A Study of the Northern Ireland Labour Market for Mechanical Engineering Skills

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

DEPARTMENT for EMPLOYMENT and LEARNING

NIERC

A Northern Ireland Skills Task Force Report

22-24 Mount Charles
Belfast, BT7 1NZ
Tel: 028 9026 1800

Published by:
Department for Employment and Learning (DEL)
39-49 Adelaide Street
Belfast, BT2 8FD

ISBN: 1 871 753 457

Copies of this report and a summary of the Key Findings are available from:
DEL, Research and Evaluation Branch,
39-49 Adelaide Street
Belfast, BT2 8FD
Tel: 028 9025 7777

Or electronically from:
www.delni.gov.uk
www.qub.ac.uk/nierc

A Study of the Northern Ireland Labour Market for Mechanical Engineering Skills

A Report prepared by

Seamus McGuinness and Karen Bonner

Priority Skills Unit

Northern Ireland Economic Research Centre

November 2002

Contents

Acknowledgements

We wish to thank all the firms who participated in the survey, without whom the research would not have been possible. We would also like to express our appreciation to those who gave invaluable advice on the sector and those who provided data. In particular, we would like to thank David Hatton and Francis Guinane of the Engineering Training Council for their help and advice throughout the study.

Preface

The Northern Ireland Skills Task Force was established in early 1999 to advise government on issues relating to the supply of, and demand for, skills in the Northern Ireland labour market. The Skills Task Force remit is:

To advise the Department of Employment and Learning on strategy to meet the skills needs of the Northern Ireland economy, the role of the Sector Training Councils, and its labour market research programme, in order to assist in targeting the allocation of education and training resources.

The Priority Skills Unit at the Northern Ireland Economic Research Centre was established by DEL as a centre of excellence for examining in detail skills issues in priority skills areas (defined as those areas where a shortage of skills could act as a constraint to the growth of the Northern Ireland economy). The principal role of the Priority Skills Unit is to provide the Northern Ireland Skills Task Force with a detailed analysis of the current and future supply/demand balance for skills in priority areas.

This research programme complements the "Northern Ireland Skills Monitoring Survey 2000" (published 2001) which assessed current skills needs among private sector employers; the Skills Monitoring Survey 20002 which has been extended to the public sector - to be published early in 2003. These surveys are run by the Skills Unit in DEL's Research and Evaluation Branch.

The first skills area covered by the priority Skills Unit focused on the IT Sector and the findings were published in August 2000 in the first Skills Task Force Report "A Study of the Northern Ireland Labour Market for IT Skills". The Electronic Engineering Sector report was published in October 2001 and the Tourist and Hospitality Industry report is also issued this month (November 2002). Two further reports are currently planned; the IT Sector is being revisited due to the rapid changes taking place in that sector - that report will be published early in 2003; the next sector to be researched will be Construction.

Summaries of these particular reports and the work of the Northern Ireland Skills Task Force generally appear in the annual (November) DEL research publication, the Labour Market Bulletin.

Please note that the views expressed or recommendations made in this Report are those of the authors only.
Publication does not necessarily imply that these views are endorsed by either the Northern Ireland Skills Task Force or DEL.

Foreword

I am pleased to present this report of research commissioned by the Northern Ireland Skills Task Force, which focuses on the demand for and supply of skills in the Mechanical Engineering sector.

In addition to this full report, "A Study of Labour Market Conditions in the Northern Ireland Mechanical Engineering Industry: A Summary of the Key Findings" is available now. The report is the third in a planned series of studies examining priority skills areas, as identified by the Skills Task Force, where skill shortages or deficiencies would constrain further development and growth in that sector and also adversely affect growth of the Northern Ireland economy.

Northern Ireland has a long tradition of engineering excellence and innovation reflected in genuinely world class products and in names such as Harland and Wolff; Shorts; Ferguson and McCandless to name but a few. The mechanical engineering industry in Northern Ireland has shown considerable resilience in the 1990s reversing a long-term trend of declining employment at a time when the UK industry as a whole has continued to contract. September 11th has impacted on local firms directly or indirectly involved in the aerospace industry. Projected employment growth is likely to be subdued in the short to medium term. However mechanical engineering remains a key industry for the local economy.

The research suggests that skills constraints are not as marked as those found in earlier studies into the electronics and IT sectors however that is not to say that there are no problems or that no actions should be taken. The research highlights current or potential difficulties relating to the supply of craft level skills; skills deficiencies in new entrants to the industry; and skills gaps in the existing workforce. Survey evidence and interviews with key informants suggest a lack of transferable basic engineering skills in workers seeking re-employment within the industry; a finding which I know is also known to those working within Invest NI. Having managed an engineering business for many years I can recognise the validity of these findings and can add my own voice to those employers who participated in the research.

The Skills Task Force has made a number of recommendations to address skills deficiencies in the mechanical engineering sector. Some of these have already been made previously by the Skills Task Force in the context of the broader economy. A number of actions have already been taken but must be sustained. Others are new and relate specifically to the needs of mechanical engineering. I trust that these recommendations are given serious consideration and can form the basis of a dialogue between key stakeholders in the industry and in government.

Once again on behalf of the Task Force, I wish to thank all those firms who participated in the survey and demonstrated their commitment to improving the skills base in their industry. I also wish to thank the Priority Skills Unit of NIERC for delivering a robust and insightful report.

BILL McGINNIS, OBE
Chairman
Northern Ireland Skills Task Force

Executive Summary

Introduction

- This report examines the mechanical engineering industry in Northern Ireland. It uses data collected by way of a comprehensive survey of firms conducted between July and August 2001. The report examines current labour market conditions and practices within the Northern Ireland (NI) Mechanical Engineering industry before going on to assess the adequacy of supply generated by the region's education and training institutions.

Industry Size and Structure

- Total employment in the NI industry was estimated at 28,620 in December 2000, accounting for just over a quarter of the region's total manufacturing employment. The Other Transport category represents the largest single sub-sector of mechanical engineering, followed by the Electrical and NEC (not elsewhere classified) Machinery sectors.

- Foreign-owned firms heavily dominate the sector accounting for over 80 per cent of total employment. The distribution of sectoral employment is also heavily skewed with over 70 per cent of industry employment concentrated within the 8 largest firms.

- The historical pattern of employment in the industry has generally mirrored that of the UK, and has been characterised by a general decline since the beginning of the 1980s. However, the rate of decline within the NI sector was slower than that of the UK industry.

- The NI pattern of employment appears to have diverged from that of the UK after 1993 when local industry experienced an upturn in employment whilst the UK level of employment remained static.

- Over 4,500 net jobs have been created within NI mechanical engineering since 1993 with the majority of job growth relatively evenly spread across the Metal Products, Electrical Machinery and Motor Vehicles sectors. Thus, it appears that the trend decline in the larger aggregates of Other Transport and Machinery NEC has been more than counter-balanced over recent years by growth within the smaller sectoral aggregates.

- Almost half of industry employment is composed of operators/assemblers, whilst craft level workers represented the next largest occupational grouping of labour, accounting for 27 per cent of employment. Approximately 13 per cent of the workforce held technician level qualifications or were graduates from mechanical engineering degree programmes. Just over 10 per cent of employment was made up of non-operational labour, such as administrators.

- Females account for 10 per cent of total employment, and are most heavily represented within the support staff aggregate. However, they account for less than 5 per cent of total employment within the two most senior operational categories (Appendix 1, Table A1).

Labour Market Conditions

- 24 firms reported a total of 124 unfilled vacancies over the period July 2000 – July 2001, with over 95 per cent of these vacancies occurring at the sub-graduate level.

- The highest rate of shortage was evident at technician level (4%), however, the relatively small size of this aggregate suggests that the gap could be bridged by relatively small increases in the supply of qualified labour. There was little evidence of shortage within the remaining occupational aggregates whilst the overall industry vacancy rate stood at just 1 per cent.

- Relative to either the electronics or IT sectors, there appears to be a significantly lower likelihood that performance levels within the mechanical engineering industry will be constrained as a result of unfilled vacancies.

- A further indicator of labour market conditions was obtained by tracking labour flows within the industry in the twelve months preceding the survey. A total of 740 workers changed jobs throughout the year, however, the actual rate

of turnover was quite small, accounting for just 4 per cent of total employment. This equated to one third of the rate reported for the electronics industry in a recent study.

- Starting salaries within the industry ranged from £12,841 for operators/assemblers to £27,876 for senior managers. However, the distribution is relatively narrow with just £2,872 separating the annual earnings of operators and graduates with less than 2 years experience.

- Wage rates offered to craft and new / inexperienced graduates within NI were broadly in line with those offered in the Republic of Ireland. However, project leaders within NI appeared to earn substantially less relative to their GB counterparts.

- Wage rates up to and including technician level 4 are broadly comparable with those of the electronics sector. However, mechanical engineering earnings lag those of electronics for more senior grades of staff.

- Evidence from key informant interviews suggest a lack of basic numeracy and literacy skills amongst applicants at operator level and a lack of transferable basic engineering skills amongst those workers seeking re-employment within the industry.

Industry Forecasts

- In order to determine the extent of any likely imbalances in the supply/demand of new entrants to the mechanical engineering labour market in NI over a 5 year time horizon we adopt two distinct methods. These enable us to generate high and low growth scenarios, which are in turn utilised to quantify the spread of any potential labour market imbalances.

- Although we are relatively confident in our forecasts, we are also conscious of the fact that the mechanical engineering sector in NI has historically been, and is likely to remain, subject to large shocks, such as the rapid downscaling of employment within shipbuilding and the impacts on the aerospace industry of September 11th.

- Over the period 2001 – 2006 employment is projected to expand, from 24,758 to 25,978 under the low growth model and from 25,022 to 31,676 under the high growth risk scenario. It should be noted that while we consider the high growth (risk based) trajectory to be highly unlikely, it does provides a useful range within which to assess the adequacy of educational and training supply.

Demand/Supply Imbalances

- The demand for new entrants is estimated through the application of demand-side ratios to our employment forecasts, whilst the extrapolation of the historical enrolments/ leavers relationship generates estimates of the number of persons likely to gain mechanical engineering related qualifications at various levels. Future labour market supply is assessed through the application of labour market entry rates to the estimates of qualified labour supply. Finally, potential labour market imbalances are assessed through a comparison of the demand for and supply of new entrants.

- The picture at craft level oscillates under the low growth model from a shortage of 132 in 2001 to a surplus of 111 in 2003 before falling back to a surplus of 77 in 2006. However, under the risk based scenario the projected balance remains in shortage throughout the forecast horizon with the level of shortfall ranging from -135 to -193.

- Supply at technician level is relatively low which when combined with the relatively stagnant demand levels forecast under the low growth model results in a situation of slight shortfalls/ surpluses over the forecast period ranging from –26 to 5. However, demand under the risk based scenario is somewhat higher generating a pattern of sustained shortage over the forecast horizon, ranging from –37 to –51.

- There appears to be little prospect of shortages occurring at graduate level with both the low growth and risk based models projecting surpluses over the forecast horizon. The projected surpluses range from 49 to 64 under

the low growth model and 36 to 41 under the risk based model

Conclusions

- There is a need to replace the "fire fighting" approach to training provision with the introduction of initiatives designed to encourage firms to participate in long-duration training irrespective of the phase of the business cycle[1] .

- The overall rate of industry skill shortage was calculated at 1 per cent and relative to either the electronics or IT sectors, there appears to be a significantly lower likelihood that industry performance will be inhibited as a result of labour market shortages[2].

- The rate of labour turnover activity within the mechanical engineering sector was again very low, amounting to one third of that reported for the electronics sector in a previous NIERC study.

- Where data was available, occupational wage rates appear to be broadly comparable with those in the Republic of Ireland (RoI). However, relative to GB, project managers in NI tend to earn significantly less. Generally, occupational earnings in mechanical engineering reflect those on offer within the IT sector but tend to lag those of electronics for more senior grades of staff.

- Since 1993, the mechanical engineering sector in Northern Ireland has been experiencing a net expansion in employment. There has been a trend decline in the larger aggregates of Other Transport and Machinery NEC but this has been more than compensated by growth within the smaller sectoral aggregates.

- Turning to the competencies of the existing workforce, there was evidence, deriving from both the survey and key informant interviews, to suggest a lack of basic numeracy and literacy skills amongst operator level staff and a lack of transferable basic engineering skills amongst workers seeking re-employment within the industry.

- There is little prospect of any graduate level shortages occurring under either the low or the high growth scenarios. However, problems are more likely to occur at craft and technician level.

- The relatively small magnitude of technician level shortages imply that they could be easily eradicated and are unlikely to constrain the performance of the industry.

- There exists a potentially greater need for actions in relation to problems at craft level with relatively more significant shortfalls predicted under both forecasting scenarios.

- The ramping up of level 3 educational and training provision need not constitute the principal policy response to potential craft level shortfalls. The general trend decline in employment within the traditionally dominant industries (Other Transport and Machinery NEC) implies that there may exist sufficient numbers of craft trained workers already available to the labour market.

- Whilst such workers may require retraining or upskilling, they could potentially be equipped with the required skills within a relatively short timeframe. Such a policy could potentially be facilitated by bodies such as DEL who are in a position to match sources of redundant skilled labour with those firms seeking craft level workers.

1 This was confirmed within a NI context through key informant interviews.

2 These problems are commonly categorised as skill shortages distinguishable from the phenomenon of skill gaps, which refer to deficiencies in the skill levels of persons already in employment.

1 Introduction

1.0 Introduction

A review of the literature on the UK mechanical engineering sector revealed that the industry has been in trend decline since the mid 70s, with the level of output in 1999 some 19% below that of 1990. Internationally, the output of UK industry is now much smaller than in Germany, Japan, France, Italy and the US (Barclays Engineering Review, 2000). The UK mechanical engineering sector comprises an indigenous component dominated by small to medium enterprises (SMEs) and a foreign-owned element, which is more technologically advanced and capable of enjoying large scale economies. Despite the relative decline of the industry, mechanical engineering firms have been experiencing problems in attracting and retaining skilled labour (Skills Taskforce, EMTA, 2000, Barclays, 2000, DfEE, 2000a, 2000b). Skills shortages have been identified as being a particular problem at craft level, specifically in the areas of CNC programmers/setters and fitters. Whilst some of these skill problems may be related to shortfalls in the flow of qualified persons to the labour market, the training culture of firms may also have aggravated the problem. Generally, firms within the industry tend to be reactive rather than proactive in their attitudes towards skill issues, with cost pressures forcing employers to reduce expensive long-duration training programmes during times of recession which in turn makes it impossible to perform optimally during times of growth due to the long-lead times associated with apprenticeship training. The general consensus of UK studies is that there is a need to replace the short term "fire fighting" approach to training provision with the introduction of initiatives designed to encourage firms to participate in long-duration training irrespective of the phase of the business cycle.

Whilst the findings of UK studies provide some useful insights, previous research by the Priority Skills Unit at NIERC has demonstrated that regional labour market conditions can diverge radically from the national picture. Consequently, this report examines current labour market conditions and practices within the Northern Ireland Mechanical Engineering industry before going on to assess the adequacy of supply generated by the region's education and training institutions.

