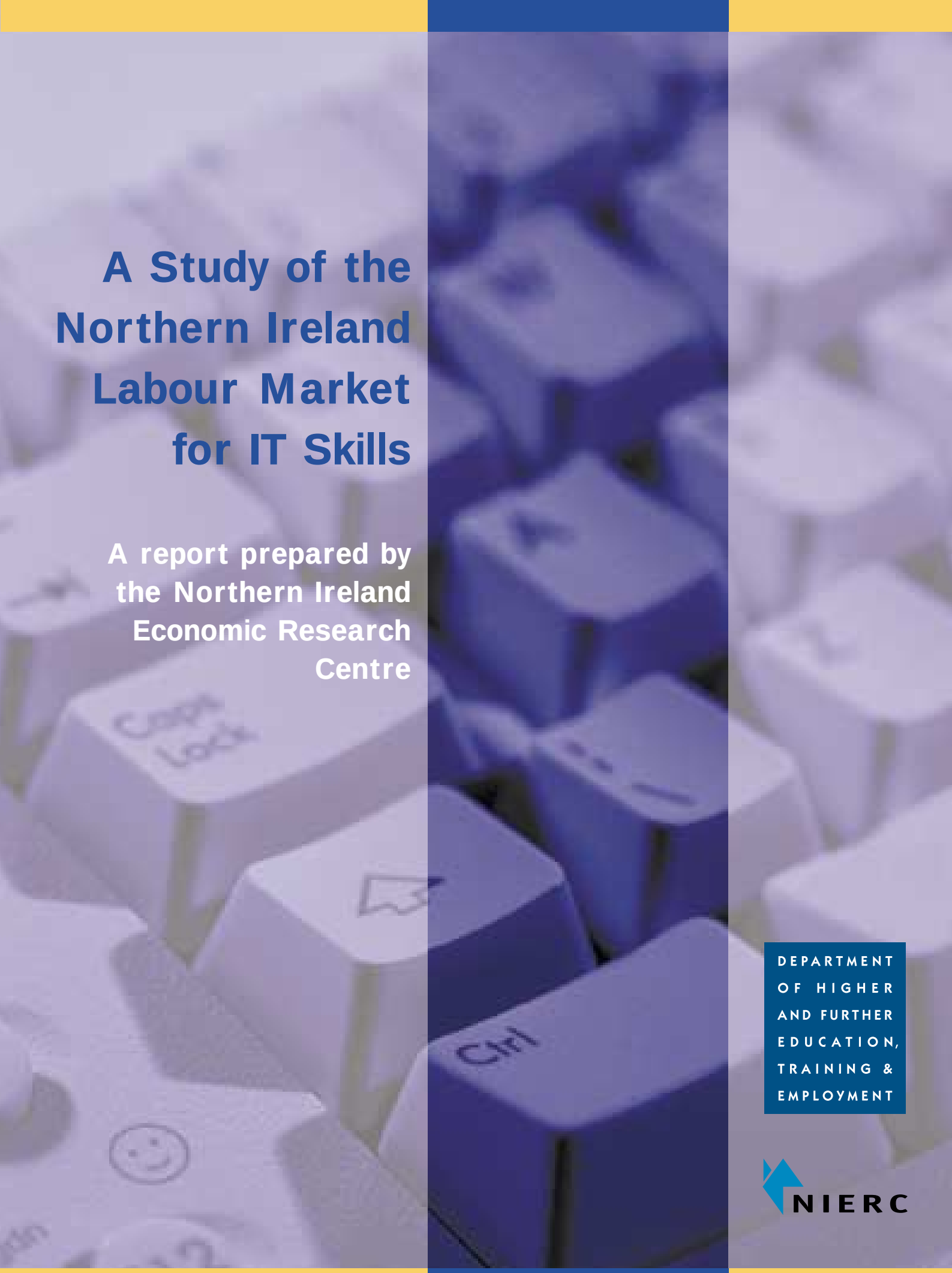

# A Study of the Northern Ireland Labour Market for IT Skills

A report prepared by the Northern Ireland Economic Research Centre

DEPARTMENT OF HIGHER AND FURTHER EDUCATION, TRAINING & EMPLOYMENT

NIERC

A Northern Ireland Skills Task Force Report

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A report prepared by the

Priority Skills Unit,
Northern Ireland Economic Research Centre

July 2000

# Contents

# Acknowledgments

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 Professor Gerry Hughes from the ESRI for his expert help and advice throughout the Study.

# Preface

The vision of the Training and Employment Agency is *"to develop a world class workforce"*.

In this context a new advisory body, the Northern Ireland Skills Task Force was established early in 1999 to advise the Training & Employment Agency and the then Department of Education for Northern Ireland (DENI) on issues relating to the supply of and demand for skills in the Labour Market; and to act as an interface with other Government Departments

At the initiative of the Skills Task Force, it was decided that a Priority Skills Unit be established at the Northern Ireland Economic Research Centre as a centre of excellence in the skills forecasting and to assist the T&EA's understanding of current and future skill needs.

The principle role of the Priority Skills Unit is to provide the Northern Ireland Skills Task Force with projections of the likely supply/demand balance in skills which the Task force identify as being potential constraints on the development of Northern Ireland's economy.

This Report comprises of two studies carried out as a background to the Skills Task Force's discussion of the prospective supply/demand position for IT qualified personnel in Northern Ireland and its implications for skills policy. The studies are presented in separate self-contained sections. They are:

## Section 1

**Employment Practices, Perceptions and IT Skill Shortages: The Case of Northern Ireland**

## Section 2

**An Analysis of Demand and Supply Conditions in the Northern Ireland IT Labour Market**

*Section 1* records the results of a survey of Northern Ireland's computer service industry, carried out in December 1999. It focuses on the computer services industry because it is this sector of the Northern Ireland economy where IT qualified personnel are concentrated.

Statistical techniques have also been employed as a means of determining factors at a company level which may be contributing to the existence of unfilled vacancies. It was found that unfilled vacancies were more likely to occur in those companies with a lesser tendency to train and utilise new graduates. Significant wage differentials were also found to exist, vis-à-vis the Republic of Ireland and Great Britain, for more senior IT practitioners.

*Section 2* uses information from the computer services industry survey, together with figures on IT qualified employment in other sectors, and combines them to estimate the numbers of newly qualified employees being demanded. These figures can then be compared with data on those flowing from education and training institutions to the labour market. Thus providing an assessment of the overall balance for IT qualified workers projected over the period 2000-2005.

Overall the scenarios suggest that shortages are unlikely in the Northern Ireland labour market for IT graduates over the next five years as long as enrolments continue to grow at their current trend rates. The possibility that some surplus of IT qualified graduates might emerge need not be a cause for concern since this might serve to boost the growth of Northern Ireland's economy.

*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 DHFETE.*

# Foreword

This report represents the results of a study investigating the balance in the demand for and supply of skills in the Information Technology sector. The study was commissioned by the Northern Ireland Skills Task Force whose role is to advise government on how best to contribute to economic growth by meeting the current and future skill needs of industry.

The Task Force identified the Information Technology sector as a priority skill area where skills shortages or deficiencies would constrain the further development of that sector and adversely affect growth of the Northern Ireland economy.

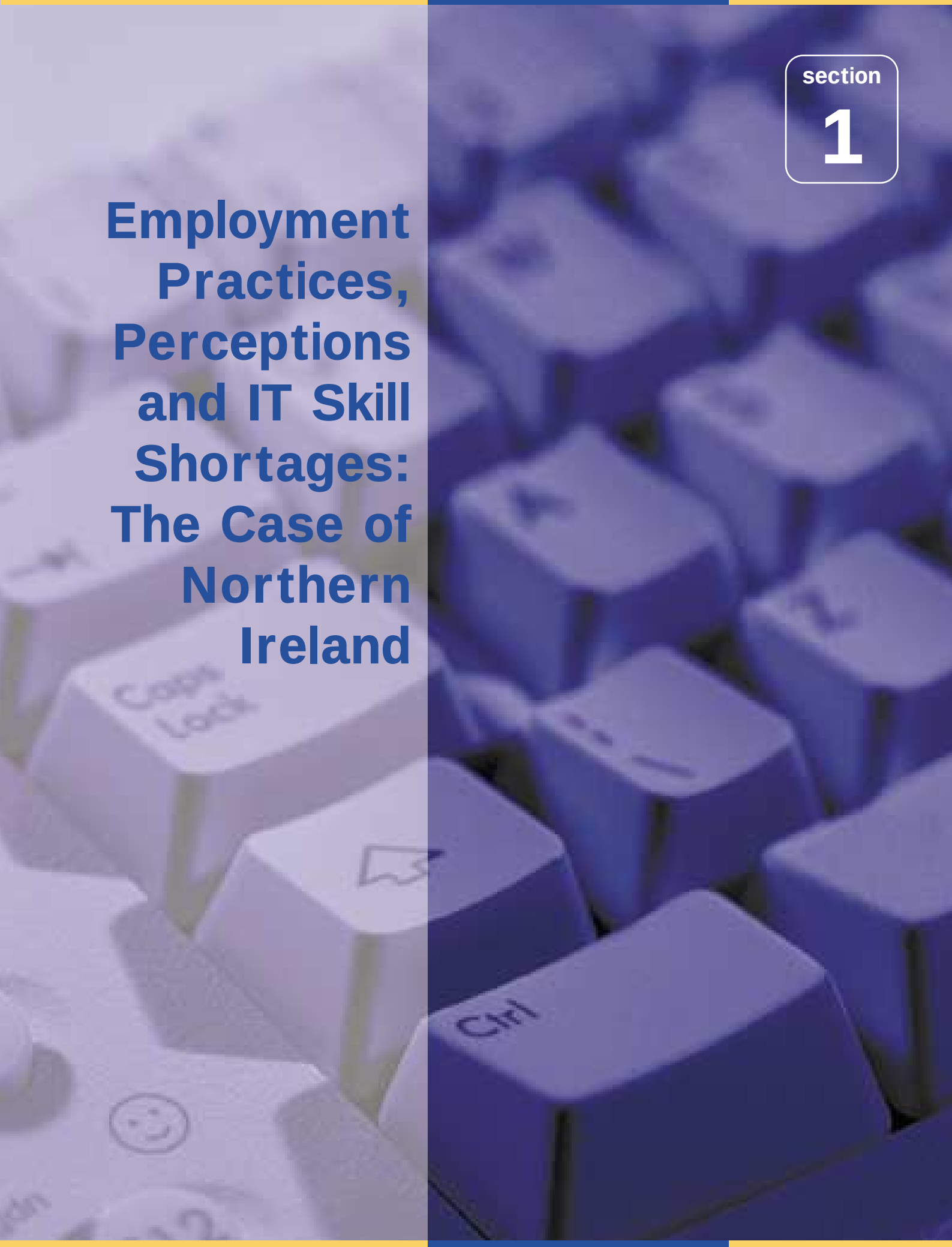
The phenomenal world-wide growth in the Information Technology sector offers immense employment opportunities for Northern Ireland and the challenge to create the "fast growing, competitive, innovative, knowledge-based economy" envisaged in Strategy 2010. The research findings suggest that employment in this sector has already increased dramatically in recent years.

The report raises a number of critical issues for the Skills Task Force to consider. It is vital that education and training resources are best targeted to ensure that the availability of skills is not a constraint on the potential growth of the Information Technology sector and this study now provides us with the high quality information needed to meet this challenge.

The research has been carried out by the Priority Skills Unit of the Northern Ireland Economic Research Centre and on behalf of the Skills Task Force I commend them on an excellent report. I also wish to thank those Northern Ireland companies who gave of their time to participate in this study and those individuals and organisations consulted as part of the research process.

Finally I welcome the publication of this report. There are issues here not just for Government to consider but for all those with an interest in the Information Technology sector. I would urge all who read it to give careful consideration to its findings.

**Bill McGinnis**
Chairman (Northern Ireland Skills Task Force)



section 1

# Employment Practices, Perceptions and IT Skill Shortages: The Case of Northern Ireland

Prepared by the Priority Skills Unit

# Contents

## Section 1

## Employment Practices, Perceptions and IT Skill Shortages: The Case of Northern Ireland

# Executive Summary

## Introduction

- This paper assesses the nature and magnitude of supply-side difficulties currently experienced by Northern Ireland IT firms. The study takes a survey-based approach concentrating on firms employing significant numbers of IT personnel.

- Official statistics estimate the size of the computer services industry to be 2,582 in 1999. On the basis of our survey information and grossed up estimates for non-respondents it is estimated that the actual size of the industry, at December 1999, was in fact 4,253.

## Survey Results

- Of the 3,260 persons employed by our 65 participant firms, 1,427 (44%) had gained some form of IT qualification. IT graduates with some prior technical experience constituted the largest single element of demand, accounting for 42 per cent of all persons recruited into the current technical workforce. Just 23 per cent of the current technical workforce were recruited directly from university with no prior experience.

- Recruitment appears to become more difficult the more experienced are the employees being sought. Less than 30 per cent of firms expressed any difficulty in recruiting non-graduate technical support staff or new graduates; however, the proportion experiencing difficulty rose to around 70 per cent for all other categories of staff. The recruitment of graduate project leaders and project managers/strategic planners seems to pose the greatest problems.

- During 1999 the computer services industry experienced recorded vacancies in the flow of IT qualified labour equivalent to 5.5 per cent of total specialist employment, with the highest incidences of shortage reported within project management (12.6%) and software development/installation & integration (5.7%).

- The impact of these shortages on company performance are believed to be important with the majority of firms reporting that their development was being severely constrained in one or more ways. Almost half of the cohort reported that their ability to develop new products was severely impeded whilst a major negative productivity effect was reported by a third.

- Over 90 per cent of firms cited the lack of persons with the required technical ability as important in explaining these unfilled vacancies. In addition, a lack of people with sufficient experience of working in IT organisations was cited by 85% of firms.

- To try and combat skill shortages the majority of firms were reducing entry requirements and training staff themselves, while over 50 per cent of companies were also improving the financial packages on offer.

- Average salary levels within Northern Ireland are broadly comparable with the UK for both non-graduate trainee posts and the bottom two tiers of systems development. However, wage rates are lagging behind the rest of the UK and Republic of Ireland for more senior systems development staff and project managers.

- Generally speaking, firms were satisfied with both the technical and interpersonal skills of their current workforce. However, some concern was raised relating to business awareness skills, particularly for those at the lower tiers of the organisational structure. The major negative impact of these deficiencies was on productivity levels, running costs and the ability to develop new products.

- In terms of new entrants, the highest level of dissatisfaction was with persons entering the labour force from post graduate IT conversion courses, although there was quite uniform dissatisfaction with the business awareness skills at all levels of educational attainment.

- There is a well-developed training culture in the sector with 63 per cent of firms providing off-the-job training and 75 per cent on-the-job

training. The most popular off-the-job courses are those that offer qualifications catering to the specific needs of firms, followed by degree courses and Microsoft certificates.

- Econometric analysis revealed that shortages are most likely for those companies whose technical employment contains a relatively low proportion of new and inexperienced graduates and a relatively high proportion of project leaders.

- Contrary to employer perceptions econometric analysis found no significant effects of skill shortages or skill deficiencies on the productivity of Northern Ireland firms. However the analysis did reveal that productivity was lower the larger was the technical employment share of new graduates.

## Conclusion

- The labour market for IT professionals in Northern Ireland is perceived by employers as being relatively tight for all workers above the inexperienced graduate level, with significant shortages occurring in the supply of systems developers and project managers in particular.

- These shortages primarily resulted from an inability to recruit suitably technically efficient and experienced staff.

- Firms' employment and human resource management practices may be contributing to the incidence of skill shortage, with firms restricting the size of their available labour pool by setting high experience requirements for entry.

- It is likely that these recruitment difficulties also stem from the large earnings differentials between Northern Ireland and the nearby labour markets of GB and the Republic of Ireland.

- Few deficiencies were reported in the technical ability or interpersonal skills of the existing workforce however, employers did perceive weaknesses in the technical abilities of new entrants from both specialist and conversion postgraduate courses.

# 1.0 Introduction

Much attention has been given in recent years to the impact of information technology (IT) on employment in industrialised countries: Berndt et al (1992), Berman et al (1994), Autor et al (1996), Doms et al (1997) and Bresnahan (1999). These studies have generally concluded that the increased use of IT has contributed to a fall in the demand for unskilled blue collar and low-level white collar workers, whilst raising the demand for people with higher-level cognitive skills. However, very little attention has been given to assessing the extent to which developed labour markets can service the increased demand for IT professionals that has accompanied the well-documented growth in computer related commerce. This inertia is somewhat surprising given the constant reference within UK media and public policy circles to the difficulties faced by firms as a result of an inadequate supply of IT workers (referred to as a skill shortage). Moreover, a recent report by the National Computer Centre (NCC) on *Salaries and Staffing Issues in IT* (1999) found that significant shortfalls were perceived to exist within several key IT occupational groupings.

In addition to these supply-side problems there is also some evidence to suggest that firms are potentially being constrained as a result of shortfalls in the competencies of their existing staff (referred to as a skills gap). A recent report to the DTI found that almost 40 per cent of IT workers sampled did not possess one or more of the competencies deemed mandatory for their work under IT National Training Organisation (ITNTO) national standards (AISS, ITNTO, 1999).

Since an adequate flow of suitably skilled IT workers is a necessary condition of ensuring sustained economic growth, this paper assesses the nature and magnitude of supply-side difficulties currently experienced by Northern Ireland firms. The study is centred around a survey-based approach concentrating on firms employing significant numbers of IT personnel.

# 2.0 Sample Information

To investigate the market for IT workers it was first necessary to identify those sectors in which they were most likely to be concentrated. The 1999 report by the ITNTO identifies the computer services industry (division 72 in the SIC 92 classification) as the most significant employer, followed by financial and business services, with substantial numbers in other service sectors, both public and private. As far as Northern Ireland is concerned, the Labour Force Survey (LFS) sample size is too small for a reliable estimate to be made of the sectoral location of IT personnel here. So for the purpose of defining a sampling frame it has been assumed that the sectoral distribution of IT workers in Northern Ireland follows that of the UK as a whole. As a consequence this element of the study focuses exclusively on employment within the computer services industry.

The size distribution of firms in the computer services sector in Northern Ireland, together with matching data on the distribution of employment across firms, is reported in Table 1. Evidently the distribution is strongly skewed. In 1999 there were 369 computer service companies operating in Northern Ireland, just 21 per cent of whom employed 5 or more persons, yet between them these firms accounted for more than 80 per cent of total employment. In order to ensure the greatest degree of coverage in terms of employment, the sample included all 77 firms with an employment greater than or equal to 5 and a random sample of 57 with an employment of less than 5. Of those firms employing 5 or more persons 53 (69%) agreed to participate in the study, whilst 39 firms (68%) employing less than 5 also gave positive responses.

**TABLE 1:** Size Distribution of SIC 72 Companies 1999

| Firm Size | N | N% | Employment | % Employment |
|---|---|---|---|---|
| 0 - 5 | 292 | 79 | 502 | 19 |
| 5 - 10 | 40 | 11 | 279 | 11 |
| 10 - 20 | 17 | 5 | 232 | 9 |
| 20 - 30 | 5 | 1 | 119 | 5 |
| 30 - 40 | 3 | 1 | 98 | 4 |
| 40+ | 12 | 3 | 1352 | 53 |
| TOTAL | 369 | 100 | 2582 | 100 |

**Source: DED (1999)**

# 3.0 Survey Results

## 3.1 Employment Profile

The preliminary results from the survey highlighted the fact that the official statistics (based on a 1997 employment survey) had significantly underestimated the growth in employment that took place within the computer services industry between 1997 and 1999. On the basis of our survey information and grossed up estimates for non-respondents it is estimated that the actual size of the industry, at December 1999, was in fact 4,253, some 65 per cent higher than the official figure. The 92 SIC72 companies participating in the study had a total employment of 3,299 comprising an estimated 78 per cent of total industry employment. Of the respondents 27 firms had no employees, and since this meant that they had no direct experience of labour market conditions, their contribution to the study was limited to providing details of their current employment and expected growth (these firms were exclusively locally owned sole traders or partnerships). The remaining 65 participating firms had a total employment of 3,250. Of this group 25 were externally owned and 40 locally owned companies, with average employment in externally owned firms (75) being twice as large as in locally owned firms (35). Moreover, if the two largest locally owned firms are excluded, the average number of employees in this grouping falls to around one-fifth of the externally owned figure.

