004).

However, given that the principal aim of this report is to identify those areas of the economy that may be experiencing skills related constraints, it is quite worrying to find that three of the most economically significant sectors are amongst the top seven sectors suffering from the most significant skills shortages and gaps. Nevertheless, as previously stated, a number of those sectors with the greatest skill needs have already been identified and scoped within previous PSU reports and so, the top performing sectors exhibiting evidence of skill shortages and gaps that have yet to be researched are Manufacture of Chemicals and Chemical Products and the Manufacture of Rubber and Plastic Products. However, there is a clear need for more information on these sectors, in addition, it might also be beneficial to assess the adequacy of the policy response in tackling the skill related problems identified under previous sectoral studies; this is being taken forward in the work of the SSCs.

**Figure 27: Sector Priorities Summary Position (PCA Weightings)**



Higher level of Skill Shortages / Deficiencies

- Transport Equipment
- Chemicals etc.
- Radio, TV etc.
- Rubber & Plastics etc
- Public Admin. Post & Telecoms
- Construction
- Electricity etc.
- Publishing etc.
- Real Estate
- Furniture etc.
- Other Business
- Financial Serv.
- Medical Instr. etc
- Rent Machinery
- Other Trans.
- Computing etc.
- Office Machinery etc.
- Land Trans. Retail
- Sale Mot.V.
- Machinery nec
- Health & Soc
- Elec Mach.
- Other Community etc. Hotels etc
- Pulp, Paper etc
- W&C Trade
- Non-Metal. Fab. Metal
- Education W. Apparel
- Food etc
- Other Mining etc. Agriculture etc
- Wood etc. Textiles etc.
- R&D

Less Economically Significant Sectors

More Economically Significant Sectors

Lower level of Skill Shortages / Deficiencies

51

**REFERENCES**[7]

Bennett, J. & McGuinness, S. (2006) "Assessing the Impact of Skill Shortages on the Productivity Performance of High-Tech Firms in Northern Ireland", Forthcoming in *Applied Economics*

Daly, A., Hitchens, D. & Wagner, K. (1985), "Productivity, Machinery and Skills in a Sample of British and German Manufacturing Plants", National Institute Economic Review, pp.48-61

DEL, (2006), "Northern Ireland Skills Monitoring Survey, 2005 Summary Report", A Report Prepared by the Skills Unit, Research and Evaluation Branch, DEL.

DETI, (2006), "Northern Ireland Research & Development Statistics 2005". A National Statistics Publication.

DETI, (2006), "UK Innovation Survey 2005: Northern Ireland Results"

DETI, (2006), "Exporting Northern Ireland Services Study"

DETI, (2006), "Facts and Figures from the Inter Departmental Business Register (IDBR) – Edition Eight. A National Statistics Publication.

DETI, (2005), "Northern Ireland Manufacturing, Sales and Exports Survey 2004/2005", A National Statistics Publication.

Enterprise Strategy Group (Forfas), (2004), "Ahead of the Curve. Ireland's Place in the Global Economy"

---

[7] Note: The cut-off date for the inclusion of references in this paper is February 2007.

Haskel, J. and Martin, C. (1996), "Skill Shortages, Productivity Growth and Wage Inflation", in Booth A. and Snower D. (eds), Acquiring Skills: Market Failures, their Symptoms and Policy Responses, Cambridge University Press.

Leitch Review of Skills, Final Report, (2006), "Prosperity for All in the Global Economy – World Class Skills".

Leitch Review of Skills, (2005) "Skills in the UK: The Long Term Challenge".

Mason. G., van Ark, B., & Wagner, K. (1993), 'Productivity, Product Quality and Workforce Skills: Food Processing in Four European Countries', National Institute of Economic and Social Research.

McGuinness, S. Bennett, J. & McCausland, G. (2006) "Assessing Attitudes towards Essential Skill Provision for 16-25 year olds within Service Sector SME's", Forthcoming International Journal of Human Resource Management.

McGuinness, S. & Bonner, K. (2002), "Employer Characteristics and Practices as Drivers of Unfilled IT Vacancies", The Service Industries Journal, Vol. 22 (4) 137-152

Nickell, S. & Nicolatsis, D. (1997), Human Capital, Investment and Innovation: What are the Connections?, Centre for Economic Performance Discussion Paper No.20, London School of Economics.

NIERC, (2004), "Measuring Service Sector Exports from Northern Ireland", Interim Internal Report of Year 3.