1.1 Employment Composition and Trends

Mechanical engineering skills are employed in many sectors of the Northern Ireland economy, however, demand tends to be most heavily concentrated within the following Standard Industrial Classification (SIC) groupings:

- Manufacture of Fabricated Metal Products (SIC 28)
- Manufacture of Machinery and Equipment Not Elsewhere Classified (NEC) (SIC 29)
- Manufacture of Electrical Machinery and Apparatus (SIC 31)
- Manufacture of Motor Vehicles, Trailers and Semi-Trailers (SIC 34)
- Manufacture of Other Transport Equipment (SIC 35)

We define the mechanical engineering industry as the amalgamation of these 5 two-digit sectors. Total employment in the NI industry was estimated at 28,620 in December 2000, accounting for just over a quarter of the region's total manufacturing employment. The Other Transport category represents the largest single two-digit sector of mechanical engineering with an employment share of 29%, followed by the Electrical and NEC Machinery sectors with shares of approximately

TABLE 1: Industrial Structure of Mechanical Engineering Sectors in NI & GB

	NI %	GB %
Manufacture of Fabricated Metal Products	21	31
Manufacture of Machinery and Equipment NEC	23	27
Manufacture of Electrical Machinery and Apparatus	11	14
Manufacture of Motor Vehicles Trailers and Semi-Trailers	16	15
Manufacture of Other Transport Equipment	29	13
Total Employment	100	100

Source: NOMIS

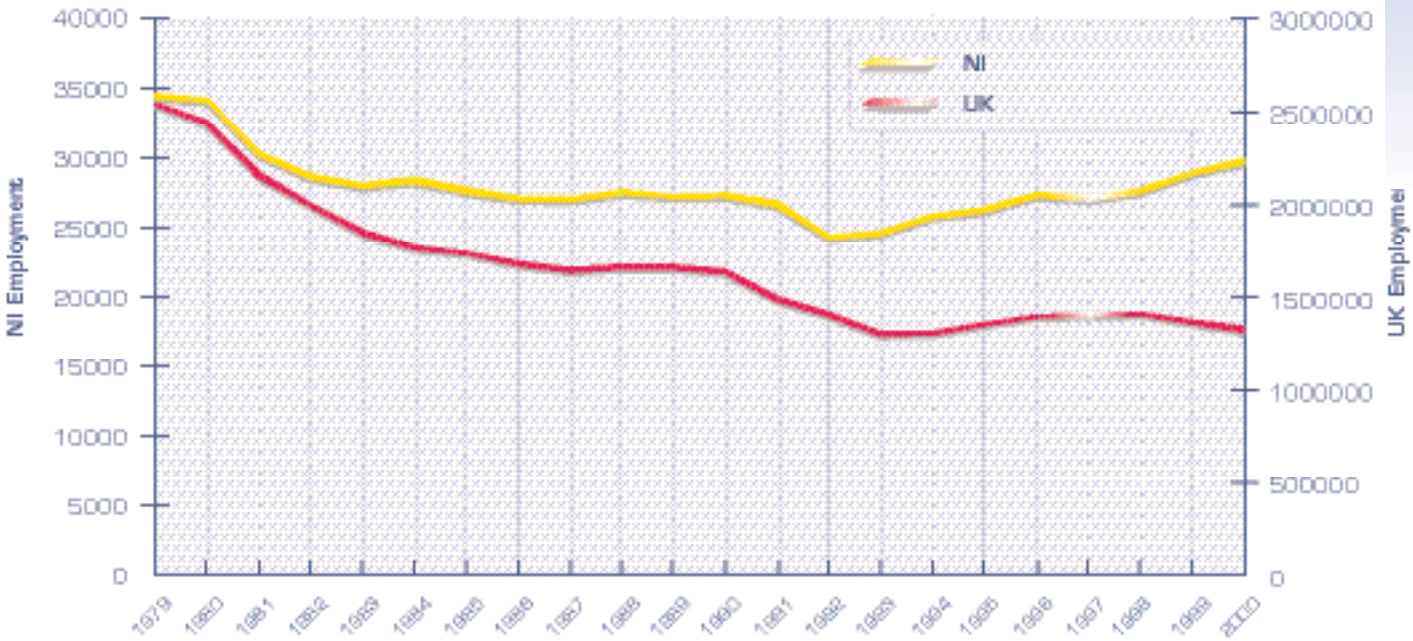
20% each (Table 1). The Other Transport sector in NI is much more dominant in terms of employment relative to the GB average whilst Fabricated Metal Products appears to be relatively under-represented within the region. The employment shares of the remaining sectors approximate those of GB (Table 2).

The historical pattern of employment in the NI mechanical engineering industry has generally mirrored that of the UK and has been characterised by a general decline since the beginning of the 1980s (Figure 1). Industry employment in NI has fallen from just under 35,000 in 1980 to below 29,000 in 2000, a reduction of 17 per cent, and an annual average decline of 0.9 per cent. However, the rate of decline within the NI sector was slower than that of the UK industry generally, which contracted by more than 45 per cent over the same period, with the number of persons employed falling from 2.8 million in 1979 to just over 1.5 million in 2000. The NI pattern of employment appears to have diverged from that of the UK after 1993 when local industry experienced an upturn in employment whilst the UK level of employment remained relatively static.

The NI trend appears to be relatively more volatile than that of the UK in that employment appears to fall very rapidly at various points between 1979 and 1995 whilst the UK decline appears to have been somewhat more gradual. An examination of the pattern of employment change over the period (Figure 2) reveals the volatility of the NI series, which appears to be particularly susceptible to rapid and extreme downturns in activity. Employment growth fell dramatically during the economic downturns of the early 1980s and 1990s whilst it was positive during the recovery of the mid to late 1990s, indicating that performance may be related to the economic cycle. However, the relationship between employment and economic growth appears to be partial as no consistent recovery was evident during the Lawson boom of the mid to late 1980s.

Decomposing the 1979-2000 decline in employment by sector (Table 2), it becomes evident that the loss of jobs was concentrated within the Machinery NEC and Other Transport sectors. However, whilst the Machinery NEC sector declined at a relatively constant rate over the period, the Other Transport sector appeared particularly prone to severe negative shocks which corresponded to the extreme troughs of Figure 2. The NI Other Transport sector has historically been dominated by just two large employers located in the shipbuilding and aerospace industries, both of which tend to be particularly susceptible to rapid downturns. Moreover, the evidence suggests that developments within the Other Transport sector, arising in the wake of the September 11th attacks in the US, may induce a further downward

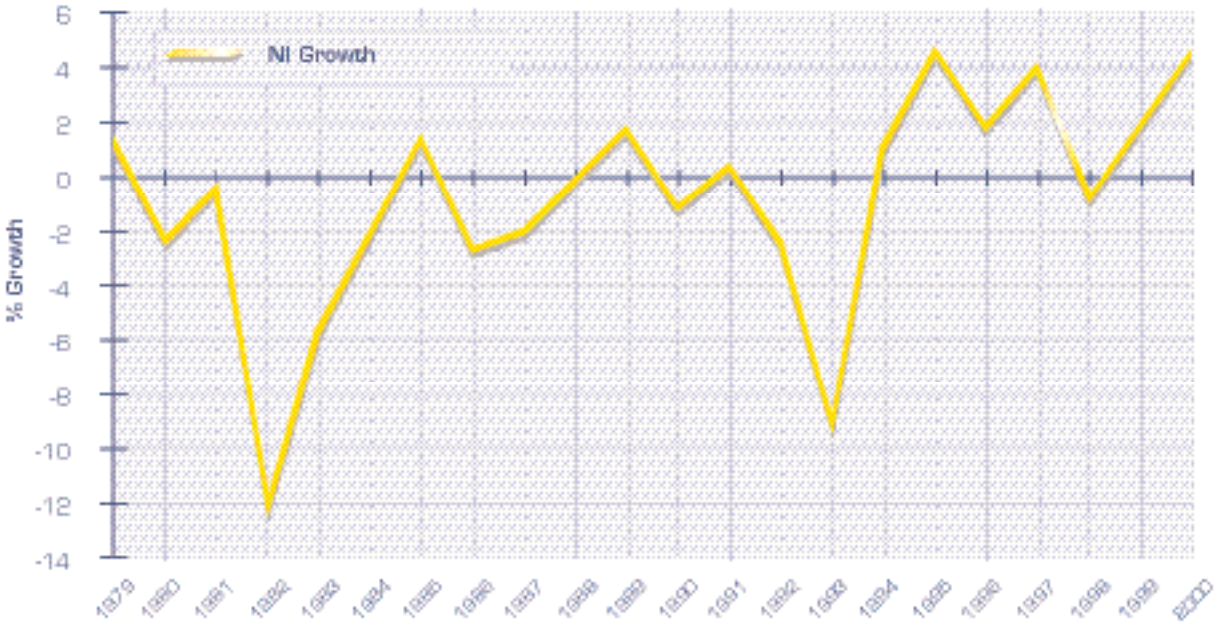
Figure 1 - Mechanical Engineering Employment in NI/UK 1979-2000



Source: NOMIS

Introduction

Figure 2 - Northern Ireland Mechanical Engineering Growth 1979-2000



Source: NOMIS

movement in aggregate mechanical engineering employment with some 2,500 job losses threatened.

However, the situation is far from being entirely negative because, as noted earlier, the mechanical engineering industry in NI has experienced some growth over recent years despite a general decline in the UK sector. Over 4,500 jobs were created within NI mechanical engineering over the period 1993 to 2000 with each of the five two-digit sectors experiencing positive growth, however, the majority of job growth was relatively evenly spread across the Metal Products, Electrical Machinery and Motor Vehicle sectors. Thus, it appears that the trend decline in the larger aggregates of Other Transport and Machinery NEC has been more than counter-balanced over recent years by growth within the smaller sectoral aggregates.

TABLE 2: Sectoral Decomposition of Industry Employment Change 1979 - 2000

	Weighted Contribution	Jobs Lost (000s)
Manufacture of Fabricated Metal Products	20.5	-5.7
Manufacture of Machinery and Equipment NEC	-45.9	-12.8
Manufacture of Electrical Machinery and Apparatus	+3.6	+1.0
Manufacture of Motor Vehicles Trailers and Semi-Trailers	+15.7	+4.4
Manufacture of Other Transport Equipment	52.9	-14.7
Total Employment	-100	-27.8

Source: NOMIS

2 Sampling Framework

Information was collected during a specifically commissioned survey of employers conducted between July and August 2001. According to official data, a total of 1,289 industrial units were operating within the five SIC groupings employing a total of 27,907[1] . Of this grouping, 812 units (employing 2,778 persons) were identified as being principally involved in activities unrelated to mechanical engineering and were consequently eliminated from our sample, leaving a cohort of 477 units employing 25,129. A list of these companies was circulated amongst a group of key informants who subsequently identified 249 firms employing 21,339 as key mechanical engineering organisations implying that 76 per cent of employment within the five SIC groupings was mechanical related. Our sample of 249 relevant firms was then stratified according to firm size with all companies employing ≥20 (n=115) contacted in addition to a random sample of smaller firms (n=45). The survey response information is summarised in Table 3. Our sample had a population of 20,581 accounting for 96 per cent of our total target population. A total of 98 firms employing 16,537 (on the basis of official figures) agreed to participate in our study indicating a survey response rate (measured in terms of employment) of 80 per cent and a target population coverage rate of 77 per cent.

TABLE 3: Survey Data

	No. of Firms	% Sample Firms	Sample Emp	% Sample Emp
Respondents	98	61	16,537	80
Not Relevant	6	4	161	1
Closed	2	1	243	1
Duplicate	1	1	13	0
Not Taking Part	11	7	948	5
No Response	42	26	2,679	13
Total Survey Sample	160	100	20,581	100

Source: NIERC (2001)

1 There is a discrepancy of around 1,000 in the official employment figures and those of NOMIS. This discrepancy is most likely due to differences in survey timing and/or grossing up methods.

3 Survey Results

3.1 Size and Ownership Distribution of Employment

Preliminary analysis of the data revealed that official sources had somewhat under-estimated the level of employment in the industry. Respondents to the survey reported a total employment of 19,464, some 18 per cent above the official estimate (Table 4). After grossing up for non-respondents and non-sampled firms, we estimate that the actual size of the NI mechanical engineering sector as of August 2001 was in fact 24,626, a level 15 per cent above the official based estimate. Foreign-owned firms heavily dominate the sector accounting for over 80 per cent of total employment. The distribution of sectoral employment is also heavily skewed with over 70 per cent of industry employment concentrated within the 8 largest firms.

TABLE 4: Structure of Respondents (n=98)

	Total Emp	%
NI Owned	3,738	19
Externally Owned	15,726	81
Total	19,464	100

Source: NIERC (2001)

3.2 Structure of Industry Employment

Almost half of the industry was composed of operators/assemblers, whilst craft level workers[2] represented the next largest occupational grouping of labour, accounting for 27 per cent of employment (Table 5). Approximately 13 per cent of the workforce held technician level qualifications[3] or were graduates from mechanical engineering degree programmes. Just over 10 per cent of employment was made up of non-operational labour, such as administrators etc., not directly involved in engineering related production activities. Females account for 10 per cent of total employment and are most heavily represented within the support staff aggregate, however, they account for less than 5 per cent of total employment within the two most senior operational categories (Appendix 1, Table A1).

TABLE 5: NI Industry Employment Structure

	No. Employees	% of Total Emp
Operators/Assemblers	9,554	49
Mechanical Craft Level	5,194	27
Mechanical Technicians	460	2
Mechanical Grads no exp	112	1
Mechanical Grads 1-2 yrs exp	294	2
Mechanical Grads 2+ yrs exp	687	3
Mechanical Project Leaders	497	3
Mechanical Senior Managers	418	2
Other Staff	2248	11
Total	19,464	100

Source: NIERC (2001)

The structure of the NI industry appears to differ substantially from the GB average with local firms more reliant on assemblers and craft level workers (Table 6). A natural reaction to a finding of higher concentrations of low-skilled labour would be to conclude that local firms' operations are more heavily focused on lower value-added activities. However, this seems unlikely given that the NI industry also employs higher proportions of graduate engineers. The employment share of non-operational staff in GB is almost twice that of NI industry and whilst little is known of the composition of this grouping, such a difference is unlikely to arise because of a higher concentration of administrative support staff in GB. Rather, GB industries' higher non-operational employment share is more likely to be driven by a divergence in the sectoral composition of industry employment that generates a greater need for professional level staff such as software and/or electronic engineers fulfilling design roles. Thus, whilst the pattern of employment in NI diverges from that of GB, there is no simple underlying pattern to these differences. It is not correct to characterise local

2 These workers are assumed to have gained qualifications up to and including NVQ level 3.

3 HND /HNC qualifications.

industry as being concentrated at the lower value-added end of the market, instead it seems more likely that the NI firms require a different mix of skills due to differences in the sectoral composition of the industry (recall, in particular, the disproportionate significance to NI of Other Transport Equipment).

TABLE 6: NI/GB Employment Structure

	NI%	GB%
Operators	49	34
Craft Workers	27	21
Technicians	2	9
Professional Engineers	9	5
Mechanical Managers	2	4
Others	11	27
Total	100	100

Source: NIERC (2001), EMTA (1999)

3.3 Employer Perceptions of the Current State of the Labour Market

As a preliminary indication of the tightness of the labour market, respondents were asked to assess the degree of difficulty involved in recruiting staff at various levels. Over 60 per cent of firms recruiting graduate engineers (with over 2 years experience), project leaders and senior managers, described the recruitment process as difficult or very difficult (Table 7). This contrasts significantly with the labour market for new graduates, which appears to be relatively well supplied with less than 15 per cent of recruiting firms reporting difficulties. Just 14 firms had a history of recruiting at the new graduate level, suggesting that the majority of firms have limited scope for filling senior posts internally, perhaps explaining the intense competition for more experienced graduate level staff. Between 50 and 60 per cent of firms also perceived the labour market for more junior levels of staff (assemblers, craft workers and technicians) to be relatively tight, although less than 20 per cent of firms described recruitment as being very difficult.