It is important to define exactly the characteristics of those workers who must be in adequate supply if the industry is to avoid a shortage constraint. Clearly not all those employed in computer services are IT practitioners, and, even of those who are, a high proportion will not have an academic background in IT (ITNTO, 1999). Moreover, we assume that the computer services industry will only be constrained if there are shortages in the flow of persons equipped with specialist skills such as Unix, C/C++, Oracle etc. As a consequence this study is primarily concerned with the demands for persons who have gained formal IT qualifications at various levels. [1]

Of the 3,250 persons employed by our 65 participant firms, 1,427 (44%) had gained some form of IT qualification, with the proportions broadly similar across the two ownership categories. Thus we assume that around 40 per cent of any increase in industry employment will consist of specialist workers. The composition of specialist labour demand was obtained by assessing the expertise of the existing workforce at the time of recruitment. IT graduates with some prior technical experience were recruited by 82 per cent of firms and constituted the largest single element of demand, accounting for 42 per cent of all persons recruited into the current technical workforce. Just 23 per cent of the current technical workforce were recruited directly from university with no prior experience (Table 2), suggesting that in the past there was a relatively low demand for new graduates due to the availability of a relatively large mobile pool of more experienced labour.

**TABLE 2:** Recruitment Structure of Computer Services

| | No. Of Firms | No. Of Employees | % Employees |
|---|---|---|---|
| Non-Graduate Technical Support | 41 | 235 | 16 |
| Graduates with no Previous Experience | 35 | 334 | 23 |
| Graduates with some Technical Experience | 53 | 597 | 42 |
| Graduate Project Leaders | 32 | 159 | 11 |
| Project / Strategic Managers | 23 | 102 | 7 |
| TOTAL | 65 | 1427 | 100 |

**Source:** NIERC (2000)
**Note:** Project leaders are defined as graduates with technical experience capable of some project management. Project managers are defined as graduates carrying out mainly project management or strategic planning functions

| TABLE 3: Ease / Difficulty of Recruitment (%) | | | | | | |
|---|---|---|---|---|---|---|
| | Very Easy | Quite Easy | Quite Difficult | Very Difficult | | N |
| Non-Graduate Technical Support | 30 | 43 | 13 | 15 | | 40 |
| Graduates with no Previous Experience | 26 | 35 | 24 | 15 | | 34 |
| Graduates with some Technical Experience | 9 | 21 | 38 | 32 | | 53 |
| Graduate Project Leaders | 3 | 26 | 26 | 45 | | 31 |
| Project / Strategic Managers | 5 | 27 | 14 | 55 | | 22 |

**Source: NIERC (2000)**

It was found that the recruitment structure differed by ownership category (Appendix 1, Tables A1 and A2). Externally owned companies employed larger proportions of new graduates and project/strategic managers whilst in locally owned firms there was a heavier emphasis on graduates with prior experience and technical support staff. In fact the ratio of new graduates employed within the external component relative to the locally owned component was 3.4:1 whilst the ratio for technical support staff is 0.6:1. Such variations might be explained through size and resource differences. Externally owned firms tend to be larger organisations with significant financial resources and so are better equipped to provide training to new graduates and they typically have hierarchical structures that create a greater demand for senior managers. The larger proportion of technical support staff and smaller proportion of new graduates in the locally owned category may mean that technical support staff in locally owned firms undertake more higher level tasks than their counterparts in externally owned companies.

## 3.2 Recruitment Difficulties and Unfilled Vacancies

Respondents were asked to assess the degree of difficulty involved in recruiting different categories of staff. It should be noted that this question was asked only to those companies who had actually recruited at the level concerned[2]. Not surprisingly, recruitment appears to become more difficult the more experienced the employees being sought (Table 3). Less than 30 per cent of firms expressed any difficulty in recruiting non-graduate technical support staff or new graduates; however, the proportion experiencing difficulty rose to around 70 per cent for all other categories of staff. The recruitment of graduate project leaders and project managers/strategic planners seems to pose the greatest problems with 45 per cent and 55 per cent of respondents respectively describing these types of workers as very difficult to recruit.

It is also worth pointing out that the market for graduates with some prior technical experience, which represents the largest component of recruitment demand (Table 2), is described by almost a third of relevant employers as very difficult. As the sector expands it is likely that the recruitment of such persons will become increasingly difficult, therefore employers may be obliged at some stage to recruit more heavily amongst the inexperienced graduate stock.

Disaggregating the data by ownership, it was found that of the 34 companies with experience in recruiting new graduates 17 were locally owned and 17 externally owned. Almost half of externally owned companies reported some difficulty in recruiting new graduates compared to less than one third of the locally owned. However, this may

1 The demand for those practitioners requiring more basic skills such as a knowledge of networking and operating systems is not a concern as research suggests that these demands can be met by combining recruitment from the non-specialist graduate pool with some elementary level of in-house training (ITCE, 1999).

2 In some instances the respondent was unable to answer if the recruitment took place before the respondent themselves joined the firm; thus there is not necessarily a direct correspondence in the various sample sizes in Tables 2 and 3.

be explained by the fact that two and half times more new graduates are employed by externally owned firms.

Thus employers in Northern Ireland perceive the labour market for IT workers to be relatively tight at all levels above graduates with no previous experience. However, this attitudinal-based indicator does not allow us to control for differences in how each individual defines a difficult process or quantify the level of shortage. In order to obtain a more well-defined and quantifiable measure of labour market shortage, data was collected on the level of unfilled vacancies for a number of broadly defined IT occupations, which in turn relate to the educational/experience-based categories used in Tables 2 and 3. These were:

- Non-graduate support
- Software development / installation & integration (A relatively broad category and we assume that this is the standard level of entry for both new IT graduates and those with some prior experience. It also encompasses project leaders)
- Project manager
- Senior manager (carrying out mainly strategic planning functions)
- Other

Twenty companies (31 per cent) of firms surveyed reported a total of 79 unfilled vacancies for IT specialist staff in the twelve months prior to December 1999 (Table 4). This sub-group had a total employment of 1,561 representing 48 per cent of total sample employment and an estimated 37 per cent of total industry employment. Given that an estimated 1,244 persons (net of those leaving) were recruited during the year, approximately 44 per cent (539) of whom are likely to have been IT specialists, it is estimated that at least 14 per cent ((79 ÷ 539) x 100) of specialist vacancies are likely to have remained unfilled during 1999. However, a more satisfactory measure of shortage is obtained by expressing unfilled vacancies as a percentage of total employment within each occupational aggregate. During 1999 the computer services industry experienced recorded vacancies in the flow of IT qualified labour equivalent to 5.5 per cent of total specialist employment, with the highest incidences of shortage reported within project management (12.6%) and software development/installation & integration (5.7%). The problem appears to be less severe for technical support staff and senior management positions.

It is possible to make some broad comparison with the level of skill shortage in Northern Ireland relative to the UK average by utilising data from the 1999 NCC study. However, such analysis is useful only for broad illustrative purposes given the significant differences in the two methodologies[3]. According to the NCC there was a

**TABLE 4:** Vacancy and Shortage by Employee Type

| | TOTAL (n=20) | | Locally-owned (n=10) | | Externally-owned (n=10) | |
|---|---|---|---|---|---|---|
| | Vacancy | % Shortage | Vacancy | % Shortage | Vacancy | % Shortage |
| Non-grad Support | 3 | 1.3 | 3 | 2.0 | 0 | 0 |
| Software Developers | 53 | 5.7 | 17 | 4.2 | 36 | 6.6 |
| Project Managers | 20 | 12.6 | 4 | 5.2 | 16 | 19.5 |
| Senior Managers | 2 | 2.0 | 0 | 0 | 2 | 2.6 |
| Other IT Related | 1 | N/A | 1 | N/A | 0 | N/A |
| TOTAL | 79 | 5.5 | 25 | 3.9 | 54 | 6.8 |

**Source: NIERC (2000)**

perceived shortfall of 6.6 per cent in the numbers of specialist IT personnel working in the UK during 1999, some 1.1 percentage points above the actual shortage found within Northern Ireland computer services[4]. Within the UK the highest perceived shortages are in the areas of systems development (10.5%) an aggregate broadly comparable to our software development/ installation & integration category, where the level of actual shortage was 4.8 percentage points lower. The NCC study also found significant shortages in technical/network support staff (8.7%), over six times higher than the level reported in this study for the comparable non-graduate support grouping. On the other hand, the perceived shortage in management staff was just 3.5 per cent in the UK study compared to an actual shortage of 8.4 per cent for project managers/senior managers in Northern Ireland. The fact that Northern Ireland firms appear to have much more difficulty in attracting persons into management positions might possibly be explained through wage differentials, a factor examined below. The smaller relative shortage in technical support and software developer staff may be a reflection that the market for new entrants in Northern Ireland has not been stretched to the extent of other UK regions. For example, if we assume a similar ratio of Higher Education (HE) and Further Education (FE) IT places per 10,000 of population, the fact that the industry in Northern Ireland is smaller than that of any other UK region implies a higher relative supply of IT qualifiers from the HE and FE sector. This in turn leads to a lower level of shortage in the occupational aggregates that absorb these new entrants.

The incidence of shortage in Northern Ireland was not confined to either externally owned or locally owned firms, with the number of firms reporting unfilled vacancies equally distributed between the two groups. However, some differences do occur in terms of the nature of shortage, with externally owned firms experiencing a 19.5 per cent shortfall in the number of project managers during 1999, almost four times the rate for the locally-owned sector. Although both categories employ similar proportions of project managers, demand growth appears to have been particularly rapid during the year within the external cohort. These externally owned firms tend to be much larger than their locally owned counterparts and are likely to have more developed management structures. The externally owned sector grew at more than twice the rate of the locally owned sector during 1999 and it had a much higher relative demand for persons to fill middle management positions, a demand that was clearly not met. Disaggregating according to firm's size it was found that almost 70 per cent of all unfilled vacancies occurred in firms employing 50 or more persons; however, the overall rate of shortfall is similar across all size bands (Appendix 1, Table A3).

The impact of these shortages on company performance is believed to be important with the majority of firms reporting that their development was being severely constrained in one or more ways. Almost half of the cohort reported that their ability to develop new products was severely impeded whilst a major negative productivity effect was reported by a third, with the incidence more common amongst externally owned firms (Appendix 1, Tables A4, A5, A6).

Thus it appears that Northern Ireland firms are experiencing significant difficulties in recruiting staff at project management and systems developer levels and that these shortages may adversely affect company performance. In order to develop a better understanding of what lies behind these skill shortages, respondents reporting unfilled vacancies were asked to rank a number of potential explanatory factors in order of importance (Appendix 1, Table A7). Over 90 per cent of firms cited the lack of persons with the required technical ability as important. In addition, a lack of people with sufficient experience of working in IT organisations also figured prominently, being ranked as important by 85 per cent of respondents. In contrast, under half of them cited a lack of persons with relevant

3 The NCC (a) measure the level of perceived as opposed to actual shortage (b) do not restrict their sample to computer services companies, and (c) use slightly different occupational aggregates.

4 The NCC study includes user support and operations staff, which we exclude from our comparisons on the basis that they represent non-specialist occupations.

| TABLE 5: Actions Taken Regarding Unfilled Vacancies (%) | | | |
|---|---|---|---|
| | TOTAL (n=20) | Externally-owned (n=10) | Locally-owned (n=10) |
| 1. Upskill existing staff | 60 | 80 | 40 |
| 2. Increase salary / introduce bonuses | 55 | 50 | 60 |
| 3. Recruit from non-IT background & train | 45 | 50 | 40 |
| 4. Recruit less qualified persons | 40 | 50 | 30 |
| 5. Change internal structure & practices | 40 | 20 | 60 |
| 6. Use of recruitment agencies | 25 | 30 | 20 |
| 7. Other | 45 | 40 | 50 |
| 8. Do nothing | 5 | 0 | 10 |

**Source: NIERC (2000)**

academic qualifications as consequential. Competition from other firms, particularly those located in Northern Ireland, and to a lesser extent the Republic of Ireland, also emerged as a significant factor. According to our respondents then, the main driving force behind the unfilled vacancies problem appears to be an extremely tight local labour market for persons with sufficient experience to fill systems development and project management posts.

When asked about the practices introduced to combat skill shortages the vast majority of affected companies did appear to be adopting a longer-term strategy, as recorded in Table 5. Exactly 80 per cent of firms stated that they were reducing entry requirements and training staff themselves, that is, adopting one or more of policies 1, 3 or 4. The preferred method appears to be training existing staff to fill empty posts, however, this practice was much more predominant amongst externally owned firms. In addition, over 50 per cent of companies were improving the financial packages on offer.

## 3.3 Relative Wages

As stated it is possible that the skill shortages recorded for Northern Ireland might be in some way connected to wages relative to those in GB and the Republic of Ireland. Since IT workers are likely to be quite mobile, significant wage differentials between different (relatively proximate) locations are likely to have a major impact on labour supply. Needless to say, the persistence of such differentials would undermine any attempt to solve a "local" shortage through training, as firms would find it almost impossible to retain their newly trained staff. Within this study it was found that 55 per cent of firms with unfilled vacancies stated that they were currently improving the financial packages on offer, even though a very low proportion of affected firms considered pay to be an important factor in explaining the incidence of unfilled vacancies.

A total of 59 firms, 36 locally owned and 23 externally owned, agreed to provide us with information on the gross annual salaries offered when advertising for various positions. It was possible to compare our results with average salary data for the UK made available by the 1999 NCC report and for the Republic of Ireland using a 1998 earnings survey conducted by Marlborough Group. Of course it would be anticipated that the UK average would have increased since 1999, and the Republic of Ireland figures would have risen even more substantially since 1998. Nevertheless, the comparisons in Table 6 are instructive. Average salary levels within Northern Ireland are broadly comparable with the UK and the Republic of Ireland for both non-graduate trainee posts and the bottom two tiers of systems development (Table 6). However, wage rates are lagging behind for more senior systems development staff and

| TABLE 6: Salary Levels as a Percentage of the Northern Ireland Average | | | | | |
|---|---|---|---|---|---|
| | NI Average | NI Indigenous | NI External | UK | RoI |
| Non-Graduate Trainee | 12918 | -4% | +6% | -7% | * |
| Graduate Trainee | 14939 | -6% | +6% | +6% | * |
| Graduate with Technical Experience | 18213 | -1% | = | +9% | +22% |
| Project Leaders | 22907 | -2% | +2% | +41% | +26% |
| Project / Strategic Managers | 26375 | -3% | +2% | +41% | +24% |

**Source: NIERC (2000), NCC (1999), and Marlborough Group (1998)[5]**

project managers. It is noticeable that wage differentials are most pronounced in the areas where skill shortages are most in evidence within the Northern Ireland computer services industry. It would appear that Northern Ireland firms may need to review their pay structures at more senior levels if they are to recruit and retain key staff.

The similarity of wage rates paid within the external and locally owned components indicates that externally owned firms have a very clear perception of the going rate within Northern Ireland. This suggests that relatively cheap labour may be an important factor influencing these firms' decisions to locate here. The exact process by which externally owned firms are setting wage rates remains unclear. It may be that these firms instinctively investigate the issue of wage levels before locating, alternatively the wage information may be provided by the agencies as a selling point, designed to encourage firms into the region.

## 3.4 How do Firms view the Competencies of their Existing Staff?

Firms were asked to rate the technical, interpersonal and business awareness competencies of their existing staff in terms of the level of each attribute they would desire in order to meet their commercial needs (Table 7). It should be noted that as a result of intra-organisational mobility there is unlikely to be any direct correlation between an individual's current status and their qualifications and experience at the time of recruitment. Generally speaking, firms were satisfied with both the technical and interpersonal skills of their current workforce with very few companies reporting any deficiencies. However, some concern was raised relating to the business awareness of IT specialists, with over a quarter of firms rating some of their employees' abilities in this area as very poor. The level of dissatisfaction was greatest at the lower tiers of the organisational structure with 21 per cent of firms employing technical support staff and 17 per cent of those employing software developers stating that these employees lacked required levels of business awareness.

The reported impact of these deficiencies on company performance was much less severe than that arising as a consequence of unfilled vacancies; nevertheless, they are worth noting. More than one quarter of firms recording a skills deficiency related a major adverse impact on productivity levels, running costs and their ability to develop new products (Appendix 1, Table A10).

## 3.5 How do Firms view the Competencies of New Entrants to the Labour Market?

Respondents were asked to rank the competencies of persons recruited with particular qualifications

5 When comparing the salary of a graduate with some technical experience we assume that it will be equivalent to that of a systems developer with less than three years' experience from the UK study and a systems analyst with 1 to 2 years' experience for Republic of Ireland. For the next two categories comparable categories of project leader and project manager were available in both the UK and Republic of Ireland studies (assuming 3 - 5 years' experience in the case of the Irish study).

| TABLE 7: Companies Reporting Skill Deficiencies by Employee Type | | | | |
|---|---|---|---|---|
| | Technical Skills | Interpersonal Skills | Business Awareness | N |
| | % | % | % | |
| Technical Support | 0 | 2 | 21 | 56 |
| Software Developers | 0 | 2 | 17 | 54 |
| Project Managers | 0 | 2 | 2 | 49 |
| Senior Managers | 3 | 3 | 3 | 38 |
| TOTAL | 2 | 5 | 26 | 65 |

**Source: NIERC (2000) Note: Skill deficiency exists when skills are described as poor or very poor**

but no previous experience, irrespective of whether or not these persons still remained within the firm (Table 8). As with existing staff, firms tended to view the business awareness skills of new entrants as poor; however, there were also significant proportions describing the technical ability of some new entrants as poor or very poor. The highest level of dissatisfaction was with persons entering the labour force from IT postgraduate conversion courses, with approximately 30 per cent of employing firms rating their technical ability and business awareness as poor or very poor. A high proportion of firms also described as poor the technical competencies of recruits from non-graduate vocational and specialist IT postgraduate courses. However, the level of dissatisfaction was significantly lower for persons graduating from IT first degrees. Finally, there was pretty uniform dissatisfaction with the business awareness skills at all levels of educational attainment.

## 3.6 The Incidence of Off-the-Job and On-the-Job Training

There is a well-developed training culture in the sector with 63 per cent of firms providing off-the-job training and 75 per cent on-the-job training; only 17 per cent of companies do not provide any form of training. The most popular courses are those that offer qualifications catering to the specific needs of firms, followed by degree courses and Microsoft certificates (Appendix 1, Table A11). Company-specific and higher education courses are much more heavily favoured by externally owned companies whilst Microsoft qualifications predominate within the locally owned sector. In relation to on-the-job training, the emphasis is on improving the technical skills of both graduates and non-graduates with companies providing between 18 and 22 days per person annually, although it is probably reasonable to assume that each person will receive such training only once (Appendix 1, Table A12).

| TABLE 8: Companies Reporting Skill Deficiencies in New Entrants by Level of Education | | | |
|---|---|---|---|
| | Technical Ability | Interpersonal Skills | Business Awareness |
| | % | % | % |
| Non-Grad Vocational | 22 | 13 | 35 |
| IT First Degree | 10 | 7 | 39 |
| IT Post Grad | 19 | 4 | 31 |
| IT Post Grad Conversion | 31 | 4 | 27 |

**Source: NIERC (2000)**

# 4.0 Econometric Analysis

The factors driving skill shortages and their impact on company performance can be examined more formally by using econometric techniques.

## 4.1 Explaining Skill Shortages and Skill Deficiencies

In order to determine the relative importance of different factors that might potentially influence the reported skill shortages a univariate probit model was estimated, the results of which are reported in Appendix 2, Table A13. The left-hand side variable is binary and takes the value 1 if the firm had reported an unfilled vacancy, otherwise it is 0. The econometric analysis confirms that skill shortages were more likely to be experienced by larger companies and that ownership was not a significant factor. In addition, those companies employing a higher share of technically skilled persons were more likely to experience a shortage; this factor is probably a proxy for the technical sophistication of a firm's activities (that is, the greater the extent to which a firm's operations are centred around product development, as opposed to product services, the more likely they are to experience a skill shortage).

The structure of graduate technical recruitment was also found to be significant, in particular for those persons employed at the systems developer level, the occupational aggregate within which almost 70 per cent of unfilled vacancies occur. The results indicate that shortages are most likely for those companies whose technical employment contains a relatively low proportion of new and inexperienced graduates and a relatively high proportion of project leaders. This implies that current recruitment practices are a significant driver of skill shortages, more specifically those firms setting higher entry requirements and thus recruiting lower levels of new and inexperienced graduates are the ones most likely to experience unfilled vacancies. In addition, firms reporting shortages were more likely to view new IT qualifiers from educational institutions as being deficient in either technical, interpersonal or business awareness attributes. This "chill factor" explains the tendency of these firms to set the higher recruitment standards thus substantially reducing their available pool of labour.

Although the coefficient on the wage variable was negative in the estimated relationship, it was not significant indicating that the wage dispersion between Northern Ireland companies is not an important factor in explaining skill shortages. However, we cannot ignore the large differentials that exist at the more senior levels relative to the adjacent IT labour markets of the Republic of Ireland and Great Britain. Although it was not possible to model this external influence it is very likely to represent an important factor in determining shortages at and above project leader level.

Contrary to the perceptions of respondents, competition for new workers (proxied by whether or not a firm lost a technical member of staff to a competitor from Northern Ireland) did not prove important. Neither was the rate of firm growth from 1997 to 1999 significant; however, given that most firms in the sample experienced significant expansion over this period the finding is not surprising. Finally, the coefficients on the variables measuring the existence of training regimes and firm location did not prove important[6].