NIERC, 2003, "Three Years On: Reassessing the Northern Ireland Labour Market for IT Skills" Department for Employment and Learning: Belfast

NIERC, 2002, "A Study of the Northern Ireland Labour Market for Mechanical Engineering Skills", Department for Employment and Learning: Belfast

NIERC, 2001, "A Study of Labour Market Conditions in the Northern Ireland Electronics Industry", Department for Employment and Learning: Belfast

Northern Ireland Tourist Board, (2006), "Visitor Tourism Performance 2004", (www.nitb.com)

Zill, N. (2006), "Are all Indicators Created Equal? Alternatives to An Equal Weighting Strategy in the Construction of a Composite Index of Child Wellbeing", Draft paper prepared for the forum "Review of the Child Well-Being Index", Westat.

# Appendix

**Table A1: Rank Position under each measure of Economic Significance.**　　　　　　　　　　　**Final Rank Position under each Weighting Scenario**

| | Emp Size | Job Cr/Loss | R&D | P&Pinn | Exp Rev PW | Exp Growth | GVA P EE | Gr GVA P EE | VATREG | FO Bus | | Neutral Rank | Subjective Rank | PCA Rank |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1, 2 & 5** | 13 | 33 | 26 | 30 | 24 | 20 | 19 | 29 | 30 | 36 | **1, 2 & 5** | 38 | 38 | 36 |
| **14** | 37 | 19 | 12 | 26 | 24 | 20 | 6 | 11 | 37 | 38 | **14** | 32 | 27 | 37 |
| **15/16** | 10 | 24 | 8 | 13 | 8 | 4 | 9 | 28 | 17 | 16 | **15/16** | 12 | 13 | 11 |
| **17** | 19 | 34 | 10 | 15 | 13 | 15 | 38 | 17 | 14 | 18 | **17** | 30 | 36 | 13 |
| **18** | 25 | 35 | 22 | 19 | 18 | 17 | 26 | 5 | 9 | 19 | **18** | 29 | 34 | 24 |
| **20** | 32 | 28 | 13 | 11 | 10 | 8 | 21 | 9 | 31 | 32 | **20** | 24 | 24 | 19 |
| **21** | 35 | 26 | 23 | 30 | 6 | 10 | 8 | 2 | 15 | 5 | **21** | 8 | 4 | 16 |
| **22** | 24 | 22 | 26 | 20 | 16 | 12 | 17 | 32 | 28 | 22 | **22** | 28 | 30 | 22 |
| **24** | 28 | 27 | 2 | 30 | 3 | 13 | 3 | 18 | 11 | 4 | **24** | 3 | 3 | 5 |
| **25** | 17 | 14 | 11 | 14 | 7 | 2 | 24 | 20 | 19 | 10 | **25** | 7 | 6 | 7 |
| **26** | 21 | 20 | 15 | 17 | 14 | 5 | 18 | 10 | 27 | 17 | **26** | 21 | 19 | 17 |
| **28** | 20 | 23 | 9 | 16 | 12 | 3 | 28 | 22 | 32 | 27 | **28** | 23 | 23 | 15 |
| **29** | 18 | 30 | 7 | 7 | 4 | 6 | 12 | 6 | 25 | 11 | **29** | 9 | 10 | 10 |
| **30** | 33 | 17 | 5 | 30 | 2 | 14 | 4 | 27 | 2 | 2 | **30** | 2 | 2 | 3 |
| **31** | 29 | 21 | 6 | 18 | 19 | 18 | 13 | 1 | 12 | 7 | **31** | 14 | 17 | 21 |
| **32** | 30 | 37 | 21 | 1 | 1 | 9 | 29 | 23 | 4 | 1 | **32** | 1 | 1 | 2 |
| **33** | 36 | 12 | 4 | 8 | 11 | 16 | 23 | 36 | 21 | 3 | **33** | 18 | 21 | 4 |
| **34/35** | 15 | 36 | 14 | 9 | 5 | 11 | 22 | 13 | 3 | 8 | **34/35** | 11 | 15 | 6 |
| **36** | 27 | 16 | 18 | 10 | 9 | 1 | 33 | 34 | 33 | 31 | **36** | 19 | 16 | 9 |
| **40/41** | 31 | 25 | 24 | 30 | 24 | 20 | 1 | 15 | 38 | 30 | **40/41** | 17 | 9 | 38 |
| **45** | 7 | 38 | 20 | 28 | 24 | 20 | 11 | 19 | 13 | 9 | **45** | 34 | 32 | 31 |
| **50** | 12 | 11 | 26 | 29 | 24 | 20 | 31 | 14 | 24 | 33 | **50** | 37 | 33 | 32 |
| **51** | 9 | 9 | 19 | 21 | 24 | 20 | 14 | 7 | 23 | 15 | **51** | 25 | 22 | 30 |
| **52** | 2 | 6 | 25 | 25 | 24 | 20 | 35 | 33 | 20 | 25 | **52** | 22 | 18 | 20 |
| **55** | 6 | 7 | 26 | 27 | 20 | 19 | 36 | 21 | 10 | 29 | **55** | 36 | 35 | 26 |
| **60** | 14 | 8 | 26 | 23 | 24 | 20 | 30 | 16 | 22 | 35 | **60** | 33 | 31 | 28 |
| **63** | 22 | 13 | 26 | 12 | 24 | 20 | 16 | 37 | 16 | 13 | **63** | 35 | 37 | 12 |
| **64** | 16 | 18 | 16 | 4 | 24 | 20 | 7 | 4 | 5 | 21 | **64** | 10 | 14 | 18 |
| **65-67** | 11 | 29 | 26 | 5 | 24 | 20 | 5 | 12 | 36 | 14 | **65-67** | 20 | 20 | 29 |
| **70** | 26 | 10 | 26 | 24 | 24 | 20 | 2 | 35 | 26 | 26 | **70** | 31 | 29 | 35 |
| **71** | 34 | 15 | 26 | 22 | 24 | 20 | 10 | 26 | 18 | 20 | **71** | 26 | 28 | 27 |
| **72** | 23 | 31 | 3 | 3 | 15 | 20 | 15 | 3 | 8 | 12 | **72** | 5 | 12 | 8 |
| **73** | 38 | 32 | 1 | 2 | 17 | 20 | 37 | 38 | 1 | 6 | **73** | 4 | 25 | 1 |
| **74** | 5 | 3 | 17 | 6 | 21 | 20 | 27 | 8 | 7 | 23 | **74** | 6 | 7 | 14 |
| **75** | 4 | 4 | 26 | 30 | 24 | 20 | 20 | 25 | 6 | 37 | **75** | 13 | 11 | 23 |
| **80** | 3 | 2 | 26 | 30 | 22 | 7 | 32 | 30 | 29 | 24 | **80** | 16 | 8 | 25 |
| **85** | 1 | 1 | 26 | 30 | 24 | 20 | 34 | 24 | 35 | 34 | **85** | 15 | 5 | 33 |
| **90-93** | 8 | 5 | 26 | 30 | 23 | 20 | 25 | 31 | 34 | 28 | **90-93** | 27 | 26 | 34 |