By utilising the results of previous NIERC studies,it is possible to benchmark perceived difficulties in the labour market for mechanical engineering staff with those reported for the NI Electronics and IT sectors. However, we must be mindful when making such comparisons, as the surveys relate to slightly different time periods, thus there is likely to have been some change in labour market conditions within the IT and electronics sectors. Nevertheless, relative to the electronics sector, a slightly higher proportion of mechanical engineering employers perceived the recruitment of operator level staff to be difficult, however, the recruitment of craft level workers was perceived to be much more problematic than in either of the other two sectors (Table 8). Conversely, the recruitment of graduate level staff was perceived to pose much less of a problem for employers in

TABLE 7: Ease of Recruitment (%)

	Very Easy	Quite Easy	Difficult	Very Difficult	N
Operators/Assemblers	21	30	30	19	94
Mechanical Craft Level	20	28	35	17	65
Mechanical Technicians	7	34	43	16	44
Mechanical Grads no exp	14	71	7	7	14
Mechanical Grads 1-2 yrs exp	5	48	38	10	21
Mechanical Grads 2+ yrs exp	0	39	33	28	36
Mechanical Project Leaders	14	20	40	26	50
Mechanical Senior Managers	13	16	26	45	38

Source: NIERC (2001)

TABLE 8: Percentage of Firms Describing Recruitment as Difficult / Very Difficult			
	Mechanical	Electronics	IT[4]
Operators / Assemblers	49	45	-
Craft Workers	52	31	28
Non-Grad Tech Support / Technicians	59	58	28
Grads no experience	14	58	39
Grads <2yrs experience	48	89	70
Grads 2+ experience	65	82	70
Project Managers	66	89	71
Senior Managers	71	78	69

Source: NIERC (2000, 2001)

mechanical engineering relative to those operating in IT or electronics.

Whilst perception-based measures of shortage are useful they can be problematic. For instance, the approach cannot generate quantifiable measures of shortfall nor is it possible to control for sources of subjective bias arising from differences in how respondents define a term such as "difficult". In order to overcome these problems, information was collected on the number of unfilled vacancies occurring in the twelve months preceding the survey, thus enabling us to generate estimates of the actual rate of shortfall occurring within each of the various occupational categories. 24 firms reported a total of 124 unfilled vacancies over the period July 2000 – July 2001 (Table 9), with over 95 per cent of these vacancies occurring at the sub-graduate level. Recruitment problems were most apparent at the operator and craft levels. Accepting that assembly level staff require little prior training, most of the current skill problems within NI mechanical engineering appear to be centred around a shortfall of new entrants (or existing workers) holding intermediate level qualifications e.g. NVQ level 3s /Modern Apprenticeships. By standardising the number of unfilled vacancies in each category by the number of persons employed in that category, we can derive actual vacancy rates[5]. Although the vast majority of vacancies occur at the operator and craft levels, the highest rate of shortage is evident at technician level. The relatively small size of the technician category implies that firms are more likely to be exposed to constraints arising from small shortfalls in the availability of qualified labour. However, on the plus side, such potential problems are easily avoided through minimal expansions in the levels of new qualifier supply. The craft level and total industry categories are the only other aggregates exhibiting positive shortage rates of 1 per cent respectively. Thus, despite the relatively high numbers of unfilled vacancies reported within the sector, our analysis suggests that, with the exception of technician level operations, the overall performance of the industry is unlikely to be heavily constrained by shortfalls.

We can once again benchmark the vacancy rates of the mechanical engineering industry against those of our earlier studies. The rate of shortfall experienced in the market for mechanical technician level staff is similar to that reported for firms in electronic engineering, however, the shortage of mechanical craft level workers appears much less severe (Table 10). Generally however, the total vacancy rate suggests that relative to either the electronics or IT sectors, there appears to be a significantly lower likelihood that

4 Within the IT study no distinction was made for support staff at NVQ3 and HND level. Consequently, one figure is quoted for both.

5 These are calculated as (unfilled vacancies/(number employed + unfilled vacancies))*100.

TABLE 9: No. and Rate of Unfilled Vacancies in last 12 months					
	No. of Firms	No. of Unfilled Vacancies	Total No. Employed	% Shortage	Vacancy Rate
Operators/Assemblers	10	46	9,554	0	0
Mech. Craft Level	16	55	5,194	1	1
Mech. Technicians	7	17	460	4	4
Mech. Grads no exp	0	0	112	0	0
Mech. Grads 1-2 yrs exp	0	0	294	0	0
Mech. Grads 2+ yrs exp	2	3	687	0	0
Mech. Project Leaders	1	1	497	0	0
Mech. Senior Managers	2	2	418	0	0
Total	24	124	17,216	1	1

Source: NIERC (2001)

TABLE 10: Comparative Vacancy Rates			
	Mechanical	Electronics	IT
Operators/Assembler	0	2	-
Craft	1	24	1
Non-Grad Tech Support	4	3	1
Grads no experience	0	10	-
Grads <2 yrs experience	0	6	-
Grads 2 + experience	0	22	-
Project Managers	0	7	11
Senior Managers	0	0	1
Total	1	4	5

Source: NIERC (2000, 2001)

performance levels within the mechanical engineering industry will be constrained as a result of skill shortages.

3.4 Causes, Consequences and Reactions to Unfilled Vacancies

Respondents were asked to rank, in terms of importance, the main factors contributing to their inability to fill vacancies at various levels (Appendix 1, Tables A2-A5). Firms generally attributed recruitment problems at operator level to a lack of interest amongst potential applicants. Firms reporting difficulties at craft and technician level ascribed their problems primarily to shortfalls in applicants with suitable qualifications/ experience, in addition, those recruiting at HND level stated that applicants tended to lack technical expertise. These results provide preliminary indications that there may exist inadequacies in the supply of NVQ 3 and HND qualified labour, whilst some concerns may also

exist in relation to the course content of technician level programmes. Firms experiencing graduate level unfilled vacancies believed these principally to derive from shortfalls of qualified applicants. However given the very small number of unfilled vacancies occurring at this level (less than 5 per cent of the total) this should not be interpreted as an indication of graduate level supply-side inadequacies.

The 24 firms reporting a total of 124 unfilled vacancies were then asked to outline the main constraints upon organisational performance arising as a result of recruitment shortfalls. Over three-quarters of affected firms asserted that their organisations experienced lower productivity, a loss of credibility or an inhibited ability to meet deadlines as a direct result of unfilled vacancies (Appendix 1, Table A6).

When asked about the actions taken to try and alleviate skill shortages, the principal response of firms was to simply carry on looking, with this strategy adopted for unfilled vacancies occurring at each level (Appendix 1, Tables A7-A10). However, other strategies were adopted which were specific to particular types of vacancy, for instance, firms experiencing difficulties in attracting assemblers tended to make use of New Deal whilst the adoption of a wider advertising campaign was favoured by firms seeking to recruit craft level workers. In an attempt to alleviate vacancies at HNC/HND level, firms tended to use recruitment agencies, with those experiencing graduate level shortages also adopting this strategy in addition to launching recruitment campaigns outside of the region.

3.5 Inter-organisational Labour Flows

A further indicator of labour market conditions was obtained by tracking labour flows within the industry in the twelve months preceding the survey. A total of 740 workers changed jobs throughout the year. The rate of turnover was highest at operator level accounting for 70 per cent of total labour flows. A significant amount of movement also took place at craft level, with almost 140 workers changing jobs throughout the year (Table 11). Despite the relatively high number of mobile workers, the actual rate of turnover was quite small, accounting for just 4 per cent of total employment. The industry turnover rate equated to one third of that reported for the electronics industry in a recent study (NIERC 2001). The bulk of inter-organisational labour flows took place between NI firms with a minimal amount of leakage to other regions or countries.

TABLE 11: Inter-organisational Labour Flows

	Total Lost	% Within NI	% of Total Emp
Operators/Assemblers	518	96	5
Mech. Craft Level	139	96	3
Mech. Technicians	22	95	5
Mech. Grads no exp.	4	100	4
Mech. Grads 1-2 yrs exp	9	100	3
Mech. Grads 2+ yrs exp	33	97	5
Mech. Project Leaders	10	100	2
Mech. Senior Managers	5	100	1
Total	740	96	4

Source: NIERC (2001)

3.6 Relative Wages

Information was collected on annual wage rates offered when recruiting staff within the various occupational categories (Table 12). This information is useful as it enables us to assess both the distribution of earnings within the industry and also across regions. Starting salaries ranged from £12,841 for operators / assemblers to £27,876 for senior managers, however, the distribution is relatively tight with just £2,872 separating the earnings of operators and graduates with less than 2 years experience. The annual earnings of new and inexperienced graduates fell below those of technicians, however, this is not necessarily surprising given the contribution to the sector made by experienced technicians and the traditional pay progression, for example experience by workers with apprenticeships. Given that significant wage differentials between proximate geographical regions are likely to impact on labour supply, an assessment was made of relative wage rates in NI vis-à-vis like firms in the Republic of Ireland (RoI) and Great Britain (GB). Comparable data for RoI was unavailable for the upper and lower ends of the distribution however, the wage rates offered to craft and new / inexperienced graduates within NI were broadly in line with those offered in the Republic of Ireland. Data availability became even more problematic for the GB sector, nevertheless, comparable data was available at craft and project leader level and whilst the wages of NI craft workers were broadly in line with those in GB, project leaders within NI appeared to earn substantially less.

Relative to other industries, wage rates up to and including technician level 4 are broadly comparable with those of the electronics sector, however, mechanical engineering earnings lag those of electronics for more senior grades of staff (Table 13). Generally speaking wage rates within mechanical engineering appear to be in line with those of the IT sector.

TABLE 12: Gross Average Annual Salaries in NI, GB & RoI (£stg)

	NI	GB	RoI
Operators/Assemblers	12,841	-	-
Mech. Craft Level	13,038	15,039	15,405
Mech. Technicians	15,846	-	13,455
Mech. Grads no exp.	15,584	-	-
Mech. Grads 1-2 yrs exp	15,713	-	14,000
Mech. Grads 2+ yrs exp	19,478	-	19,500
Mech. Project Leaders	20,436	29,921	-
Mech. Senior Managers	27,876	-	-

Source: NIERC (2001), New Earnings Survey (2000), Marlborough Group (2001)
Note: RoI Craft Level salary represents the mean annual salary of fitters and toolmakers with 1-2 years experience. RoI technician salary represents the average annual salary for technicians with 1-2 years experience.

TABLE 13: Gross Average Annual Salaries: Mechanical, Electronics & IT			
	Mechanical	Electronics	IT
Operators/Assemblers	12,841	10,275	-
Craft Level/Technicians Level 3	13,038	13,821	12,918
Technician Level 4	15,846	14,451	12,918
Mech. Grads <2 yrs exp	15,584	17,194	14,939
Mech. Grads 2+ yrs exp	19,478	22,217	-
Mech. Project Leaders	20,436	24,971	22,907
Mech. Senior Managers	27,876	34,000	26,375

Source: NIERC (2000, 2001)
Note: The Salaries for the IT sector were recorded in 2000 whilst those for electronics are 2001 figures

3.7 Perceived Competencies of New Entrants

In order to provide an indication of employers' satisfaction with the quality, structure and content of educational programmes, respondents were asked to assess the competencies of new entrants to the industry at the various educational levels. Between 20 and 40 per cent of employers were of the opinion that the business awareness skills of new entrants were below required levels (Appendix 1, Table A11), with the highest degree of dissatisfaction recorded for NVQ 3 and HNC / HND new entrants (38 and 32 per cent respectively). There was some concern relating to the IT and technical competencies of new NVQ 3 entrants, with 21 and 15 per cent of employers respectively reporting deficiencies in these areas. There was also dissatisfaction with the technical/IT training component of HNC / HND programmes, however, the proportions recording deficiencies were somewhat lower than was the case for NVQs (14 and 7 per cent respectively) (Appendix 1, Table A11). Generally, employers seemed relatively satisfied with the IT and interpersonal competencies of undergraduate/postgraduate qualifiers, however there may be issues surrounding the technical content of some postgraduate courses with 11 per cent of firms reporting deficiencies amongst new entrants from these programmes.

3.8 Skill Priorities of Employers

Respondents were asked to rank the importance of equipping new entrants with certain skills, with a recognition that such demands would vary according to educational category. However, these responses do not imply deficiencies within existing course structures, they merely represent the training preferences of existing employers i.e. there has been no analysis matching training provision with demand. A range of skills appear to be in demand at craft level with at least 60 per cent of employers ranking the following skills as most important; welding (78%), milling / grinding etc. (66%), CNC machine operating (63%) (Appendix 1, Table A12). At technician and graduate level the skills demanded by employers in order of preference are quality control, production management and design with over two thirds of relevant employers categorising the attainment of these skills as most important (Appendix 1, Table A13 & A14). The acquisition of management skills is also classified as an important component of graduate engineer training, which when considered alongside the perceived deficiencies in the business awareness skills of graduates (and other new entrants) emphasises the importance of such attributes in the eyes of employers.

3.9 Perceived Competencies of Existing Staff

Respondents were also asked to rank the competencies of existing staff on the basis that such skill gaps could also inhibit company performance. However, given that we are dealing with a stock concept, such deficiencies do not imply inadequacies within existing training structures. Poor problem solving skills amongst assembly level staff were reported by 20 per cent of employing firms whilst 10 per cent of relevant employers also reported low literacy standards amongst this group (Appendix 1, Table A15). Given that assemblers constitute around 50 per cent of total industry employment, such basic skill deficiencies have the potential to severely constrain the performance of the industry. In addition to constraining output, a lack of basic skills will also generate higher industry recruitment and training costs, this was highlighted by a key informant who reported that of 3,000 operator level applications, 34% did not meet basic entry requirements. Further, when applicants met paper entry requirements our key informant reported that new entrants required retraining in basic functions such as precision measuring and shop floor health & safety, even when such staff were recruited from other mechanical engineering firms. Whilst these findings require validation, they are worrying in that they suggest a lack of basic numeracy and literacy skills amongst applicants at operator level and a lack of transferable basic engineering skills amongst those workers seeking re-employment within the industry. Another key informant cited the lack of basic skills at operator level to be a particular problem given the need for competent shop floor level staff to fill team leader roles arising from the increased use of cellular working models within the industry.

In relation to existing staff carrying out higher level functions, there was some dissatisfaction with the level of business awareness amongst craft, technician and new / inexperienced graduate level workers (Appendix 1, Table A16). Around one-quarter of firms employing craft level labour reported skill gaps in computer literacy standards suggesting a need for continuous upgrading of IT skills at this level (Appendix 1, Table A16). However, firms were relatively satisfied with the general IT competency and technical skills of professional / technical support level staff (Appendix 1, Table A16). Finally, 18 per cent of firms reported deficiencies in the interpersonal skills of technician level 4 staff.

The consequences of skill gaps amongst existing staff were felt to be significant with over 70 per cent of employers expressing a view that such deficiencies led directly to lower productivity and/or higher running costs (Appendix 1, Table A17). In addition, almost two-thirds of firms stated that their ability to meet deadlines was impeded.

3.10 The Incidence of Off-the-Job and On-the-Job Training

Information was provided on both the level and intensity of training provided within organisations (see Appendix 1, Table A18). Most of the emphasis on off-the-job training appears to be concentrated on enhancing the skill levels of assembly level staff which perhaps is a consequence of the problem relating to both new and existing workers discussed earlier. Relative to the electronics sector, off-the-job training is more heavily concentrated within the lower occupational tiers and is generally less common amongst technician and graduate level groupings. The overall proportion of mechanical engineering firms delivering off-the-job training is 15 percentage points below that reported in a recent study of the electronics sector (NIERC 2001).

There appears to be a relatively well developed culture of on-the-job training in the industry. Compared to the electronics sector, skill enhancement operations once again tended to be concentrated within the lower occupational tiers (Appendix 1, Table A19). Nevertheless, 97 per cent of companies sampled undertook some form of on-the-job training, a proportion that exceeded those reported within recent studies of the electronics and IT sectors respectively (Appendix 1, Table A19) (NIERC 2001).

