

**Authors**

**Dr. Eileen Drew  
Ms. Candy Murphy**

**Women in Science & Technology  
Employment**

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**Goodbody Economic Consultants**

Ballsbridge Park, Ballsbridge, Dublin 4 • Tel: 353-1-641-0482 • Fax: 353-1-668-2388  
[www.goodbody.ie](http://www.goodbody.ie) • e-mail – [econsultants@goodbody.ie](mailto:econsultants@goodbody.ie)

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## 1. Background to the Study

### 1.1 Introduction

This section of the report provides an introduction, which sets the context for the current study. It is structured as follows:

- a) Objectives of the study;
- b) The economic and labour market environment;
- c) Current participation of women in Science, Engineering and Technology (SET) occupations;
- d) The policy environment;
- e) Methodology used in the study;
- f) Outline of report.

### 1.2 Objectives of the Study

The overall aim of this research is to examine how measures to address the under-representation of women Science and Technology (SET) could contribute to alleviating the skill shortages currently experienced in Irish industry.

The specific study objectives are to:

- Assess the nature and scale of skill shortages in Science and Technology in Ireland;
- Examine the level of representation of women in Science and Technology in Ireland compared with other EU states;
- Identify and review measures used, or usable - at both national and European level - to increase women's representation in Science and Technology;
- Evaluate these measures in terms of:
  - appropriateness to Irish conditions
  - potential benefits
  - potential negative impact
  - identification of good practice.
- Recommend how and by whom identified beneficial measures can best be supported to ensure maximum impact on the S&T skills base in Ireland.

### 1.3 Economic and Labour Market Environment

Ireland continues to experience the fastest growth in GNP within the European Union, with average GNP increases of almost 8 per cent per annum over the period of the late 1990's. This has led to buoyancy in the Irish labour market with increasing employment in both the manufacturing and services sectors. Sectors such as IT, electronics and internationally traded services have grown substantially, as has the chemical industry. In parallel with foreign led industry, Irish-owned sectors such as engineering and consumer foods have also expanded both in terms of production and employment.

Employment in industry accounted for 22 per cent of male employment and 14.2 per cent of female employment in 2000 (CSO, 2000). Women's employment continues to be based more heavily than male in the service sector and service occupations. All available trends indicate a continuing increase in demand for female labour and a tightening of labour market conditions. It is increasingly recognised that women can make a contribution to meeting existing and future labour shortages in Ireland (National Competitiveness Council 2000). The current

economic situation provides an opportunity for women to participate in greater numbers while at the same time contributing to meeting industry's growing needs for more skill intensive labour. Below we examine some of the recent reports on skill shortages in the SET sector.

### **Skill Shortages In SET**

The first report of the Expert Group on Future Skills Needs (The First Report of the Expert Group on Future Skills Needs, 1998) highlighted potential skill shortages in the IT sector that were likely to have an increasingly adverse impact on industrial policies aimed at attracting international inward investment. Assuming that Ireland's economic growth remained high, the Expert Group projected an annual demand for 8,300 technologists up to the year 2003. Relating these forecasts to the estimated annual supply of graduate technologists the annual skills gap was estimated to be 2,200 consisting of 800 engineering and computer science professionals and 1,400 engineering and computer science technicians. (This report focused on higher level skill needs in the software and hardware related areas of the IT sector.)

The Expert Group in its second report (The Second Report of the Expert Group on Future Skills Needs, 2000) acknowledged that, due to the Government's investment of an additional £75 million for 5,400 third level places in electronics and software at degree and technician level, the "current shortage of degree professionals will be virtually eliminated". However the Expert Group still forecast that there would be a shortfall among technicians, hence the recommendation in the second report that priority be given to increasing numbers on the Accelerated Technician Programmes and on making these courses permanent, as well as on encouraging companies to support existing workers who wish to obtain third level qualifications (Expert Group, 2000a). The Expert Group in its second report expressed particular concern that there could be a shortfall in the supply of computer science technicians.

The Expert Group examined skills needs in the chemical and biological sciences, which account for c.100,000 jobs in Ireland. They estimated that demand for employment, particularly in the chemical, pharmaceutical, plastic and rubber, medical devices, biotechnology and food, drink and tobacco sectors would increase by one-third to 132,500 by 2005 (Expert Group, 2000a).

The breakdown of projected demand was for 250 higher degree graduates, 620 primary graduates and 350 technicians per annum. Taking into account the current supply, the Expert Group estimated that an additional requirement for 410 graduates annually up to 2005.

The Expert Group stated that 1,150 extra places are needed at third level for degree students to meet demand in pharmaceutical, chemical, food and biotechnology sectors. It also expressed concern about the falling number of school-leavers studying science at third level, and the decrease in second level students taking chemistry at Leaving Certificate level from 21 per cent in 1987 to 12 per cent in 1999.

The work of the Expert Group on future skill needs, highlights the need to take action to address forecast skill shortages in a variety of SET occupations. This study focuses on exploring the extent to which actions specifically targeted at women can help address those shortages and on identifying the type of measures required to encourage more women to enter and remain in such occupations.

## **1.4 Current Participation of Women in Science, Engineering and Technology Occupations**

According to the 1996 Census of Population (CSO, 1998) the proportion that women form of 'scientific and technical' occupations overall rose by 2 percentage points from 18 per cent of the total in 1991 to 20 per cent in 1996. Women's representation in 'Computer Software' occupations however fell from 44 per cent in 1991 to 37 per cent in 1996, largely reflecting a decline in the numbers employed as computer operators, an occupation in which women predominate.

A report by Women in Technology and Science (WITS 1994) noted that *"the considerable social progress towards equality of opportunity between women and men achieved in the past twenty years has not been reflected in S & T"*. They went on to describe the field as an *"area of predominantly male interest and influence"*. This pattern was ascribed to:

1. Fewer women entering SET occupations;
2. A lower retention rates for women trained in SET are retained;
3. A lower proportion of women at senior levels in SET is significantly lower than for men, even in areas like biology where women are numerically well represented;
4. The absence of women from SET decision-making boards and committees.

The situation in Ireland is mirrored in many other countries and there is a shared concern that without active intervention to ensure equality through a range of policy measures, the under-representation of women will continue.

A Communication from the Commission of the European Communities (1999) noted that women frequently encounter obstacles in their career, and this results in them being under-represented in SET posts. Some of these obstacles are specific to women in SET, others reflect more general conditions for women in the labour market. The Commission documents four critical stages:

- Staying on the job market;
- Staying in a scientific career
- Progressing in the scientific career;
- Being appointed to positions of responsibility and power within the scientific community.

*"The wastage, as regards human resources, if one ignores 50 per cent of the population, as well as the loss of potential diversity and balance in the work force, with the concomitant low level of customer satisfaction, should be apparent to all"* (Lane 1997).

## 1.5 The Policy Context

In this section, the EU and national policy context in relation to gender equality is outlined. Mainstream EU policies in pursuit of greater gender equality in the labour market and women's representation in SET are outlined followed by a summary of key national policies in these areas.

### 1.5.1 EU Policies relating to Equal Opportunities for Women and Men

Under Articles 2 and 3 of the Treaty of Amsterdam, equality of opportunity between women and men became established as one the European Union's objectives. The Treaty's new Article 13 enables appropriate measures to be taken against discrimination, while Article 141 provides the specific legal basis for equality of treatment between men and women.

A Communication from the European Commission *"Incorporating Equal Opportunities for Women and Men into all Community Policies and Activities"*, (Commission of the European Communities, 1996) outlined the challenge ahead: *"to build a new partnership between men and women to ensure that both participate fully on an equal footing..."* The principle of 'mainstreaming' was presented as a policy to promote equality in relation to all general policies and measures to achieve equality *"by actively and openly taking into account at the planning stage their possible effects on the respective situations of men and women"*.

Referring to European Councils which had stressed the importance of the promotion of equal opportunities for women and men, the Communication from the Commission referred to a

"Mobilisation of all Community policies" in which the "promotion of equality must not be confused with the simple objective of balancing the statistics: it is a question of promoting long-lasting changes in parental roles, family structures, institutional practices, the organisation of work and time, etc..." (Commission of the European Communities, 1996)-

The EU Fourth Medium-Term Action Programme on Equal Opportunities for Men and Women (1996-2000) approved by Council in 1995 developed the concept of gender mainstreaming. Article 2 set out the principle of integrating the equal opportunities for men and women dimension in to all policies and activities. The programme's aims were as follows:

- (a) to promote integration of the equal opportunities for men and women dimension in all policies and activities;
- (b) to mobilise all the actors in economic and social life to achieve equal opportunities for men and women;
- (c) to promote equal opportunities for men and women in a changing economy, especially in the fields of education, vocational training and the labour market;
- (d) to reconcile working and family life for men and women;
- (e) to promote a gender balance in decision-making;
- (f) to make conditions more conducive to exercising equality rights.

A Council recommendation on the balanced participation of women and men in the decision-making process was discussed in Brussels in May 1996. It recommended that Member States adopt a "comprehensive, integrated strategy designed to promote balanced participation of women and men in the decision-making process and develop or introduce the appropriate measures to achieve this" (Commission of the European Communities 1996a). It sought educational and training materials free of prejudicial and discriminatory stereotypes, portraying a balance of professional, domestic and social responsibilities and *balanced participation of men and women at all levels*.

### 1.5.2 EU Policies relating to Women and Science

The European Commission has also expressed concern about the under-representation of women in science and technology in general and in decision-making in particular. A European Parliament's *Resolution on Women and Research* called upon Member States to 'promote positive measures to further the presence of women at the highest level in universities and research institutes'. A major conference on Women and Science in 1998 contributed to the European Commission's *Women and Science: Mobilising Women to Enrich European Research*. The document called for active discussion and sharing of experience on the issue of women in science as well as better indicators for measuring inequality.