The pseudo $R^2$ indicates that these largely internal factors explain 40 per cent of variations in the occurrence of unfilled vacancies amongst our cohort of firms. The model suggests that any study of skill shortages should include the human resource management practices of companies, a factor that the literature has previously tended to ignore.

An attempt was made to examine factors that might potentially explain the incidence of skill deficiencies in an econometric context within both a univariate and a bivariate framework; however, no significant effects were found. The results imply that skill deficiencies are not determined by size, location, training regimes or human resource

6 Our results partially correspond with the findings of Green, Machin & Wilkinson's 1998 study of 2,061 British establishments, which found a significant positive coefficient on the skilled share of employment and size variables. However, the UK study found a significant negative wage effect, which was absent within our model.

management practices. Nevertheless, the coefficient on the variable dummying a negative perception of educational output was positive and significant; however, it was not possible to find a sufficiently well specified model containing the variable that rejected the null hypothesis of zero slopes. However, the analysis indicates that any future research in the area of skill deficiencies should examine more closely current standards within the training and educational sectors with specific reference to the extent to which students are being equipped with softer skills such as business awareness.

## 4.2 Productivity Effects

Approximately two-thirds of firms with unfilled vacancies reported that their productivity levels were being adversely affected, with the proportion even higher for those companies reporting skill deficiencies (Appendix 1, Tables A4 & A10). There are two possible ways in which shortages could lower productivity. Firstly, shortages increase the costs of recruiting skilled labour, forcing firms to eventually substitute less productive unskilled workers. Secondly, shortages may put workers in a stronger bargaining position to demand an easier pace at work (see Haskel & Martin, 1993) which will also reduce productivity.

Factors with the potential to influence productivity levels were examined in an Ordinary Least Squares (OLS) regression, the results of which are reported in Appendix 2, Table A14. The dependent variable is the log of the value of turnover per employee in 1999, whilst the independent variables include dummy variables for reported skill gaps and deficiencies. It should be noted that the sample size is reduced because only 48 of the 65 respondents agreed to provide us with turnover information[7]. The proportion of firms reporting shortages and deficiencies stood at 31 and 27 per cent respectively, which corresponds almost exactly to the level of representation within the complete sample. The results indicate that neither skill shortages nor deficiencies have a significantly negative influence on productivity levels; in fact the coefficient on the shortage variable is positive. Eliminating the insignificant variables and estimating a parsimonious model, we find that productivity is positively related to external ownership and negatively related to firm size and the new graduate share of technical employment, with these variables collectively explaining almost a third of the variation in productivity levels.

A perhaps more rigorous test of any adverse influence arising from shortages or deficiencies is achieved by running the regression on productivity growth between 1997 and 1999. The sample size is now reduced to 33 due to the absence of 1997 turnover data, either because the firm was not alive at this point in time or the information could not be obtained from existing sources; however, the sample remains representative. Again neither the skill shortage nor deficiency variables prove important with only ownership and the new graduate technical employment share remaining significant when the regression is parsed (the size variable drops out).

Thus, in contrast to the perceptions of respondents, neither skill shortages nor skill deficiencies appear to exert a statistically significant negative influence on productivity. Productivity was lower in those firms employing higher proportions of new graduates, which perhaps provides a rationale as to why some computer service firms are reluctant to recruit this type of employee. Finally, it is worth noting that a significant connection was detected between external ownership and productivity.

7 The OLS regressions were estimated within TSP, which eliminates records with missing observations. As some respondents failed to provide wage information the unparsed model (which contains the wage variable) has slightly fewer observations than the parsed model (which excluded the wage variable).

# 5.0 Summary and Conclusions

The labour market for IT professionals in Northern Ireland is perceived by employers as being relatively tight for all workers above the inexperienced graduate level. More specifically, there is evidence that there are significant shortages occurring in the supply of systems developers and project managers. The common view expressed by respondents was that these shortages primarily resulted from an inability to recruit suitably technically efficient and experienced staff. This in itself provides a strong indication that those firms experiencing unfilled vacancies are reluctant to recruit and train relatively inexperienced labour. This was borne out in the econometric analysis, which revealed that lower levels of graduate utilisation significantly raise the probability of experiencing an unfilled vacancy. It seems then that firms' employment and human resource management practices may be contributing to the incidence of skill shortage, with firms restricting the size of their available labour pool by setting high experience requirements for entry. Having set these requirements, firms are finding it very difficult to recruit the experienced staff they seek. In part their recruitment difficulties stem from the large earnings differentials between Northern Ireland and the nearby labour markets of GB and the Republic of Ireland.

Few deficiencies were reported in the technical ability or interpersonal skills of the existing workforce; however, some concern was raised in relation to the business awareness particularly of lower-level specialist staff. There is also some evidence that employers perceive weaknesses in the technical abilities of new entrants from both specialist and conversion postgraduate courses.

Finally, a more formal statistical analysis revealed no significant effect of skill shortages or skill deficiencies on the productivity of Northern Ireland firms. However, the econometric results did reveal that productivity was significantly lower the larger the technical employment share of new graduates, which might provide an explanation for the apparent reluctance of some employers to hire this type of labour.

# References


AISS, ITNTO, 1999, Skills 99: *IT Skills Summary*, Report to the Department of Trade and Industry, London

Autor, D., Katz, L., Krueger A., 1998, 'Computing Inequality: Have computers changed the labor market?', *Quarterly Journal of Economics*, November 1998; pp:1169-1213

Barron, T., 1999, '*Wooing IT Workers',Training & Development*, April 1999; pp20-24

Beard, J., Breen E., 1998, *IT Labour Market Assessment*, DFEE Research Briefs, Research Report No.71

Berman, E., Bound, J., Griliches, Z., 1994, 'Changes in the demand for skilled labor within US manufacturing industries: Evidence from the annual survey of manufacturing', *Quarterly Journal of Economics*, May 1994; pp367-398

Berndt, E., Morrison, C., Rosenblum, L., 1992, *High-Tech capital formation and labor composition in US manufacturing industries: An exploratory analysis*, NBER Working Paper No. 4010

Bresnahan, T., 1999 'Computerisation and Wage Dispersion: An Analytical Reinterpretation', *The Economic Journal*, Vol. 109 June;
pp F390 -F15

Crone, M., 1999, *Computer Services and Software Employment in the UK and Ireland, 1991-97: An Exploration of Official Data with Particular Reference to Northern Ireland,* NIERC Report Series, Report No. 16, NIERC, Belfast

Doms, M., Dunne, T., Troske, K., 1997, 'Workers, Wages and Technology', *The Quarterly Journal of Economics*, February 1997; pp253-290

Expert Group on Future Skills Needs, 1999, *The First Report of the Expert Group on Future Skills Needs*, Forfas, Dublin

Green, F., Machin S., Wilkinson D., 1998, 'The Meaning and Determinants of Skills Shortages', *Oxford Bulletin of Economics and Statistics*, Vol. 60 (2) 1998; pp165-187

Haskel, J., Martin, C., 1993, 'Do Skill Shortages Reduce Productivity? Theory and Evidence from the UK', *The Economic Journal*, Vol. 103, 1993; pp386-394

IFF Research, 1998, *Skill Needs in Great Britain and Northern Ireland 1998*, IFF Research, London

ITCE Skills Strategy Group, 1999, *Skills for the Information Age: Second Report from the ITCE Skills Strategy Group*, DFEE, Sheffield

ITCE Skills Strategy Group, 1999, *Final Report from the ITCE Skills Strategy Group*, DFEE, Sheffield

Irish Software Association, 1998, *To Boldly Go....The Irish Software Industry - A Strategy for Growth*, The Irish Software Association, Dublin

Keynote, 1998, C*omputer Market (UK) October 1998*, Keynote

Marlbrough Group, 1998, *Salary Survey 1998*, Marlborough Group, Dublin

Mason, G., 1999, *The labour market for Engineering, Science and IT graduates: Are there mismatches between Supply and Demand?*, DFEE Research Briefs, Research Report No. 112

National Computing Centre, 1999, *Salaries and Staff Issues in IT 1999*, National Computing Centre

Software Industry Federation, 1999, *A Strategy for the Software Industry in Northern Ireland*, Software Industry Federation, Belfast

T&EA, SIF, ITNTO, 1999, *Information Technology Skills Framework: A Guide for Northern Ireland*

# Appendices

# Appendix 1: Survey Results

| **TABLE A1:** Recrutiment Structure - Locally-Owned Firms | | | |
|---|---|---|---|
| **(n=40)** | **No. Of Firms** | **No. Of Employees** | **% Of Employees** |
| Non-Graduate technical support | 27 | 148 | 23 |
| Graduates with no previous experience | 18 | 76 | 12 |
| Graduates with some technical experience | 30 | 312 | 49 |
| Graduate project leaders | 18 | 77 | 12 |
| Project / strategic managers | 11 | 24 | 4 |
| TOTAL | 40 | 637 | 100 |

**Source: NIERC (2000)**

| **TABLE A2:** Recrutiment Structure Externally-Owned Firms | | | |
|---|---|---|---|
| **(n=25)** | **No. of Firms** | **No. of Employees** | **% of Employees** |
| Non-graduate sechnical support | 14 | 87 | 11 |
| Graduates with no previous experience | 17 | 258 | 33 |
| Graduates with some technical experience | 23 | 285 | 36 |
| Graduate project leaders | 14 | 82 | 10 |
| Project / strategic managers | 12 | 78 | 10 |
| TOTAL | 25 | 790 | 100 |

**Source: NIERC (2000)**

| **TABLE A3:** Labour Market Shortage by Firm Size | | | | | | |
|---|---|---|---|---|---|---|
| **Firm Size** | **<20 (n = 6)** | | **20 - 49 (n = 6)** | | **50+ (n = 8)** | |
| | Vacancy | % Shortage | Vacancy | % Shortage | Vacancy | % Shortage |
| Non-grad support | 2 | 2.9 | 0 | 0.0 | 1 | 0.7 |
| Software developers | 9 | 6.6 | 9 | 7.8 | 35 | 5.2 |
| Project managers | 1 | 5.3 | 1 | 3.7 | 18 | 15.9 |
| Senior managers | 1 | 7.7 | 0 | 0.0 | 1 | 1.3 |
| Other IT Related | 0 | n/a | 1 | n/a | 0 | n/a |
| TOTAL | 13 | 5.5 | 11 | 6.0 | 55 | 5.5 |

**Source: NIERC (2000)**

# Appendix 1: Survey Results

| TABLE A4: Difficulties Arising from Unfilled Vacancies (n=20) | | | | | | | |
|---|---|---|---|---|---|---|---|
| Rank | Lower productivity | Loss of orders | Lower quality product | Higher running costs | Inability to develop new products | Failure to meet deadlines | Reduced credibility |
| | % | % | % | % | % | % | % |
| Major Impact | 35 | 20 | 5 | 20 | 45 | 20 | 5 |
| Some Impact | 30 | 25 | 15 | 40 | 15 | 55 | 40 |
| No Impact | 35 | 55 | 80 | 40 | 40 | 25 | 55 |

**Source: NIERC (2000)**

| TABLE A5: Difficulties Arising from Unfilled Vacancies - Locally-owned firms (n=10) | | | | | | | |
|---|---|---|---|---|---|---|---|
| Rank | Lower productivity | Loss of orders | Lower quality product | Higher running costs | Inability to develop new products | Failure to meet deadlines | Reduced credibility |
| | % | % | % | % | % | % | % |
| Major Impact | 20 | 10 | 0 | 30 | 50 | 20 | 0 |
| Some Impact | 40 | 30 | 0 | 50 | 20 | 60 | 40 |
| No Impact | 40 | 60 | 100 | 20 | 30 | 20 | 60 |

**Source: NIERC (2000)**

| TABLE A6: Difficulties Arising from Unfilled Vacancies - Externally-owned firms (n=10) | | | | | | | |
|---|---|---|---|---|---|---|---|
| Rank | Lower productivity | Loss of orders | Lower quality product | Higher running costs | Inability to develop new products | Failure to meet deadlines | Reduced credibility |
| | % | % | % | % | % | % | % |
| Major Impact | 50 | 30 | 10 | 10 | 40 | 20 | 10 |
| Some Impact | 20 | 20 | 30 | 30 | 10 | 50 | 40 |
| No Impact | 30 | 50 | 60 | 60 | 50 | 30 | 50 |

**Source: NIERC (2000)**

| TABLE A7: Reasons for Unfilled Vacancies (n=20) | | | | | | | |
|---|---|---|---|---|---|---|---|
| % | Shortage of qualified applicants | Lack of technical ability | Shortage of sufficient experience | Cannot pay enough | Competition from NI employers | Competition from ROI employers | Competition from GB employers |
| Very Imp | 10 | 75 | 65 | 10 | 35 | 10 | 5 |
| Important | 35 | 20 | 20 | 15 | 40 | 25 | 20 |
| Not Imp | 55 | 5 | 15 | 75 | 25 | 65 | 75 |

**Source: NIERC (2000)**

# Appendix 1: Survey Results

| TABLE A8: Reasons for Unfilled Vacancies - Locally-owned firms (n=10) | | | | | | | |
|---|---|---|---|---|---|---|---|
| % | Shortage of qualified applicants | Lack of technical ability | Shortage of sufficient experience | Cannot pay enough | Competition from NI employers | Competition from ROI employers | Competition from GB employers |
| Very Imp | 10 | 80 | 60 | 0 | 30 | 20 | 10 |
| Important | 50 | 10 | 10 | 20 | 40 | 20 | 20 |
| Not Imp | 40 | 10 | 30 | 80 | 30 | 60 | 70 |

**Source: NIERC (2000)**

| TABLE A9: Reasons for Unfilled Vacancies - Externally-owned firms (n=10) | | | | | | | |
|---|---|---|---|---|---|---|---|
| % | Shortage of qualified applicants | Lack of technical ability | Shortage of sufficient experience | Cannot pay enough | Competition from NI employers | Competition from ROI employers | Competition from GB employers |
| Very Imp | 10 | 70 | 70 | 20 | 40 | 0 | 0 |
| Important | 20 | 30 | 30 | 10 | 40 | 30 | 20 |
| Not Imp | 70 | 0 | 0 | 70 | 20 | 70 | 80 |

**Source: NIERC (2000)**

| TABLE A10: Difficulties Arisiing for Firms with Skill Deficiencies (n=18) | | | | | | |
|---|---|---|---|---|---|---|
| Rank | Lower productivity | Loss of orders | Lower Quality product | Higher costs | Inability to develop | Failure to meet deadlines |
| Very Imp | 28 | 6 | 11 | 28 | 28 | 11 |
| Important | 44 | 17 | 22 | 44 | 22 | 44 |
| Not Imp | 28 | 78 | 67 | 28 | 50 | 44 |

**Source: NIERC (2000)**

| TABLE A11: Incidence of Off-The-Job Training | | | |
|---|---|---|---|
| | TOTAL | Indigenous | External |
| | % | % | % |
| Company specific | 28 | 20 | 40 |
| Higher Qualifications | 26 | 15 | 44 |
| Microsoft | 26 | 30 | 20 |
| NVQ | 6 | 10 | 0 |
| Other Vocational | 6 | 8 | 4 |
| Other | 6 | 8 | 4 |
| TOTAL | 63 | 58 | 72 |

**Source: NIERC (2000)**

| TABLE A12: Companies Providing On-The-Job Training | | |
|---|---|---|
| TOTAL | % Of Total Sample | Av. No Days |
| Technical Skills for non-graduates | 48 | 22 |
| Technical skills for graduates | 69 | 18 |
| Project management skills for graduates | 31 | 15 |
| Strategic management skills for graduates | 26 | 9 |
| TOTAL | 75 | n/a |

**Source: NIERC (2000)**

# Appendix 2: Econometric Results

| TABLE A13: Results from Univariate Probit Model of Skill Shortages | |
|---|---|
| Constant | -5.489 **[**-1.335**]** (1.657)*** |
| Externally owned (dummy) | 0.198 **[**0.048**]** (0.515) |
| Employment growth 1997-1999 | -0.0004 **[**0.0001**]** (0.0005) |
| Firm size 1999 (logged) | 0.915 **[**0.222**]** (0.329)*** |
| Technical staff share of total employment | 3.360 **[**0.840**]** (1.188)*** |
| New and inexperienced graduate share of technical employment | -1.814 **[**-0.440**]** (0.880)** |
| Graduate Project leader share of technical employment | 3.670 **[**0.891**]** (1.749)** |
| Participates in off-the-job training (dummy) | 0.502 **[**0.122**]** (0.542) |
| Participates in on-the-job training (dummy) | -0.861 **[**-0.210**]** (0.756) |
| Located in central Belfast (dummy) | -0.605 **[**-0.147**]** (0.598) |
| Mean techical salary (logged) | -0.001 **[**-0.0002**]** (0.001) |
| Lost workers to competitor companies (dummy) | 0.256 **[**0.062**]** (0.502) |
| Perceived deficiencies in the quality of new entrants (dummy) | 1.327 **[**0.322**]** (0.591)** |
| | |
| Number of observations | 65 |
| Number of positive observations | 20 |
| Log Likelihood | -23.602 |
| Pseudo $R^2$ | 0.412 |

**Marginal effects in square brackets, standard errors in round brackets. Pseudo $R^2$ is calculated as 1-L/Ls where L is the log likelihood and Ls is the restricted log likelihood. Note: the significance of each coefficient is also noted: *** denotes significiance at the 99% level; ** at the 95% level and * at the 90% level.**

# Appendix 2: Econometric Results

| TABLE A14: Results from OLS Productivity Levels Regressions | | |
|---|---|---|
| | **Unparsed Model** | **Parsed Model** |
| Constant | 4.282 (1.769)** | 4.944 (0.108)*** |
| Externally owned (dummy) | 0.199 (0.111)* | 0.157 (0.089)* |
| Firm size 1999 (logged) | -0.097 (0.056)* | -0.115 (0.040)*** |
| Technical employment share | 0.219 (0.176) | |
| New graduate share of tech employment | -0.440 (0.209)** | -0.466 (0.179)** |
| Graduate leader share of tech employment | 0.034 (0.392) | |
| Off-the-job training (dummy) | -0.009 (0.109) | |
| On-the-job training (dummy) | -0.223 (0.146) | |
| Located in central Belfast (dummy) | 0.010 (0.101) | |
| Mean technical salary (loggged) | 0.057 (0.190) | |
| Lost workers to competitor companies (dummy) | -0.010 (0.113) | |
| Perceived deficiencies in quality of new entrants (dummy) | 0.185 (0.112) | |
| Reported skill shortage (dummy) | 0.001 (0.109) | |
| Reported skill deficiency (dummy) | -0.073 (0.106) | |
| | | |
| Number of observations | 45 | 48 |
| Adjussted $R^2$ | 0.263 | 0.303 |
| F Statistic (zero slopes) | 2.207** | 7.801*** |

**Note: The figures are regression coefficients with the standard error in the parentheses. The significance of each coefficient is also noted: *** denotes significiance at the 99% level; ** at the 95% level and * at the 90% level. All standard errors are heteroskedastic-consistent**

# Appendix 2: Econometric Results

| TABLE A15: Results from OLS Productivity Growth Regressions | | |
|---|---|---|
| | **Unparsed Model** | **Parsed Model** |
| Constant | -0.601(1.621) | 0.043 (0.035) |
| Externally owned (dummy) | 0.301 (0.126)** | 0.269 (0.080)*** |
| Firm size 1997 (logged) | -0.042 (0.047) | |
| Technical employment share | 0.305 (0.230) | |
| New graduate share of tech employment | -0.340 (0.166)* | -0.411 (0.136)*** |
| Graduate leader share of tech employment | 0.120 (0.261) | |
| Off-the-job training (dummy) | -0.069 (0.061) | |
| On-the-job training (dummy) | 0.088 (0.082) | |
| Located in central Belfast (dummy) | -0.005 (0.086) | |
| Mean technical salary (logged) | 0.103 (0.393) | |
| Lost workers to competitor companies (dummy) | 0.141 (0.101) | |
| Perceived deficiencies in quality of new entrants (dummy) | 0.010 (0.089) | |
| Reported skill shortage (dummy) | -0.006 (0.085) | |
| Reported skill deficiency (dummy) | -0.096 (0.119) | |
| | | |
| Number of observations | 31 | 33 |
| Adjusted $R^2$ | 0.194 | 0.374 |
| F Satistic (zero slopes) | 1.159 | 10.552*** |

**Note: The figures are regression coefficients with the standard error in the parentheses. The significance of each coefficient is also noted: *** denotes significiance at the 99% level; ** at the 95% level and * at the 90% level. All standard errors are heteroskedastic-consistent**