4 The Balance of Educational/Training Supply and Industry Demand

In addition to providing an overview of general labour market conditions in the mechanical engineering industry, this report also assesses the adequacy of current labour supply emanating from educational and training institutions over a five year forecast horizon[6]. The subsequent analysis is purely quantitative in nature, designed solely to identify any potential supply-side imbalances that might exist. Accordingly issues relating to course content and /or quality are not considered. The methodological framework employed for this element of the study follows five distinct stages:

(i) The production of industry level employment forecasts for the period 2001 – 2006.

(ii) The estimation of the demand for new entrants through the application of demand-side ratios to the forecasts generated under step (i).

(iii) The extrapolation of the historical enrolments/ leavers relationship to project estimates of the number of persons likely to gain mechanical related qualifications at various levels.

(iv) Future labour market supply is assessed through the application of labour market entry rates to the forecasts generated under step (iii).

(v) Comparing the demand [step (ii)] and supply [step (iv] projections assesses potential labour market imbalances.

The above analysis is adapted slightly so that risk scenarios on either the demand or the supply side can be considered and their implications assessed.

4.1 Forecasting Future Industry Employment

Future industry employment is assessed through the application of two distinct modelling approaches, the first looks at the balance between new firm start ups, survivor growth and firm failure rates, whilst the second is based upon standard econometric modelling techniques. The adoption of distinct modelling scenarios facilitates the development of a "forecasting range" within which future supply conditions can be assessed.

4.1.1 Accounting Based Approach

The first method incorporates the growth expectations of existing firms (derived from our survey) into a simple accounting relationship, with end of year employment depending on the balance between survivor growth, new firm formation and company closures. The model can be formally written as follows:

Et = St + Nt (1) *where*

St = Et-1*((1-Cr)*(1+Sr)) (2)

Nt = (Et-1*Fr)*((1-Cr)*(1+Nr)) (3)

Et, Employment end of year t
St, Net Survivor employment end of year t
Nt, Net new firm employment end of year t
Cr, Closure rate
Sr, Existing firm survivor growth rate
Fr, New firm formation rate
Nr, New firm survivor growth rate

The model is essentially driven by the survivor growth term Sr, which is based on the 2002 – 2006 employment expectations of existing firms contacted in the course of our survey. The new firm formation rate (Fr) was generated from a time-series, which tracked start-up activity within the sector between 1995 – 2001. The closure rate was calculated on the basis of a weighted average of IDB and LEDU closure rates for the period 1996–1998 (Full details of the rates and model are given in Appendix 2).

The new firm survivor growth term (Nr) recognises the fact that new firms typically experience higher rates of growth than established firms. However, due to insufficient data on historical new firm growth within the NI mechanical engineering sector, the rates used in the model were computed as half the mean of the combined IT and electronics new firm survivor growth rates (See Appendix 2 for details).

6 The supply side analysis is restricted to full-time students as doubt surrounding the economic status of part-time students implies that they cannot be considered as additional labour supply.

4.1.2 Scenario 2 - The Time-Series Approach

This methodology uses time-series econometric forecasting techniques to estimate future employment growth in the mechanical engineering sector, based on the past values of a set of explanatory variables. Appendix 2 details the estimation procedures, the resultant model can be written as follows:

$$NIgrow_t = c + \beta_1 * \mathbf{Realint}_{t-1} + \beta_2 * \mathbf{Realint}_{t-2} + \beta_3 * \mathbf{Germrintt}\text{-}2 + \beta_4 * \mathbf{Ukcapg}_{t-1} + \beta_5 * \mathbf{Ukcapg}_{t-2} \quad (4)$$

where

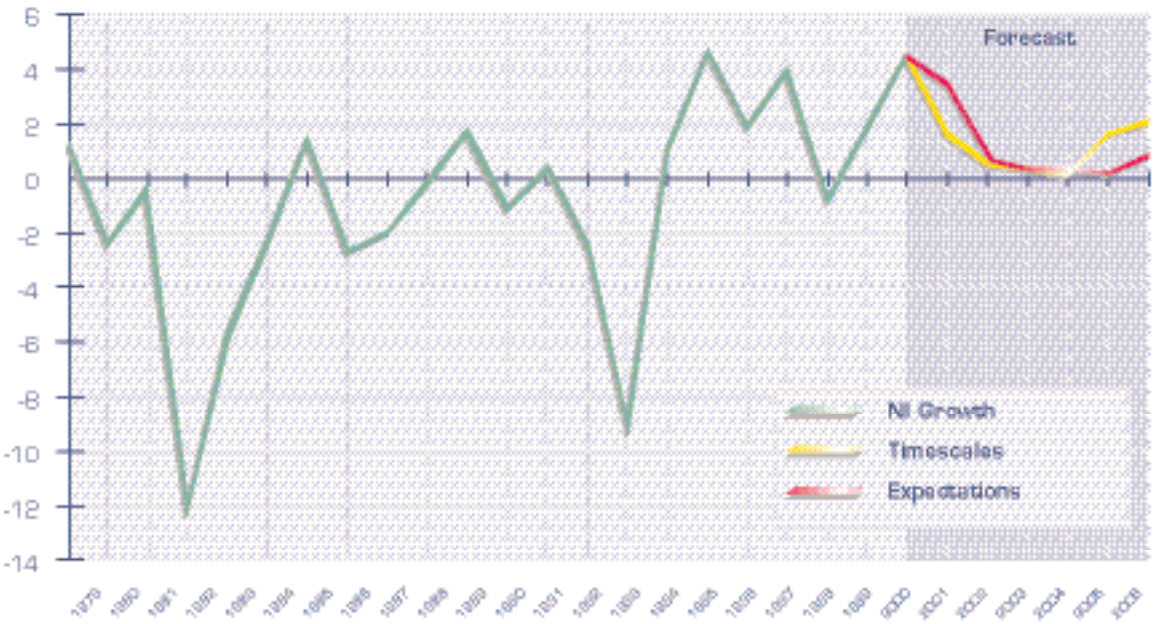
NIgrow = growth in Northern Ireland mechanical engineering sector
Realint = UK real interest rate
Germrint = German real interest rate
Ukcapg = growth in UK per capita GDP

The results indicate that growth in UK per capita GDP exerts the largest influence on NI mechanical engineering, with employment in the sector rising by just under 2 per cent for every 1 per cent growth in the economy. The model also suggests that a tightening of domestic monetary policy has an overall negative influence on growth, whilst a rise in German interest rates tends to boost growth implying that employment tends to be positively linked to the European business cycle[7].

4.2 Projected Employment Growth

The growth rates projected under each of the scenarios are illustrated in Figure 3. The models generate almost identical forecasts with growth predicted to be relatively depressed under each scenario, ranging from between 0.2% and 2.1% over the period 2002 to 2006. The most notable factor of both forecasting scenarios is a lack of growth over the forecast horizon. The lower growth within the models is readily explained by a predicted general slowdown in macroeconomic activity (time-series), which has fed through to relatively pessimistic firm level expectations (expectations-based). In previous NIERC studies the various projection techniques adopted have yielded high and low growth scenarios which have facilitated the development of a third medium growth state[8] (NIERC 2000, 2001), however, in this instance the similarity of the projections have rendered this unworkable. Whilst the uniformity of our models' output is reassuring, it is still important that our analysis

Figure 3 - Historical & Forecast Employment growth: 1979-2006



Source: DETI (2001) NIERC (2002)

7 The German interest rate is included as an explicit indicator of European monetary policy and as a proxy for European business conditions (both of which could have disparate influences on employment growth). The positive coefficient on the German interest rate would tend to suggest that the business cycle effect represents the over-riding influence.

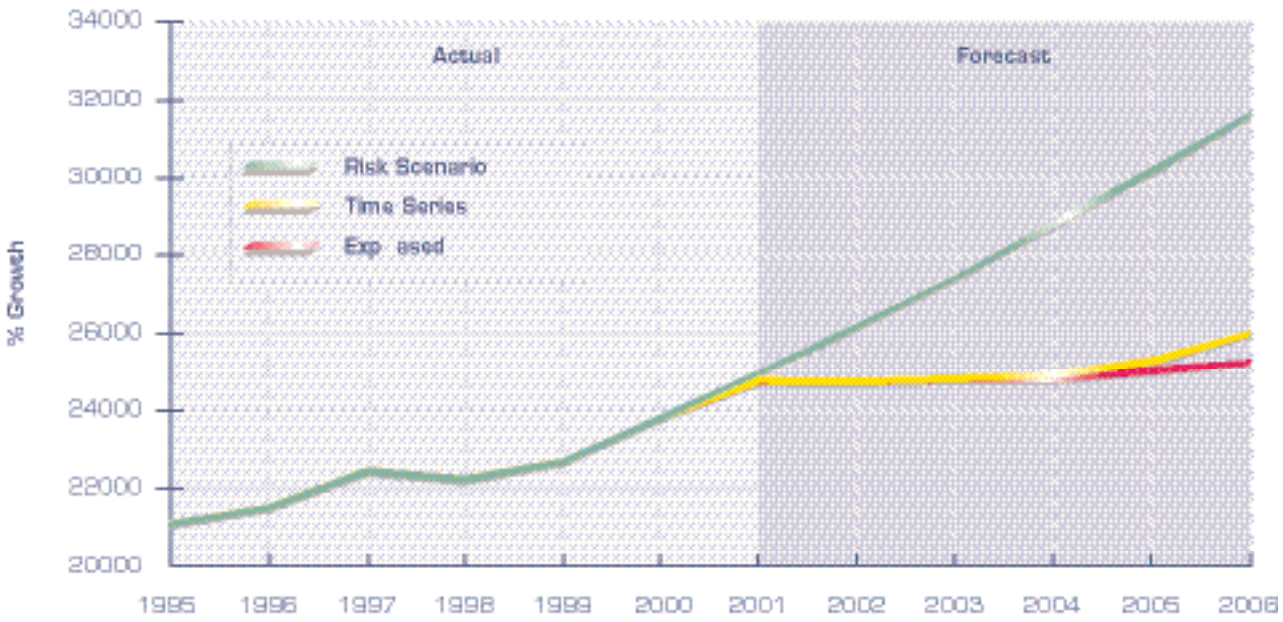
8 This was derived by taking the mean growth rates of the two extreme scenarios.

guards against the possibility that growth may follow a more accelerated path due to, for example, unforeseen positive external shocks. Consequently, a "high growth" scenario was incorporated into the framework based on the possibility that future employment expands at a rate equivalent to twice the annual average historical growth rate recorded for the period 1995 – 2000. Under this high risk scenario employment is projected at a rate of 4.8% annually. ***Whilst we believe such a growth trajectory to be highly unlikely, it provides a useful range within which to assess the adequacy of educational and training supply.***

The employment trajectories generated under the various scenarios are illustrated in Figure 4. Due to the fact that the survey was conducted during July/August 2001 it was necessary to estimate employment for the remaining 4 months of the year, consequently each scenario generates a slightly different end of year 2001 figure. The principal characteristics of the forecasts are summarised below:

- Over the period 2001 – 2006 employment is projected to expand from 24,691 to 25,331 under the expectations-based model, from 24,758 to 25,978 under the time-series model and from 25,022 to 31,676 under the high growth/high risk scenario.
- Under the time-series and expectations-based models employment is projected to remain relatively constant at around 25,000 over the forecast period.
- The high risk scenario represents an almost linear extension of the 1999 – 2001 employment pattern across the forecast horizon.
- Since both the time-series and expectations-based models generate very similar projections we consequently employ just one i.e. the slightly more optimistic time-series model.

Figure 4 - Actual & Forecast Employment 1995-2006



Source: DETI (2001) NIERC (2002)

4.3 Estimating the Demand for New Entrants

The demand for new entrants at NVQ3, HND and new graduate level was estimated by applying appropriate industry level demand coefficients for each grouping to the industry employment forecasts. Asking respondents to detail the breakdown of their future recruitment activities (in percentages) across the various employment categories facilitated the derivation of firm level demand coefficients. Industry level coefficients were then calculated for each occupational aggregate as the weighted average of the

individual firm level ratios with the weighting applied according to 2001 firm size (equation 5).

$$Dfind = \frac{\sum_{n}^{i} empi * dfi}{\sum emp} \quad (5)$$

The industry demand coefficients reported in Table 14 reveal that assemblers constitute the largest single element of future demand accounting for almost two thirds of anticipated future recruitment flows. Exactly 30 per cent of demand is directly related to supply generated by educational and training institutions. Craft level demand represents the most important component of new entrant requirements accounting for almost a quarter of total demand and over three-quarters of qualified new entrant demand. Relative to the existing employment structure (Table 5) the envisaged pattern of recruitment is more heavily orientated towards assemblers and away from support staff. The relative decline in the position of support staff is largely unsurprising, as one would not expect functions such as administration and finance to expand proportionately with the rest of the organisation.

TABLE 14: Anticipated Recruitment Structure of Qualified Labour

	%
Operators/Assemblers	60
Mechanical Craft Workers (Level 3)	23
Mechanical Technicians (Level 4)	4
Mechanical Grads no experience	3
Mechanical Grads 1-2 yrs exp	4
Mechanical Grads 2+ yrs exp	2
Mechanical Project Leaders	1
Mechanical Senior Managers	1
Other Staff	2
Total	100

Source: NIERC (2001)

Additional new entrant demand was assessed by applying the above ratios for craft, technician and new graduate level staff to estimates of additional employment generated by the time-series and the "high demand" scenario. Given that additional demand is driven by these forecasting models, it must be remembered that whilst total industry employment is assumed to expand linearly under the "high demand" scenario, under the time-series scenario growth is minimal over a significant portion of the forecast horizon. The demand for craft level workers was relatively buoyant in 2001 with estimates of 207 and 267 generated under the time-series and risk scenarios respectively. However, whilst the demand for craft workers under the risk model increases steadily to 336 in 2006 (Appendix 2, Table A38), under the time-series model annual demand falls between 10 and 30 over the 2002–2004 period before rising to 96 in 2005 and 123 in 2006 (Appendix 2 Table A32). Technician level demand under the risk model remained relatively constant at around 50 over the forecast horizon (Appendix 2, Table A39), however under the time-series model demand fell from 36 in 2001 to between 2 and 5 over the 2002– 2004 period before rising to approximately 20 during 2005 and 2006 (Appendix 2, Table A33). In relation to graduates, there was again little fluctuation in the output of the risk model with annual demand estimated at approximately 30–40 per annum in this instance (Appendix 2, Table A40). Finally, under the time-series model new graduate demand falls close to zero after 2001 and in fact does not rise above 10 until 2005 (Appendix 2, Table A34).

4.4 Assessing new-entrant Supply

Our supply figures are based on students participating in full-time study since many part-time students are already employed and thus cannot be assumed to constitute additional labour market supply. Final labour market supply is assessed through the application of labour market entry rates to an estimated qualifying student flow derived from the historical enrolments/leavers relationship. Thus our supply estimates are not based on university planning regimes or student preferences, but instead merely represent projected outcomes based on the assumed continuation of historical relationships.