The Fifth Action Programme (1998-2002) actively sought the participation of women in the field of R & D noting, in the Annex II to the programme that "*particular account will be taken of the need to encourage the participation of women in the fields of research and technological development*". The Programme adopted a two-year track approach for measuring inequality:

- (1) To promote dialogue among women scientists and policy decision-makers on women in science; and
- (2) A Gender and Science Watch System (Genderwatch) to monitor and implement the integration of the gender dimension in the Fifth Framework Programme.

This Genderwatch system is aimed at increasing the participation and involvement of women in all aspects of the Fifth Framework Programme. It focuses on:

- a) Promoting research by women with the objective of achieving 40 per cent women in scholarships, advisory groups and research evaluation panels;



- b) Promoting research for women through ensuring that the gender dimension is included in all work programmes;
- c) Promoting research on women, aimed at increasing the understanding of women's role in society.

Gender impact studies are to be carried out to measure progress against these objectives.

In 1999, the Council of the EU passed a Resolution inviting Members to:

- Review established mechanisms for collecting gender desegregated statistics;
- Engage in the dialogue proposed by the Commission about policies implemented in Member States; and
- Pursue the objective of gender equality in science by appropriate means.

To this end it was envisaged that universities, research councils, centres and institutes, companies employing scientists as well as Member States and the Commission itself would have a role in thinking through the enhanced focus on gender equality (ETAN, 2000).

In November 1998 the Commission set up a Group of Experts meeting under the auspices of the ETAN (European Technology Assessment Network), consisting of a dozen women scientists. The remit of the group was to identify the challenges for increasing women's participation in European research policy. The report of the group (ETAN, 2000) has been discussed by a group of national civil servants (the Helsinki Group). The group members represent all the EU Member States (with observers from Associate States) and are engaging in dialogue on policy issues with a particular emphasis on gender sensitive indicators and good practice.

### 1.5.3 National Policy relating to Equal Opportunities for Women and Men

The National Development Plan (2000-2006) is designed to underpin the development of a dynamic competitive economy over the period 2000-2006, building upon the unprecedented economic progress of recent years. The objective of the Plan is to increase the capacity of Ireland's economy to sustain strong and sustainable output and economic growth, including the promotion of 'Social Inclusion', targeted at groups affected by social exclusion.

Ireland, in line with EU policy, is now taking a dual approach towards the achievement of gender equality. This involves:

1. mainstreaming of equal opportunities so that all policy takes into account its possible effect on the respective situation of women and men;
2. promoting and funding specific measures to help women achieve equality of opportunity.

A commitment to these objectives is obtained in the National Development Plan (NDP) which states that:

*"As the Commission's guidelines indicate, equality for men and women is a basic democratic principle underpinned by the Treaty of Amsterdam. Its incorporation into all policies is therefore no longer an option but an obligation. Mainstreaming equal opportunities must therefore be introduced into all Structural Funds programming. This involves both efforts to promote equality and specific measures to help women and the mobilisation of all general policies by actively and openly taking into account at the planning stage their possible effects on the respective situation of women and men..."*

The National Development Plan goes on to state that:

*"The Plan provides for a number of specific actions designed to ensure that men and women share the benefits of the Plan. It contributes to the achievement of a more equal society for men and women through the mainstreaming of equal opportunities across all sectors."*

The National Development Plan emphasises that while much has been achieved in the area of gender equality 'much remains to be done'. The Plan states that:

*"While much progress has been made in the area of employment and human resources to improve equality as between men and women, much remains to be done. There is a need for measures to tackle attitudinal and cultural barriers both within the workplace, to participation by women in the work force and within the home, in relation to the balance to be struck between work and family responsibilities and the sharing of such responsibilities. There is also a need to support women's access to education and training and to continue to develop the strategy to combat violence against women. Moreover, increasing women's input to the decision-making process is a major priority. An allocation of £23.2 million (€29.5 million) is being provided to finance measures to promote equality including retaining and up-skilling for women employees, promoting greater sharing of family responsibilities, support for career development and entrepreneurship amongst women and the gender proofing of personnel practices in employment."*

The National Development Plan also expresses a commitment to gender proofing of all policies to ensure that where possible such policies support the objective of greater gender equality.

#### **1.5.4 National Policies relating to Women and Science**

Forfás has particular responsibility for the development of state policies designed to stimulate enterprise and employment. A key element of this work involves ensuring that Ireland is positioned at the forefront of the knowledge-based economy. The Irish Council for Science, Technology & Innovation (constituted as a sub-board of the Forfás Board) advises the government on policy for science and technology and related matters.

A number of reports which have made wide-ranging recommendations in relation to the promotion and development of science and technology at all levels in Ireland have been prepared by the Irish Council for Science, Technology and Innovation (ICSTI). The Council has prepared reports making recommendations aimed at improving science, technology and mathematical education in schools, benchmarking SET education in Ireland against other countries, raising awareness about STI issues, increasing innovation in Irish industry, as well as a number of specific reports on other aspects of science and technology. Following the Technology Foresight exercise, the Irish Council for Science, Technology and Innovation recommended that a new fund for research be established. Science Foundation Ireland was established in 2000 and will support the development of world class research facilities in niche areas of information and communications technology and biotechnology over the period 2000-2006.

Through the Expert Group on Skills Needs, efforts are being made to raise awareness about the need to increase the numbers of people in Ireland with science and technology qualifications, if skill shortages are to be addressed, and if Ireland is to remain a key player in the development of these sectors-especially in the science, computer software and engineering areas.

This current study builds on this work and looks particularly at the role of women in the SET sector. It thus represents an attempt to draw together the twin themes of economic development and equality of opportunity in a way that will maximise opportunities for women in the area of science and technology while at the same time helping to ensure that threatened skill shortages in this area are averted.

A recent report by the National Competitiveness Council (2000) emphasised the threat to Ireland's competitiveness if current and potential skill shortages are not addressed. It identified four target groups with the potential to increase the supply of labour:

- women returners;
- older people not in the labour market;
- unemployed; and
- migrants.

The first of these groups, are married women aged over 35 years who have left the labour market. Although female participation rates in Ireland have been rising, the participation rate of 62 per cent among women aged 25-54 years is well below the 15 EU Member States average of 72 per cent (Central Statistics Office, 2000). The most recent data for age specific participation rates indicate (Central Statistics Office 1997), that while 39 per cent of all women were in the labour market in 1997, the participation rate for women aged 25-44 years was 61 per cent compared with 32 per cent for women aged 45-64 years. The National Competitiveness Council therefore recommended a number of measures aimed at increasing the participation rate of women, particularly those aged 35 years or over who are not currently in the labour market. The measures sought were:

- the completion of the 3 year tax individualisation programme;
- implementation of childcare supports by 2002;
- increased training provision for women returning to paid employment, particularly centred on skill enhancement and targeted towards labour scarcity.

In addition to women returners the report stressed three other supply measures aimed at:

- older people not in the labour market;
- those on the margins e.g. long term unemployed; and
- recruitment from outside the European Economic Area (EEA) to attract skills in short supply within Ireland (National Competitiveness Council, 2000).

The National development Plan 2000-2006 commits all third level colleges to the development of an equality policy which includes the setting up of Equality networks. These networks will develop and promote strategies to encourage equality of access, benefit and outcome for participants in third level education. It also proposes supporting third level institutions in facilitating access for mature students to third level education

As this review of EU and National Policy has shown, policies aimed at increasing women's participation in the labour market have been found to require the adoption of a wide range of complementary measures to:

1. Specifically support women's' access to education and training;
2. Increase women's participation in decision-making structures.
3. Tackle attitudinal and cultural barriers within the workforce; and
4. Achieve a balance between work and family responsibilities for both women and men.

## **1.6 Methodology**

In order to meet the terms of reference outlined above the following methodologies were applied in the current study. These methodologies take into account the labour market environment and the EU and National Policy context outlined above.

### **1.6.1 Literature Review**

The literature review focused on analysing available sources of information on:

- Skill shortages in Irish industry;
- Factors contributing to women's under-representation in SET;
- Measures to address women's under-representation in SET.

#### **1.6.2 Analysis of available statistics on women's participation in Science, Engineering and Technology**

This involved reviewing available statistics on trends in both the demand and supply of women with SET qualifications to date, as well as available forecasts of likely future demand and supply levels and imbalances. EU statistics on the labour market experience of women SET graduates are unavailable. In the absence of harmonised statistics on SET occupations and educational attainment throughout the EU, this Section concentrates on Irish published and unpublished data sources.

#### **1.6.3 Key Informant Interviews**

Interviews were conducted with key informants in relevant organisations in order to obtain their views on how best to increase the participation of women in SET occupations.

#### **1.6.4 Focus Groups**

In order to elicit the views and experience of women who hold SET qualifications, two Focus Groups sessions were held with women:

- currently involved in SET occupations in key sectors; and
- who had obtained SET qualifications but were no longer engaged in SET occupations in key industrial sectors.

#### **1.6.5 Survey of Companies**

A survey of SET companies was undertaken in order to obtain their views on:

- current skill shortages in SET;
- their experience of employing women in SET posts;
- their use or otherwise of specific measures to attract/retain female applicants/staff;
- possible future measures aimed at addressing women's under-representation in the context of current skill shortages.

#### **1.6.6 Identification and Evaluation of Measures**

This stage of the study involved reviewing all the measures identified in earlier stages of the study that have been used to date to address the under-representation of women in SET within Ireland or abroad. It also involved a follow-up of a number of specific measures that have been introduced to date and which were likely to have wider relevance in a national context.