# Appendix 3: IT Questionnaire

Contact: _____

Position: _____

Company Name: _____

Address: _____

_____

Description of Main Activity: _____

| | Male | Female |
|---|---|---|
| Current Employment | | |

Current Turnover _____

Birth Year of Company _____

Ownership (N Irish, US etc) _____

How many employees do you expect to recruit over the next 5 years? (In which years?)

| | Number |
|---|---|
| 2000 | |
| 2001 | |
| 2002 | |
| 2003 | |
| 2004 | |
| 2005 | |

# Appendix 3: IT Questionnaire

## A) Labour Force Requirements and Salary Levels

**1. Please state the number of employees, if any, that you currently have that were recruited at the following levels**

| | Current emp | Desired current emp |
|---|---|---|
| Non Graduate IT technical support staff (HND / HNC / NVQ 3 level) | ☐ | ☐ |
| IT Graduates with no experience (Degree / Postgrad / conversion level) | ☐ | ☐ |
| IT Graduates with experience in carrying out mainly technical functions excludes placement year experience | ☐ | ☐ |
| IT Graduates with experience in carrying out mainly technical functions but capable of project management | ☐ | ☐ |
| IT Graduates with sufficient experience to undertake mainly project management / strategic planning functions | ☐ | ☐ |

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

| | Ease of recruitment |
|---|---|
| Non Graduate IT technical support staff (HND / HNC / NVQ 3 level) | ☐ |
| IT Graduates with no experience (Degree / Postgrad / conversion level) | ☐ |
| IT Graduates with experience in carrying out mainly technical functions | ☐ |
| IT Graduates with experience in carrying out mainly technical functions but capable of project management | ☐ |
| IT Graduates with sufficient experience to undertake mainly project management / strategic planning functions | ☐ |

# Appendix 3: IT Questionnaire

**3. Please state the Gross average annual salary paid when recruiting employees in each group**

| | |
|---|---|
| Non Graduate IT technical support staff (HND / HNC / NVQ 3 level) | |
| IT Graduates with no experience (Degree / Postgrad / conversion level) | |
| IT Graduates with experience carrying out mainly technical functions | |
| IT Graduates with experience carrying out mainly technical functions but capable of project management | |
| IT Graduates with sufficient experience to undertake mainly project management / strategic planning functions | |

**4. Have you lost any of the following workers to other employers in the last 12 months? If so, in which area are these employers?**

| | NI | GB | RoI | Else |
|---|---|---|---|---|
| Non Graduate IT technical support staff (HND / HNC / NVQ 3 level) | | | | |
| IT Graduates with no experience (Degree / Postgrad / conversion level) | | | | |
| IT Graduates with experience carrying out mainly technical functions | | | | |
| IT Graduates with experience carrying out mainly technical functions but capable of project management | | | | |
| IT Graduates with sufficient experience to undertake mainly project management / strategic planning functions | | | | |

# Appendix 3: IT Questionnaire

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

| | No. |
|---|---|
| Non-graduate technical support staff | ☐ |
| Software developers / Installation & integration | ☐ |
| Project Managers | ☐ |
| Senior managers / Strategic Planners | ☐ |

**6. (If company has unfilled vacancies) Please rank in order from 1 to 3 the most important factors explaining your difficulties, where 1= very important, 2=important, 3=not important**

| | |
|---|---|
| A shortage of people with the relevant academic qualifications | ☐ |
| A shortage of people with the required technical ability | ☐ |
| A shortage of people with sufficient experience in IT organisations | ☐ |
| Your company cannot pay enough | ☐ |
| Competition from other employers From within Northern Ireland | ☐ |
| Competition from other employers From the Republic of Ireland | ☐ |
| Competition from other employers From GB | ☐ |

**7. Does your company take any of the following actions to try and fill hard-to-fill vacancies?**

| | |
|---|---|
| Recruit less qualified people | ☐ |
| Recruit people from other areas and train them | ☐ |
| Train existing staff to fill the vacancy | ☐ |
| Change internal structures and practises | ☐ |
| Increase the salary to make the job more attractive | ☐ |
| Other (please state) | ☐ |

# Appendix 3: IT Questionnaire

## B) Skill Levels of New Entrants to the IT Sector

**8. Have you ever recruited people with the following qualifications (who have no previous experience)?**

BTEC National / NVQ 3 / HND / C ☐

IT First Degree Graduate ☐

IT Post Grad ☐

IT Post Grad Conversion ☐

**9. (For relevant categories) Please rank from 1-5 the competencies of these new entrants to your sector at the time of recruitment, where 1 = Very good, 2 = good, 3 = satisfactory, 4 = poor, 5 =Very poor**

| Skills | Technical | Interpersonal | Business Awareness |
|---|---|---|---|
| BTEC National / NVQ3 | ☐ | ☐ | ☐ |
| IT First Degree Graduate | ☐ | ☐ | ☐ |
| IT Post-grad | ☐ | ☐ | ☐ |
| IT Post-grad Conversion | ☐ | ☐ | ☐ |

## C) Skill Levels of Existing Workforce

**10. Do you currently employ people in any of the following positions?**

Technical support staff ☐

Software developers / Installation & integration ☐

Project Managers ☐

Senior managers / Strategic Planners ☐

**11. (For relevant categories) Please rank from 1-5 the competencies of these existing workers where 1 = Very good, 2 = good, 3 = satisfactory, 4 = poor, 5 =Very poor**

| Skills | Technical | Interpersonal | Business Awareness |
|---|---|---|---|
| Technical support staff | ☐ | ☐ | ☐ |
| Software developers / Installation & integration | ☐ | ☐ | ☐ |
| Project Managers | ☐ | ☐ | ☐ |
| Senior managers / Strategic Planners | ☐ | ☐ | ☐ |

## D) Skill Shortages / Skill Gaps as a Constraint on Growth

**12. 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 ☐

**13. 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

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

Yes ☐ No ☐

**If yes, which of the following qualifications are these?**

NVQs ☐

Other nationally recognised vocational e.g. RSA, BTEC, City & Guilds ☐

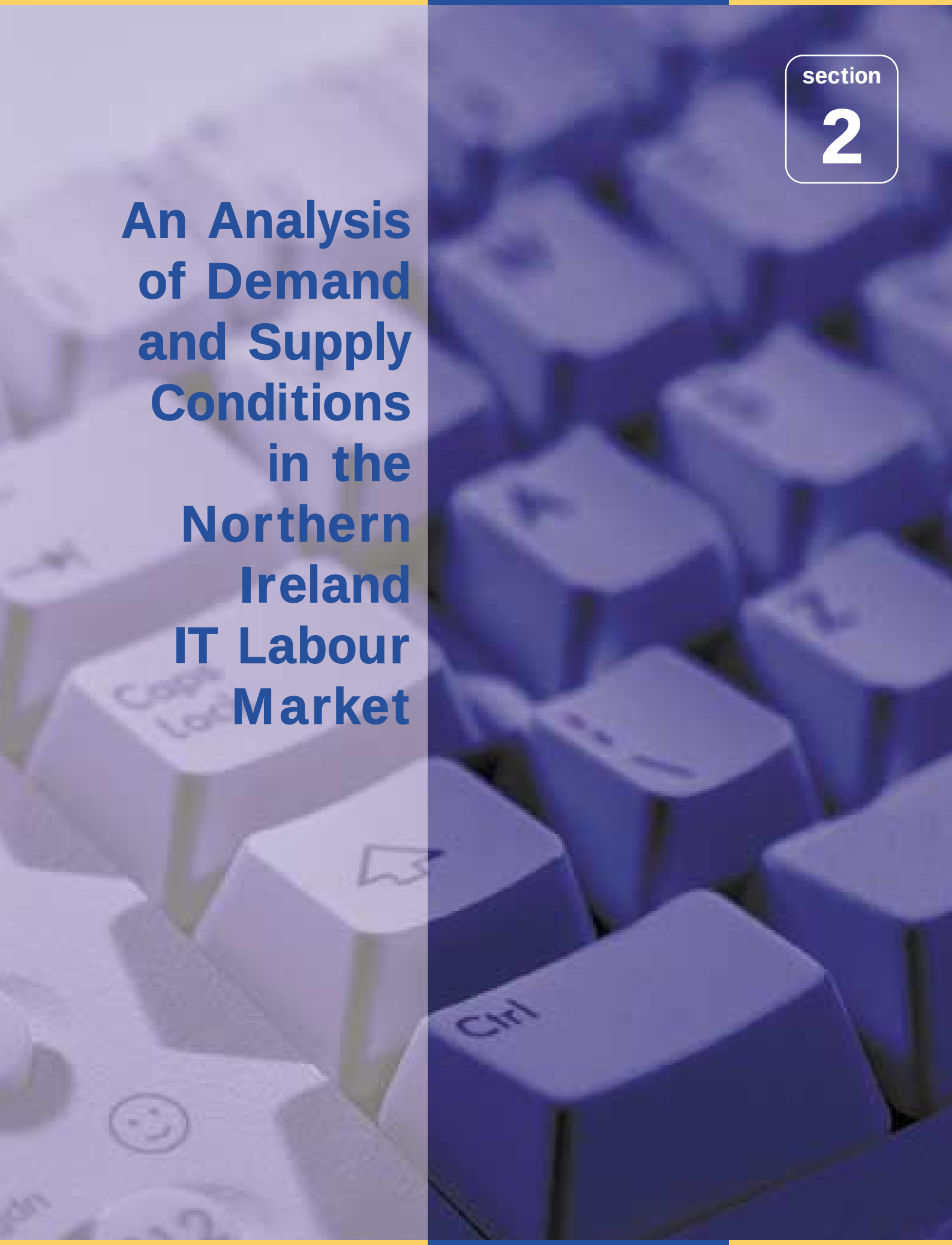
Qualifications specific to your company ☐

Microsoft accredited courses ☐

Higher qualifications such as degrees ☐

**15. Do you provide any on-the-job training in the following areas? If so, how many days per year training do you provide?**

| | | No. Days |
|---|---|---|
| Technical skills for non-graduates (HNC / HND / NVQ 3 Level) | ☐ | |
| Technical skills for graduates (Degree / Postgrad / Conversion) | ☐ | |
| Project Management skills for graduates | ☐ | |
| Strategic management skills for graduates | ☐ | |



section 2

# An Analysis of Demand and Supply Conditions in the Northern Ireland IT Labour Market

Prepared by the Priority Skills Unit

# Contents

## Section 2

## An Analysis of Demand and Supply Conditions in the Northern Ireland IT Labour Market

# Executive Summary

## Introduction

- This paper seeks to determine the likely extent and duration of any imbalances in the labour market for new IT graduates and technical support staff in Northern Ireland for the period up to and including 2005.

- The demand for these persons will be heavily concentrated within the computer services industry (division 72 in the SIC92 classification) but we realise that people with IT skills will be in demand throughout the economy and we make allowance for that in our projections of demand.

- Over the period 1992 to 1999 the computer services industry grew at an average annual rate of 22 per cent with locally owned expanding by 18 percent annually and the externally owned by 29 per cent. By December 1999 employment in the industry is estimated to have reached 4,253.

## Estimating Future Demand and Supply

- In estimating the future demand for IT practitioners we explore the consequences of some alternative assumptions about firms' growth rates, thus generating some alternative scenarios for the evolution of employment in the industry i.e. low, medium and high growth.

- It is forecast that computer services employment will rise in 2005 to 6,686 on the low growth scenario, 8,380 on the medium and 11,874 on the high growth scenario. The medium growth scenario is regarded as the most realistic projection.

- The projected levels of demand for both new graduates and non-graduate technical support staff are particularly high during 2000. Between 2001 and 2005 the low and medium growth models predict a steady but not spectacular growth in the demand for new graduates whilst the demand for technical support staff is forecast to remain relatively constant.

- The annual supply of both specialist IT graduates and technical support staff is projected to almost double over the next five years. The supply of graduates is projected to increase from 344 in 1999/2000 to 628 in 2004/2005, while the supply of technical support staff will rise from 123 to 258 in 2004/05.

## Demand and Supply Imbalances

- A surplus of graduates is forecast under all three growth scenarios which increases steadily through to 2005. In 2000 it is between 184 and 248, with the numbers rising to between 252 and 502 in 2005.

- Some shortages may be experienced in the labour market for technical staff during 2000 as a result of exceptional developments outside the computer services sector. Thenceforth surpluses are projected under each scenario after 2001, with the surplus rising to between 104 and 189 in 2005.

## Risk Factors

- Assuming the extreme demand case i.e. all of the demand for graduate-level IT staff (excluding the demand for project managers and senior managers) must be met from the annual flow of new graduates, the high growth scenario produces a slight shortage, but only for the year 2000, a rough balance for the years 2001 and 2002, and then small surpluses thereafter. The medium and low growth scenarios are in surplus throughout.

- Alternatively on the supply side, assuming that enrolments remain at 1999 levels, on the high growth scenario we come very close to a shortage in the year 2005, with the surplus falling to just 25 graduates. However, significant surpluses of new graduates would emerge with either the low or medium growth scenarios.

- Again under the assumption of constant enrolments it is projected that the market for

technical staff would register shortages in 2000 and 2005 in the high growth case. However even in the low and medium growth cases, it is far from certain that demand will be met, with the projected surplus significantly less than one hundred in each case.

## Conclusion

- The scenarios described here suggest that shortages are unlikely to emerge in the Northern Ireland labour market for IT graduates over the next five years, although this is based on university enrolments growing at their current trend.

- The fact that adhering to enrolment targets will in all likelihood generate a surplus should not be viewed as a serious cause for concern as any surplus IT graduates will easily find appropriate employment either in the Republic of Ireland or GB. They may also constitute an important source of experienced labour supply that could potentially be attracted back into Northern Ireland. A surplus of IT graduates will also appeal to inward investing firms.

- Although no shortages are envisaged within the market for technical support staff, there is a need to expand supply beyond that currently generated by the post-compulsory education and training system. However, it is also desirable to avoid the possibility of large labour market surpluses of persons holding NVQ level 3 qualifications as these persons may not be very mobile and, as a consequence, once finding themselves surplus to requirements may be obliged to enter non-IT related employment.

- Overall a framework is required for tracking the whole stock of IT workers, not just the annual flow of new entrants. It would then be possible to determine more readily what measures might be needed, beyond their initial education, to ensure that the development of Northern Ireland's economy was not constrained by shortages of experienced IT practitioners.

# 1.0 Introduction

It is now generally accepted that many UK firms are experiencing substantial difficulties in recruiting skilled IT personnel and supply-side shortages are commonly cited as the principal explanation. Such "skill shortages" are likely to significantly constrain the development of computer related commerce amongst the fastest growing areas of the UK economy.

A number of (mainly consultancy-based) studies have attempted to examine the labour market position within an IT specific context. The most comprehensive compilation of data is to be found in the National Computer Centre (NCC) *Report on Salaries and Staffing Issues in IT* (1999). The NCC survey-based study found that during 1998 11% of companies sampled reported that they perceived shortages within the labour market, with this figure falling back in 1999 to the pre 1998 level of 7.7%. The survey suggests that the high levels of perceived shortage and staff turnover reported for 1998 were a short-term effect of rapid increases in demand, and that this influence has now largely worked its way through the system. However the NCC view that current difficulties within the IT labour market are a temporary phenomenon is not universal. A number of recent studies by, among others, the ICTE Strategy Group (1999), the Northern Ireland Software Industry Federation (NISIF) (1999) and DFEE (1998), suggest that the problems are endemic and require a policy response. Thus although it is generally accepted that the labour market for IT skills is tight, there is less agreement about the permanence of this state of affairs.

## 1.1 The Government Response

The implications of an IT skills shortfall have not been lost on the UK Government which has commissioned an Information Technology Communications & Electronics (ITCE) Skills Strategy Group to examine the issue. However, it is far from clear (indeed not always to the Strategy Group itself) that discussing IT skills within this broader context is necessarily helpful. The ITCE sector as defined by the DTI comprises all companies located within SIC 72 (computer services), SIC 22 (publishing), SIC 30 & 32 (manufacture of computer equipment, electronic components, broadcast and network equipment, consumer electronics and electronic instrumentation), SIC 64 (telecommunications), SIC 92 (broadcasting services) and also firms involved with music and digitised content (these cut across many SIC groups). The use of this aggregate relies on some very strong assumptions about the "convergence of technologies". But it is not obvious, in practice, that the ITCE grouping is sufficiently homogeneous to represent a sensible framework within which the issue of skill needs could be addressed. If it is to be useful the SIC categories brought together in this grouping should form a sector displaying a common set of key skills. But this does not seem to be the case: skill needs and requirements vary substantially depending on which of the IT, electronics or telecommunication industries are under discussion. As the ITCE report itself points out, managerial, professional and technician level workers account for over three-quarters of employees in the IT sector compared to around half in telecommunication services and electronics manufacturing. Telecommunication services and electronics manufacturing use high proportions of electrical and electronic engineers, while the IT industry attracts entrants from many other occupational groups. The electronics sector has a relatively large number of professional engineers supported by an even larger operator and assembler workforce, which is not the case for IT or telecommunications[1].

Since we doubt the usefulness of discussing the skills position for the ITCE "industry", we have taken an approach which focuses on particular key skills. Accordingly this paper examines the demand and supply for persons with IT skills in Northern Ireland.

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1 The following conveys something of the ambivalence of the ITCE Skills Strategy Group to the aggregate with which way they have to work: "ITCE occupations give rise to a complex pattern of skill needs. For example, electronic occupations need very specific technical skills and knowledge, and a sound foundation in mathematics and physics. On the other hand, many roles in IT services are suitable for people without deep technical skills at the point of recruitment, with many employers often interested in transferable, interpersonal skills on the basis that technical skills will be developed in employment". ITCE Skills Strategy Group, FInal Report (1999, p9). Paragraphs 2.1 to 2.9 of their Report detail their difficulties in finding the commonalties between IT & C&E.

The demand for these persons will be heavily concentrated within the computer services industry (division 72 in the SIC 92 classification) but we realise that people with IT skills will be in demand throughout the economy and we make some allowance for that in our projections of demand. Such a framework seems both natural and intuitive and avoids the difficulties inherent within the broad industrial approach. Whilst an adequate supply of both IT workers and electronic engineers is vital to the development of the economy, we are not convinced that it is helpful to examine these key skills within a single framework.

## 1.2 Towards an Acceptable Framework?

Most of the work on IT specific skills conducted in the UK has centred on the examination of broad labour market indicators such as staff turnover and vacancy statistics (DFEE 1999, ITNTO 1999, DFEE 1998, Keynote 1998). The resulting analysis stops short of detailed estimates of the nature and/or extent of supply-side shortage. A more rigorous approach was developed for the Republic of Ireland, which is known to be experiencing similar difficulties, within which forecasts of potential labour market imbalances were generated under a series of growth scenarios for the period up to 2006 (Expert Group on Skills, 1999). However, such a formal forecasting framework, whilst a step forward, would benefit from being complemented by an examination of firm-level employment policies. This point can be illustrated from our recent study of the Northern Ireland IT labour market, which found that local firms were experiencing difficulties in recruiting IT staff, in part at least as a consequence of their own human resource management practices, a factor independent of labour market supply (NIERC 2000). This paper seeks to build on our earlier work by determining the likely extent and duration of any imbalances in the labour market for new IT graduates and technical support staff in Northern Ireland for the period up to and including 2005. The findings when combined with our survey-based work will allow us to paint a more complete picture of the labour market position. The analysis draws together data from our earlier survey work along with official statistics in an attempt to formulate an acceptable framework within which labour market conditions may be effectively assessed.

# 2.0 Data review

## 2.1 Sample Information

In order to investigate the market for IT workers it was first necessary to identify those sectors in which they were most likely to be concentrated. The 1999 report by the IT National Training Organisation (ITNTO) identifies the computer services industry (SIC 72) as the most significant employer, followed by financial and business services, with substantial numbers in other service sectors, both public and private. As far as Northern Ireland is concerned, the Labour Force Survey sample size is too small for a reliable estimate to be made of the sectoral location of IT personnel here. So, for the purpose of defining a sampling frame it has been assumed that the sectoral distribution of IT workers in Northern Ireland follows that of the UK as a whole. As a consequence this study focuses on employment within the computer services industry.

The size distribution of firms in the computer services sector in Northern Ireland together with matching data on the distribution of employment across firms is reported in Table 1. Evidently the distribution is strongly skewed. In 1999 the were 369 computer service companies operating in Northern Ireland, just 20 per cent of whom employed 5 or more persons, yet between them these firms accounted for more than 80 per cent of total employment. In order to ensure the greatest degree of coverage in terms of employment, the sample thus consists of all firms with an employment greater than or equal to 5 (n=77) and a random sample of 57 with an employment of less than 5. Of those firms employing 5 or more persons 53 (69%) agreed to participate in the study whilst 39 firms (68%) employing less than 5 also gave positive responses.

Outside the computer services sector a number of employers were surveyed in central government [2], education, banking and communications. In total 144 organisations were contacted of which 101 (70%) agreed to participate.

In terms of questionnaire design the Information Technology National Training Organisation's (ITNTO) skills framework was closely followed in relation to job classifications and the categorisation of academic qualifications.