The Balance of Educational/Training Supply and Industry Demand

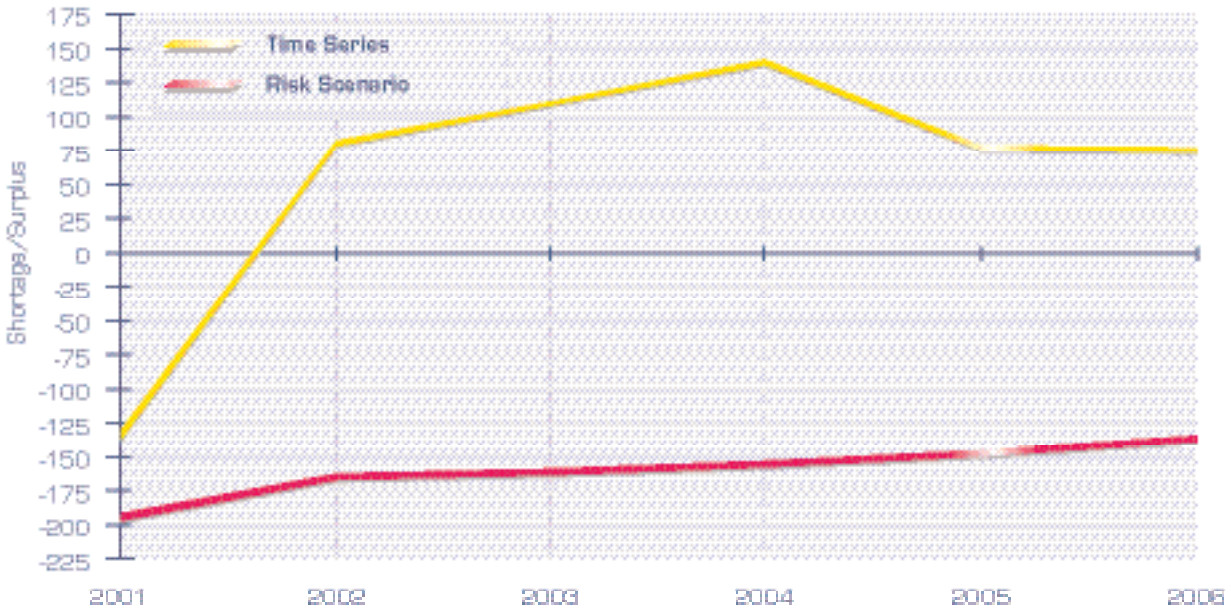
The enrolment projections are shown in Appendix 2, Tables A41 and A42. Total undergraduate enrolments fell slightly over the 1996/97 – 2000/01 period, however, due to the increase in enrolments at the individual course level our projections show a net growth in future undergraduate enrolments from 164 in 2001/02 to 200 in 2005/06. Total postgraduate enrolments have fallen continuously from 82 to 31 in the period 1996/97 – 2000/01, this downward trend is projected to continue until 2005/06[9] with enrolments falling to just 24 in that year.

The number of NVQ Level 3 enrolments tripled between 1996/97 and 2001/02, from 98 to 317, however it seemed unlikely that this trend would continue over the forecast period due to the large numbers of places that would need to be filled. Thus in order to project level 3 enrolments forward, the mean growth rate for total Full Time Further Education enrolments over the period 1996/97 – 2000/01 was used (15% p.a.). However, this scenario, based on the aggregate FE expansion rate, would still see enrolments rise to 644 in 2005/06 representing a**n extremely optimistic growth path, which must be borne in mind when assessing potential imbalances**. The number of NVQ Level 4/HND enrolments is projected to remain relatively constant over the forecast horizon at around 45.

The leavers' projections are aggregated up from course level information and allow for variations in the time taken to complete individual courses. Thus at FE level 3, leavers in period t are assessed as a proportion of entrants in t-2, similarly at undergraduate level, leavers from sandwich courses in t are assessed as a constant proportion of enrolments in t-4 and so on (see Appendix 2, Tables A43 and A44). Over the period 2001/02 to 2005/06 the number of graduates is projected to rise slightly from 155 to 162, with Level 4 and HND qualifiers expected to remain quite low, at just 13 per annum. Finally, the number of persons gaining NVQ Level 3 qualifications is projected to rise from 143 in 2001/02 to 252 in 2005/06.

Labour market supply at each level is derived by the application of labour market entry rates, supplied by DEL, to the qualifier numbers (Appendix 2, Table A45). Over the forecast horizon 2001/02 – 2005/06 graduate supply is expected to rise slightly from 76 to 81 with Level 4 supply expected to remain negligible at between 7 and 10 workers per annum. The Level 4/HND supply figures are low because only a quarter of students enrolling on HND courses at HE institutions actually obtain the qualification. However, this does not necessarily imply poor completion rates as students transferring across onto degree programmes may also contribute. Finally, NVQ

Figure 5 - NVQ Level £ Supply minus Craft level Demand 2001-2006



Source: NIERC (2002)

9 Within the historical enrolments figures the rate of reduction in courses with falling enrolments is less than the rate of expansion in courses with rising enrolments resulting in an apparently declining historical trend exhibiting growth over the forecast horizon.

Level 3 supply is projected to rise from 75 to 201 over the forecast period.

4.5 Projected Imbalances

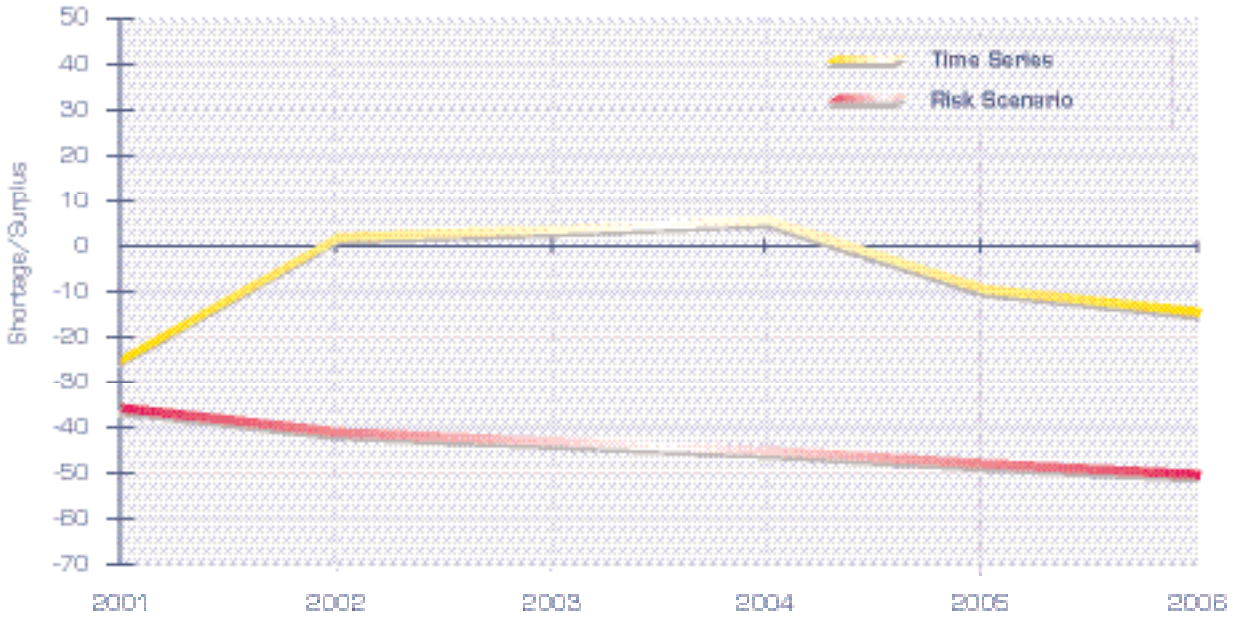
By subtracting forecast demand from forecast supply, we can assess the adequacy of educational and training provision at the different qualification levels.

The pattern of craft level supply oscillates under the time-series model from a shortage of 132 in 2001 to a surplus of 111 in 2003 before falling back to a surplus of 77 in 2006. However, under the risk scenario the projected balance remains in shortage throughout the forecast horizon with the level of shortfall ranging from -135 to -193.

However, remember that underlying the craft level projections is an assumption of rapid supply-side expansion that if not met will have serious implications for the surpluses projected under the time series model (Figure 5).

Supply at technician level is relatively low which when combined with the relatively stagnant demand levels forecast under the time-series model results in a situation of slight shortfalls / surpluses over the forecast period ranging from –26 to 5. However, demand under the risk based scenario is somewhat higher generating a pattern of sustained shortage over the forecast horizon, ranging from –37 to –51 (Figure 6).

Figure 6 - HND & NVQ Level 4 Supply Minus Technician Demand 2001-2006

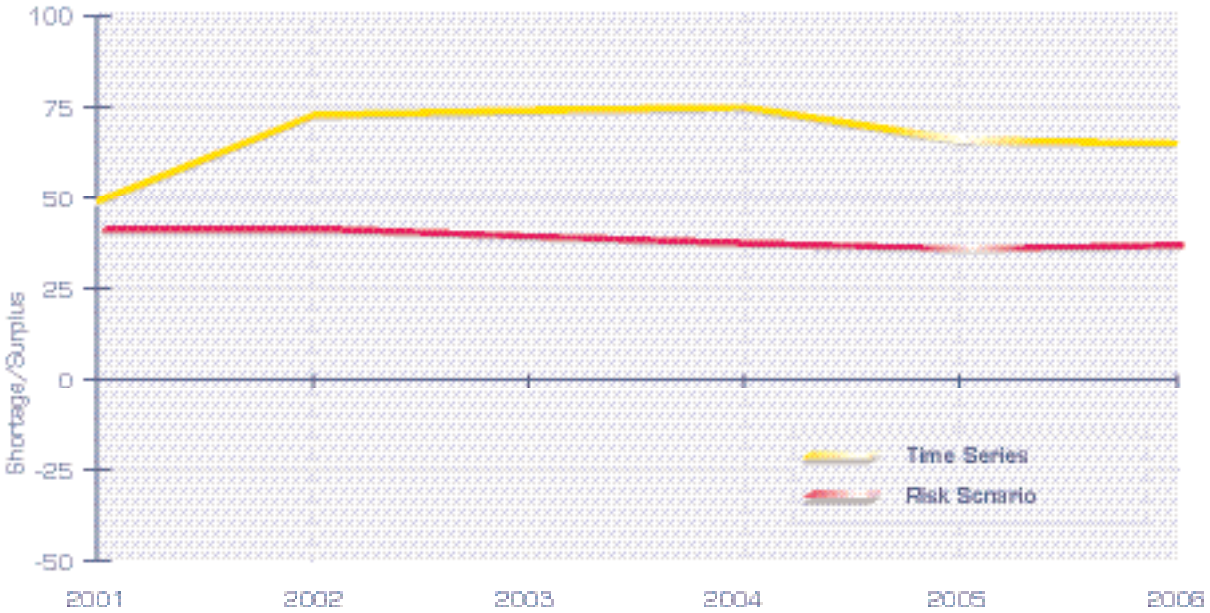


Source: NIERC (2002)

The Balance of Educational/Training Supply and Industry Demand

Finally, there appears to be little prospect of shortages occurring at graduate level with both the time series and risk models projecting surpluses over the forecast horizon. The projected surpluses range from 49 to 64 under the time series model and 36 to 41 under the risk based model (Figure 7).

Figure 7 - Graduate Supply minus Graduate Demand 2001-2006



Source: NIERC (2002)

5 Summary and Conclusions

Employment in the NI mechanical engineering industry has been in general decline since the beginning of the 1980s, with growth rather volatile and particularly susceptible to rapid and extreme negative shocks. The current industry structure is heavily skewed in terms of ownership and firm size, with 80 per cent of employment located in foreign owned companies and over two thirds located in fewer than 10 firms. Employers perceived the labour market for experienced graduate engineers to be relatively tight, with some difficulties also reported at operator, craft and technician levels. Nevertheless, perceived difficulties at graduate engineer level did not translate into unfilled vacancies, indicating that whilst recruitment at these levels was perceived as problematic firms were generally successful in filling professional level posts. In the twelve months preceding the survey a total of 124 vacancies remained unfilled within the industry with the vast majority of these occurring at the operator, craft and technician levels. Although the highest number of unfilled vacancies occur at craft and operator level, the highest rate of shortage was evident at technician level implying that the relatively small size of this aggregate leaves it much more susceptible to constraints arising from skill shortages. The overall rate of industry skill shortage was calculated at 1 per cent and relative to either the electronics or IT sectors there appears to be a significantly lower likelihood that industry performance will be inhibited as a result of unfilled vacancies. Staff turnover in the mechanical engineering industry equated to 4 per cent of total employment with the vast majority of activity concentrated between NI firms as opposed to labour leakages to other regions. The rate of labour turnover activity within the mechanical engineering sector was again quite low, amounting to one third of that reported for the electronics sector in a previous NIERC study (NIERC 2001).

Where data was available, occupational wage rates appear to be broadly comparable with those in the RoI, however, relative to GB, project managers in NI tend to earn significantly less. Generally, occupational earnings in mechanical engineering reflect those on offer within the IT sector but tend to lag those of electronics for more senior grades of staff.

There were concerns relating to the business awareness competencies for all levels of entrants from the education and training sector and the IT and technical competencies of NVQ level 3 new entrants. Finally, turning to the competencies of the existing workforce, there was evidence, deriving from both the survey and key informant interviews, to suggest a lack of basic numeracy and literacy skills amongst operator level staff and a lack of transferable basic engineering skills amongst workers seeking re-employment within the industry.

In relation to the forecasting scenarios, both the time-series and expectations based models developed within this study predict that the mechanical engineering sector is unlikely to grow rapidly over the forecast horizon, nevertheless the possibility of a more rapid growth scenario is accounted for by the inclusion of a "high demand" scenario. There is little prospect of any graduate level shortages occurring under either the time-series or the "high demand" scenarios. However, problems are more likely to occur at craft and technician level. Whilst the small size of technician level shortages imply that they could be easily eradicated and are unlikely to constrain the performance of the industry, there is a potentially greater need for action in relation to problems at craft level with relatively more significant shortfalls predicted under both forecasting scenarios. In addition, potential shortages at craft level will be even more pronounced should the assumed supply-side expansion fail to materialise[10].

Although we are relatively confident in our forecasts, we are also conscious of the fact that the mechanical engineering sector in NI has historically been, and is likely to remain, subject to large shocks such as the rapid downscaling of employment within shipbuilding and the impacts that September 11th had on the aerospace industry. Whilst the labour market position in

10 For instance, should craft supply remain at 2001 levels between 2001 – 2006 shortfalls will range from –48 and –132 under the time-series model and –193 and –261 under the risk based model.

relation to craft workers is prone to a rapid reversal, policy must remain focused on the alleviation of potential supply-side constraints. However, the ramping up of level 3 educational and training provision need not constitute the principal policy response to potential shortfalls. The general trend decline in employment within the traditionally dominant two digit industries (Other Transport and Machinery NEC) implies that there may exist sufficient numbers of craft trained workers already available within the labour market. Whilst such workers are likely to have been working outside their trades for some time and thus require retraining, they could potentially be equipped to re-enter their chosen professions within a relatively short time frame. Such a policy could potentially be facilitated by bodies such as DEL who are in a position to match sources of redundant skill labour with those firms seeking craft level workers.