#### **1.6.7 Presentation of Conclusion and Recommendations**

In this final stage of the study we draw together the main findings and present a range of conclusions and recommendations that address the objective of the study as outlined in Section 1.2.

## 2. Analysis of Available Statistics on Women's Representation in SET

### 2.1 Introduction

This Section examines current and forecast demand for SET skills in the Irish economy and compares this with the existing and future supply of men and women with SET qualifications. This is followed by an analysis of women's representation in SET employment and third level education.

### 2.2 Current Demand for Women/Men in SET Occupations

#### 2.2.1 Employment by Occupational Level

The only national source of data on occupations is the Census of Population. In 1996, the Central Statistics Office adopted a new occupational classification that differs from the one used in previous census years. The 1996 Census provided comparative data for 1991 and 1996 only (Tables 2.1 and 2.2) and its data is used in our analysis. However, while Table 1 Appendix A sets out the occupational distribution of men and women in SET in 1986 and 1991 using the previous occupational classification; For example, the occupations: chemist, engineering technician, computer science manager and software engineer are not included in the 1986 Central Statistics Office data.

For ease of interpretation this Section utilises the categories specified by the Central Statistics Office: Scientific (relating to science occupations), Technical (relating to engineering occupations) and Computer Software (relating to computer science occupations).

A breakdown of SET workers according to gender and regional distribution is shown in Table 2, Appendix A.

#### ***Female Share of SET Employment 1991-1996 (Table 2.1)***

According to the 1996 Census of Population (CSO, 1998) the proportion of women in 'Scientific and Technical' occupations covering both science and engineering occupations, rose by 2 percentage points from 18 per cent in 1991 of the total to 20 per cent in 1996. Table 2.1 shows that women's representation was highest among scientific professionals and lowest amongst engineering professionals. The highest participation level occurs in the IT area. Leaving aside the IT data, the percentage participation of women in the science area is higher than in engineering although it is not true for all cases (e.g. compare chemical/production/ QC at 21% with physicists at 16%). The Science and Technical occupations with female participation rates above the 20 per cent average were: chemists, biological scientists, other natural scientists and laboratory technicians, and those with less than 20% participation were other science technicians and physicists.

Further evidence of occupational segregation by gender is evident in the Computer Software occupations (see Table 2.1). Within these occupations, women are under-represented (under 37 per cent in all occupations) except as computer operators (62 per cent). Women's representation fell as a proportion of all computer software posts from 44 per cent in 1991 to 37 per cent in 1996. This decline is due in part to the fall in the number of computer operator positions and also to the increased male representation in the growing software engineer occupation. Women's share of software engineering occupations decreased from 23 per cent in 1991 to 21 per cent in 1996. However the proportion of women computer systems managers increased from 19 per cent 1991 to 24 per cent in 1996. The proportion of women computer analysts / programmers remained static at 31 per cent between 1991 and 1996.

**Table 2.1 Women's Representation in SET Occupations in 1991 and 1996**

Specific Occupation	% Women 1991	% Women 1996
<b>SCIENTIFIC</b>		
Chemists	38%	39%
Biological Scientists	22%	34%
Physicists	14%	16%
Other Natural Scientists	38%	46%
Laboratory technicians	49%	54%
Other Scientific Technicians	11%	19%
<b>TECHNICAL</b>		
Civil and Mining Engineers	3%	6%
Mechanical Engineers	2%	4%
Electrical/Electronic Engineers	5%	5%
Chemical, Production, QC Engineers	19%	21%
Design and Development Engineers	11%	10%
Other Engineers/Technologists	6%	10%
Engineering Technicians	4%	12%
Electrical/Electronic Technicians	7%	10%
Architectural, Civil Engineer Technicians	13%	15%
Draughtspersons	9%	10%
Building Inspectors & Surveyors	4%	5%
Marine, Insurance/other Surveyors	4%	9%
<b>Total (Scientific and Technical)</b>	<b>18%</b>	<b>20%</b>
<b>COMPUTER SOFTWARE</b>		
Computer Systems Managers	19%	24%
Software Engineers	23%	21%
Computer Analyst/Programmes	31%	31%
Computer Operators	68%	62%
<b>Total (Computer Software)</b>	<b>44%</b>	<b>37%</b>

Source: Census of Population 1996, Vol. 7, Occupations, Table 8 (1998)

***Women's Participation in Scientific and Technical Occupations 1991-96 (Table 2.2)***

According to the 1996 Census 35,319 people were employed in 'Scientific and Technical' occupations, compared with 25,083 in 1991, an increase of 41 per cent in 5 years. The number of women in 'Scientific and Technical' occupations rose from 4,396 in 1991 to 7,019 in 1996, a 60 per cent increase, compared to an increase of 37 per cent for men.

Among science professionals, chemists, biological scientists and other natural scientists, women's representation increased by a net 505 jobs, with the major rise in the number of women employed occurring among other natural scientists (+255), compared with chemists (+87) and physicists (-4).

The increase in female engineering professionals, civil and mining, mechanical, electrical/chemical, design and development and 'other' was of a similar magnitude at +486. The highest increase for women was in 'other engineering' (+196) and electrical/electronic engineering (+110), compared with chemical, production and QC engineering (+16).

The data also indicate that the major increase in women's representation in SET employment has occurred in 'Scientific and Technical' technician (associate professional) level as: laboratory technician (+801), other scientific technician (+412), electrical/electronic technician (+237), and other engineering technician (+169). Engineering technicians have risen by a factor of 4.

Taking Table 2.1 and Table 2.2 together the data indicate that the number of women in professional 'Scientific and Technical' occupations increased significantly between 1991-96, particularly among biological scientists, other natural scientists, electrical/electronic engineers and other engineers. However, the proportion of women in such occupations remains significantly lower than men, except as chemists and biological scientists.

At technical level a different pattern emerges with women accounting for over 50 per cent of laboratory technicians in the 'Scientific' area in 1996, while the percentage of women working as technicians in the 'Technical/Engineering' area remains low – at 11 per cent in 1996.

**Women's Participation in Computer Software Occupations 1991 and 1996 (Table 2.2)**

In total, 19,598 persons were employed in 'Computer Software' occupations in 1996, compared with 13,958 in 1991, an increase of 40 per cent. Only 965 of these additional jobs were held by women (20%), while the number of men in computer software occupations increased by 4675 (60%). This pattern largely reflects the reduction in numbers employed as computer operators between 1991-96, an occupation that is predominantly female. However, the number of women at manager and engineer level increased by 616 (+ 292 per cent) and 185 (+40 per cent) respectively between 1991-96, compared to an increase of 184 per cent for male computer systems managers and 60 per cent for male software engineers.

**Table 2.2 Number of People in SET Occupations by Gender in 1991 and 1996 (% in brackets)**

Specific Occupation	Women		Men		Women		Men	
	1991		1991		1996		1996	
<b>SCIENTIFIC</b>								
Chemists	313	(38)	504	(62)	400	(39)	615	(61)
Biological Scientists	432	(22)	1522	(78)	599	(34)	1186	(66)
Physicists	62	(14)	404	(86)	58	(16)	301	(84)
Other Natural Scientists	233	(38)	389	(62)	488	(46)	575	(54)
Laboratory technicians	1957	(49)	2044	(51)	2758	(54)	2355	(46)
Other Scientific Technicians	151	(11)	1224	(89)	563	(19)	2358	(81)
<b>Sub Total Scientific</b>	<b>3148</b>	<b>(34)</b>	<b>6087</b>	<b>(66)</b>	<b>4866</b>	<b>(40)</b>	<b>7390</b>	<b>(60)</b>
<b>TECHNICAL</b>								
Civil and Mining Engineers	105	(3)	3006	(97)	185	(6)	3022	(94)
Mechanical Engineers	28	(2)	1207	(98)	64	(4)	1712	(96)
Electrical/Electronic Engineers	34	(5)	634	(95)	144	(5)	2515	(95)
Chemical, Production, QC Engineers	427	(19)	1810	(81)	443	(21)	1692	(79)
Design and Development Engineers	58	(11)	475	(89)	106	(10)	964	(90)
Other Engineers/Technologists	32	(6)	469	(94)	228	(10)	2102	(90)
Engineering Technicians	33	(4)	751	(96)	121	(12)	906	(88)
Electrical/Electronic Technicians	154	(7)	2019	(93)	391	(10)	3692	(90)
Architectural/Civil Engineer Technicians	109	(13)	715	(87)	190	(15)	1081	(85)
Draughtspersons	221	(9)	2282	(91)	214	(10)	1982	(90)
Building Inspectors & Surveyors	43	(4)	1140	(96)	56	(5)	1133	(95)
Marine, Insurance/other Surveyors	4	(4)	92	(96)	11	(9)	109	(91)
<b>Sub Total Technical</b>	<b>1248</b>	<b>(8)</b>	<b>14600</b>	<b>(92)</b>	<b>2153</b>	<b>(9)</b>	<b>20910</b>	<b>(91)</b>
<b>Total (Scientific and Technical)</b>	<b>4396</b>	<b>(18)</b>	<b>20687</b>	<b>(82)</b>	<b>7019</b>	<b>(20)</b>	<b>28300</b>	<b>(80)</b>
<b>COMPUTER SOFTWARE</b>								
Computer Systems Managers	211	(19)	914	(81)	827	(24)	2598	(76)
Software Engineers	458	(23)	1563	(77)	643	(21)	2499	(79)
Computer Analyst/Programmes	1564	(31)	3436	(69)	2377	(31)	5310	(69)
Computer Operators	3974	(68)	1838	(32)	3325	(62)	2019	(38)
<b>Total (Computer Software)</b>	<b>6207</b>	<b>(44)</b>	<b>7751</b>	<b>(56)</b>	<b>7172</b>	<b>(37)</b>	<b>12426</b>	<b>(63)</b>

Source: Census of Population 1996, Vol. 7, Occupations, Table 8 (1998)

### 2.2.2 Age Profile of SET Workers

Table 3, Appendix A shows SET employment by gender and age group in 1996. This shows that the level of women's representation in scientific and technological occupations was above the overall average (20 per cent) in the 20-34 age groups, at 28 per cent, after which it fell to 15 per cent for 35-44 year olds, and below 10 per cent thereafter.