**TABLE 1:** Size Distribution of SIC 72 Companies 1999

| Firm Size | N | N% | Employment | % Employment |
|---|---|---|---|---|
| 0 - 5 | 292 | 79 | 502 | 19 |
| 5 - 10 | 40 | 11 | 279 | 11 |
| 10 - 20 | 17 | 5 | 232 | 9 |
| 20 - 30 | 5 | 1 | 119 | 5 |
| 30 - 40 | 3 | 1 | 98 | 4 |
| 40+ | 12 | 3 | 1352 | 53 |
| TOTAL | 369 | 100 | 2582 | 100 |

**Source: DED (1999)**

## 2.2 Computer Service Sector Employment in Northern Ireland

Official statistics, based on the 1997 Census of Employment, estimate that employment in the computer services industry in Northern Ireland increased from 2,240 in 1997 to 2,582 in 1999. However, from our survey data it is obvious that the size of the sector in 1999 was well in excess of the official figure. Significant growth appears to have taken place during 1998 and 1999 within both locally and externally owned firms that has not been included in the official statistics.

Splitting the sector according to ownership creates a framework within which more realistic estimates of 1998 and 1999 employment levels can be developed. By combining historical information from the NIERC export databases with the survey data, employment levels within the externally owned sector can be calculated for the period 1992 to 1999. Employment in locally owned firms for 1992 to 1997 is estimated as the difference between official total employment and estimated employment in externally owned firms. However, due to a lack of reliable official employment data

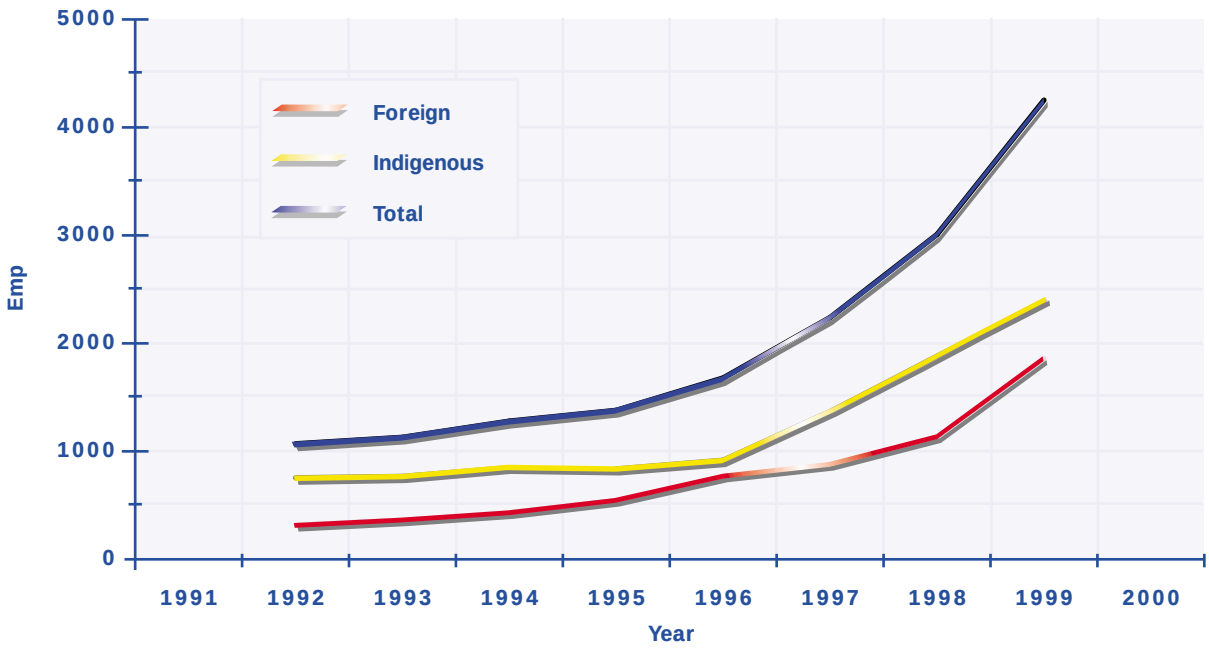
2 Information for the 10 public-sector departments was provided by a single source.

for 1998 and 1999 it was necessary to find an alternative method of estimating the size of the locally owned sector for these two years. Employment for 1999 was estimated by grossing up the official firm level employment recordings of non-respondents by factors derived from surveyed firms for particular size bands of companies. The grossed up 1999 employment figure was then combined with estimated employment for 1997 (official 1997 total employment less foreign sector employment in 1997) to interpolate a figure for 1998. The final estimates suggested that employment within the entire industry grew by 33 per cent during 1998 and by 41 per cent in 1999. By December 1999 employment is estimated to have reached 4,253, with locally owned firms accounting for 56 per cent of the total.

Over the period 1992 to 1999 the computer services industry grew at an average annual rate of 22 per cent with, the locally owned group expanding by 18 per cent annually and the externally owned by 29 per cent. It is clear from Figure 1 that employment in both ownership categories is on a broadly similar growth path, with the rate of expansion particularly rapid over the period 1996 to 1999. It should be noted though, that the locally owned group is dominated by a small number of very large companies with just two firms accounting for 38 per cent of employment in locally owned firms and 56 per cent of their employment growth between 1997 and 1999. The expansion of employment in externally owned firms can largely be attributed to the work of the Industrial Development Board (IDB) with the number of externally owned firms growing from just 8 in 1992 to 25 in 1999. However, there is at present very little known about the nature and extent of linkages between firms in the two ownership categories or, therefore, about the relationship between employment growth in locally owned firms and foreign direct investment.

The rapid expansion of computer services employment since 1996 is not unique to Northern Ireland as a similar pattern has been observed, although perhaps to a lesser degree, across the UK (see Crone 2000). At least some of the recent growth in computer services employment has generally been attributed to transitory factors such as the millennium bug and preparations for the launch of the single currency in January 2002.

**Figure 1: Computer Services Employment, 1992 - 1999**




**Source: NIERC (2000)**

## 2.0 Data review

The growth in employment is therefore not expected to continue at recent rates, with many analysts expecting the labour market for IT workers to begin to slow after the year 2000: Keynote (1998), NCC (1999). Needless to say, predicting future growth rates for this sector is problematic, as demand tends to alter rapidly. Nevertheless, one might reasonably expect that employment in externally owned firms will continue to grow more rapidly than in the locally owned group, given the efforts of the IDB and the improving image of Northern Ireland as a location for investment. The future trajectory of locally owned firms is much more difficult to assess, since little is known about how a cohort of relatively small and presumably young firms are likely to evolve in a fast-changing market.

Despite its recent rapid rates of growth, the Northern Ireland computer services sector has still a relatively small share of private sector employment. A comparative regional analysis of the industry conducted by Crone (2000) found the regional distribution of employment to generally follow that for the business and financial services sector. Location quotients (LQ) were calculated for 1997, as the share of private service employment in computer services divided by the UK average share. Only three regions have an LQ greater than 1 (that is a share above the UK average): the South East, Greater London and Eastern regions. At the opposite end of the spectrum there were a group of three lagging regions - Wales, Merseyside and Northern Ireland, with Northern Ireland much the worst-placed region. Crone reports that in 1997 the computer services sector accounted for 0.61 per cent of Northern Ireland private service sector employment with an LQ of 0.31(a share a third of the UK average).

# 3.0 Estimating the Future Demand for IT Practitioners

The projection of the employment trajectory of a particular sector of the economy is a difficult matter and whilst it is possible in principle to develop an "industry" model using, for example, an input-output framework data limitations make that impossible in the present case. The approach adopted here is quite straightforward. We explore the consequences of some alternative assumptions about firms' growth rates (which are allowed to vary across ownership category) by building them into a fairly simple, mechanical, model. By adding up the results across firms, some alternative scenarios are generated for the evolution of employment in the industry.

## 3.1 Model Specification

The model consists, quite simply, of an accounting relationship which allows us to track the implications of a set of assumptions about the birth, growth and death of firms. More specifically, it is assumed that we can divide the firms in the industry into two groups, "survivors" and "new firms". For the "survivors" the level of employment depends on the balance between the survivor growth rate and the degree of employment loss (referred to as a closure rate), whilst the amount of new firm employment depends on the balance between the new firm formation rate and the closure rate. This model specification for the locally owned sector can be written symbolically as

$$E_t = E_t\text{-}1*((1-Cr)*(1+Sr)) + E_t\text{-}1*(Fr*(1-Cr)) \quad (1)$$

**$E_t$, employment end of year t**
**Sr, survivor growth rate**
**Cr, closure rate**
**Fr, new firm formation rate**

Thus a short-term fixed relationship is assumed between the size of the locally owned sector at the beginning of any one year and the level of employment in new start-ups. However, this assumption is not valid for the external sector where the level of new firm formation is largely dependent on the activities of the IDB and as a result the form of the external model differs slightly, i.e.

$$E_t = E_t\text{-}1*((1-Cr)*(1+Sr)) + (Id*(1-Cr)) \quad (2)$$

**Id, IDB generated employment in period t**

## 3.2 The Scenarios

Three different scenarios for computer services employment growth - *low*, *medium* and *high* - have been constructed by varying the assumptions about survivor growth rates. A full description of the data underpinning the scenarios is set out in Appendix 1; the main empirical assumptions were

**Low Growth**

**Locally-owned**: survivor growth, closure rate and new firm formation rate; calculated as averages for 1994-1998 of all LEDU-assisted firms using LEDU annual client performance reports.

**Externally-owned**: survivor growth, calculated as average of externally owned SIC 72 firms derived from IDB data 1994-1998; closure rate half locally owned rate; new firm formation rate, one-and-a-half times the SIC 72 externally owned average 1994-1998[3].

**High growth**

**Locally-owned**: survivor growth rate based on locally owned firms' 2000-2005 expectations from the survey; closure rate, as in the *Low* scenario; new firm formation rate as in the low-growth scenario. However, these new firms are grown at new firm survivor growth rates which are based on the 1999 to 2004 growth expectations of a group of surveyed locally owned companies set up in 1998.

**Externally-owned**: survivor growth based on externally owned firms' expectations from the survey; closure rate, as in the *Low* scenario; new firm formation rate as in the low-growth

3 Given that the Northern Ireland foreign investment policy has been extremely successful in recent years, attracting 22 per cent of all UK FDI - promoted employment in computer services from 1997 to 1999 (Crone, 2000), it is thought that the 1994-1998 hisorical average of 44 jobs was probably an underestimate. As a consequence the estimated level of annual new firm employment is increased by a factor of 50 per cent to 66.

scenario. The new firms are grown at rates based on the 2000 to 2005 growth expectations of a group of surveyed externally owned companies set up in 1999.

**Medium Growth**

Average over *Low* and *High* scenarios of survivor growth rates.

Due to a lack of comprehensive data on locally owned computer service firms the low-growth scenario uses the historical performance rates averaged across all LEDU-supported firms for the period 1994 to 1998 and applies them to the data for the locally owned computer services component from 2000 through to 2005. The rationale for this approach is that LEDU firms are typically small and locally owned and have historically enjoyed faster rates of growth than non-assisted locally owned Northern Ireland firms. By taking these rates and applying them to the locally owned computer services data we allow for the faster average rates of survivor growth and new firm formation and a lower closure rate that might be expected given the recent dynamic history of the computer services sector.

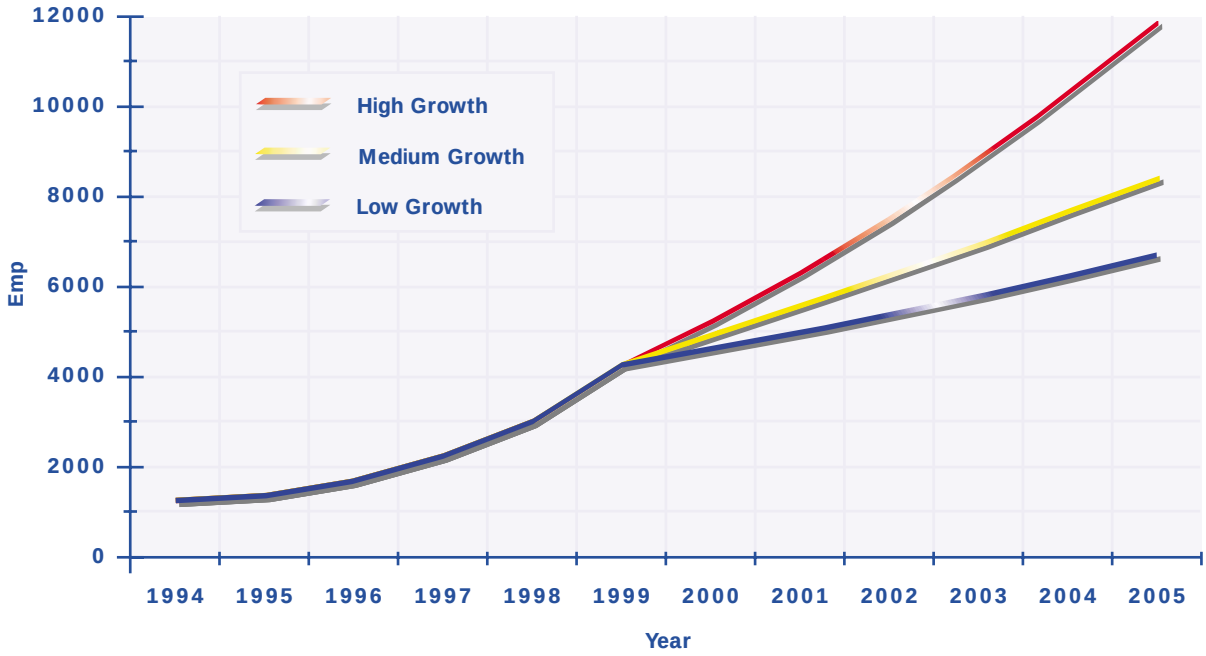
In the low-growth model firms in both ownership categories starting up in year t will join the survivor cohort in t+1 and thereafter expand at the survivor rate. This methodology may be criticised on the basis that newer firms will have a higher growth rate than more established companies and as such should be treated separately. However, the annual LEDU client surveys and IDB data, from which the historical survivor growth rates were calculated, use exactly the same methodology with new firms in t entering the survivor cohort in t+1. Thus the historical survivor growth rate contains a dynamic that takes account of the lagged inclusion of new firm employment within the survivor stock.

For the high growth scenario the employment expectations of the firms, recorded in the survey, were incorporated into the model as the survivor growth rates. The problem now arises that these future projections are based on the expectations of survivors and unlike the low-growth model do not contain a dynamic which takes account of the higher growth of new firms. To overcome this problem, the calculations (based on equations 1 and 2) were carried out separately for pre 2000 survivors and post 1999 new starts using different growth rates. The new firm survivor growth rates were obtained by taking the 2000 to 2005 growth expectations of a group of externally owned companies set up in 1999 and the 1999 to 2004 expectations of locally owned firms set up in 1998 (there was an insufficient cohort of 1999 new locally owned firms). The level of total employment in any year was obtained by adding the end of year survivor employment to the end of year new firm employment within each ownership category and then summing the result. Details of each modelling methodology are reported in Appendix 1.

## 3.3 Computer Services Employment Trajectories

The 1999 employment figure of 4,253 is the last point based on actual data, and the models are used to project employment for the period 2000 to 2005. It is forecast that employment will rise to 6,686 on the low-growth scenario, 8,380 on the medium- and 11,874 on the high-growth scenario. Given that the low-growth model is based on data from the period 1994 to 1998 and that the locally owned growth rates are not directly related to computer service activity, relatively little weighting is given to the rapid surge in demand that took place between 1997 and 1999. Although a degree of slow-down is expected, growth is likely to remain relatively buoyant implying that the low-growth model is probably too pessimistic. Conversely, the high-growth model is based on the future expectations of existing firms, which are likely to be rather bullish given the rapid expansion of the sector in recent years, so the projections are likely to give too great a weight to the growth experienced between 1997 and 1999. Since some slow-down is anticipated, the high-growth model is probably too optimistic. By implication then, we regard the medium-growth scenario, which provides a compromise between the two more extreme positions, as the most realistic projection of the prospects for the growth of employment in Northern Ireland's computer services sector.

**Figure 2: Actual & Forecast Employment 1994 - 2005**




**Source: NIERC (2000)**

It is interesting to note that the high-growth scenario resembles a projected extension of the growth between 1997 and 1999, whilst the low-growth scenario is more akin to the 1994 to 1996 expansion path. Finally the slope of the line representing the medium-growth scenario is similar to the growth over the period 1996 to 1997. The indigenous sector remains dominant throughout the forecasting period under each of the methodologies; however, significant convergence does take place under the medium- and high-growth models. Thus it seems probable that at some stage in the medium to long term employment in external firms will exceed that of the indigenous sector; however, any dominance is likely to be slight. Details of the various modelling scenarios are given within Appendix 1.

## 3.4 The Expected Demand for Non-graduate Support Staff and IT Graduates

The principal objective of this study is to determine the extent of possible future imbalances between the demand for, and supply of, non-graduate IT technical support staff and IT graduates. As we know, not all those employed within the computer services industry are IT practitioners, and even of those that are IT practitioners, a high proportion will not have an academic background in IT. Results from our survey (NIERC 2000) revealed that just 44% of persons employed by computer service firms had gained some form of IT qualification, with the proportions broadly similar for the locally and externally owned sectors. Thus new graduate and technical support demand is derived for each ownership component by applying the recruitment ratios estimated in our survey (and reproduced in Table 2) to the change in technical employment in any one year under each growth scenario. The demand estimates from both ownership categories are then added over the projection period to obtain total computer services demand.

We know from our survey that the market for graduates with some technical experience, which represents the largest component of demand, is already relatively tight with 70% of employers reporting some difficulty in recruiting this type of labour (NIERC 2000). So it seems reasonable to expect that as the computer services sector continues to grow, and the supply of this type of worker becomes increasingly scarce, employers will be forced to recruit more heavily from amongst new graduates. According to our survey,

# 3.0 Estimating the Future Demand for IT Practitioners

| TABLE 2: Structure of Technical Employment at the time of Recruitment | | |
|---|---|---|
| | Locally-owned (%) | Externally-owned (%) |
| Non-graduate technical support | 23 | 11 |
| Graduates with no previous experience | 12 | 33 |
| Graduates with some technical experience | 49 | 36 |
| Graduate project leaders | 12 | 10 |
| Project / strategic managers | 4 | 10 |
| TOTAL | 100 | 100 |
| | | |
| Technical Emp as a share of total Emp. | 46 | 42 |

**Source: NIERC (2000)**

49 per cent of current technical employees working for locally owned firms were recruited as graduates with some previous technical experience, whilst only 12 per cent were recruited as new graduates. It is expected that labour market conditions will necessitate an annual reduction of at least 7 percentage points in the recruitment share of experienced graduates, offset by a matching increase in the new graduate share. The situation within the externally owned sector is less dramatic, with the recruitment shares of experienced and new graduates standing at 33 and 36 per cent respectively, so here we assume an annual swing of just 4 percentage points. The projections for technical support and new graduate demand in the computer services sector under the various growth scenarios are set out in Table 3 (for separate projections of the different occupational groups see Appendix 2).

| TABLE 3: Forecast Demand for Computer Services 2000 - 2005 | | | | | | |
|---|---|---|---|---|---|---|
| | IT Graduate Demand | | | IT Technical Support Demand | | |
| | Low | Medium | High | Low | Medium | High |
| 2000 | 33 | 65 | 97 | 26 | 49 | 72 |
| 2001 | 44 | 80 | 136 | 28 | 50 | 81 |
| 2002 | 57 | 96 | 178 | 30 | 51 | 89 |
| 2003 | 71 | 114 | 228 | 32 | 53 | 99 |
| 2004 | 86 | 146 | 280 | 34 | 62 | 107 |
| 2005 | 98 | 155 | 348 | 34 | 56 | 119 |
| TOTAL | 389 | 657 | 1267 | 185 | 322 | 567 |

**Source: NIERC (2000)**

To arrive at a total for the employment of qualified IT practitioners we need to cover those who work outside the computer services sector. We have included in this group: a number of large telecommunications organisations, the IT development department of a major banking and financial services firm; an organisation servicing the IT needs of government departments; and Northern Ireland's two major universities. The total employment of this non-computer services group in 1999 was 2,901 of which technical employment accounted for 42 per cent (Table 3). Clearly these sections contain substantial numbers of IT qualified staff, and in fact have a technical employment share of just 2 percentage points lower than the corresponding figure for the computer services sector.