References

Barclays Mechanical Engineering Review, May 2000

DfEE, 2000, *An Assessment of Skill Needs in Engineering*, DfEEa

DfEE, 2000, *Skill Shortages; An Initial Survey of the Evidence*, DfEEb

EMTA, 2000, *Labour Market Survey of the Engineering Industry in Britain*, EMTA, Watford

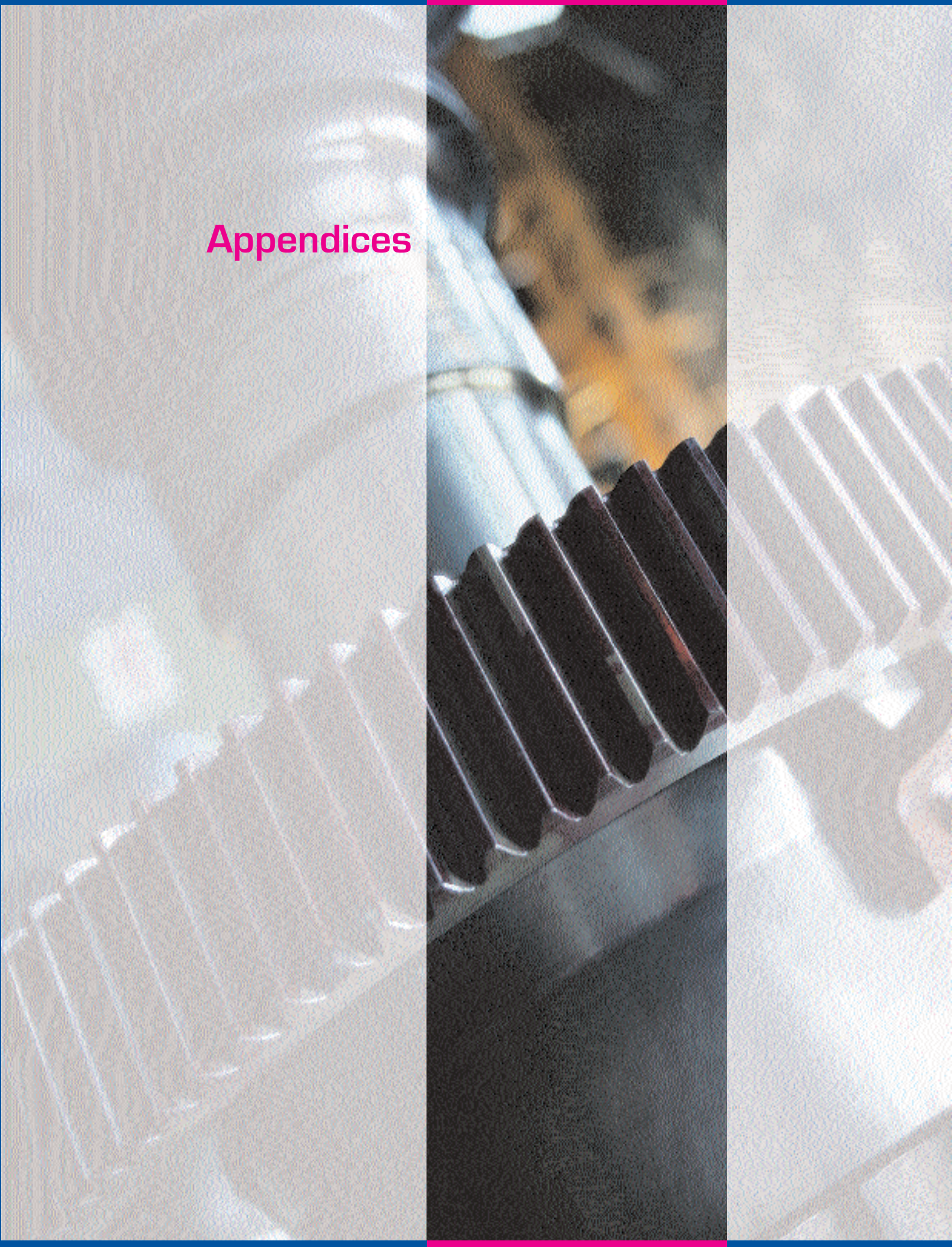
Marlborough Group, 2000, Salary Survey 2000, Marlborough Group, Dublin

NIERC 2000, *A Study of the Northern Ireland Labour Market for IT Skills*, DHFETE, Belfast

NIERC 2001, *A Study of Labour Market Conditions in the Northern Ireland Electronics Industry*, DEL, Belfast

Skills Taskforce 2000, *Engineering and Skills Formation in Britain; Cyclical and Structural Issues*, Skills Taskforce Research Paper 7

Appendices



Appendix 1: Survey Results

TABLE A1: Current Employment Structure of Respondent Firms (n=98)				
	No. Employed	% of Total Employment	% of Mechanical Employment	% Females
Operators/Assemblers	9,554	49	55	9
Mechanical Craft Level	5,194	27	30	1
Mechanical Technicians	460	2	3	3
Mechanical Grads no experience	112	1	1	5
Mechanical Grads <2 yrs experience	294	2	2	5
Mechanical Grads 2+ yrs experience	687	4	4	6
Mechanical Project Leaders	497	3	3	3
Mechanical Senior Managers	418	2	2	2
Other Staff	2,248	12	-	43
Total Mechanical Employment	17,216	88	100	6
Total Employment	19,464	100	-	10

Source: NIERC (2001)

TABLE A2: Reasons for Unfilled Vacancies at Assembler Level (n=10) (%)						
%	Not enough interest in assembler work	Negative perception of manufacturing	Salaries offered too low	Poor attitude of applicants	Lack of work experience	Competition from other employers
Very Imp	90	50	50	60	60	40
Important	10	20	20	20	30	10
Not Imp	0	30	30	20	10	50

Source: NIERC (2001)

TABLE A3: Reasons for Unfilled Vacancies at Craft Level (n=16) (%)						
%	Shortage of qualified applicants	Lack of work experience	Negative perception of engineering	Salaries offered too low	Poor attitude of applicants	Competition from other employers
Very Imp	88	69	25	13	13	50
Important	6	25	44	44	69	38
Not Imp	6	6	31	44	19	13

Source: NIERC (2001)

TABLE A4: Reasons for Unfilled Vacancies at HNC/HND Level (n=7) (%)						
%	Shortage of qualified applicants	Lack of technical ability	Lack of relevant experience	Salaries offered too low	Negative perception of engineering	Competition from other employers
Very Imp	71	86	71	14	14	57
Important	14	14	29	14	14	14
Not Imp	14	0	0	71	71	29

Source: NIERC (2001)

Appendix 1: Survey Results

TABLE A5: Reasons for Unfilled Vacancies At or Above Graduate Level (n=4) (%)

%	Shortage of qualified applicants	Lack of technical ability	Lack of relevant experience	Salaries offered too low	Negative perception of engineering	Competition from other employers
Very Imp	100	25	50	25	25	75
Important	0	75	50	0	25	25
Not Imp	0	0	0	75	50	0

Source: NIERC (2001)

TABLE A6: Difficulties Arising for Firms from Unfilled Vacancies (n=24) (%)

%	Lower Productivity	Loss of Orders	Lower Quality Product	Higher Running Costs	Inability to Develop New Products	Failure to Meet Deadlines	Impact on Firm's Credibility
Very Imp	54	46	21	42	30	54	50
Important	25	29	29	29	13	33	33
Not Imp	21	25	50	29	57	13	17

Source: NIERC (2001)

TABLE A7: Actions Taken Regarding Unfilled Vacancies at Assembler level (n=10)

	%
Recruit from other firms	40
Advertise more widely	70
Use recruitment agencies	80
Carry on looking	100
Increase the salary	60
Use Jobskills/New Deal	90
Use Bridge-to-Employment	50
Other	10

Source: NIERC (2001)

TABLE A8: Actions Taken Regarding Unfilled Vacancies at NVQ 3 Level (n=16)

	%
Recruit from other firms	38
Recruit from FE directly	63
Recruit from Jobskills directly	75
Advertise more widely	100
Use recuitment agenies	81
Carry on looking	100
Increase the salary	63
Implement MA programme	25
Other	6

Source: NIERC (2001)

Appendix 1: Survey Results

TABLE A9: Actions Taken Regarding Unfilled Vacancies at HNC/HND Level (n=7)

	%
Recruit Staff from other firms	29
Recruit less qualified	71
Recruit from outside NI	57
Train existing staff	86
Change internal structures	86
Increase Salary	86
Use Recruitment Agencies	100
Carry on looking	100
Implement MA Programme	57
Other	0

Source: NIERC (2001)

TABLE A10: Actions Taken Regarding Unfilled Vacancies at HNQ 3 Level (n=4)

	%
Recruit Staff from other firms	50
Recruit less qualified	25
Recruit from outside NI	100
Train existing staff	75
Change internal structures	75
Increase Salary	50
Use Recruitment Agencies	100
Carry on looking	100
Other	0

Source: NIERC (2001)

TABLE A11: % of Companies Reporting Skill Gaps in New Entrants by Level of Education

	Technical %	Interpersonal %	Business awareness %	IT Knowledge %
NVQ Level 3	15	8	38	21
HNC/HND	14	7	32	7
First Degree Graduate	4	4	30	0
Post Graduate	11	0	22	0

Source: NIERC (2001)

TABLE A12: Importance of providing NVQ Level 3 Workers with the following skills (%)

	Very Important → Not Important				
	1	2	3	4	5
Tool Making/Tool Fitting	24	13	18	15	31
CNC Machine Operating	42	21	11	9	17
Milling/Grinding/Turning/ Other Machine Operating	41	25	19	4	11
Mechanical Maintenance Fitting	29	25	23	8	15
Sheet Metal Working	46	16	10	8	20
Metal Plate Working	43	15	11	9	22
Welding	64	14	6	5	11

Source: NIERC (2001)

Appendix 1: Survey Results

TABLE A13: Importance of providing HND Workers with the following skills (%)

	Very Important → Not Important				
	1	2	3	4	5
Design	44	24	12	9	11
Quality Control	54	22	15	3	6
Testing	31	26	19	8	16
Production	36	39	12	7	6
Procurement/Technical Sales	26	37	15	11	11

Source: NIERC (2001)

TABLE A14: Importance of providing Graduate Workers with the following skills (%)

	Very Important → Not Important				
	1	2	3	4	5
Design	43	30	9	7	11
R&D	22	31	23	14	10
Engineering Management	30	42	21	4	4
Manufacturing & Production	46	31	15	5	4
Testing	26	23	27	9	15
Quality Control	51	28	10	5	6
Sales & Marketing	35	27	19	11	9

Source: NIERC (2001)

TABLE A15: % of Companies Reporting Skill Gaps Amongst Existing Staff by Employee type

	Literacy %	Numeracy %	Teamworking %	Problem Solving %
Operators/Assemblers	10	3	5	20

Source: NIERC (2001)

Appendix 1: Survey Results

TABLE A16: % of Companies Reporting Skill Gaps Amongst Existing Staff by Employee Type	Technical %	Interpersonal %	Business Awareness %	Computer Literacy %
Level 3 Craft	0	9	28	25
Technician Level 4	0	18	18	9
Graduates no experience	0	0	14	0
Graduates <2 yrs experience	0	5	10	5
Grads 2+ yrs experience	6	6	3	3
Project Leaders	0	3	2	5
Senior Managers	1	1	1	3

Source: NIERC (2001)

Note: Skill gap exsists when Skills are described as poor or very bad.

TABLE A17: Difficulties Arising for Firms from Skill Deficiencies (n=42) (% of firms)	Lower productivity %	Loss of orders %	Lower quality product %	Higher running costs %	Inability to develop new products %	Failure to meet deadlines %
Very Imp	33	21	29	40	17	33
Important	40	24	24	31	24	31
Not Imp	26	55	48	29	60	36

Source: NIERC (2001)

TABLE A18: Incidence of Off-the-Job Training (% of firms)	Mechanical	Electronics
Training for Assemblers/Operators	48	37
Other Recognised Vocational for Assemblers/Operators	37	30
Professional Programmes for Technicians	21	40
Professional Programmes for Engineers	17	33
Qualifications Specific to Company	9	14
Higher Qualifications	18	26
Total	55	70

Source: NIERC (2001), IDS (2000)

Appendix 1: Survey Results

TABLE A19: Incidence of On-the-Job Training (n=95) (% of firms)			
	Mechanical	Electronics	IT
Technical Skills for Assemblers/Operators	94	74	-
Technical Skills for Craft Workers	60	49	48
Technical Skills for Technicians	43	56	48
Technical Skills for Graduates	31	49	69
Project Management Skills for Graduates	26	42	31
Senior Management Skills for Graduates	20	33	26
Total	97	91	75
Percentage of On-the-Job Training Conducted by Existing Staff	83	84	-
Percentage of On-the-Job Training Conducted by External Persons	17	16	-

Source: NIERC (2001)

Appendix 2: Projection Methodologies and Tables

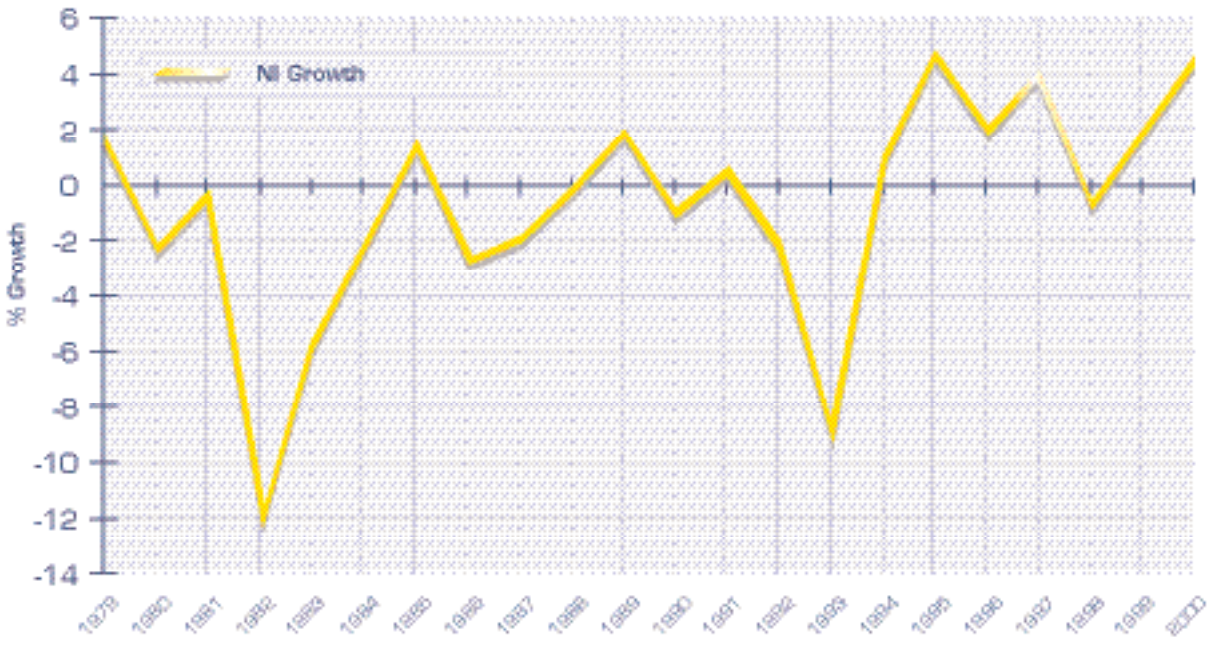
Mechanical Engineering Time-Series Model

We have defined the mechanical engineering sector as the amalgamation of the manufacture of fabricated metal products (SIC28), the manufacture of machinery and equipment not elsewhere classified (SIC29), the manufacture of electrical machinery and apparatus not elsewhere classified (SIC31), the manufacture of motor vehicles, trailers and semi-trailers (SIC34) and the manufacture of other transport equipment (SIC35). Total employment within the sector stood at 28,620 in June 2000 with Division 35 constituting the largest component, accounting for 29 per cent of mechanical engineering employment. Figure A1 plots employment growth in the sector between 1979 – 2000, growth has been largely negative over the period and has only recently picked up in the recovery of the mid to late 1990s.

The movements in mechanical engineering employment growth can be explained through the application of econometric time-series techniques, with the resulting model enabling us to generate employment forecasts for the period 2002-2006. In order to avoid the problem of spurious regressions, the first step in the analysis was to establish that the dependant variable (log difference of employment) was stationary. A weighted symmetrical procedure generated a test statistic of –3.765 significant at 99 per cent, thus the null hypothesis of non-stationarity can be rejected. The choice of potential explanatory variables include the growth in UK per capita real GDP which is designed to take account of the relationship with the economic cycle; UK real interest rates encapsulate domestic demand, whilst the German real interest rate is included to take account of demand from the EU, as sales to Europe account for around one-quarter of the sector's revenues. (NIERC 2000)

Table A20 shows the results of a vector autoregression between NI mechanical engineering employment growth, the two interest rate series and UK per capita GDP growth. Testing for block exogeniety, i.e. a variable depends only on its own lagged value and not on the value of others, indicates that NI employment growth is endogenous whereas the other three variables are exogenous.