The age pattern is very different in the 'Computer Software' area, where women were in the majority in computer software-related occupations among employees aged less than 20 years and their representation never fell below 29 per cent even among workers aged 55-64 years and over. In the absence of an in depth empirical study<sup>1</sup> it is not clear to what extent this pattern is in response to high level demand for computer software skills by employers, leading to the provision of supports aimed at encouraging the re-entry of women into computer software occupations, and/or a higher retention rate of older women in these occupations.

These differences in age patterns between 'Scientific and Technical' occupations and 'Computer Software' occupations may reflect a variation in the retention rates among different occupational levels. (Women in 'Computer Software' are mainly employed as computer programmers or operators.) or it may reflect a tendency for women to remain in occupations where they constitute a significant proportion of the total. We do not have the data necessary to identify the actual contributory factors operating in this area.

### 2.2.3 Educational Qualification Profile of SET Workers

Table 4, Appendix A shows the pattern of educational qualifications among men and women working in SET occupations. The Table indicates that the pattern of educational qualifications is broadly similar for women and men in the 'Scientific and Technical' occupations –with 88 per cent of women and 83 per cent of men holding a third level qualification. However the situation differs greatly in the 'Computer Software' area where 54 per cent of women had third level qualifications in 1996, compared with 75 per cent of men. This again reflects the concentration of women in lower level occupations in the Computer Software sector in 1996.

## 2.3 Anticipated Future Demand for Science, Engineering and Technology (SET) Occupations

### 2.3.1 Employment Projections for SET Occupations

FÁS/ESRI (Hughes et al., 2000) estimate that future growth in demand for engineering and science professionals (engineers, scientists) will continue at 6.0 per cent annually up to 2005. In absolute terms the numbers employed in those occupations is forecast to increase from 25,200 to 40,300 between 1997 and 2005. Table 2.3 shows the forecast changes in employment in SET professions relative to levels prevailing in 1993 and 1997. These forecasts are based on the 1981 and 1986 Censuses of Population and the annual Labour Force Surveys 1989-1997<sup>2</sup>.

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<sup>1</sup> A major study is currently being undertaken by the Employment Research Centre, Trinity College Dublin, 2001 into 'Innovations in Information Society Sectors – Implications for Women's Work, Expertise and Opportunities in European Workplaces: <http://www.tcd.ie/erc/Servemploi/index.htm>

<sup>2</sup> For details of the methodology used in the FÁS/ESRI occupational forecasting model see reports No. 3 and 4, published in 1993 and 1995 respectively.



**Table 2.3 Actual and Projected Employment in Engineering and Science 1993-2005\***

<b>Professionals</b>	<b>1993</b>	<b>1997</b>	<b>2005*</b>	<b>% Increase 1997-2005*</b>
Men	19,600	21,400	32,700	53%
Women	2,100	3,800	7,600	100%
Total	21,700	25,200	40,300	60%
<b>% Female Share</b>	<b>9.7%</b>	<b>15.1%</b>	<b>18.9%</b>	
<b>Associate Professionals</b>				
Men	13,400	18,300	30,900	69%
Women	5,800	9,500	17,200	81%
Total	19,200	27,800	48,000	73%
<b>% Female Share</b>	<b>30.2%</b>	<b>34.2%</b>	<b>35.8%</b>	

Source: Hughes et al., 2000

\* denotes projected

A similar pattern of growth is predicted among the 'Associate Professional' engineering and science occupations (referring to the technical level or physical and life science technicians, electronic technicians, system analysts, computer programmers) at 7.1 per cent annually, representing an increase of 20,200 jobs in these occupations between 1999 and 2005. The authors (Hughes et al., 2000: 46) conclude that this "highlights the continuing demand for workers with computing, information technology, and telecommunication skills".

Hughes et al (2000) anticipate a rise in the number of women among engineering and science professionals from 2,100 in 1993 and 3,800 in 1997 rising to 7,600 by 2005, representing a projected 100 per cent increase between 1997 and 2005, albeit from a small base. The number of women in the 'Associate Professional' engineering and science occupations is expected to rise from 5,800 in 1993 and 9,500 in 1997 to 17,200 in 2005, an anticipated 81 per cent increase over the period 1997-2005. The FÁS/ESRI report anticipates that the female share of engineering and science 'associate professional' posts will increase from 34 per cent to 36 per cent of the total and from 10 per cent to 19 per cent among 'Associate Professionals' according to FÁS/ESRI between 1997 and 2005. Between 1993-1997 the number of female engineering and science professionals and associate professionals rose from 7,900 to 13,300, an increase of 1,350 p.a.

These forecasts are based on past trends and indicate the likely number and percentage of women in these occupations, if present trends continue. The forecasts show that, if past trends continue, women will reach 19 per cent of the total number of professionals employed in engineering and science by 2005, and 36 per cent of those employed at associate professional/ technical level.

## 2.4 Potential Supply of Women with SET Skills

### 2.4.1 Number with SET Qualifications

Data from the Central Statistics Office can be used to illustrate the potential size of the pool of women and men with SET qualifications (degree and non-degree) in 1986 and 1996 (no such information was collected in 1991). These are categorised into: natural science, engineering (including architects, surveyors) and computer science. Table 2.4 shows the size of the pool with SET qualifications. It indicates that the representation of women among those with SET qualifications is considerably higher in science and computer science than in engineering.

The proportion which women account for of those with science qualifications grew from 41 per cent to 46 per cent between 1986 and 1996 and in computer science the proportion increased from 32 per cent in 1986 to 37 per cent in 1996. However, the percentage of women who

held engineering qualifications remained low over the period, accounting for 4 per cent of all persons in 1986 and 7 per cent in 1996.

**Table 2.4 Number of Persons (aged 15 years and over) with SET Qualifications in 1986 and 1996**

	1986			1996		
	No. Men	No. Women	% Women	No. Men	No. Women	% Women
<b>Science</b>	9,078	6,211	41%	16,067	13,428	46%
<b>Engineering</b>	27,349	1,092	4%	55,409	3,932	7%
<b>Computer Science</b>	1,844	855	32%	8,456	5,006	37%
<b>Total</b>	<b>38,271</b>	<b>8,158</b>	<b>21%</b>	<b>79,932</b>	<b>22,366</b>	<b>28%</b>

Source: CSO (1998), Census of Population, Vol. 8, Table 19.

#### 2.4.2 Employment of those with SET Qualifications in SET Employment

Given the CSO changes in occupational categories that occurred between 1986 and 1996, it is not possible to compare the specific occupations held by women and men with SET qualifications over that decade. However, Table 2.5 provides a breakdown of occupations held by wo/men with SET qualifications in 1996. (A summary of the key occupations held by wo/men in 1986 is set out in Table 5 Appendix A).

Table 2.5 shows the occupational breakdown of women with SET qualifications in 1996. Taking the numbers employed in 'Scientific and Technical', 'Engineering and Allied Trade' and 'Computer Software' it shows that approximately 40 per cent of men and 34 per cent of women with science or computer science qualifications are employed in scientific or technical occupations.

A third of women are in 'other occupations' (not elsewhere defined) and a further 23 per cent are employed as teachers, compared to 28 per cent and 16 per cent of men respectively. While 11 per cent of men with science / computer science qualifications are employed as managers and executives only 6 per cent of women are so employed.

The number of men and women with engineering qualifications varies greatly – nearly 55,000 men and 4,000 (Table 2.4) women. However, Table 2.5 indicates a relatively similar pattern of employment for women and men with an engineering qualification. 46 per cent of men are employed in 'Scientific and Technical', 'Engineering and Allied Trades', and in 'Computer software', compared to 44 per cent of women. Twenty nine per cent of both genders are in other occupations and 4-5 per cent are employed as teachers.

These figures indicate that there is a high degree of 'leakage' of both men and women with such qualifications into other forms of employment.

Table 2.5 Occupations held by People aged 15 years and over with SET Qualification in 1996 by Gender

Science Qualification (inc. Computer Science)	No. Men	% of Men	No. Women	% of Women
Scientific & Technical	3,773	18%	2,914	21%
Managers & Executives	2,240	11%	883	6%
Engineering & Allied Trades	213	1%	29	0%
Teachers	3,447	16%	3,204	23%
Building & Construction	182	1%	24	0%
Computer Software	4,794	22%	1,947	14%
Other Professional	652	3%	480	3%
Other Occupations	6,090	28%	4,757	33%
<b>TOTAL</b>	<b>21,391</b>	<b>100%</b>	<b>14,238</b>	<b>100%</b>

  

Engineering Qualification	No. Men	% of Men	No. Women	% of Women
Scientific & Technical	15,026	31%	1,068	36%
Manager & Executives	5,146	10%	222	7%
Engineering & Allied Trades	5,505	11%	62	2%
Teachers	2,064	4%	145	5%
Building & Construction	4,536	9%	347	11%
Computer Software	1,742	4%	175	5%
Other Professional	1,012	2%	159	5%
Other Occupations	14,500	29%	916	29%
<b>TOTAL</b>	<b>49,531</b>	<b>100%</b>	<b>3,094</b>	<b>100%</b>

Source: CSO (1998), Census of Population, Vol. 8, Table 25.