A closer analysis of the data revealed that almost 70 per cent of the IT practitioners were concentrated in the telecommunications category. Moreover in that category, as you will see from Table 4, the technical employment proportion for telecommunications was over a half. The rest of the non-computer services grouping recorded a technical employment ratio of less than one third. It is also interesting to note the striking contrast in the composition of technical employment between the telecommunications category and the rest. For the telecommunications firms there are substantial proportions in the new graduate (45%) and the higher management grades (project leader and project/strategic manager add to 16%), whilst in the rest the more important proportions are in non-graduate technical support and experienced graduate categories. It would appear that, at least as far as the profile of employment is concerned, the telecommunications firms bear quite a close resemblance to computer service firms (and within that sector rather closer to the externally owned than the locally owned).

Perhaps these empirical findings should come as no surprise since the main activity descriptions of the telecommunications firms turn out to be IT

related R&D and Systems & Software engineering. Indeed, on the basis of these descriptions alone it might have been plausible to have classified these firms as being in the computer services SIC grouping.

Demand is estimated by taking the expected employment growth of each organisation as recorded in their responses to our survey over the period to 2005 and, once again, distributing this growth according to the employment share of each occupational aggregate. Unsurprisingly, the growth in projected demand is dominated by the figures for telecommunications (Table 5). In particular, the extraordinary demand figures for 2000 are the result of the continued planned expansion of one of them and so can be viewed as a temporary blip in the data unrelated to any external influences.

**TABLE 4:** Structure of Technical Employment at the Time of Recruitment in non-SIC 72 Firms

| | Telecomm only % | Other than Telecomm % | TOTAL % |
|---|---|---|---|
| Non-graduate Technical Support | 24 | 49 | 31 |
| Graduate with no previous experience | 45 | 22 | 38 |
| Graduate with some technical experience | 15 | 24 | 18 |
| Graduate Project leaders | 15 | 4 | 12 |
| Project / strategic managers | 1 | 1 | 1 |
| Total | 100 | 100 | 100 |
| | | | |
| Total Employment in 1999 | 1675 | 1226 | 2901 |
| Total Technical Staff | 849 | 364 | 1213 |
| Technical Emp as a share of total Emp. | 51 | 30 | 42 |

**Source: NIERC (2000)**

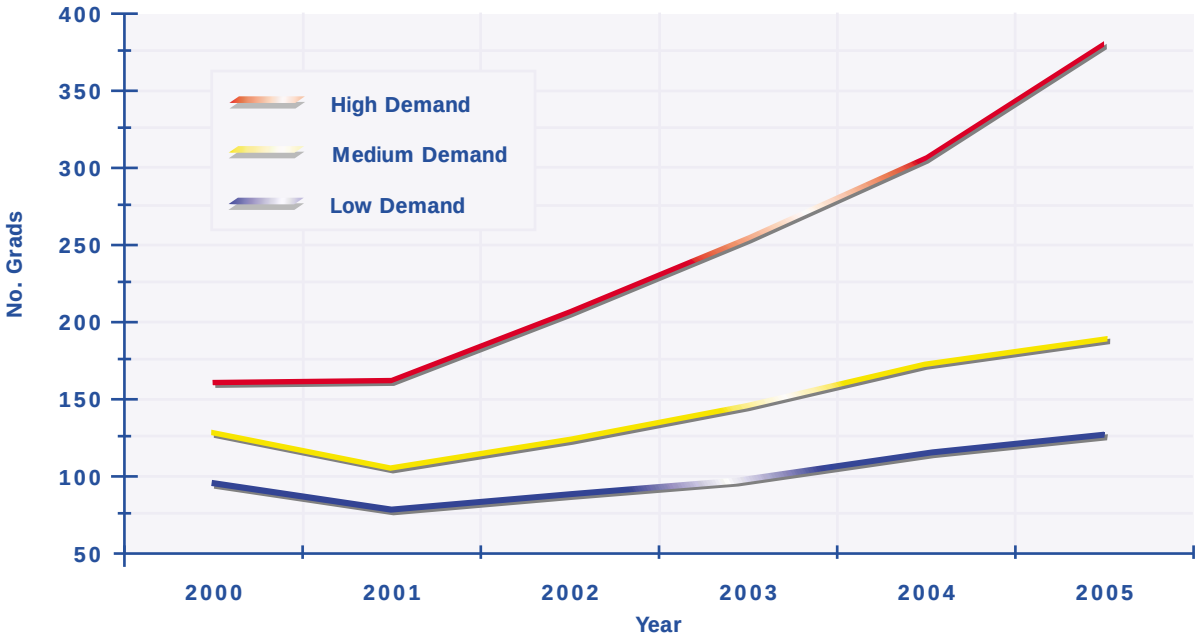
Let us now move on to consider the overall demand picture. The projected levels for both new graduates and non-graduate technical support staff are particularly high during 2000 due mainly (as we have just seen) to high levels of expected growth within non-SIC 72 firms (Figures 3 & 4). Between 2001 and 2005 the low- and medium-growth models predict a steady but not spectacular growth in the demand for new graduates whilst the demand for technical support staff is forecast to remain relatively constant. However, demand expands much more rapidly within the high-growth model with significant divergence taking place between the high-growth forecasts and those generated by both the medium- and low-growth models after 2001. Nevertheless, the magnitudes of the projections appear relatively small in absolute terms with the demand for new graduates estimated to lie between 126 and 376 persons in 2005 whilst the demand for technical support staff is likely to lie within the range 69 to 154.

**TABLE 5:** Forecast Demand for Non-SIC 72 Firms 2000 - 2005

| | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 |
|---|---|---|---|---|---|---|
| IT technical support demand | 78 | 35 | 35 | 35 | 35 | 35 |
| Telecomm component | 57 | 14 | 14 | 14 | 14 | 14 |
| | | | | | | |
| IT graduate demand | 62 | 28 | 28 | 28 | 28 | 28 |
| Telecomm component | 62 | 27 | 27 | 27 | 27 | 27 |

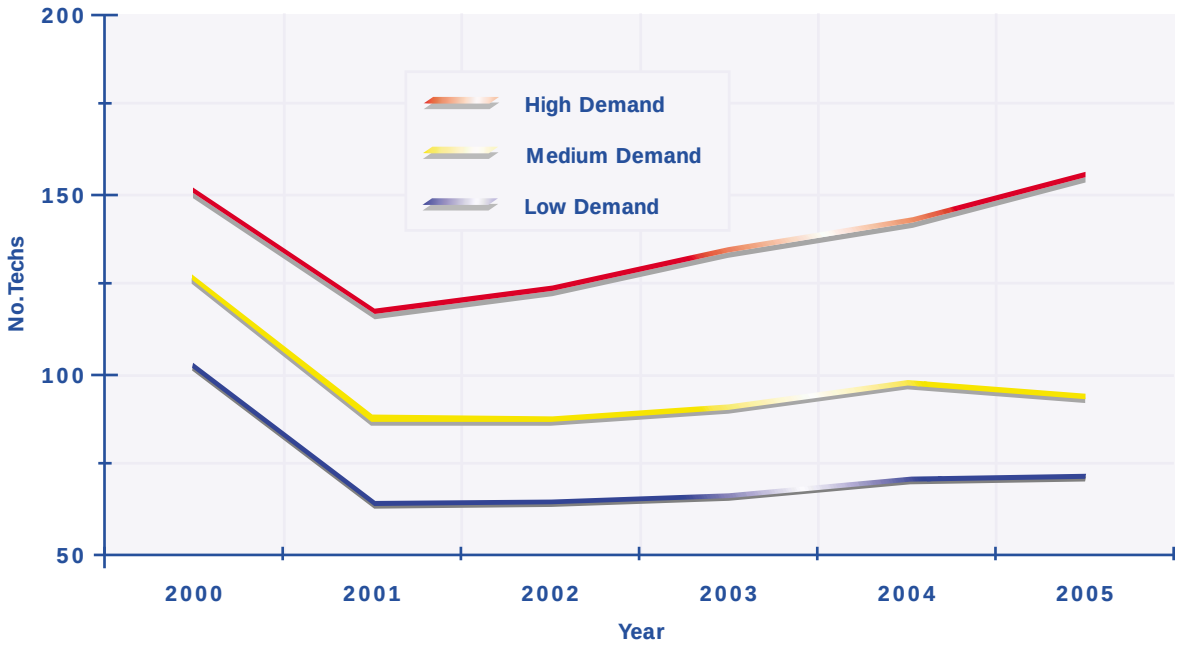
**Source: NIERC (2000)**

**Figure 3: Aggregate IT Graduate Demand 2000 - 2005**




**Source: NIERC (2000)**

**Figure 4: Aggregate Non-graduate Technical Demand 2000 - 2005**




**Source: NIERC (2000)**

# 4.0 Assessing the Supply of New Labour Market Entrants

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. Educational output is estimated by quantifying the enrolments/leavers relationship for each education aggregate. For instance, leavers from the Further Education sector in year t are assessed as a percentage of enrolments in t-2; within the Higher Education sector graduates are assessed as a proportion of enrolments in t-4 for courses with a placement year and t-3 for those with none. Finally postgraduate courses are assessed on the basis of the previous year's enrolments. These ratios are then applied to the enrolment data over the forecasting horizon. Enrolments information is not available after 1999, implying that in order to generate leavers estimates for the period 2000 to 2005 it is necessary to find a method of projecting enrolments forward to 2004 for one-year courses, 2003 for two-year courses and so on. This is achieved by projecting forward trend enrolments growth.

However, educational output does not equate to labour supply as many will enter further education or training, some will leave the country to find work whilst others become economically inactive (NIERC 2000). To effectively estimate IT supply labour market entry rates were calculated and applied to the annual forecast output of each educational aggregate (see Technical Appendices).

The educational output ratios and labour market entry rates applied within the study are detailed in Table 6[4]. A potential policy tool presents itself when we consider that approximately 66 per cent of enrolments on single honours undergraduate computing courses at QUB and 94 per cent at the University of Ulster eventually graduate. Thus, there is some scope to examine the issue of improving QUB completion rates as a means of increasing graduate supply should the need arise.

The labour market entry rates set out in Table 6 are estimated by using information on the first destination of Northern Ireland leavers qualifying in 1997/98. The data indicates that about two thirds of IT undergraduates and just over half of postgraduates enter the Northern Ireland labour market (the rest either go abroad to work, or participate in further training). Clearly, the extremely low proportions of NVQ level 3 and HND achievers entering the labour market from the further education sector represent the most remarkable aspect of these figures. According to DFHETE 74 per cent of NVQ level 3 and 75 per cent of HND achievers gaining qualifications from further education institutions go on to higher education. As a consequence, there is a relatively small flow of newly qualified technical support staff from the further education sector to the labour market. Given the very large proportions of these students choosing to participate in higher level study rather than enter employment, it is important to determine quite precisely the extent to which these students are moving on to Northern Ireland institutions and eventually feeding through into the higher education supply here, as opposed to elsewhere in the UK. It would certainly not be optimal if we were to discover that the main function of IT education within the Northern Ireland FE colleges was the generation of supply for GB HE institutions with very little prospect of these persons returning to the region

**TABLE 6:** Leavers and Market Entry Ratios

| | Enrolments / Graduate Ratio | Labour Market Entry Rates |
|---|---|---|
| NVQ level 3 | 0.58 | 0.14 |
| HND (FE sector) | 0.53 | 0.24 |
| HND (HE sector) | 0.93 | 0.58 |
| Undergraduate QUB | 0.66* | 0.64 |
| Undergraduate UU | 0.94* | 0.64 |
| Postgraduate QUB | 0.77* | 0.56 |
| Postgraduate UU | 0.81* | 0.56 |

**Source: NIERC (2000), DENI (1999), UU (1999), QUB (1999)**
*** single honours only**

4 The Further Education data is slightly peculiar in that the official statistics only reflect the level of enrolments as of November in any one year. Since colleges enrol students continually this implies that the official data may underestimate the actual level of enrolment activity. This anomaly does not preclude the use of the enrolments / leavers ratio as a basis for projecting future supply but it does imply that the FE ratios cannot be interpreted as completion rates for courses below HND level (the likelihood of additional enrolments on such courses after November will be significantly lower than for level 3 courses).

upon obtaining their degrees. Unfortunately, as it stands the first destination data does not enable us to determine the extent of any problem; however, the issue is certainly of sufficient importance to warrant further research.

In projecting the supply of IT graduates from higher education we have included only IT students in a single honours course (those taking a joint or combined degree have been excluded from the count on the grounds that they will graduate with a lower level of expertise). The annual supply of specialist IT graduates is projected to almost double over the next five years, from 344 in 1999/2000 to 628 in 2004/2005 (an average annual rate of 12.8 per cent)(Table 7). As stated these forecasts are generated on the assumption that past enrolment trends will continue over what is a relatively short time horizon; nevertheless this is a rather strong assumption, thus the methodology takes no account of university planning regimes or student preferences. It is probably more feasible to view the projected enrolments in the context of a series of supply-side benchmarks that could be subject to manipulation given the existence of any labour market shortages/surpluses.

The supply of technical support staff covers the labour market entry of persons holding IT qualifications from NVQ 3 to HND level. The projected trend growth in NVQ level 3 enrolments has built into it a change in the qualifying criteria for level 3 Jobskills courses which took effect in 1999. Previously recognized Training Organisations could only provide Jobskills training to persons registered as unemployed; now, under the new regulations, Jobskills programmes at and above NVQ level 3 are open only to the employed. The rationale for this change was to shift the onus for training from the state to the employer; thus the trainee is now to be paid a wage instead of an allowance. It is this administrative change which apparently triggered the dramatic increase in further education level 3 enrolments during 1999 (see Appendix 3, Table A24), as those without jobs, no longer eligible for Jobskills, enrolled at further education colleges. Given these circumstances the 1999 enrolment figure was not included in the trend calculation, but even excluding it, NVQ level 3 enrolments still expanded dramatically between 1994 and 1998, at an average annual rate of 24 per cent (Table 8). The extent to which the expansion in level 3 enrolments reflects a policy shift or, alternatively, a change in student preferences remains unclear. However, low levels of labour market entry recorded from both of these groups means that there will, in any event, be little impact on the supply of technical support staff.

Of course, this change in regulations also implies that the Jobskills graduates will not be counted as

**TABLE 7:** Forecast IT Graduate Supply 1999/00 - 2004/05

| | 1999/2000 | 2000/2001 | 2001/2002 | 2002/2003 | 2003/2004 | 2004/2005 |
|---|---|---|---|---|---|---|
| Computer Science | | | | | | |
| UG | 147 | 182 | 173 | 219 | 247 | 280 |
| PG | 197 | 203 | 232 | 265 | 303 | 348 |
| TOTAL | 344 | 384 | 404 | 484 | 551 | 628 |
| | | | | | | |
| Computer Science & Combined | | | | | | |
| UG | 188 | 233 | 223 | 276 | 318 | 368 |
| PG | 197 | 203 | 232 | 265 | 303 | 348 |
| TOTAL | 385 | 436 | 454 | 541 | 621 | 716 |

**Source: NIERC (2000)**

labour market entrants since qualifying trainees are already in employment. However, if the programme can succeed in persuading significant numbers of employers to participate it will have the effect of lowering the labour market demand for technical support staff. In addition, if it becomes evident that large proportions of sub-degree qualifiers from FE institutions are indeed going to study in GB and failing to return upon qualification, then an expansion of Jobskills may present a feasible alternative for reducing any shortfall in technical labour.

**TABLE 8:** Forecast IT Technical Support Supply 1999/00 - 2004/05

| | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 |
|---|---|---|---|---|---|---|
| NVQ 3 | 53 | 65 | 80 | 98 | 121 | 148 |
| HND / NVQ Level 4 | 70 | 74 | 88 | 95 | 102 | 109 |
| TOTAL | 123 | 139 | 168 | 193 | 222 | 258 |

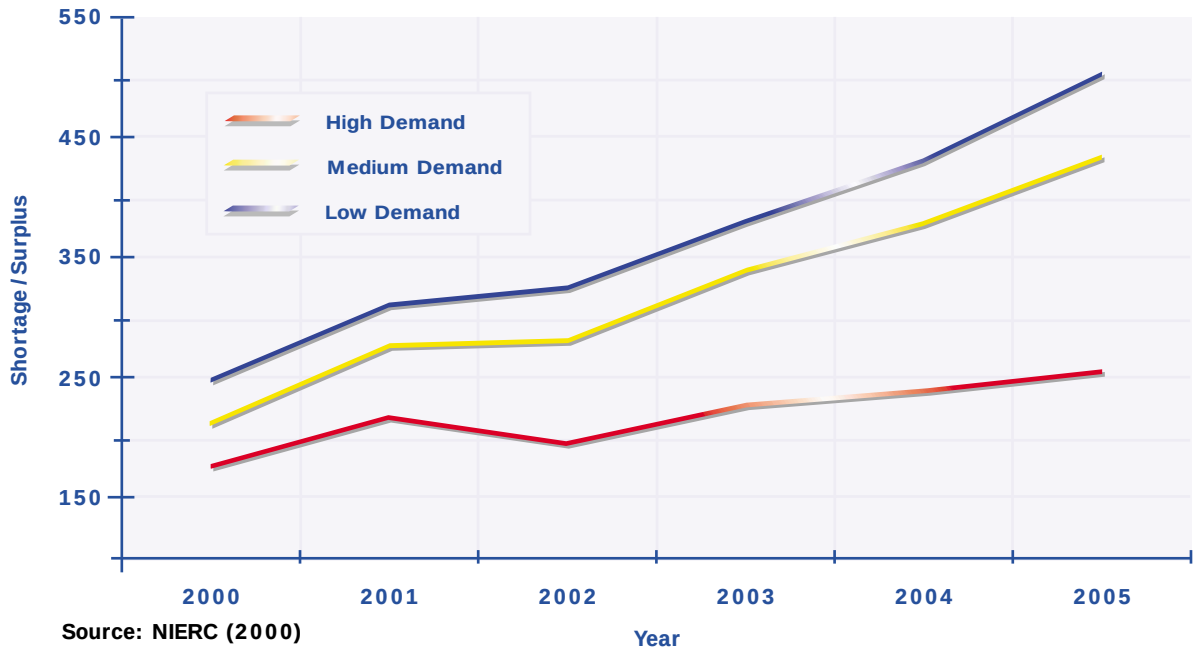
**Source: NIERC (2000)**

# 5.0 Demand / Supply Imbalances

We can derive the magnitude of the demand/supply imbalance in the IT labour market by comparing figures for the demand for new IT workers from our three scenarios with the corresponding projected supply numbers. The position for higher education graduates is displayed on Figure 5. As you will see, there is a surplus under all three scenarios which increases, pretty steadily, through to 2005. In 2000 it is between 184 and 248, with the numbers rising to between 252 and 502 in 2005.

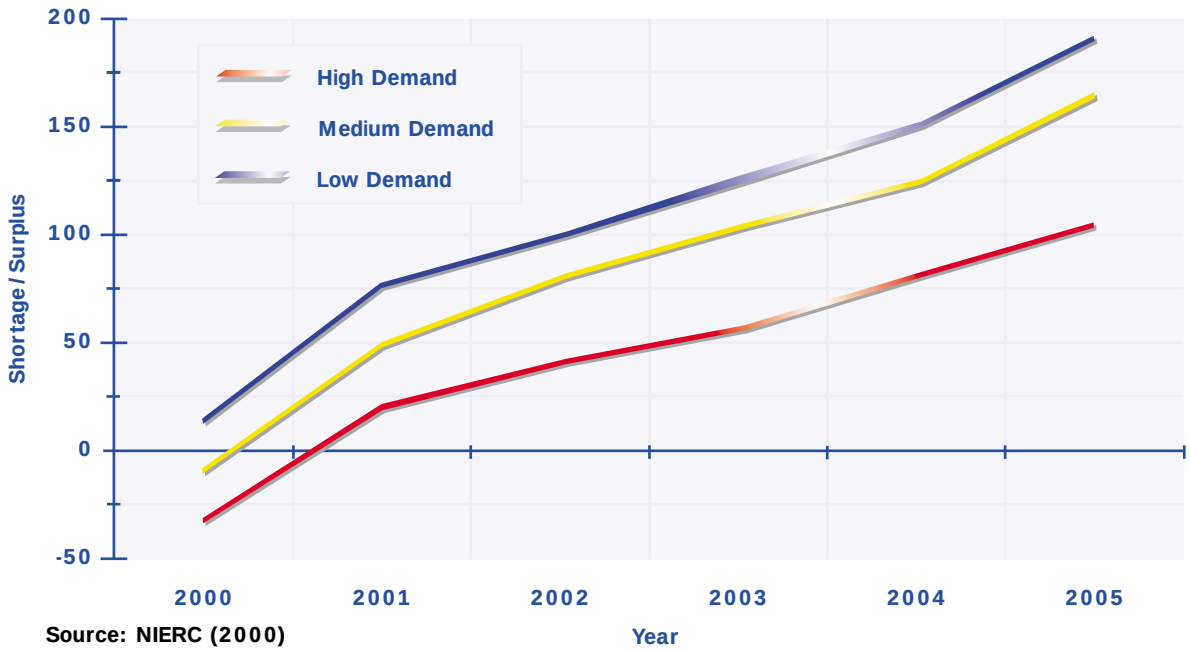
The labour market for technical support staff seems unlikely to be constrained by shortages over the next few years. However, some shortages may be experienced during 2000 as a result of exceptional developments outside the computer services sector. Thenceforth surpluses are projected under each scenario after 2001, with the surplus rising to between 104 and 189 in 2005 (Figure 6).