Note: For R&D, P&P Innovation, Export Revenue and Export Growth, those sectors given an equal rank in the above table are either zero or having missing data, in which case, we assume low or poor performance in that sector and award a zero value.

**Table A2: Rank Position under each measure of Skill Need**

| SIC 92 | EXSS % EST | EXSS % VAC | SK GAPS % EST | SK GAPS % EMP |
|---|---|---|---|---|
| 1, 2 & 5 | 34 | 34 | 35 | 38 |
| 14* | 34 | 34 | 33 | 35 |
| 15/16* | 32 | 31 | 25 | 24 |
| 17* | 31 | 33 | 22 | 27 |
| 18* | 21 | 32 | 10 | 36 |
| 20* | 34 | 34 | 31 | 23 |
| 21* | 34 | 34 | 35 | 1 |
| 22* | 8 | 11 | 29 | 26 |
| 24* | 2 | 3 | 32 | 15 |
| 25* | 5 | 6 | 24 | 2 |
| 26* | 25 | 28 | 19 | 17 |
| 28* | 27 | 27 | 4 | 12 |
| 29* | 7 | 26 | 3 | 16 |
| 30* | 17 | 17 | 13 | 5 |
| 31* | 26 | 18 | 30 | 34 |
| 32* | 3 | 9 | 35 | 3 |
| 33* | 14 | 13 | 34 | 32 |
| 34/35* | 1 | 1 | 16 | 31 |
| 36* | 29 | 5 | 27 | 7 |
| 40/41* | 4 | 20 | 8 | 28 |
| 45 | 12 | 4 | 18 | 14 |
| 50 | 22 | 22 | 15 | 10 |
| 51 | 30 | 29 | 28 | 25 |
| 52 | 19 | 21 | 21 | 8 |
| 55 | 23 | 24 | 12 | 11 |
| 60 | 20 | 19 | 20 | 21 |
| 63* | 13 | 16 | 23 | 19 |
| 64* | 33 | 2 | 17 | 33 |
| 65-67 | 15 | 12 | 7 | 4 |
| 70 | 11 | 7 | 11 | 13 |
| 71* | 16 | 14 | 35 | 37 |
| 72* | 9 | 15 | 14 | 9 |
| 73* | 34 | 34 | 1 | 30 |
| 74 | 10 | 10 | 26 | 29 |
| 75* | 6 | 8 | 2 | 6 |
| 80 | 28 | 30 | 9 | 22 |
| 85 | 18 | 25 | 6 | 20 |
| 90-93 | 24 | 23 | 5 | 18 |