#### 2.4.3 Numbers with SET Qualifications not in the Labour Market

The CSO data also provide a breakdown of qualifications according to employment status. Table 2.6 shows the scale and proportions of wo/men holding SET and non-SET qualifications that were not in the labour force in 1986 and 1996. These percentages have been calculated on the basis of the number of wo/men with qualifications who were outside the labour market in 1986/96 as a percentage of the total number of fe/males, with such qualifications.

The figures indicate that there were 5000 women and 9000 men approximately with SET qualifications (including architecture and surveying) that were not in the labour force in 1996. Over a quarter of women with science qualifications were not in the labour force in 1996 compared to 16 per cent of men.

The distribution of those with SET qualifications not in the labour force in 1996 varied for men and women by area within SET. Of the total number of SET qualified women not in the labour force 70 per cent have science qualifications, 17 per cent have engineering qualifications and 13 per cent have computer science qualifications. This compares with 27 per cent, 65 per cent and 7 per cent respectively for men.

**Table 2.6 Wo/Men with qualifications aged 15 years and over NOT in the Labour Force 1986 and 1996**

	1986			1996		
	No. Men	No. Women	% of Total Fe/(male) with Qualification*	No. Men	No. Women	% of Total Fe/(male) with Qualification*
Natural and other Sciences	1,056	1,813	29% (12%)	2,495	3,548	26% (16%)
Engineering, Architecture and Surveying	1,992	252	23% (7%)	5,878	838	21% (11%)
Computer Science and Computer Engineering	76	101	12% (4%)	637	648	13% (8%)

Source: CSO (1998), Census of Population, Vol. 8, Table 19.

\* Total refers to the total under each category in Table 2.4

The percentage of men with any scientific or technical qualification (including medical, social and other sciences) not in the labour force averaged 14% in 1996. This indicates that the level found in SET is below the 17% average. While figures by age are not available it would appear likely that most of these men are over 55 years of age. For example there are 5878 men with engineering, architecture and surveying qualifications not in the labour force and 6246 men with such qualifications aged 55 and over. In contrast the number of women with natural and other science qualifications not in the labour force in 1996 was 3548 while the number of women with such qualifications aged over 55 was 946. This indicates the presence of a number of younger women with such qualifications not currently in the labour market.

## 2.5 Comparison of Supply and Demand in SET

In this section we draw together the statistics presented above to compare the supply and demand position of wo/men with SET qualifications in 1996. Table 2.7 indicates that demand for computer software/computer science employees outstripped the supply of those with such qualifications in 1996, for both men and women, indicating that a significant number of such employees are entering these occupations without a computer science qualification. The findings also indicate that there is a potential pool of women with science qualifications not currently employed in the SET sector. However in this area potential supply was well in excess of current demand in 1996. In engineering there was a pool of qualified women – 838 (21 per cent of all women with engineering qualifications), who were outside the labour force in 1996.

**Table 2.7 Supply/Demand for SET Occupations 1996**

SET Sector	TOTAL Supply: ♀ (♂) with SET Qualifications A	Current Demand: ♀ (♂) employed in SET B	No's of ♀ (♂) with SET Qualifications not in Labour Force C
Scientific	13,428 (16,067)	4,866 ( 7,390)	3,548 (2,495)
Technical / Eng	3,932 (55,409)	2,153 (20,910)	838 (5,878)
Computer Software Science	5006 (8,456)	7,172 (12,426)	648 (637)

Derived from CSO data in Tables 2.2 (B), 2.4 (A) and 2.6 (C)

## 2.6 Future Supply of Wo/Men into SET Occupations

While Section 2.5 examined the representation of women and men in SET occupations, Section 2.6 looks at the recent supply of new graduates with science, engineering and computer science qualifications according to gender.

### 2.6.1 The Number of SET Graduates in 1998

Section 2.6.1 examines the most recent annual supply of male and female SET graduates from universities and Institutes of Technology, drawing upon unpublished data supplied by the Higher Education Authority (HEA) for Irish universities and the National Council for Educational Awards (NCEA) for students leaving Institutes of Technology. Table 2.8 summarises the number of female and male graduates and postgraduates in 1998.

Table 2.8 SET Undergraduates and Postgraduates in 1998

All Undergraduate Degree holders (Full-time and Part-time) – Universities and Institutes of Technology				
	Male	Female	Total	Female graduates as % of Total
Science	1,140	1,163	2,303	51%
Engineering	1,074	286	1,360	21%
Computer Science	488	182	670	27%
<b>Total</b>	<b>2,702</b>	<b>1,631</b>	<b>4,333</b>	<b>38%</b>
All Postgraduate degree holders (Full-time and Part-time) – Universities and Institutes of Technology				
	Male	Female	Total	Female graduates as % of Total
Science	294	300	594	51%
Engineering	199	69	268	26%
Computer Science	492	358	850	42%
<b>Total</b>	<b>985</b>	<b>727</b>	<b>1,712</b>	<b>43%</b>

Source: [http://www.heai.ie/pub\\_rep/Statistics/Statistical%20Reports.htm](http://www.heai.ie/pub_rep/Statistics/Statistical%20Reports.htm) and NCEA Statistics Report (unpublished) 2000.

Table 2.8 shows that women represented 38 per cent of all SET graduates in 1998 and that women now account for just over 50 per cent of science graduates and post graduates. However, they accounted for just over one fifth 21 per cent of those with engineering undergraduate degrees and over one-quarter 25 per cent at postgraduate level. This indicates that women are increasing as a proportion of engineers, but at a relatively slow rate, particularly when related to the rising demand for engineering professionals. Within computer science a different pattern emerges in which women comprised only 27 per cent of those graduating from undergraduate degree courses while they accounted for 42 per cent of those with postgraduate degrees. In absolute terms the figures indicate that almost twice as many women are pursuing post-graduate qualifications in computer science than there are at undergraduate level. This may be due to the number of women undertaking postgraduate conversion courses in computer science.

## 2.7 Women's Representation in SET at Tertiary Level

Having looked at the graduate and postgraduate pool of SET graduates, Section 2.7 examines the numbers of undergraduate and postgraduate students who were pursuing SET studies at Universities and Institutes of Technology in 1999.

### Women in SET Courses at Irish Universities

The proportion of women in science degree courses was 57 per cent in 1999 compared with 19 per cent in engineering and 30 per cent in computer science. For further details according to individual universities see Table 6, Appendix A. This table also shows that there are some

divergences between universities. It was in NUI Galway that women attained the highest representation as computer science undergraduates 38 per cent. Conversely it was in UL, DCU and NUI Galway that least progress has been made with levels of 13, 14 and 16 per cent in 1999 respectively in engineering. It is also worth noting that the University of Limerick is the single largest institution in terms of undergraduate engineering students in Ireland.

#### **Postgraduate Representation of Women in SET**

Careers in SET are critically dependent not only on the output of undergraduates into the job market but also on the numbers who enter postgraduate research studies at third level colleges. The growing demand by Irish industry for postgraduate and post doctorate SET graduates was highlighted in the second report of the Expert Group on Skill needs (2000a). Table 7, Appendix A, sets out the numbers of wo/men who were engaged in full-time postgraduate study in science, engineering and computer science in 1999. It illustrates a slightly regressive trend from women's representation in science at undergraduate level 57 per cent) into postgraduate studies at 48 per cent. This contrasts with women's higher representation at postgraduate level in both engineering and in computer science. Whereas women accounted for 19 per cent of engineering undergraduates, they were 21 per cent of postgraduates. The shift is even greater in computer science where women account for 30 per cent of students at undergraduate level and 40 per cent at postgraduate level. The table also demonstrates the considerable variation between colleges. DCU has the lowest rates of female participation at postgraduate level in science 38 per cent and engineering 11 per cent. However TCD has the lowest proportion of female postgraduates in computer science 30 per cent followed by DCU 32 per cent.

#### **Women in SET Courses at Irish Institutes of Technology**

The representation of women at undergraduate level in Institutes of Technology is not dissimilar to that pertaining in the university sector and is illustrated in Table 8, Appendix A which sets out the distribution of women in engineering courses, science and computer science courses. This table shows that while female undergraduates are in the majority among those studying science 61 per cent, in common with other third level institutions, their representation in engineering is even lower than the current level in the university sector (7-10 per cent). Furthermore this table does not differentiate between certificate/diploma and degree undergraduates. Table 9, Appendix A, shows the number of students taking science in Institutes of Technology in terms of award level. It suggests that female school leavers are more likely than their male equivalents to enter as certificate/diploma students in science and computer science. It is also possible that this registration at Certificate/Diploma level is at the expense of degree students, the number of which has fallen since the current fourth years took up places in Institutes of Technology. Conversely there does seem to be a potential improvement in the representation of female school leavers on engineering degree/diploma/certificate courses and in 'other' courses at all levels.

## **2.8 Female Representation in SET Subjects at Secondary Level**

The participation of girls in secondary level education has been rising steadily since the 1960s (Hannan et al. 1983). Of the total number of 123,956 Leaving Certificate students in 1997/98 girls comprised 63,838 or 51.5 per cent of the total (Dept. of Education and Science, 1999). However this figure does not take account of the considerable gender variation in subjects taken. Details of these differences in Leaving Certificate participation in science and technology subjects in 1997/98 are set out in Table 10, Appendix A. The data show that girls accounted for 52 per cent of those taking Maths and that they predominate in biology (66 per cent), Computer Studies (58 per cent) and Chemistry (51 per cent). In all other science and related subjects girls were in a minority. For example only 4,990 girls took LC Physics compared with 14,681 boys.