Figure A1 - Graduate Supply minus Graduate Demand 2001-2006



Appendix 2: Projection Methodologies and Tables

Table A21 shows the results of a parsed OLS regression. The model indicates that NI mechanical engineering growth is positively related to the UK real interest rate in t-2, the German real interest rate in t-2 and growth in per capita real GDP in both t-1 and t-2 whilst it is negatively related to the UK real interest rate in t-1. The largest influence on mechanical engineering employment is the growth in UK per capita GDP, with employment in the sector rising by just under 2 per cent for every 1 per cent growth in the economy. The model explains three quarters of movements in NI mechanical engineering employment growth between 1981 – 2000 and is plotted against the actual values in Figure A2. Whilst the model appears to have overestimated the boom of the late 1980s and slightly underestimated the growth of the mid 1990s, in general it picks up the trend well and can be used with confidence to forecast the future performance of the sector.

TABLE A20: Block Exogeniety Test Results

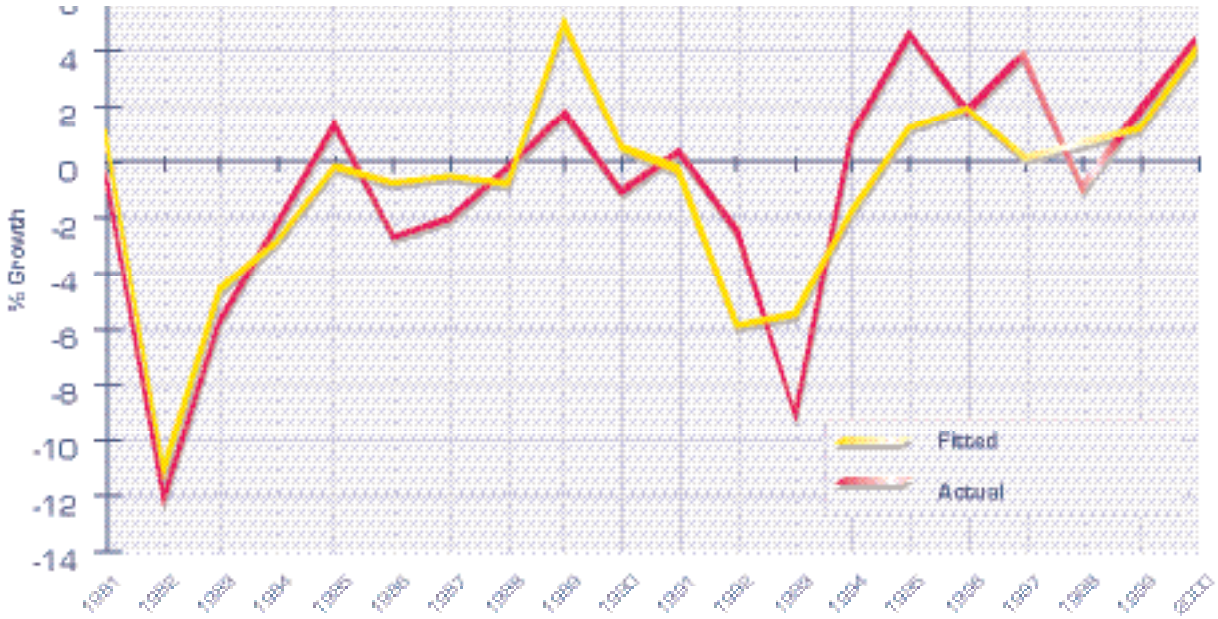
NI VAR (2 lags)	
	F STAT (block exog)
NI GROWTH	5.015 **
UK REAL INTEREST RATE	0.170
GERMAN REAL INTEREST RATE	0.118
UK PER CAP GDP GROWTH	0.322

TABLE A21: NI Mechanical Engineering Growth 1981-2000

	NI GROWTH
C	-0.035 (0.015)**
REALINT (-1)	-0.011 (0.004)**
REALINT (-2)	0.007 (0.004)*
GERMRINT (-2)	0.008 (0.004)**
UKCAPG (-1)	0.722(0.388)*
UKCAPG (-2)	1.046(0.365)**
N	20
R^2	0.743
R^2 Adj	0.651
LM Het Test	0.013

Appendix 2: Projection Methodologies and Tables

Figure A2 - Mechanical Engineering Model 1981 - 2000



Source: DETI (2001) NIERC (2002)

Using forecasts of the explanatory variables in conjunction with the model allows us to estimate growth in NI mechanical engineering employment. Table A22 shows the forecast growth rates for the sector covering the period up to 2006. Employment in the sector is forecast to grow very slowly, particularly between 2002-2004 when annual growth will be less than 1 per cent. The sector picks up again slightly in the latter two years of the forecast period, although the growth rate remains at around just 2 per cent. Figure A3 depicts actual employment growth in the sector together with the forecast growth rates.

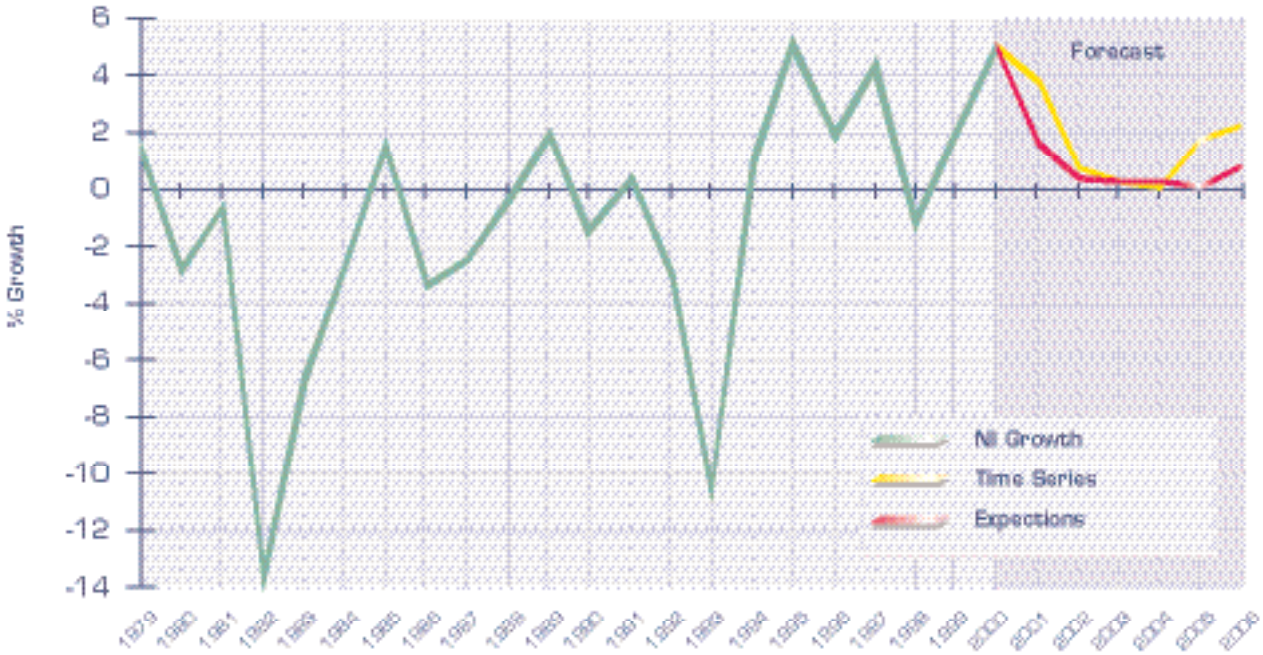
TABLE A22: Forecast Growth Rates

Year	Forecast Growth (%)
2001	1.61
2002	0.55
2003	0.35
2004	0.18
2005	1.66
2006	2.11

Source: NIERC (2002)

Appendix 2: Projection Methodologies and Tables

Figure A3 - NI Mechanicsl Engineering Growth 1979 - 2006



Source: NOMIS (2001)

TABLE A23: Time-Series Employment Projections	
End Year	Total Employment
1995	21,177
1996	21,575
1997	22,501
1998	22,311
1999	22,752
2000	23,860
2001	24,758
2002	24,894
2003	24,981
2004	25,026
2005	25,442
2006	25,978

Source: NIERC (2002)

Appendix 2: Projection Methodologies and Tables

Accounting Based Approach

The start-up rates were derived from the historical employment series of NI mechanical engineering firms, with data on start-ups only available for the three years shown (Table A24). For the closure rate, average IDB and LEDU closure employment was calculated for the period 1996-1998. Of total industry employment 86 per cent was located in IDB assisted firms and 14 per cent in LEDU client firms. Thus a weighted closure rate was adopted i.e. 86 per cent of the IDB rate and 14 per cent of the LEDU rate for each year. However, considering the low start-up rate, a figure equating to half the mean closure rate was thought to be more appropriate for use in the model (Table A25).

Firms' expected employment growth, obtained from the survey, was used to generate survivor growth rates (Table A26). A separate model was generated to account for new firm employment growth. In our cohort of mechanical engineering firms there was insufficient data from which to calculate new firm employment growth thus a rate equating to half the mean of new firm employment growth for the IT and electronic engineering sectors was used (Table A27).

TABLE A24: Start -up Rate

	1995	1996	1999	Mean
%	0.04	0,01	0.12	0.0578

Source: NIERC (2001)

TABLE A25: Closure Rates

	1996	1997	1998	Mean	Half of Mean
Weighted Closure Rate (%)	1.24	2.98	2.2	2.1	1.05

Source: NIERC (2001)

TABLE A26: Survivor Firms' Expected Employment Growth

	Employment	% Growth
2001	19,464	
End Year 1	19,579	0.59
End Year 2	19,932	1.80
End Year 3	20,198	1.33
End Year 4	20,468	1.34
End Year 5	20,701	1.14
End Year 6	21,071	1.79

Source: NIERC (2001)

Projection Methodologies and Tables

Total end year employment was calculated as the sum of survivor and new firm employment (Table A28). The annual new firm employment is shown in Table A29 and represents net figures i.e. closure rates have been applied.

TABLE A27: New Firms' Expected Employment Growth

	Mean IT & Electronics Growth %	Mean Mechanical Growth %
End Year 1	71	36
End Year 2	29	15
End Year 3	25	13
End Year 4	17	9
End Year 5	12	6
End Year 6	11	5

Source: NIERC (2001)

TABLE A28: Expectations-Based Model

	Aug 2001	2001	2002	2003	2004	2005	2006
Start Year Employment		**24,626**	**24,685**	**24,866**	**24,932**	**25,001**	**25,020**
- closures		85	259	261	262	263	263
= survivor employment		24,541	24,426	24,605	24,670	24,738	24,758
+ survivor growth employment		145	440	327	331	282	443
= survivor end year employment	24,626	24,685	24,866	24,932	25,001	25,020	25,201
+ new firms employment		5	25	48	74	101	131
End Year Employment		**24,691**	**24,891**	**24,980**	**25,075**	**25,122**	**25,331**

Source: NIERC (2001)

TABLE A29: New Firm Employment Model

Born	2001	2002	2003	2004	2005	2006
Start Year Employment	24,626	24,685	24,866	24,932	25,001	25,020
2001	5	6	7	7	8	8
2002		19	22	25	27	28
2003			19	22	25	27
2004				19	22	25
2005					20	22
2006						20
Total	**5**	**25**	**48**	**74**	**101**	**131**

Source: NIERC (2001)

TABLE A30: Expectations-Based Employment Projections	
End Year	Total Employment
1995	21,177
1996	21,575
1997	22,501
1998	22,311
1999	22,752
2000	23,860
2001	24,691
2002	24,891
2003	24,980
2004	25,075
2005	25,122
2006	25,331

Source: NIERC (2001)

Demand Projections

Respondents to the survey were asked to specify the number of each category of staff that would be required if their company was to expand by 100 people. The results, shown in Table A31, were weighted by firm size then applied to the employment projections of both models to forecast future demand for craft workers (level 3), technicians (level 4) and new graduates (See Tables A32 – A40).

TABLE A31: Anticipated Recruitment Structure of Qualified Labour	
	%
Operators/Assemblers	60
Mechanical Craft Workers (Level 3)	23
Mechanical Technicians (Level 4)	4
Mechanical Grads no experience	3
Mechanical Grads 1-2 yrs exp	4
Mechanical Grads 2+ yrs exp	2
Mechanical Project Leaders	1
Mechanical Senior Managers	1
Other Staff	2
Total	100

Source: NIERC (2001)

TABLE A32: Demand for Level 3 Craft Workers - Time - Series Model		
Year	**Total Craft Workers**	**Total Additional Demand**
2000	5,488	
2001	5,694	207
2002	5,726	31
2003	5,746	20
2004	5,756	10
2005	5,852	96
2006	5,975	123

Source: NIERC (2001)

TABLE A33: Demand for Level 4 Technicians - Time - Series Model

Year	Total Technicians	Total Additional Demand
2000	954	
2001	990	36
2002	996	5
2003	999	3
2004	1,001	2
2005	1,018	17
2006	1,039	21

Source: NIERC (2001)

TABLE A34: Demand for New Graduates - Time - Series Model

Year	Total New Graduates	Total Additional Demand
2000	716	
2001	743	27
2002	747	4
2003	749	3
2004	751	1
2005	763	12
2006	779	16

Source: NIERC (2001)

TABLE A35: Demand for Level 3 Craft Workers - Expectations - Based Model

Year	Total Craft Workers	Total Additional Demand
2000	5,488	
2001	5,679	191
2002	5,725	46
2003	5,745	20
2004	5,767	22
2005	5,778	11
2006	5,826	48

Source: NIERC (2001)

TABLE A36: Demand for Level 4 Technicians - Expectations - Based Model

Year	Total Technicians	Total Additional Demand
2000	954	
2001	988	33
2002	996	8
2003	999	4
2004	1,003	4
2005	1,005	2
2006	1,013	8

Source: NIERC (2001)

TABLE A37: Demand for New Graduates - Expectations - Based Model

Year	Total New Graduates	Total Additional Demand
2000	716	
2001	741	25
2002	747	6
2003	749	3
2004	752	3
2005	754	1
2006	760	6

Source: NIERC (2001)

TABLE A38: Demand for Level 3 Craft Workers - Risk - Based Scenario

Year	Total Craft	Total Demand
2000	5,488	
2001	5,755	267
2002	6,033	278
2003	6,324	291
2004	6,630	305
2005	6,950	320
2006	7,285	336

Source: NIERC (2002)

TABLE A39: Demand for Level 4 Technicians - Risk - Based Scenario		
Year	Total Technicians	Total Demand
2000	954	
2001	1,001	46
2002	1,049	48
2003	1,100	51
2004	1,153	53
2005	1,209	56
2006	1,267	58

Source: NIERC (2002)

TABLE A40: Demand for New Graduates - Risk - Based Scenario		
Year	Total New Graduates	Total Demand
2000	716	
2001	751	35
2002	787	36
2003	825	38
2004	865	40
2005	906	42
2006	950	44

Source: NIERC (2002)

Enrolments, Leavers & Labour Market Supply Projections

Forecast enrolments were generated separately for each of the institutions, based on the average enrolment growth for individual courses between 1996/97 – 2000/01.

Completion rates were calculated in order to project forward the number of graduates and are based on the historical enrolments/leavers relationship. At UU, undergraduate courses with a placement year were assessed as a percentage of enrolments in t-4, those without placement and HND courses as a percentage of enrolments in t-3 whilst postgraduate courses were based on the previous year's enrolments. Completion rates for QUB were calculated separately for each course. The number of graduates each year was estimated by applying, to the relevant enrolment figure, the proportion taking three, four or five years to complete.

First Destination information was used to estimate the number of entrants to the labour market (Table A45).