**Figure 5: Single Honours Graduate Supply minus Graduate Demand 2000 - 2005**




**Source: NIERC (2000)**

**Figure 6: HND + NVQ Level 3 Supply minus Technical Support Demand 2000 - 2005**




**Source: NIERC (2000)**

# 5.0 Demand / Supply Imbalances

## 5.1 A Comparison with the Findings of the Northern Ireland Software Industry Federation

In their June 1999 document entitled "The way forward" the Northern Ireland Software Industry Federation (SIF) attempted to provide some estimates of potential supply / demand imbalances within the Northern Ireland "software sector" over the period 1999 to 2004. Although the SIF fail to specify exactly how they define the "software sector" we might presume it to be in some way correlated with division SIC 72. The SIF estimate that the Northern Ireland "software sector" will grow from around 4000 employees in 1999 to 18,000 in 2004 implying an annual average growth rate of 35 percent. The rate of expansion projected by the SIF does seem very optimistic and at least one commentator has already expressed doubt about the plausibility of such a growth scenario (Crone 2000). In order to put the SIF projections in context Table 9 compares them with our high growth scenario.

Dealing firstly with the current structure of employment, assuming that the list of computer services firms provided to NIERC accurately reflects the industry's current composition, the SIF aggregate appears to have significantly underestimated the current level of indigenous employment in the computer service related activity. Secondly, the level of indigenous start-up activity in 1999 as forecast by the SIF is over 5 times that estimated by NIERC for the SIC 72 aggregate. Recent data from LEDU (which concentrates on assisting firms with a high export and growth potential) put the total level of assisted start-up employment across all sectors in Northern Ireland at 383 for 1999 with the figure for assisted computer services employment standing at just 23 for the year. In addition, according to our data total indigenous computer services employment (existing firms + new starts) increased by just 433 during 1999, providing a further indication that the SIF estimate of 1000 additional jobs due to start-ups is well wide of the mark.

There are also major differences in our expectations of how the various components of computer services / software employment will evolve over the next few years. The most striking difference occurs in the expected level of external employment where the SIF figure is almost twice that generated under our high growth scenario. In the absence of any detail of the methodology and empirical assumptions that underpin the SIF demand estimates it is not possible to comment further on this wide divergence.

The SIF document concludes that there will be significant shortfalls in the supply of new graduates over the forecast period and recommends various initiatives to fill the gap. However, the SIF analysis appears to assume that any growth in total employment within the "software sector" requires an exact increase in the supply of new graduates i.e. the analysis assumes that IT graduates constitute 100 per cent of recruitment demand. Our evidence shows that this is not a realistic assumption. For example, the results of our survey indicate than less than half of the persons employed within Northern Ireland computer services possess an IT qualification with the overall recruitment share for new graduates standing at just 10 percent. Thus the SIF assumptions on the nature of demand are likely to

**TABLE 9:** SIF & NIERC High Growth Comparisons

| | Indigenous | | External | | Start-up | | Total | |
|---|---|---|---|---|---|---|---|---|
| | 1999 | 2004 | 1999 | 2004 | 1999 | 2004 | 1999 | 2004 |
| SIF | 1000 | 4500 | 2000 | 10000 | 1000 | 3500 | 4000 | 18000 |
| NIERC | 2394 | 3600 | 1859 | 5061 | 172 | 1628 | 4253 | 10289 |
| SIF-NIERC | | +900 | | +4939 | | +1872 | | +7711 |

**Source: NIERC (2000), SIF (1999)**

over-estimate the supply-side requirements for new graduates.

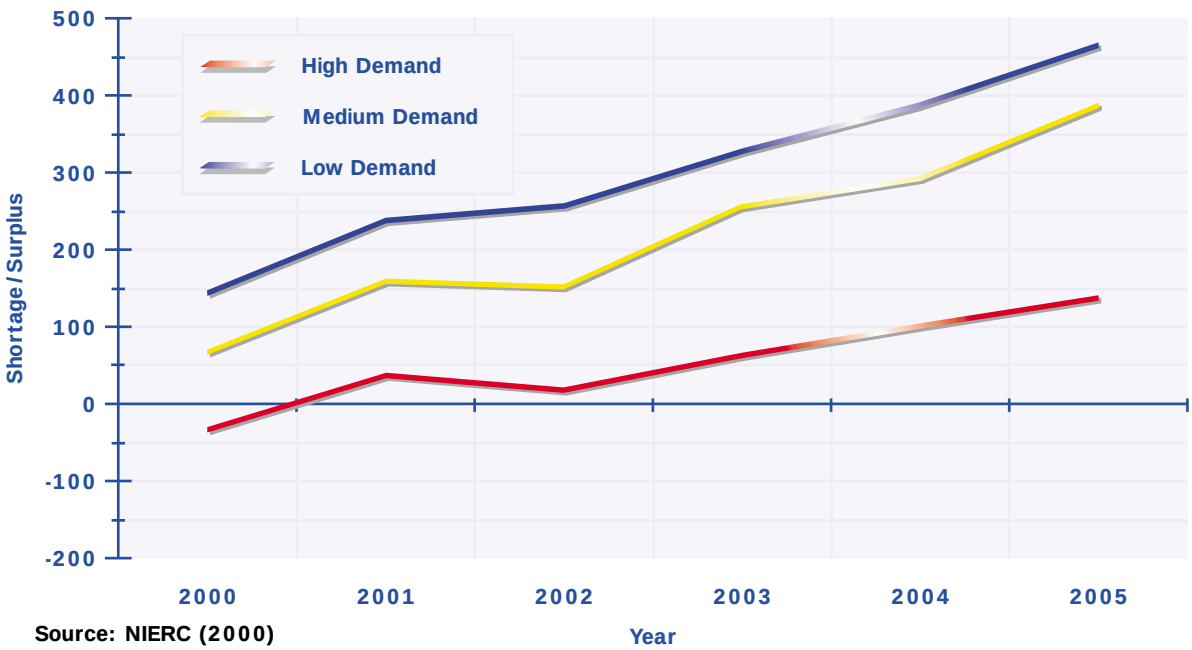
Overall, we feel that the SIF analysis runs into difficulty from the outset by not precisely defining the nature of the aggregate with which they are working. In relation to forecast growth, while the SIF projections may represent an optimistic or even aspirational perspective, there is a need for clarification in terms of the assumptions that underpin their analysis with particular reference to forecast start-up levels and inward investment activity. In the absence of such clarification it is impossible to test if their optimism is well founded. Finally, the assumption that any increases in employment demand must be supplied entirely by new IT graduates does not take employment composition or recruitment patterns into account and will result in a significant exaggeration of supply side requirements.

## 5.2 Risk Factors

It might be helpful to put the magnitude of our projected surpluses in perspective by assuming even more buoyant conditions on the demand side. Let us consider the possibility that the market for experienced graduates becomes so tight that firms are obliged to recruit even larger numbers of new graduates. More specifically, to take the most extreme case, we will assume that all of the demand for graduate-level IT staff (excluding the demand for project managers and senior managers) must be met from the annual flow of new graduates. Under this assumption, as you will see from Figure 7 the high-growth scenario produces a slight shortage, but only for the year 2000, a rough balance for the years 2001 and 2002, and then small surpluses thereafter. The medium and low growth scenarios are in surplus throughout.

It is also useful to examine the "risks" from the supply side by considering the consequences of enrolments remaining at 1999 levels. The results of this exercise for single honours graduates are displayed in Figure 8 from which it is obvious that significant surpluses of new graduates would emerge with either the low- or medium-growth scenarios. However, on the high-growth scenario we come very close to a shortage in the year 2005, with the surplus falling to just 25 graduates. Although we consider the high-growth scenario too optimistic it illustrates very graphically here the consequences of any levelling off in enrolments. Evidently, the supply-side "cushion" which we saw earlier depends fairly importantly on continued expansion of IT places in institutions of higher education.

**Figure 7: Single Honours Graduate Supply minus New+Experienced Graduate Demand 2000-2005**

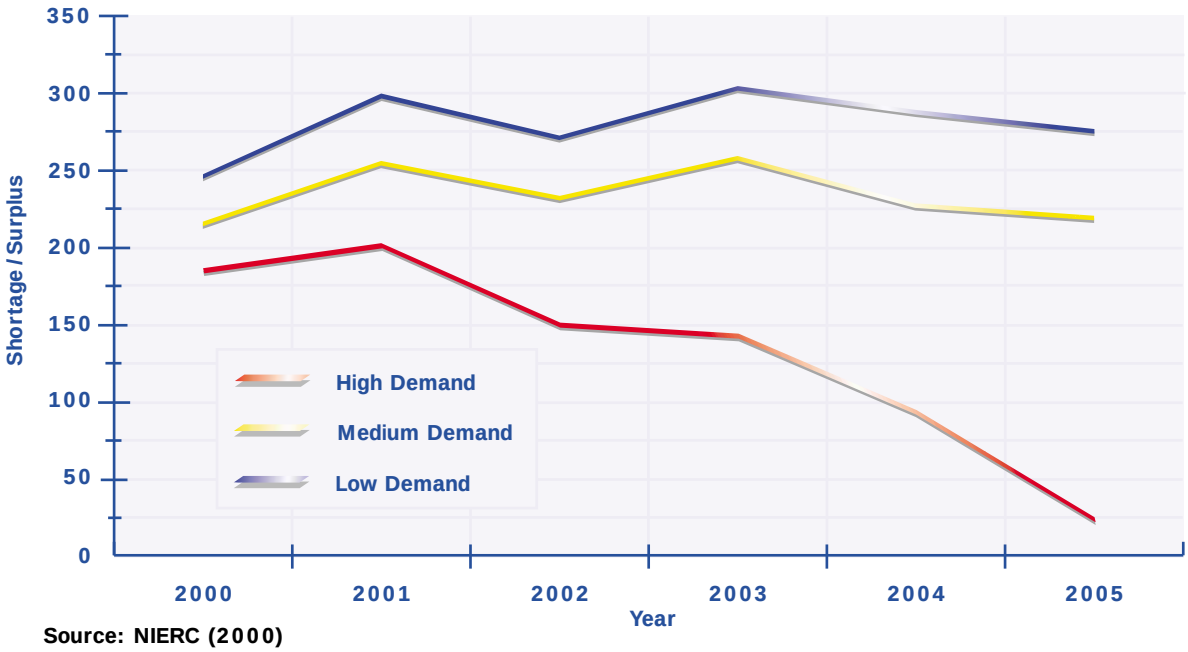



**Source: NIERC (2000)**

## 5.0 Demand / Supply Imbalances

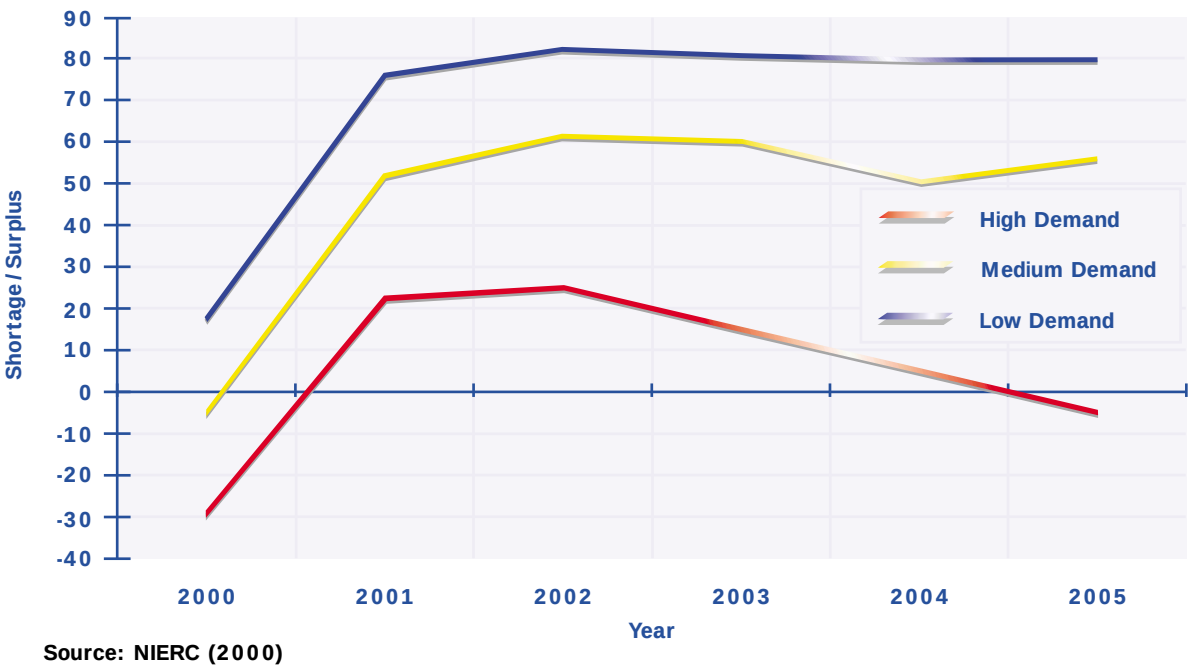
The alternative scenarios for technical support staff under the assumption of constant enrolments are depicted in Figure 9. In the high-growth case it is projected that the market for technical support staff would register shortages in 2000 and 2005. However even in the low- and medium-growth cases, it is far from certain that demand will be met, with the projected surplus significantly less than one hundred in each case. But there is a further issue here. As we have seen, the low levels of labour market entry from NVQ level 3 and HND courses imply that under the current system expanding enrolments by 1,757 in the period up to 2003 will generate an additional supply of just 110 technical support staff. Indeed this illustrates in a concrete way an important question (certainly meriting further research) about the most cost-effective way of meeting the demand for non-graduate technical support staff.

**Figure 8: Single Honours Graduate Supply minus Graduate Demand 2000-2005 under Static Enrolments**




**Source: NIERC (2000)**

**Figure 9: HND + NVQ Level 3 Supply minus Technical Support Demand 2000-2005 under Static Enrolments**




**Source: NIERC (2000)**

# 6.0 Some Concluding Remarks

One important finding is that a distinction should be made between the two segments of the IT labour market: university graduates and non-graduate technical support staff; and we will discuss them in turn. The scenarios described here seem to suggest that shortages are unlikely to emerge in the Northern Ireland labour market for IT graduates over the next five years. However, it is worth reiterating that the supply-side projections assume university enrolments continue growing on their current trend. So our enrolments figures might be interpreted as targets to be followed by the universities if adequate labour market flows are to be ensured. Nevertheless, even under the extreme assumptions of high growth and a zero supply of experienced graduates, demand will be met throughout the projection period provided the 2000 undergraduate and 2002 postgraduate enrolment targets are met and maintained. The fact that adhering to the 2000-2004 enrolment targets will in all likelihood generate a surplus should not be viewed as a serious cause for concern. Certainly, any surplus IT graduates will easily find appropriate employment either in the Republic of Ireland or GB. And, importantly, in doing so may well constitute an important source of experienced labour supply that could potentially be attracted back into Northern Ireland. Moreover, a surplus of IT graduates will appeal to inward investing firms seeking an attractive location thus providing a boost to foreign direct investment (indeed, the availability of skilled labour is widely thought to have been an important factor in the last decade's rapid expansion of the economy in the Republic of Ireland).

Although no shortages are envisaged within the market for technical support staff, there is a need to expand supply beyond that currently generated by the post-compulsory education and training system and serious consideration must be given to the most effective method of achieving this. Given the very low labour market entry rates, an expansion of further education enrolments is likely to have very little impact and, in this context, a targeting of resources towards the current Jobskills level 3 provision and/or higher education enrolments at HND level seems a better prospect. In any event, it seems desirable to avoid the possibility of large labour market surpluses of persons holding NVQ level 3 qualifications, as it is unlikely that many benefits would accrue. For example, unlike university graduates or even the HND-qualified, NVQ3 holders might not be very mobile and, as a consequence, once finding themselves surplus to requirements they might well be obliged to enter non-IT related employment.

Needless to say, like much research, the findings reported here raise some important issues requiring further work. Here we have been concerned with the possibility of imbalance in the market for the newly qualified (together with its potential implications for educational policy), but there is an important and rather wider question about prospects in the IT labour market. A framework is required for tracking the whole stock of IT workers, not just the annual flow of new entrants. With the appropriate measurements in place it would then be possible to determine more readily what measures might be needed, beyond their initial education, to ensure that the development of Northern Ireland's economy was not constrained by shortages of experienced IT practitioners.

# References


AISS, ITNTO, 1999, Skills 99: *IT Skills Summary*, Report to the Department of Trade and Industry, London

Autor, D., Katz, L., Krueger A., 1998, 'Computing Inequality: Have computers changed the labor market?', *Quarterly Journal of Economics*, November 1998; pp1169-1213

Barron, T., 1999, *'Wooing IT Workers'*, *Training & Development*, April 1999; pp20-24

Beard, J., Breen E., 1998, *IT Labour Market Assessment*, DFEE Research Briefs, Research Report No.71

Berman, E., Bound, J., Griliches, Z., 1994, 'Changes in the demand for skilled labor within US manufacturing industries: Evidence from the annual survey of manufacturing', *Quarterly Journal of Economics*, May 1994; pp367-398

Berndt, E., Morrison, C., Rosenblum, L., 1992, *High-Tech capital formation and labor composition in US manufacturing industries: An exploratory analysis*, NBER Working Paper No. 4010

Bresnahan, T., 1999 'Computerisation and Wage Dispersion: An Analytical Reinterpretation', *The Economic Journal,* Vol. 109 June; pp F390 -F15

Crone, M., 1999, *Computer Services and Software Employment in the UK and Ireland, 1991-97: An Exploration of Official Data with Particular Reference to Northern Ireland*, NIERC Report Series, Report No. 16, NIERC, Belfast

Doms, M., Dunne, T., Troske, K., 1997, 'Workers, Wages and Technology', *The Quarterly Journal of Economics*, February 1997; pp253 - 290

Expert Group on Future Skills Needs, 1999, *The First Report of the Expert Group on Future Skills Needs*, Forfas, Dublin

Green, F., Machin S., Wilkinson D., 1998, 'The Meaning and Determinants of Skills Shortages', *Oxford Bulletin of Economics and Statistics*, Vol. 60 (2) 1998; pp165-187

Haskel, J., Martin, C., 1993, 'Do Skill Shortages Reduce Productivity? Theory and Evidence from the UK', *The Economic Journal*, Vol. 103, 1993; pp386-394

IFF Research, 1998, *Skill Needs in Great Britain and Northern Ireland 1998*, IFF Research, London

ITCE Skills Strategy Group, 1999, *Skills for the Information Age: Second Report from the ITCE Skills Strategy Group*, DFEE, Sheffield

ITCE Skills Strategy Group, 1999, *Final Report from the ITCE Skills Strategy Group*, DFEE, Sheffield

Irish Software Association, 1998, *To Boldly Go....The Irish Software Industry - A Strategy for Growth*, The Irish Software Association, Dublin

Keynote, 1998, *Computer Market (UK)* October 1998, Keynote

Marlbrough Group, 1998, *Salary Survey 1998*, Marlborough Group, Dublin

Mason, G., 1999, *The labour market for Engineering, Science and IT graduates: Are there mismatches between Supply and Demand?*, DFEE Research Briefs, Research Report No. 112

National Computing Centre, 1999, *Salaries and Staff Issues in IT 1999*, National Computing Centre

Software Industry Federation, 1999, *A Strategy for the Software Industry in Northern Ireland*, Software Industry Federation, Belfast

T&EA, SIF, ITNTO, 1999, *Information Technology Skills Framework: A Guide for Northern Ireland*

# Appendices

# Appendix 1: The Modelling Approach

## Employment Projections

**Historical low-growth model**

The growth, closure and new firm formation rates applied in the locally owned model were derived from LEDU client survey reports from 1994 to 1998, details of which are given in Table A1.

For externally-owned firms, the survivor growth and new firm formation rates were based on the performance of the externally owned sector over the period 1994 to 1998, details of which are outlined in Table A2. Mean annual new firm employment was found to be 44. However, the higher rate of 66 per annum was thought more suitable for the forecast period. A closure rate of 2.15 per cent, i.e. half that of the indigenous sector, was also applied in the external model.