However, despite being numerically under-represented overall in some science and technology subjects at Leaving Certificate, research shows that girls out-perform boys in achieving higher grades A, B and C. The proportions for each grade attained in the subject groups can be seen in Table 11, Appendix A.

Unpublished CAO figures show that 45 per cent of those taking honours level maths in 1999 were girls and of (xxx 85 per cent) of these girls achieved grade C or above compared to 81 per cent of boys (see Table 2.9).

Table 2.9 Numbers Taking Honours Maths by Grade Achieved and Gender

Grade	Boys	Girls	Total
A1	652	421	1,073
A2	557	472	1,029
B1	568	584	1,152
B2	715	686	1,401
B3	746	690	1,436
C1	760	669	1,429
C2	750	582	1,332
C3	570	473	1,043
D1	466	308	774
D2	313	214	527
D3	263	166	429
E	137	78	215
F	30	17	47
<b>Total</b>	<b>6,527</b>	<b>5,360</b>	<b>11,887</b>
<b>% of Total</b>	<b>55%</b>	<b>45%</b>	<b>100%</b>
<b>% getting Grade C or above</b>	<b>81%</b>	<b>85%</b>	

Source: Unpublished CAO information 1999

Relating Leaving Certificate achievement to career and subject choice indicates there are no academic criteria that lead girls to continue to specialise in science (particularly the life sciences) but not in engineering. According to the Points Commission the science cluster incorporates 34 different courses, of which 29 of the courses had a points rating between 350 and 450 points. Only three of the courses had a rating over 450 and one course offered a place to all qualified applicants. In the engineering cluster that includes all courses in engineering and computer science there are 54 courses and 35 of these had a points rating between 350 and 450 points, while 6 had a points rating above 450 and 4 were rated below 300. Furthermore the most common subject requirement for engineering is less stringent than for science with most colleges require a 'C' in higher-level mathematics.

## 2.9 EU Comparisons

Table 2.10 below shows the number of persons employed as technicians by gender in 1998 for each EU country, with comparative information for 1997. Technicians are defined as those employed in "technician" and "associated professional" occupations.

Table 2.10 Employment as Technicians\* by Gender in EU Countries 1997 and 1998

Country	Male		Female		Total	
	1997	1998	1997	1998	1997	1998
EU 15	51.3		48.7	-	100	
Belgium	65.3	64.0	34.7	36.0	100	100
Denmark	42.1	43.5	57.9	56.3	100	100
Germany	42.8	42.4	57.2	57.6	100	100
Greece	57.9	54.7	42.6	45.3	100	100
Spain	62.8	63.4	37.2	36.6	100	100
France	49.9	49.2	50.1	50.8	100	100
Ireland	69.2	-	30.8	-	100	-
Italy	66.8	65.3	33.2	34.6	100	100
Luxembourg	59.3	56.3	40.7	43.8	100	100
Netherlands	50.4	50.9	49.6	49.1	100	100
Austria	53.3	53.0	46.7	47.0	100	100
Portugal	49.2	52.4	50.8	47.6	100	100
Finland	42.2	43.9	58.1	56.1	100	100
Sweden	54.4	53.5	45.7	46.3	100	100
UK	55.2	54.1	44.8	45.9	100	100

Source: Eurostat Labour Force Survey (1997/98)

\* Technicians (ISCO088) - Major Group 3: Physical and Engineering Science Associate Professionals covering:

- 31 Physical and Engineering Science Associate Professionals
- 311 Physical and Engineering Science Technicians
- 312 Computer Associate Professionals
- 313 Optical and Electronic Equipment Operators
- 314 Ship and Aircraft Controllers and Technicians
- 315 Safety and Quality Inspectors

Table 2.10 shows that 'technician' employment broke down, on average, 50 per cent male and 50 per cent female across the EU in 1997. Figures for Ireland and the EU are not available for 1998.

However, comparing the 1997 country figures it is apparent that Ireland had the lowest percentage of female technicians at 30.8 per cent of the total, compared to an EU average of 48.7 per cent. Only Belgium, Spain and Italy had a female percentage value of under 40 per cent, whereas this figure increased to 57 per cent in Germany and 58 per cent in Finland. These statistics would indicate that Ireland is well below the EU average in female technician employment and was at the bottom of the table in 1997, the latest year for which comparative data is available.

These figures are some contradicted by data produced by Eurostat on employment of scientists and engineers by gender across the EU for 1999, as illustrated in Table 2.11.



Table 2.11 Distribution of People Employed as Scientists and Engineers in 1999

Country	Gender %		Total (%)
	Female	Male	
EU 15	31.2	68.8	100
Belgium	47.8	52.2	100
Denmark	24.8	75.2	100
Germany	21.0	79.0	100
Greece	29.0	71.0	100
Spain	37.3	62.7	100
France	23.8	76.2	100
Ireland	51.0	49.0	100
Italy	29.3	70.7	100
Luxembourg	20.1	79.9	100
Netherlands	31.2	68.8	100
Austria	29.0	71.0	100
Portugal	43.8	56.2	100
Finland	50.9	49.1	100
Sweden	40.5	59.5	100
UK	37.1	62.9	100

Exceptions to the reference period – EL: 1998; IRL: 1997

Source: Eurostat 2000 – Statistics on Science and Technology in Europe 1985-1999

Table 2.11 places Ireland well above the average in terms of the percentage of females employed as scientists and engineers, at 51 per cent, compared to an EU average of 31 per cent, with Germany at 21 per cent. It is difficult to interpret these results. However, they may reflect the relatively high proportion of women scientists in Ireland.

## 2.10 Key Findings

1. An analysis of the number of women with SET third level qualifications indicates that, by 1996, science was approaching a position of equal participation by men and women, at 46 per cent, women were becoming an increasing proportion of those holding computer science qualifications at 37 per cent, while only 7 per cent of those holding engineering qualifications were women. This trend of increasing female participation in the sciences is continuing, as evident in the number of more recent science graduates and post graduates that are women and in the numbers of women currently studying science.
2. The variation that is evident **within** SET qualifications, and in higher-level education, between the sciences, engineering and computer sciences, is replicated within the labour market. In 1996, women constituted 40 per cent of those in 'Scientific' occupations, 20 per cent of those in 'Technical Engineering' occupations, and 37 per cent of Computer Software occupations in 1996.
3. The potential pool of women with engineering qualifications who either left the labour market (838) or were employed outside SET (378), is small relative to forecast demand and to the number of men in similar situations. However a higher proportion of such men are likely to be over 55 years of age.

## 2.11 Conclusions

The analysis of the available statistics provides a very important background against which future decisions aimed at increasing women's participation in SET occupations, particularly in areas of skill shortages, can be framed.

The results indicate that strategies aimed at increasing the number of women in the labour force with engineering qualifications, an area where significant increased demand is forecast, should focus primarily on:

- a) encouraging more women to study engineering at third level.
- b) explore whether it would be possible to convert women graduates from other disciplines into engineering.

In the area of scientific qualifications the findings indicate that women currently constitute 50 per cent of science graduates and students. Strategies in this area should be addressed at:

- a) exploring reasons why a significant proportion of female scientists are no longer working within SET occupations in industry and at addressing ways of encouraging such women to remain in such occupations.
- b) encouraging women in the 35 + age group to remain within/re-enter the SET sectors.

In the area of computer software where significant skill shortages exist the findings would indicate that measures are required to:

- a) support women in this sector to up-skill/obtain qualifications that will allow them to progress to software engineering and systems manager levels.
- b) encourage more men and women, to enter educational programmes aimed at careers in this sector either through initial qualifications or conversion up-skilling/reskilling courses.

### 3. Review of Literature on Women in Science, Engineering and Technology Occupations

#### 3.1 Introduction

Section 2 of the report analysed statistical data sources in order to establish the Irish situation in relation to the demand and supply of women in science, engineering and technology (SET) occupations, in the context of forecast skill shortages in the SET industry. The literature review, that follows, explores available research in order to try and identify the factors that lead to the type of vertical and horizontal segregation pattern of SET employment found in the Irish situation. This review of the literature reflects the orientation and preoccupation of research to date. The material manifests certain biases: reflecting a 1970s and 1980s interest in levels of women in SET, particularly in education; a stronger body of knowledge on US experience rather than EU or Ireland; a preoccupation with science rather than engineering/computer science; only very limited material on women's experience and employment in SET; and a strong emphasis on academic, rather than industrial, career patterns for women with SET qualifications. This is reiterated by the statement by the Commission of the European Communities (1999:7) that "statistics on what becomes of women scientists once they embark on their scientific career and move into the job market are, unfortunately, very inadequate".

Despite this uneven coverage, a wide body of knowledge can be drawn from national and international sources to provide a useful backdrop to this study - not least in placing the issue of women's participation in SET occupations increasingly within the labour market arena. As Lane (1999: 1) states:

*"Increasing attention has been drawn to the problems faced by women in science, engineering and technology (SET). Women are unequally represented in science and their career progression is not comparable to their male colleagues. The growing interest in this topic may partly be because of the growing awareness of the huge untapped economic potential that women represent".*

This section of the report therefore focuses on identifying factors that might account for the occupational patterns found in the statistical analysis in Section. 2.

The section is structured as follows:

- a) An analysis of factors influencing women's participation in SET employment; and
- b) An analysis of factors influencing women's participation in higher education.

#### 3.2 Women in SET Employment

##### 3.2.1 Introduction

Following a short overview of the key trends emerging from the international literature, the key findings are presented under the following headings:

- a) Factors influencing women's participation in SET;
- b) Work and Family Roles; and
- c) Organisational Issues.