*Caution, small numbers

**Final Rank Position under each Weighting Scenario**

| SIC 92 | Neutral Rank | PCA Rank |
|---|---|---|
| 1, 2 & 5 | 38 | 36 |
| 14 | 37 | 37 |
| 15/16 | 32 | 33 |
| 17 | 34 | 34 |
| 18 | 31 | 32 |
| 20 | 36 | 35 |
| 21 | 25 | 27 |
| 22 | 16 | 9 |
| 24 | 3 | 2 |
| 25 | 4 | 4 |
| 26 | 29 | 28 |
| 28 | 17 | 30 |
| 29 | 10 | 19 |
| 30 | 13 | 18 |
| 31 | 33 | 24 |
| 32 | 5 | 3 |
| 33 | 28 | 14 |
| 34/35 | 1 | 1 |
| 36 | 15 | 12 |
| 40/41 | 11 | 10 |
| 45 | 9 | 7 |
| 50 | 21 | 22 |
| 51 | 30 | 29 |
| 52 | 20 | 20 |
| 55 | 22 | 25 |
| 60 | 26 | 21 |
| 63 | 24 | 16 |
| 64 | 14 | 5 |
| 65-67 | 7 | 13 |
| 70 | 8 | 8 |
| 71 | 35 | 17 |
| 72 | 12 | 15 |
| 73 | 6 | 38 |
| 74 | 18 | 11 |
| 75 | 2 | 6 |
| 80 | 27 | 31 |
| 85 | 19 | 23 |
| 90-93 | 23 | 26 |

## APPENDIX 2 - Principal Components Analysis (PCA)

PCA is a multivariate statistical technique that identifies patterns of correlation within a set of variables and substitutes a new variable, a factor, for the group of original variables. PCA is effectively a data reduction exercise whereby a set of variables (or indicators in this case) are reduced into a smaller number of variables that explain a high proportion of the variability in the original dataset. PCA then identifies a second group of attributes and derives factors for each of these based on the variance[8] that remains unexplained after the variance accounted by the first factor is removed (the residual variance) and so on. In this context we use PCA to generate objective weights for each of the economic contribution indicators. Only those components with an eigenvalue[9] of one or more are retained and the weights are derived from the factor loadings of the individual variables within each component, each component with an eigenvalue of one or more is in turn weighted according to the proportion of the overall variance that they explain.

In general, we would expect that within each component, variables of a similar nature will tend to "hang together" thus we should be able to broadly characterise the components. The results from our analyses are presented in **Tables A3** and **A4**. In **Table A3** the principal components estimates are presented, as we can see, on the basis of our selection criteria (eignevalue of one or more), four components are retained and collectively these account for 72.5% of the total variance in the data with the first factor representing the most significant single element accounting for over a quarter of the total variance. The individual factor loadings for the principal component are given in the first column of **Table A4** and the highest weights are given to proportion of NI businesses that are product and process innovators, R&D expenditure per employee and, the number of VAT Registrations (as proportion of the stock of existing businesses). We can, therefore, think of this component as encapsulating new firm creation and innovation, which appear

---

[8] The variance of a random variable is a measure of its statistical dispersion, indicating how its possible values are spread around the expected value.
[9] An eignevalue is a statistic that quantifies variation in a group of variables and its accountability by a particular factor.

to be highly correlated; the negative loadings on some variables indicate that these joint attributes are not generally evident in particularly fast growing sectors, whether that growth is in employment or GVA per employee. The second component encapsulates the combination of high numbers of VAT Registrations, employment size and job creation / loss. The third component identifies export growth and export revenue per employee and the fourth, the count of foreign owned businesses, the proportion of NI Businesses that are product and process innovators and growth in GVA per employee. The objective ranks are obtained by multiplying the standardised value of each attribute in each sector by its factor loading (**Table A4**) to generate four component scores which are then weighted by the share of the variance that each component accounts for to give an overall score on the basis of which the individual sectors are ranked.