**TABLE A1:** LEDU Employment Rates

| | 1994 | 1995 | 1996 | 1997 | 1998 | Mean |
|---|---|---|---|---|---|---|
| Start Year | 30460 | 32087 | 34554 | 37787 | 40437 | |
| Survivor Employment | 6.0% | 2.4% | 1.9% | 5.9% | 7.0% | 4.6% |
| New Start Employment | 8.1% | 9.8% | 9.9% | 5.7% | 4.0% | 7.5% |
| Closure Employment | 2.6% | 3.2% | 1.9% | 4.0% | 9.8% | 4.3% |
| End Year | 32930 | 36036 | 38393 | 40343 | 42744 | |

**Source: LEDU Clients Survey 1994 - 1998**

**TABLE A2:** Externally-owned Firms Employment Rates

| | 1994 | 1995 | 1996 | 1997 | 1998 | Mean |
|---|---|---|---|---|---|---|
| Start Year | 420 | 486 | 613 | 869 | 1011 | |
| Survivor Employment | 13.8% | 9.7% | 10.0% | -2.8% | 9.2% | 8.0% |
| New Start Employment | 12 | 57 | 149 | 3 | 117 | 44 |
| End Year | 486 | 613 | 869 | 1011 | 1690 | |

**Source: NIERC (2000)**

**Details of the low-growth scenario are given in tables A3-A5**

**TABLE A3:** Historical Low-Growth Employment Model - Indigenous

| | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 |
|---|---|---|---|---|---|---|---|
| **Start year employment** | | **2394** | **2568** | **2755** | **2956** | **3171** | **3402** |
| - closure employment | | 103 | 110 | 118 | 127 | 136 | 146 |
| **= survivor employment** | | **2291** | **2458** | **2637** | **2829** | **3035** | **3256** |
| + survivor growth employment | | 105 | 113 | 121 | 130 | 140 | 150 |
| + new firm employment | | 180 | 193 | 207 | 222 | 238 | 255 |
| - new firm closure employment | | 8 | 8 | 9 | 10 | 10 | 11 |
| **End year employment** | **2394** | **2568** | **2755** | **2956** | **3171** | **3402** | **3649** |

**Source: NIERC (2000)**

# Appendix 1: The Modelling Approach

| TABLE A4: Historical Low-Growth Employment Model - External | | | | | | | |
|---|---|---|---|---|---|---|---|
| | **1999** | **2000** | **2001** | **2002** | **2003** | **2004** | **2005** |
| **Start year employment** | | **1859** | **2029** | **2209** | **2399** | **2600** | **2812** |
| - closure employment | | 40 | 44 | 47 | 52 | 56 | 60 |
| **= survivor employment** | | **1819** | **1986** | **2161** | **2347** | **2544** | **2751** |
| + survivor growth employment | | 146 | 159 | 173 | 188 | 204 | 220 |
| + new firm employment | | 66 | 66 | 66 | 66 | 66 | 66 |
| - new firm closure employment | | 1 | 1 | 1 | 1 | 1 | 1 |
| **End year employment** | **1859** | **2029** | **2209** | **2399** | **2600** | **2812** | **3036** |

**Source: NIERC (2000)**

| TABLE A5: Low-Growth Employment Projections | | | |
|---|---|---|---|
| | **Indigenous** | **External** | **TOTAL** |
| 1995 | 837 | 543 | 1380 |
| 1996 | 918 | 762 | 1680 |
| 1997 | 1368 | 872 | 2240 |
| 1998 | 1881 | 1128 | 3009 |
| 1999 | 2394 | 1859 | 4253 |
| 2000 | 2568 | 2029 | 4597 |
| 2001 | 2755 | 2209 | 4964 |
| 2002 | 2956 | 2399 | 5355 |
| 2003 | 3171 | 2600 | 5771 |
| 2004 | 3402 | 2812 | 6214 |
| 2005 | 3649 | 3036 | 6686 |

**Source: NIERC (2000)**

# Appendix 1: The Modelling Approach

**High-growth model**

For the high-growth scenario, the firm's expected employment growth, obtained from the survey, was used to generate survivor growth rates. These yearly growth rates were calculated for both locally owned and external firms (Table A6). The closure rates applied in this scenario remained the same as those applied in the previous scenario for both locally and externally owned firms i.e. 4.3 per cent for indigenous and 2.15 per cent for external firms.

Separate models were generated to account for new firm employment growth each containing a distinct set of survivor growth rates. For locally owned firms the growth rates were based on the expectations of a cohort of companies born in 1998. Yearly growth rates were calculated for years 1-5, based on their expected employment growth between 1999-2005. For the externally owned firms the new firm growth rates were obtained from those firms who were born in 1999 and who provided employment growth figures up to 2005. Details of the survivor rates applied within the new firm models are given in Table A7.

Total end year employment is calculated as the sum of the survivor and new firm employment within each ownership category; note that this end year employment is the following year's start year employment, from which indigenous new firm employment is estimated. It should also be noted that the annual new firm employment in Tables A10 and A11 represents net figures, i.e. closure rates have been applied.

**TABLE A6:** Firms Expected Employment Growth

| | Indigenous Employment | % Growth | External Employment | % Growth |
|---|---|---|---|---|
| 1999 | 1387 | | 1773 | |
| 2000 | 1625 | 17 | 2256 | 27 |
| 2001 | 1870 | 15 | 2743 | 22 |
| 2002 | 2115 | 13 | 3205 | 17 |
| 2003 | 2360 | 12 | 3667 | 14 |
| 2004 | 2605 | 10 | 4124 | 12 |
| 2005 | 2850 | 9 | 4581 | 11 |

**Source: NIERC (2000)**

**TABLE A7:** New Indigenous & External Firms Expected Employment Growth

| | Indigenous | | External | |
|---|---|---|---|---|
| | Employment | Growth | Employment | Growth |
| Emp1999 | 65 | | 143 | |
| Emp2000 | 79 | 1.22 | 376 | 2.63 |
| Emp2001 | 99 | 1.25 | 584 | 1.55 |
| Emp2002 | 119 | 1.20 | 792 | 1.36 |
| Emp2003 | 139 | 1.17 | 1000 | 1.26 |
| Emp2004 | 159 | 1.14 | 1208 | 1.21 |
| Emp2005 | 179 | 1.13 | 1416 | 1.17 |

**Source: NIERC (2000)**

# Appendix 1: The Modelling Approach

**Details of the high-growth scenario are given in tables A8-A12**

| TABLE A8: High-Growth Employment Model - Indigenous | | | | | | | |
|---|---|---|---|---|---|---|---|
| | **1999** | **2000** | **2001** | **2002** | **2003** | **2004** | **2005** |
| **Start year employment** | | **2394** | **2681** | **2950** | **3190** | **3419** | **3600** |
| - closure employment | | 103 | 115 | 127 | 137 | 147 | 155 |
| **= survivor employment** | | **2291** | **2565** | **2823** | **3053** | **3272** | **3445** |
| + survivor growth employment | | 389 | 385 | 367 | 366 | 327 | 310 |
| **= survivor end year employment** | **2394** | **2681** | **2950** | **3190** | **3419** | **3600** | **3755** |
| + new firm employment | | 172 | 406 | 721 | 1124 | 1628 | 2239 |
| **End year employment** | | **2853** | **3356** | **3911** | **4543** | **5228** | **5994** |

**Source: NIERC (2000)**

| TABLE A9: High-Growth Employment Model - External | | | | | | | |
|---|---|---|---|---|---|---|---|
| | **1999** | **2000** | **2001** | **2002** | **2003** | **2004** | **2005** |
| **Start year employment** | | **1859** | **2310** | **2735** | **3131** | **3493** | **3828** |
| - closure employment | | 40 | 50 | 59 | 67 | 75 | 82 |
| **= survivor employment** | | **1819** | **2261** | **2676** | **3064** | **3418** | **3746** |
| + survivor growth employment | | 491 | 475 | 455 | 429 | 410 | 412 |
| **= survivor end year employment** | **1859** | **2310** | **2735** | **3131** | **3493** | **3828** | **4158** |
| + new firm employment | | 65 | 231 | 483 | 818 | 1233 | 1722 |
| **End year employment** | | **2375** | **2966** | **3614** | **4311** | **5061** | **5880** |

**Source: NIERC (2000)**

| TABLE A10: New Firm Employment Model - Indigenous Firms | | | | | | |
|---|---|---|---|---|---|---|
| **Born** | **2000** | **2001** | **2002** | **2003** | **2004** | **2005** |
| Start year emp | 2394 | 2853 | 3356 | 3911 | 4537 | 5228 |
| 2000 | 172 | 201 | 241 | 276 | 309 | 338 |
| 2001 | | 205 | 239 | 286 | 328 | 368 |
| 2002 | | | 241 | 281 | 336 | 386 |
| 2003 | | | | 281 | 328 | 392 |
| 2004 | | | | | 326 | 380 |
| 2005 | | | | | | 375 |
| **TOTAL** | **172** | **406** | **721** | **1124** | **1628** | **2239** |

**Source: NIERC (2000)**

| TABLE A11: New Firm Employment Model - External Firms | | | | | | |
|---|---|---|---|---|---|---|
| **Born** | **2000** | **2001** | **2002** | **2003** | **2004** | **2005** |
| 2000 | 65 | 166 | 252 | 335 | 414 | 490 |
| 2001 | | 65 | 166 | 252 | 335 | 414 |
| 2002 | | | 65 | 166 | 252 | 335 |
| 2003 | | | | 65 | 166 | 252 |
| 2004 | | | | | 65 | 166 |
| 2005 | | | | | | 65 |
| **TOTAL** | **65** | **231** | **483** | **818** | **1233** | **1722** |

**Source: NIERC (2000)**

# Appendix 1: The Modelling Approach

| TABLE A12: High-Growth Employment Projections | | | |
|---|---|---|---|
| | Indigenous | External | TOTAL |
| 1995 | 837 | 543 | 1380 |
| 1996 | 918 | 762 | 1680 |
| 1997 | 1368 | 872 | 2240 |
| 1998 | 1881 | 1128 | 3009 |
| 1999 | 2394 | 1859 | 4253 |
| 2000 | 2853 | 2375 | 5228 |
| 2001 | 3356 | 2966 | 6322 |
| 2002 | 3911 | 3614 | 7525 |
| 2003 | 4543 | 4311 | 8854 |
| 2004 | 5228 | 5061 | 10288 |
| 2005 | 5994 | 5880 | 11874 |

**Source: NIERC (2000)**

**Medium-Growth Scenario**

The third scenario was that of medium growth. In order to calculate this, the same model as the low-growth scenario was used, with the same closure and new firm start-up rates. However, in this case the survivor growth rates were calculated as the mean of those used for the low-growth and high-growth scenarios (Table A13). It is assumed that these rates contain a sufficient new firm dynamic so the model specification used in the low-growth scenario is adopted.

| TABLE A13: Mean of Survivor Growth Rates | | | | | | |
|---|---|---|---|---|---|---|
| | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 |
| Indigenous | 10.8 | 9.8 | 8.8 | 8.3 | 9.6 | 6.8 |
| External | 17.5 | 14.5 | 12.5 | 11 | 10 | 9.5 |

**Source: NIERC (2000)**

| TABLE A14: Medium-Growth Employment Model - Indigenous | | | | | | | |
|---|---|---|---|---|---|---|---|
| | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 |
| **Start year employment** | | **2394** | **2710** | **3043** | **3386** | **3753** | **4205** |
| - closure employment | | 103 | 117 | 131 | 146 | 161 | 181 |
| **= survivor employment** | | **2291** | **2594** | **2912** | **3241** | **3591** | **4025** |
| + survivor growth employment | | 247 | 254 | 256 | 269 | 345 | 274 |
| + new firm employment | | 180 | 203 | 228 | 254 | 281 | 315 |
| - new firm closure employment | | 8 | 9 | 10 | 11 | 12 | 14 |
| **End year employment** | **2394** | **2710** | **3043** | **3386** | **3753** | **4205** | **4600** |

**Source: NIERC (2000)**

# Appendix 1: The Modelling Approach

| TABLE A15: Medium-Growth Employment Model - External | | | | | | | |
|---|---|---|---|---|---|---|---|
| | **1999** | **2000** | **2001** | **2002** | **2003** | **2004** | **2005** |
| **Start year employment** | | **1859** | **2202** | **2532** | **2851** | **3162** | **3468** |
| - closure employment | | 40 | 47 | 54 | 61 | 68 | 75 |
| **= survivor employment** | | **1819** | **2155** | **2477** | **2790** | **3094** | **3393** |
| + survivor growth employment | | 318 | 312 | 310 | 307 | 309 | 322 |
| + new firm employment | | 66 | 66 | 66 | 66 | 66 | 66 |
| + new firm closure employment | | 1 | 1 | 1 | 1 | 1 | 1 |
| **End year employment** | **1859** | **2202** | **2532** | **2851** | **3162** | **3468** | **3780** |

**Source: NIERC (2000)**

| TABLE A16: Medium-Growth Employment Projections | | | |
|---|---|---|---|
| | **Indigenous** | **External** | **TOTAL** |
| 1995 | 837 | 543 | 1380 |
| 1996 | 918 | 762 | 1680 |
| 1997 | 1368 | 872 | 2240 |
| 1998 | 1881 | 1128 | 3009 |
| 1999 | 2394 | 1859 | 4253 |
| 2000 | 2710 | 2202 | 4912 |
| 2001 | 3043 | 2532 | 5574 |
| 2002 | 3386 | 2851 | 6238 |
| 2003 | 3753 | 3162 | 6914 |
| 2004 | 4205 | 3468 | 7673 |
| 2005 | 4600 | 3780 | 8380 |

**Source: NIERC**

# Appendix 2: Demand Projection

| **TABLE A17:** Specialist IT Demand - SIC 72 Companies 2000 - 2005 - Low-Growth Scenario | | | | | | | |
|---|---|---|---|---|---|---|---|
| | **2000** | **2001** | **2002** | **2003** | **2004** | **2005** | **TOTAL** |
| Tech Support Staff | 26 | 28 | 30 | 32 | 34 | 34 | 185 |
| IT Graduates no experience | 33 | 44 | 57 | 71 | 86 | 98 | 389 |
| IT Graduates with experience | 65 | 60 | 55 | 48 | 40 | 29 | 297 |
| IT Graduates capable of Project Management | 17 | 18 | 19 | 20 | 22 | 22 | 117 |
| IT Graduates capable of Strategic Planning | 10 | 11 | 12 | 12 | 13 | 14 | 72 |
| TOTAL Demand | 151 | 162 | 172 | 183 | 195 | 197 | 1061 |

**Source: NIERC (2000)**

| **TABLE A18:** Specialist IT Demand - SIC 72 Companies 2000 - 2005 - Medium-Growth Scenario | | | | | | | |
|---|---|---|---|---|---|---|---|
| | **2000** | **2001** | **2002** | **2003** | **2004** | **2005** | **TOTAL** |
| Tech Support Staff | 49 | 50 | 51 | 53 | 62 | 56 | 322 |
| IT Graduates no experience | 65 | 80 | 96 | 114 | 146 | 155 | 657 |
| IT Graduates with experience | 123 | 109 | 93 | 79 | 69 | 46 | 519 |
| IT Graduates capable of Project Management | 32 | 32 | 32 | 33 | 38 | 35 | 202 |
| IT Graduates capable of Strategic Planning | 20 | 20 | 20 | 20 | 21 | 20 | 121 |
| TOTAL Demand | 289 | 292 | 292 | 299 | 336 | 313 | 1822 |

**Source: NIERC (2000)**

| **TABLE A19:** Specialist IT Demand - SIC 72 Companies 2000 - 2005 - High-Growth Scenario | | | | | | | |
|---|---|---|---|---|---|---|---|
| | **2000** | **2001** | **2002** | **2003** | **2004** | **2005** | **TOTAL** |
| Tech Support Staff | 72 | 81 | 89 | 99 | 108 | 119 | 567 |
| IT Graduates no experience | 97 | 136 | 178 | 228 | 281 | 348 | 1267 |
| IT Graduates with experience | 181 | 177 | 166 | 152 | 130 | 104 | 909 |
| IT Graduates capable of Project Management | 47 | 53 | 58 | 64 | 70 | 77 | 368 |
| IT Graduates capable of Strategic Planning | 30 | 34 | 37 | 41 | 44 | 49 | 235 |
| TOTAL Demand | 428 | 480 | 528 | 583 | 632 | 697 | 3345 |

**Source: NIERC (2000)**

# Appendix 2: Demand Projection

| **TABLE A20:** Specialist IT Demand - 2000 - 2005 Non SIC 72 Companies | | | | | | | |
|---|---|---|---|---|---|---|---|
| | **2000** | **2001** | **2002** | **2003** | **2004** | **2005** | **TOTAL** |
| Tech Support Staff | 78 | 35 | 35 | 35 | 35 | 35 | 253 |
| IT Graduates no experience | 63 | 28 | 28 | 28 | 28 | 28 | 203 |
| IT Graduates with experience | 34 | 11 | 11 | 11 | 11 | 11 | 89 |
| IT Graduates capable of Project Management | 34 | 11 | 11 | 11 | 11 | 11 | 89 |
| IT Graduates capable of Strategic Planning | 2 | 0 | 0 | 0 | 0 | 0 | 2 |
| TOTAL Demand | 211 | 85 | 85 | 85 | 85 | 85 | 636 |

**Source: NIERC (2000)**

| **TABLE A21:** Aggregate Demand for IT Specialists - 2000 - 2005 - High-Growth Scenario | | | | | | | |
|---|---|---|---|---|---|---|---|
| | **2000** | **2001** | **2002** | **2003** | **2004** | **2005** | **TOTAL** |
| Tech Support Staff | 150 | 116 | 124 | 134 | 143 | 154 | 820 |
| IT Graduates no experience | 160 | 164 | 206 | 256 | 309 | 376 | 1470 |
| IT Graduates with experience | 215 | 188 | 177 | 163 | 141 | 115 | 998 |
| IT Graduates capable of Project Management | 81 | 64 | 69 | 75 | 81 | 88 | 457 |
| IT Graduates Capable of Strategic Planning | 32 | 34 | 37 | 41 | 44 | 49 | 237 |
| TOTAL Demand | 639 | 565 | 613 | 668 | 717 | 782 | 3981 |

**Source: NIERC (2000)**

# Appendix 3: Enrolments Projections

| TABLE A22: QUB Enrolments 1996/97 - 2003/04 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Actual | | | | Projected | | | |
| Level | Course | 1996/97 | 1997/98 | 1998/99 | 1999/00 | 2000/01 | 2001/02 | 2002/03 | 2003/04 |
| UG | Computer Science | 108 | 123 | 134 | 185 | 221 | 265 | 316 | 379 |
| | Combined | 49 | 48 | 53 | 44 | 42 | 41 | 40 | 38 |
| | | | | | | | | | |
| PG | | | | | | | | | |
| Msc | Computer Applic | 59 | 64 | 111 | 92 | 107 | 124 | 144 | 167 |
| | | | | | | | | | |
| | Total | 216 | 235 | 298 | 321 | 370 | 429 | 500 | 583 |

**Source: NIERC (2000), QUB (1999)**

| TABLE A23: UU Enrolments 1994/95 - 2003/04 | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Estimated | | Actual | | | | Projected | | | |
| Enrolments | 94/95 | 95/96 | 96/97 | 97/98 | 98/99 | 99/00 | 00/01 | 01/02 | 02/03 | 03/04 |
| Computer Science/Software (Single 4years) | 21 | 157 | 171 | 219 | 186 | 225 | 245 | 267 | 291 | 318 |
| MMedia Design (Single 4 years) | 0 | 0 | 0 | 0 | 14 | 17 | 21 | 25 | 30 | 36 |
| Computing (Combined 3 years) | | 15 | | | | | | | | |
| Computing (Combined 4 years) | 43 | 66 | 95 | 130 | 135 | 163 | 214 | 280 | 366 | 480 |
| | | | | | | | | | | |
| Mres (1 Year) | 22 | 22 | 19 | 20 | 18 | 18 | 17 | 17 | 16 | 15 |
| Mphil (1 Year) | 0 | 0 | 0 | 0 | 7 | 6 | 6 | 6 | 6 | 0 |
| MSC/PG (1 Year) | 36 | 48 | 125 | 196 | 258 | 298 | 343 | 394 | 453 | 521 |
| | | | | | | | | | | |
| TOTAL | 101 | 151 | 239 | 346 | 432 | 502 | 600 | 721 | 872 | 1053 |

**Source: NIERC (2000), UU (1999)**

| TABLE A24: Enrolments at FEIs 1994/95 - 2003/04 | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Actual | | | | | Projected | | | | |
| | 94/95 | 95/96 | 96/97 | 97/98 | 98/99 | 99/00 | 00/01 | 01/02 | 02/03 | 03/04 |
| Level 3 | 257 | 317 | 392 | 488 | 631 | 781 | 967 | 1197 | 1482 | 1835 |
| Level 4 | 188 | 188 | 219 | 207 | 222 | 231 | 240 | 250 | 260 | 270 |
| Level 4 UU | 85 | 97 | 120 | 124 | 82 | 128 | 139 | 152 | 166 | 182 |
| | | | | | | | | | | |
| Total | 530 | 602 | 731 | 819 | 935 | 1140 | 1346 | 1599 | 1908 | 2287 |

**Source: DHFETE (2000), NIERC (2000), UU (1999)**