### 3.2.2 International Overview

Internationally, the prevailing literature suggests that women scientists have been found to be at a disadvantage in the workplace and to have a more difficult time finding employment than their male counterparts (UNCSTD, 1995). This pattern has important implications for the careers and earning potential of women working in SET occupations.

A study in the Massachusetts Institute of Technology revealed that women were:

*"...invisible, excluded from a voice in their departments and from positions of any real power. This marginalisation had occurred as the women progressed through their careers at MIT, making their jobs increasingly difficult and less satisfying... Their most common concern was the extraordinary difficulty of combining family and work". (MIT, 1999)*

An interesting finding of this study was that each generation of young women in MIT, including those who are now senior faculty, began their career believing that the problem of gender discrimination had been solved by the previous generation, only to discover that gender inequality was still a problem (MIT, 1999).

A study, by the Committee on Women in Science and Engineering (CWSE, 1994) of the US National Research Council, claimed that women chose careers in life, behavioural and social sciences mainly within academe or government. The report went on to outline the main barriers for women working in such occupations within industry:

- recruitment and hiring practices;
- workplace environment;
- paternalism;
- allegations of reverse discrimination;
- sexual harassment;
- different standards;
- styles of communication;
- perceptions of the role of women;
- retention;
- opportunities for advancement (CWSE, 1994).

One of the consequences of the employment environment outlined above is that more women than men have been found to leave the SET sectors and/or the labour market. In a seven year longitudinal study in the US covering the period up to the early nineties, it was estimated that "women are twice as likely to leave occupations related to science and engineering for occupations in other fields, and fifteen times more likely to leave the labour force altogether" (Preston, 1994). Married women with children were found to have the highest exit rates from science and engineering (27.4 per cent) compared with married men with children (10.0 per cent). The four main reasons for leaving SET posts in the US during the 1990s were found to be: high skill-depreciation rates; changes in labour market conditions that lower wages; family circumstances; and occupational mismatches. The study also showed that it was younger rather than older women who were more likely to exit (Preston, 1994). Regrettably no similar longitudinal research has been conducted into women's SET employment in Ireland/EU.

Research conducted in the US compared women 'Stayers', who remained in SET for their careers, as opposed to 'Changers' who left SET during their postgraduate years or early working career, and 'Leavers' who exited at graduation. Women in the group of 'Stayers' were more likely to have received encouragement by both their college teachers and their parents, especially their mothers, to pursue a career in SET. This group were least likely to have encountered conflict reconciling their current occupation with family needs. The impact of family support/encouragement is echoed by focus group participants, in Section 4.

3.2.3 Factors Influencing Women's Representation in SET

**Occupational Segregation within SET**

Women's representation in the SET sector was examined in Section 2. This analysis showed that women were under-represented in the professional and managerial levels, particularly in the engineering and computer software area. This is a pattern known as vertical segregation whereby men predominate at the higher echelons. Within engineering the level of female representation remains very low. These patterns are evident across many societies. Similarly to Ireland, there has been a rise in women's entry to all science-based disciplines in the US, except physics and engineering where the number of women reached a plateau at c. 15 per cent over the last decade (Campbell, 1996).

The issue of occupational segregation was examined in Ireland in a study undertaken in Ireland in the 1980s in the electronics industry (Wickham and Murray 1987). It showed that women represented 53 per cent of all staff but only 3 per cent of managers, 16 per cent of professionals, 6 per cent of technicians and 30 per cent of supervisory staff. A more recent study of equal opportunities in the dairy industry (Carroll, 1996) showed that women accounted for 25 per cent of scientific and technological employment and 37 per cent of those working in research and development. Once this proportion is desegregated by grade it is evident that women:

*"are not making the jump from purely technical work into management, whether senior or junior. The figures of 1.72 per cent (senior management), 8.47 per cent (middle management) and 18.75 per cent in junior management, combined with the 8.13 per cent of scientific/technological employment in supervisory grades contrast with those of 43.64 per cent of women in technical grades"* (Carroll, 1996).

This pattern of occupational segregation is found throughout Irish Industry and services. A recent study by the ESRI (2000) compiled various information on the distribution of men and women employment by occupation over time. A summary of their findings is presented in Table 3.1.

**Table 3.1 Percentage of Women in Occupations listed 1984, 1993 and 1997**

	% of Women		
	1984	1993	1997
Engineering and Related trades	7	7	5
Clerical Workers	72	78	80
Proprietor and Managers	20	27	28
Professional and Technical	48	51	53
Administrative, Executive and Managerial	11	19	27
<b>Total % of women across all occupations</b>	<b>31</b>	<b>36</b>	<b>38</b>

Source: ESRI, 2000 (from Labor Force and Quarterly National Household Surveys)

Table 3.1 shows a highly segregated labour force both vertically and horizontally. It does show however that over time some progress is being achieved at administrative, executive and managerial level and at proprietor and manager level. It also indicates the increasing proportion of women at the professional and technical level – reflecting our findings for SET in Section 2. However the categories used by the ESRI in this analysis are very broad.

**Career Planning**

Available literature indicates that gender differences in career aspirations and expectations may still influence the representation of women in SET. According to Collin (1998), men think in terms of a career plan whereas women tend to go from one task to another according to what seems important at the time. Men in SET are also perceived as more competitive in the workplace than their female peers (Byrne, 1993). Collin (1998) argues that the most

successful women in science and technology are those who have adopted a 'male approach' to career planning i.e. who conduct career planning as though it were a business undertaking. These are the people who know what invitations to accept, which fields of research are most profitable and promising, what the research can lead to in terms of publications.

#### **Progression and Recognition**

(Hall and Sandler, 1984)

Evidence suggests that the representation of women in SET occupations tends to diminish at each level of the occupational ladder (Cronin and Roger, 1999). It is well recognised, particularly in the United States, that post-doctoral appointments are special since they "bridge the gap between the Ph.D. and employment" (CWSE, 1994). The need for an increased supply of post graduate researchers in the science and technology area was highlighted in the Export Group on future skill needs (Forfás 2000); hence it is worth examining the experience of such female/male graduates in an international context.

Peer review is used to assess grant proposals and manuscripts submitted for publication in scientific journals and for assessment of grant applications. The use of colleague review has been justified by the view that fellow researchers are best placed to assess the performance and future prospects of researchers in their relevant fields of expertise. For example, it is an essential part of the selection process for national grants e.g. from Enterprise Ireland as well as those from EU and other sources. Recent findings from studies abroad indicate that such assessors have difficulties in detaching themselves from the object of study, i.e. fellow scientists, and that they are inclined to make gender-biased decisions (Wennerås and Wold, 1998). This study showed that women had to present 2.6 times more papers in a journal of certain prestige in order to obtain the same score for 'scientific competence' from reviewers as a male candidate with the same scientific output. This could be an issue not only in relation to the advancement of Irish women in SET but also in relation to accessing key research funding for research assistance and equipment.

#### **3.2.4 Work and Family Issues**

It is generally recognized that women tend to have different working patterns from men and are more likely to take breaks from employment. In the UK the average woman loses £140,000 of lifetime earnings as a result of becoming a mother (Women's Unit, 2000) and the effects of motherhood on employment prospects are well documented. Support for women in the labour force who are also mothers, including the greater availability of flexible working hours, generous maternity leave and childcare facilities, are increasing. However, US research suggests that taking up flexible work options still results in a disadvantage for women, in the form of a 'flexi-glass' ceiling (Weedon, 2000). New research techniques, findings and technologies accumulate during a leave of absence. Although women in all careers face similar problems following a leave of absence, the situation is especially critical in SET disciplines where research and technology may change radically each year (Matyas, 1985a).

Women continue to hold primary responsibility for the maintenance and development of the home, and for childcare (The Industrial Society, 2000). The Industrial Society found that women who choose to remain at home to care for young children face serious obstacles when they attempt to re-enter their careers. Employers see them as retaining prime responsibility for their children. Women contribute an average of 35 hours of housework a week, whereas men are estimated to do an average of five hours. In a survey carried out in the UK, mothers were found to be more likely than fathers to be responsible for childcare and GP appointments, even in households where both parents worked full time and the women earned slightly more than their partners (The Industrial Society, 2000).

In a recent study of the effects of new motherhood in an Irish competitive private sector IT organisation, 36 per cent of the women questioned expressed the need for more flexible work packages to smooth the return to work in line with their new responsibilities (ISIS Research Group, 1999). Half of the sample recorded difficulty in accessing childcare and out of those who did not record difficulty, two-thirds had older children, indicating that childcare arrangements may be a particular problem for first time mothers. Several of the women

surveyed indicated that the pressures of balancing career and new motherhood were too difficult to sustain on a full time basis, and were planning to withdraw from the workplace. Wennerås and Wold, (1998) cite family responsibilities as the main reason for the excessively high drop-off rate of women from the SET career ladder:

### 3.2.5 Organisational Issues

Once gender imbalances have been established, it is difficult for organisations to alter the prevailing (mostly male) culture. Female scientists often find themselves carrying out tasks set for them by other people (Collin, 1998). According to Collin, marginalisation can take place even within research teams. Collin also argues that men seem happier to take on managerial roles for peri-scientific tasks of an administrative or economic nature.

The gender imbalance at management level has also been found to contribute to discrimination between the sexes when it comes to determining scientific objectives or setting limits to the application of scientific and technological techniques (Collin, 1998).

### 3.2.6 Summary

The literature review has highlighted a range of factors affecting women's participation in SET occupations within industry. The under-representation of women can be attributed to:

- a) Particular difficulties women in SET occupations face in obtaining recognition for their contribution;
- b) An unsupportive workplace environment;
- c) Difficulties in reconciling work and family commitments.