TABLE A41: Aggregate Enrolments on HE Mechanical Engineering Courses 1996/97 - 2005/06										
	Actual					Forecast				
	96/97	97/98	98/99	99/00	00/01	01/02	02/03	03/04	04/05	05/06
Total UG Enrolments	173	168	168	166	159	164	171	179	189	200
Total PG Enrolments	82	73	39	35	31	30	28	27	26	24
Total	**255**	**241**	**207**	**201**	**190**	**194**	**199**	**206**	**215**	**225**

Source: UU (2001), QUB (2001), NIERC (2001)

TABLE A42: Aggregate Enrolments on Mechanical Engineering Courses 1996/97 - 2005/06										
	Actual					Forecast				
	96/97	97/98	98/99	99/00	00/01	01/02	02/03	03/04	04/05	05/06
NVQ Level 3 (or equiv)	98	186	200	208	317	365	421	485	559	644
NVQ Level 4 & HND (UU)	58	56	56	55	45	46	46	47	47	48
Total	**156**	**242**	**256**	**263**	**362**	**411**	**467**	**532**	**606**	**692**

Source: DEL (2002), UU (2001), NIERC (2002)

TABLE A43: Aggregate Graduates from HE Mechanical Engineering Courses 1996/97 - 2005/06

	Actual					Forecast				
	96/97	97/98	98/99	99/00	00/01	01/02	02/03	03/04	04/05	05/06
Total UG Graduates	142	138	140	147	119	126	126	127	132	138
Total PG Graduates	66	73	74	30	33	29	27	26	25	24
Total	**208**	**211**	**214**	**177**	**151**	**155**	**153**	**153**	**156**	**162**

Source: UU (2001), QUB (2001), NIERC (2001)

TABLE A44: Aggregate Full Pass Leavers from Mechanical Engineering Courses 1996/97 - 2005/06

	Actual					Forecast				
	96/97	97/98	98/99	99/00	00/01	01/02	02/03	03/04	04/05	05/06
NVQ Level 3 (or equiv)	21	102	86	88	94	143	165	190	219	252
NVQ Level 4 & HND (UU)	26	26	20	18	18	13	13	13	13	13
Total	**47**	**128**	**106**	**106**	**112**	**156**	**178**	**203**	**232**	**266**

Source: DEL (2002), UU (2001), NIERC (2002)

TABLE A45: NI Labour Market Entry Rates for Mechanical Engineering Qualifiers

	Entry Rate
NVQ Level 3	80%
NVQ Level 4	56%
HND (HE Sector)	50%
UG	50%
PG	50%

Source: DEL (2002)

TABLE A46: Forecast Supply of New Labour Market Entrants 2001 - 2006

	Level 3 Craft Workers	Level 4 Technicians	Graduates
2001	75	10	76
2002	114	7	77
2003	131	7	77
2004	151	7	77
2005	174	7	78
2006	201	7	81

Source: NIERC (2002)

Appendix 3: Questionnaire

Mechanical Engineering Questionnaire

Contact	
Position	
Company Name	
Address	
Description of Main Activity	
Birth of Company (Month & Year)	

		Male	Female
Current Employment			
Current Turnover			
Turnover 1997			
Proportion of current total sales made up by exports (outside UK)			
Proportion of firms activities concentrated in Research and Development			
Ownership (N Irish, GB, RoI, US etc)			

How many employees do you expect to recruit over the next 5 years under current labour market conditions? (end of year emp.)

	2001	2002	2003	2004	2005	2006
Number						

A) LABOUR FORCE REQUIREMENTS AND SALARY LEVELS

1. Please state the number of employees if any, that you currently have that are employed at the following levels, (irrespective of the level at which they were recruited)

	current emp number	Female
Operators/Assemblers		
Non Graduate mechanical craft-level workers (up to and inc. NVQ level 3 or qualified apprentices)		
Non Graduate Mechanical Eng. Technicians (HND/HNC)		
Mechanical Eng Graduates With no previous experience (Degree/Postgrad)		
Mechanical Eng Graduates with Some but less than 2 years Experience (Excluding placement year)		
Mechanical Eng Graduates with 2 years+ experience but below group leader level (Excluding placement year)		
Mechanical Eng Project managers/ Group leaders		
Mechanical Eng Senior Managers		
Other Staff (HR, Admin etc.)		

2. Please state the Gross average annual salary currently paid when recruiting employees in each group

Operators/Assemblers	
Non Graduate Mechanical craft level workers (NVQ level 3)	
Non Graduate Mechanical Eng technicians (HND/HNC)	
Mechanical Eng Graduates with no experience (Degree/Postgrad)	
Mechanical Eng graduates with some but less than 2 years experience (excludes placement year)	
Mechanical Eng Graduates with 2+ years experience but below group leader level (excludes placement year)	

Mechanical Eng Project Managers/Group Leaders	
Mechanical Eng Senior Managers	

3. Please state your level of difficulty, if any, in recruiting those workers above (in ques. 1), where 1 = very easy, 2 = quite easy, 3 = difficult, 4 = very difficult

	Ease of recruitment
Operators/ assemblers	
Non Graduate mechanical craft level workers (NVQ level 3)	
Non Graduate Mechanical Eng Technicians (HND/HNC)	
Mechanical Eng Graduates with no previous experience (Degree/Postgrad)	
Mechanical Eng graduates with some but less than 2 years Experience *Excludes placement year*	
Mechanical Eng Graduates with 2 years+ Experience but below group leader level *Excludes placement year experience*	
Mechanical Eng Project managers/Group leaders	
Mechanical Eng Senior Managers	

4. In theory if your company was to expand by 100 people (including non-mechanical staff) please indicate how they are likely to be distributed across the following categories:

	emp	Prop of NVQ/HND Taken Directly from School/College/Apprenticeship
Operators/Assemblers		
Non Graduate mechanical craft-level workers *(up to and inc. NVQ level 3 or qualified apprentices)*		
Non Graduate Mechanical Eng technicians (HND/HNC)		
Mechanical Eng Graduates with no previous experience (Degree/Postgrad)		
Mechanical Eng graduates with some but less than 2 years Experience *(Excluding placement year)*		

Mechanical Eng Graduates with 2 years+ Experience but below project manager/group leader level (Excluding placement year) ☐

Mechanical Eng Project managers / Group leaders ☐

Mechanical Eng Senior Managers ☐

Other Staff (HR, Admin etc.) ☐

5. *Please rank in order from 1-5 how important it is for FE colleges/RTOs to equip **NVQ level 3 workers with the following skills** (1 being very important, 5 being not important)*

Tool Making / Tool Fitting ☐

CNC Machine Operating ☐

Milling/ Grinding/ Turning/ or Other Machine Operating ☐

Mechanical Maintenance Fitting ☐

Sheet Metal Working ☐

Metal Plate Working ☐

Welding ☐

6. *Please rank in order from 1-5 how important it is for FE colleges to equip **technician level workers (HND) with the following skills** (1 being very important, 5 being not important)*

Design (e.g. draughtspeople & CAD technicians) ☐

Quality Control (e.g. quality control, assurance, calibration technicians) ☐

Testing (e.g. test technicians) ☐

Production (e.g. production control, planning) ☐

Procurement/Technical Sales ☐

7. Please rank in order from 1-5 how important it is for universities to equip ***graduate level workers with the following skills*** *(1 being very important, 5 being not important)*

Design	
Research & Development	
Engineering Management	
Manufacturing & Production	
Testing	
Quality	
Sales & Marketing	

8. Have you lost any of the following workers to other employers in the last 12 months? If so, in which areas are these employers (numbers)?

		Location of other employer			
	Total	NI	GB	RoI	Else
Operators/assemblers					
Non graduate mechanical craft level workers (NVQ level 3)					
Non Graduate Mechanical Eng Technicians (HND/HNC)					
Mechanical Eng Graduates with no experience (Degree/Postgrad)					
Mechanical Eng Graduates with less than 2 years experience					
Mechanical Eng Graduates with 2+ years experience but below group leader level					
Mechanical Eng Project Managers/ Group Leaders					
Mechanical Eng Senior Managers					

9. Please indicate the number of unfilled vacancies, if any, your company has had in the following areas in the last 12 months

	Number
Operators/Assemblers	
Non graduate mechanical craft level workers	

Non-graduate Mecanical Eng Technicians ☐

Mechanical Eng graduates, no Prev experience ☐

Mechanical Eng graduates with some but < 2 years experience ☐

Mechanical Eng Graduates, 2+ years Experience ☐

Mechanical Eng Project Managers/ Group Leaders ☐

Mechanical Eng Senior managers ☐

10. (Only Ask if company has unfilled vacancies at or above Graduate level (new and experienced)) Please rank in order from 1 to 3 the most important factors explaining your difficulties in recruiting staff at or above graduate level (includes new & experienced graduates), where 1= very important, 2=important, 3=not important

A shortage of people with the relevant qualifications ☐

A shortage of people with the required technical ability ☐

A shortage of people with sufficient experience in mechanical eng organisations ☐

Salaries offered are too low ☐

Negative perception of engineering as a profession ☐

Competition from other employers ☐

11.Does your company take any of the following actions to try and fill hard-to-fill vacancies occurring at and above graduate level (includes new and experienced graduates)?

Seek to recruit staff from other firms ☐

Recruit less qualified people ☐

Recruit people from outside NI ☐

Train existing staff to fill the vacancy ☐

Change internal structures and practises ☐

Increase the salary to make the job more attractive ☐

Use recruitment agencies ☐

Just carry on looking ☐

12.(Only ask if company has unfilled vacancies at HNC/HND level)) Please rank in order from 1 to 3 the most important factors explaining your difficulties in recruiting staff at technician level (includes HND/HNC), where 1= very important, 2=important, 3=not important

A shortage of people with the relevant qualifications ☐

A shortage of people with the required technical ability ☐

A shortage of people with sufficient experience in mechanical eng organisations ☐

Salaries offered are too low ☐

Negative perception of engineering as a profession ☐

Competition from other employers ☐

13.Does your company take any of the following actions to try and fill hard-to-fill vacancies occurring at HNC/HND level?

Seek to recruit staff from other firms ☐

Recruit less qualified people ☐

Recruit people from outside NI ☐

Train existing staff to fill the vacancy ☐

Change internal structures and practises ☐

Increase the salary to make the job more attractive ☐

Use recruitment agencies ☐

Just carry on looking ☐

Implement a Modern Apprenticeship Programme ☐

Other (please state) ☐

14.(Only ask if company has unfilled vacancies at craft level (NVQ 3 or equiv) Please rank in order from 1 to 3 the most important factors explaining your difficulties in recruiting staff at craft level (NVQ 3 or equiv), where 1= very important, 2=important, 3=not important

A shortage of people with relevant qualifications (NVQ 3 or equiv) ☐

Lack of suitable work experience amongst applicants ☐

Negative perception of engineering as a profession ☐

Salaries offered are too low ☐

Poor attitude, motivation of applicants ☐

Competition from other employers for craft workers ☐

15.Does your company take any of the following actions to try and fill hard-to-fill vacancies occurring at craft/ NVQ 3 or equiv level?

Seek to recruit staff from other firms ☐

Seek to employ directly from the FE colleges ☐

Seek to employ directly from Jobskills Training Organisations ☐

Advertise more widely ☐

Use recruitment agencies ☐

Just carry on looking ☐

Increase the salary to make the job more attractive ☐

Implement a Modern Apprenticeship programme ☐

Other (please state) ☐

16.(Only ask if company has unfilled vacancies at assembler level (below NVQ 3) Please rank in order from 1 to 3 the most important factors explaining your difficulties in recruiting staff at assembler level (below NVQ 3), where 1= very important, 2=important, 3=not important

Not enough people interested in doing operator/ assembler type work ☐

Negative perception of engineering as a profession ☐

Salaries offered are too low ☐

Poor attitude, motivation of applicants ☐

Lack of suitable work experience amongst assemblers ☐

Competition from other employers for assemblers/operators ☐

17.Does your company take any of the following actions to try and fill hard-to-fill vacancies occurring at assembler level?

Seek to obtain staff from other firms ☐

Advertise more widely ☐

Use recruitment agencies ☐

Just carry on looking ☐

Increase the salary to make the job more attractive ☐

Makes use of the T&EA Jobskills or Newdeal ☐

Makes use of the T&EA bridge to employment ☐

Other (please state) ☐

B) Skill levels of new entrants to the Mechanical Engineering Sector

18. Have you ever recruited people with the following qualifications (who have no previous experience other than work placement)?

NVQ Level 3 (or equiv)	☐
HNC/HND	☐
Mechanical Eng First Degree Graduate	☐
Mechanical Eng Post Grad	☐

19. (For relevant categories) Please rank from 1-5 the competencies of these new entrants to your sector at the time of recruitment in terms of the company's desired pre-requisites, where 1 = Very good, 2 = good, 3 = satisfactory, 4 = poor, 5 =Very poor

Skills	Technical	Interpersonal	Business Awareness	Knowledge of any relevant IT applications
NVQ3 (or equiv)	☐	☐	☐	☐
HNC/HND	☐	☐	☐	☐
Mechanical Eng First Degree Graduate	☐	☐	☐	☐
Mechanical Eng Post-grad	☐	☐	☐	☐

C) Skill Levels of existing workforce

20.(For relevant staff categories – refer to question 1) Please rank from 1-5 the competencies of these existing workers in terms of the company's requirements where 1 = Very good, 2 = good, 3 = satisfactory, 4 = poor, 5 =Very poor

Skills	Technical	Interpersonal	Business Awareness	Computer Literacy
Mechanical Eng Craft level staff	☐	☐	☐	☐
Mechanical Eng Technicians	☐	☐	☐	☐
Mechanical Eng grads with no previous experience	☐	☐	☐	☐
Mechanical Eng grads with Some but< 2 years experience	☐	☐	☐	☐
Mechanical Eng grads with 2+ Years experience	☐	☐	☐	☐
Mechanical Eng Project Managers/ Group Leaders	☐	☐	☐	☐
Mechanical Eng Senior managers	☐	☐	☐	☐

Skills	Literacy	Numeracy	Teamworking	Problem solving
Operators/ Assemblers	☐	☐	☐	☐

D) Skill shortages/skill gaps as a constraint on growth

21. Please rank from 1-3 the main difficulties arising for your firm from problems in filling vacancies where 1=very important, 2=important, 3=not important

Lower Productivity ☐

Loss of orders to competitors ☐

Lower quality product ☐

Higher running costs ☐

Inability to develop new products ☐

Failure to meet deadlines ☐

Impact on Firm's credibility ☐

22. Please rank from 1-3 the main difficulties arising for your firm from deficiencies in the skill levels of your existing staff, if any, where 1=very important, 2=important, 3=not important

Lower Productivity ☐

Loss of orders to competitors ☐

Lower quality product ☐

Higher running costs ☐

Inability to develop new products ☐

Failure to meet deadlines ☐

E) Off-the-job Training

23. Do you provide any off- the-job training leading to formal qualifications?

Yes

No

If yes, which of the following qualifications are these?

Training for assembler/ operator staff ☐

Other nationally recognised vocational for assembler/ operator staff e.g. RSA, BTEC, City & Guilds ☐

Professional/ Institute programmes for technicians ☐

Professional/ Institute programmes for professional engineers ☐

Qualifications specific to your company ☐

Higher qualifications such as degrees ☐

24. Do you provide any on-the-job training (in the areas listed below)?

Yes ☐

No ☐

If so, how many days per year training do you provide in the following areas?

		No. Days	Ongoing
Technical skills for assemblers/operators	☐	☐	☐
Technical skills for non-graduate craft workers (NVQ 3)	☐	☐	☐
Technical skills for non-graduate technicians (HNC/HND)	☐	☐	☐
Technical skills for graduates (Degree/Postgrad)	☐	☐	☐
Project Management skills for graduates	☐	☐	☐
Senior management skills for graduates	☐	☐	☐

What proportion of this on-the-job training is conducted by members of staff ☐

What proportion of this on-the-job training is conducted by external persons ☐