**Table A3: Initial Results from PCA – Economic Significance Indicators**

| Component | Eigenvalue | Difference | Proportion | Cumulative |
|---|---|---|---|---|
| Component 1 | 3.336 | 1.345 | 0.334 | 0.334 |
| Component 2 | 1.991 | 0.713 | 0.199 | 0.533 |
| Component 3 | 1.279 | 0.131 | 0.128 | 0.661 |
| Component 4 | 1.147 | 0.315 | 0.115 | 0.775 |
| Component 5 | 0.832 | 0.381 | 0.083 | 0.859 |
| Component 6 | 0.451 | 0.028 | 0.045 | 0.904 |
| Component 7 | 0.423 | 0.132 | 0.042 | 0.946 |
| Component 8 | 0.292 | 0.119 | 0.029 | 0.975 |
| Component 9 | 0.173 | 0.097 | 0.017 | 0.993 |
| Component 10 | 0.075 | . | 0.008 | 1.000 |

**Table A4: PCA Results: Principal Components (Eigenvectors) – Economic Significance Indicators**

| Variable | Comp1 | Comp2 | Comp3 | Comp4 |
|---|---|---|---|---|
| Employment Size | -0.367 | 0.352 | 0.123 | 0.382 |
| Job Creation / Loss | -0.369 | 0.346 | 0.060 | 0.350 |
| R&D Exp per EE | 0.353 | 0.313 | -0.293 | -0.016 |
| % P&P Innovators | 0.350 | 0.091 | 0.307 | -0.375 |
| Export Rev per EE | 0.373 | -0.168 | 0.246 | 0.547 |
| Export Growth | 0.111 | -0.203 | 0.653 | 0.016 |
| GVA per EE | 0.018 | -0.415 | -0.532 | 0.087 |
| Growth GVA per EE | -0.156 | -0.469 | -0.019 | 0.134 |
| No. VAT Reg. | 0.346 | 0.432 | -0.141 | -0.007 |
| Foreign Owned Bus. | 0.432 | -0.037 | -0.106 | 0.516 |

**Table A5: Initial Results from PCA – Skill Needs Indicators**

| Component | Eigenvalue | Difference | Proportion | Cumulative |
|---|---|---|---|---|
| Component 1 | 1.753 | 0.761 | 0.438 | 0.438 |
| Component 2 | 0.992 | 0.016 | 0.248 | 0.686 |
| Component 3 | 0.976 | 0.696 | 0.244 | 0.930 |
| Component 4 | 0.280 | . | 0.070 | 1.000 |

**Table A6: PCA Results: Principal Components (Eigenvectors) – Skill Needs Indicators**

| Variable | Comp1 | Comp2 | Comp3 | Comp4 |
|---|---|---|---|---|
| Ext. Skill Shortages - % Est | 0.690 | 0.048 | 0.158 | -0.705 |
| Ext. Skill Shortages - % Est | 0.688 | -0.094 | 0.158 | 0.702 |
| Skill Gaps - % Est | -0.166 | 0.566 | 0.805 | 0.056 |
| Skill Gaps - % Emp | 0.154 | 0.817 | -0.549 | 0.083 |

## APPENDIX 3 - Data Construction

This section of the annex takes each of the indicators separately and describes in detail the sources of the data and where necessary, how the indicators were constructed.

### *Employment Size / Job Creation/Loss*

The data for both of these indicators was derived from the NI Quarterly Employment Survey (QES). The QES provides estimates of the number of employee jobs and covers all public sector employers, all employers with 25 or more employees and a representative sample of smaller firms. It provides employee jobs estimates by gender, working pattern and by Standard Industrial Classification for Northern Ireland as a whole. The sample size is chosen so that estimates of total employee jobs should be accurate to within +/-1% of the Census of Employment total.

Job creation / loss is simply calculated as the number of new jobs / number of jobs lost to each sector between 2002 and 2003.

### *R&D Expenditure per Employee in Employment*

The data for this indicator was derived using the Business Expenditure on Research & Development (R&D) Survey (BERD) and the NI QES. The BERD is an annual survey conducted by the Department of Enterprise, Trade and Investment (DETI). Total BERD consists of intramural expenditure (R&D carried out within the company) and extramural expenditure (R&D funded by firms in NI but undertaken by other firms in the UK and abroad).

R&D expenditure per employee in employment was derived by dividing the total BERD in each 2-digit SIC by the total number of employees in that sector.

*Proportion NI Enterprises that are Product and Process Innovators*

Initially we had intended to present this indicator as the number of product and process innovations per employee in employment, however, this information was not available. The data used for this indicator is derived from the Northern Ireland element of the UK Innovation Survey 2005 conducted by the Department of Trade and Industry (DTI) and covering the three year period from 2002 to 2004. The survey is part of a wider European Community Innovation Survey (CIS).

The data presented in our study is simply an average of the percentage of firms engaging in product innovations and the percentage engaging in process innovations over the period 2002 to 2004.

*Export Revenue per Employee in Employment*

Given that exporting has traditionally been unique to manufacturing industries, most of the export information relates to manufacturing firms and was taken from the Manufacturing Sales and Exports Survey (MSES) conducted by DETI every year since 1991. The MSES provides information on the value of sales and exports generated by businesses classified within the Manufacturing industry in NI. However, given the increasing importance of tradeable services and to keep our analysis consistent some information was also obtained on service sector exports. This information was taken from a variety of sources including the 2006 Exporting Northern Ireland Services Study 2004 (DETI, 2006), Measuring Service Sector Exports from Northern Ireland (NIERC, 2004), and the Northern Ireland Tourist Board. The Exporting Northern Ireland Services Study covers sectors 72, 73, 74 and 92 (identified as high export potential). Other services such as tourism and education which could also be considered exporters, are not covered in any surveys, export information from these sectors was derived from the Northern Ireland Tourist Board website and interviews with a number of education establishments (conducted by NIERC for the Measuring Service Sector Exports from

Northern Ireland study (NIERC, 2004)). While these sources may not be directly comparable, it is the only information available.

The MSES provides manufacturing export information by broad industry group. In order to present the data by 2-digit SIC we used weights constructed by ERINI. The NI QES was again used to calculate export revenue per employee. It is also worth noting again that where we have no export information for a sector we have to assume that either very little or no exporting activity, and record a zero figure for that sector.

*Export Growth*

Data for this indicator was derived mainly from the MSES. Service sector export information was also available for both 2002 and 2003 for SIC 55 and SIC 80 (from Measuring Service Sector Exports from Northern Ireland (NIERC, 2004), and the Northern Ireland Tourist Board).

Again, in order to present the data by 2-digit SIC we weighted the MSES data (provided by DETI) using weights constructed by ERINI. Where we have no export information for a sector we have to assume this is an indication of either very little or no exporting activity and record a zero figure for that sector. Growth is calculated over the one year period 2002 to 2003.

*GVA per Employee in Employment / Growth in GVA per Employee in Employment*

Initially, GVA per employee in employment information was provided to us by DETI from the NI Annual Business Inquiry (ABI). However, given that the ABI excludes some vital sectors from the survey we were unable to use this data. Instead, we used GVA data from Regional Forecasts Limited (RFL) which is taken from Regional accounts (and scaled to match Blue Book totals).

Where a 2-digit SIC breakdown was not available, RFL data was split on the basis of a weight calculated from the ABI data.

The NI QES was again used to calculate export revenue per employee.

***Number of VAT Registrations expressed as a Percentage of the Stock of Existing Businesses***

Data for this indicator was derived from the Small Business Service[10] (SBS), which is an agency of the DTI. The number of VAT registrations was available only by broad industry group and so, data on the number of VAT registrations by 2-digit SIC, was derived by applying a weight calculated from employment share. Data on the stock of existing businesses was supplied by the Office for National Statistics (ONS).

***Count of Foreign Owned Businesses in Northern Ireland expressed as a Percentage of the Total Stock of Businesses***

Information on the number of foreign owned businesses operating in each sector was provided by DETI from the Inter Departmental Business Register (IDBR) publication. This information is the result of a combination of sources - the market information company Dun and Bradstreet, Invest NI and the Investor Responsibility Research Centre, Washington DC. Employment information was unavailable as the majority of SICs were suppressed due to disclosure.

To express this as a percentage of the stock of existing businesses we used the data provided by ONS.

---

[10] www.sbs.gov.uk

people:skills:jobs:

**Department for Employment and Learning**
www.delni.gov.uk

INVESTOR IN PEOPLE

**Further information**
telephone: 028 9025 7609
fax: 028 9025 7696
email: reb@delni.gov.uk
web: www.delni.gov.uk