These factors have been found to lead to a situation whereby a higher proportion of women than men tend to leave employment altogether, or exit from the SET sector to seek employment in more conducive environments e.g. teaching. The findings would indicate that supports to encourage a higher level of retention of women in SET occupations in industry are therefore required, in addition to measures that would encourage greater recruitment of women into particular occupations within the SET sector.

## 3.3 Women's Participation in Higher Education

### 3.3.1 Introduction

The pattern of participation of women in SET employment is heavily influenced by their experience within the educational sector.

As Byrne states:

*"There is considerable field evidence from Universities that the women who do manage to make it through to graduation when they are...below critical mass level, are either exceptionally gifted, unusually motivated and hardworking and, usually, very middle-class."* (Byrne, 1993, p. 185)

This section examines key factors influencing the participation of women/girls at different educational levels in SET courses, under the following headings:

- Factors influencing women's experience of SET at 3<sup>rd</sup> level;
- Factors influencing women's choice of studies at 3<sup>rd</sup> level;

### 3.3.2 Factors Influencing Women's Experience of SET at Third Level

#### *The Learning Environment*

Sexism in communication styles as represented by non-verbal behaviour and teaching approaches, creates a 'chilly climate' in the classroom and in higher education in general (Hall and Sandler, 1984). In mixed sex groups, men tend to talk more than women do and also exert more control over the topic of conversation (Kramarae, 1988). Kramarae argues that men also interrupt women more frequently than women interrupt men; male lecturers call on men more often, nod and gesture more in response to men's questions, wait longer for men to answer than women, and ask men more challenging questions.

These problems tend to be greater in engineering and technology courses. This is because women are still in a small minority, there are few female lecturers, and male lecturers are unfamiliar with working with women. It is argued that this contributes to the lowering of female 'students' self-esteem, self-confidence and career aspirations (Kramarae, 1988). No comparable research into this topic has been undertaken, to date, in Ireland.

In the newer field of information technology, Mahony and Van Toen (1990) believe that particular types of computing are unattractive to women. They argue that within academic research, computing has become characterised by a reliance on mathematical formalism. Areas such as Artificial Intelligence, formal methods and computer vision, are given priority. However, more creative approaches, which approximate art-based skills, are more likely to meet the real needs of organisations:

*"The preference for working in hard areas sometimes acts as a way of displaying technical machismo in a way in which many women do not want to participate as it specifically undermines their own gender identity."* (Mahony & Van Toen, 1990: 321).

The current growth in Irish e-business points to a rising demand for more diverse IT/business/technical skills and reiterates the need for creative and technology/creative approaches to business needs (Expert Group, 2000b). This could provide more attractive fields for women than 'pure' engineering/computer science careers.

#### *Communication Styles*

Byrne (1993) argued that primary and secondary schooling produces students that use different styles of communication, according to their male or female sex. According to research, men create and validate language and meaning in science and technology (Kramarae, 1988). Therefore, Kramarae (1998) argues that women and men find it difficult to communicate in a mixed learning environment in university. He found that men tend to relate to other men as equals around technology. When men have interests in some common technical area, they exchange information, in a common language, to share ideas and knowledge. When men and women communicate however, the information flow is more one-sided i.e. men may explain a technological matter to women, but they do not discuss it with them (Kramarae, 1988). As the educational process in SET fields is heavily dependent on learning from fellow students, this communication problem could be a real barrier for women succeeding in a mostly male environment. It can also be said that language and communication continue to be barriers to women in SET at industry level (Kramarae, 1988). These findings were reinforced by the studies by Cronin et al. (1999) in Scottish universities. These findings highlight the importance of creating a critical mass of female students in each SET area if a more gender – neutral approach to learning is to evolve.

#### *Rational Career Choices*

The predominance of a 'male orientated culture' alone cannot account for the gender differences found in participation in different courses. Medicine has long possessed a male culture and yet gradually women have successfully increased their participation rates (Clegg and Trayhurn, 1999). In terms of financial reward and prestige, science and engineering have fallen behind other elite professional careers to which women have been eager to secure



entrance (Siann, 1997). Siann (1997) argues that men and women are making highly rational career choices based on the long-term decline of certain industries. He also states that women's participation increases where computing is combined with other subjects such as business, and when it is combined with languages, women form the majority. Women are not only being pragmatic in relation to the rewards a career offers, but are also making positive choices about requiring jobs that allow for the application of social skills and interpersonal contact.

### 3.3.3 Factors Affecting Womens' Choice of SET Studies at Third Level

#### ***Sex-Role Stereotyping***

Sex-role stereotyping has been well documented as a major reason for girl's avoidance of certain SET careers (Hannan et al, 1983, Vockell and Lobonc, 1981, Broverman et al., 1972). Engineering was found to be particularly avoided because girls were afraid that they would be considered unfeminine if they enter this field (Brush, 1991). In a 1999 study by the Equal Opportunities Commission in Northern Ireland, it was found that the 'masculinisation' of science is created by the perceptions of both boys and girls (EOC, 1999). Boys make strong claims that science is a boy's subject, and girls, although they do not see science as a male domain, contend that some aspects of science are more suited to boys' interests and experiences.

#### ***Lack of Female Role Models***

Remick and Miller noted the lack of female role models in scientific careers (1978). For most girls their first role model is their science or technology teacher. Female scientists surveyed by Remick and Miller (1978) reported that the encouragement of a teacher was the deciding factor in their choice of career. The existence of positive role models was identified as important among focus group members (Section 4).

#### ***Exposure to Computer Skills***

Unlike other disciplines where higher levels of male participation go back hundreds of years, computing is one that is less than three decades old. However there is already evidence of a growing gender differentiation in access to computers and in the perceptions of computing as user-friendly (Byrne, 1993). According to Byrne, parents still buy computers more readily for their sons than for their daughters, and sons also dominate computer use in the home. Byrne also argues that, at school, boys get territorial priority for hands-on work on scarce computer resources. Girls arrive at tertiary level with less computer skills than boys. Boys are also less willing to work co-operatively on computer than girls, which is essential unless everyone has access to their own micro-computer (McCaffrey and Underwood, 1990).

#### ***Experience at Secondary Level***

Further back in the educational system, there are many educational and societal factors affecting girls' participation in SET courses of study at third level. Ireland is unique in having little or no science taught at primary level (JOC, 2000). Science was first introduced to the Irish primary curriculum in 1900, but was eliminated in 1934 to make room for compulsory Irish. However, Science has been in the primary curriculum since 1971. The process of reintroducing a science element to primary education was proposed in 1990, but it will be 2002 at the earliest before such a programme is in place. Even with the introduction of this programme, some pupils will only be exposed to the minimum requirement of one hour of science per week.

One in every three Irish secondary schools does not offer the full range of science subjects, and a recent survey also found that 65 per cent of schools reported that they have insufficient science equipment. It is also far more difficult to obtain high points in the Leaving Certificate in Physics and Chemistry than in any other subjects. These factors have contributed to the declining number of both male and female students choosing these subjects (JOC, 2000).

### 3.4 Conclusions

The literature review provides some clues as to the key factors that might influence women's participation in SET occupations. Unfortunately much of this literature refers back to the 1980s and early 1990s. Research in this area has yet to catch up with the recent trend of equal if not more women than men entering the science fields at third level.

The findings of the research however can still have particular relevance as the engineering area where women remain significantly under-represented, and, where a male culture and related expectations is still the norm. Because of the relative 'newness' of the computer software field there is still time to learn from the experience of older sciences and to work consciously to ensure that academic and work climates are welcoming and supportive of women applicants. Evidence from 2<sup>nd</sup> level successes, highlights the fact that it is not lack of academic ability or confidence to venture into historically male areas (e.g. medicine) that limits women's progression into SET occupations. Therefore more broad-based societal, issues are likely to be operating as important factors in influencing these choices and must be addressed. Such factors include:

- Persistent sex role stereotyping in certain occupations and thus the need to address this through good career guidance and raised public awareness.
- The difficulties that girls/women experience in entering a predominantly male learning environment – in relation both to peers and teachers and thus the importance of moving towards a more gender balanced situation in these areas.
- The need to provide support for women with SET qualifications that will allow them to progress within their SET careers while also balancing family/work responsibilities.
- The need to 'sell' the engineering and computer software professions as worthwhile and challenging career options to young women with the qualifications to succeed in these areas.

## **4. Qualitative Analysis of Women and SET Issues**

### **4.1 Introduction**

This Section reports on the outcome of two focus group meetings held with women with SET qualifications and on a number of one-to-one interviews held with a range of key stakeholders. These inputs were used to assess the extent to which the issues identified in the literature review are reflected in the views of key stakeholders in Ireland. (See Appendix B for a list of those interviewed.) In particular we sought to explore the extent to which the issues identified still pertained in Ireland today.

The objective in holding focus group sessions was to seek the voice, views and experience of women with SET qualifications. The discussions broke into two parts - the first related to validating or otherwise, the findings and conclusions presented in the literature review in Section 3. This was important because, apart from studies into the secondary educational system, there is relatively little published research on women's experience at college level and in SET employment within Irish companies, particularly of a recent nature. The second part of the discussion was to seek proposals for action, based on participants' own experience that could be used to help formulate measures to increase the representation of women in SET. These views were incorporated into the review of measures in Chapter 6.

An invitation was issued by email to members of WITS asking for volunteers who would be interested in participating in a focus group, including women who had opted for careers outside SET or who had left the labour market. Through using the network's database 27 women indicated their willingness to attend a focus group session. Of these, 18 were able to attend one of the two sessions. (See Appendix C for a list of women that attended the focus group meetings).

The first Focus Group comprised 10 women, who have been working in the SET field and this session took place on 16 October 2000. The second Focus Group comprised 9 participants whose careers had progressed to a situation wherein they were using their SET qualification in areas such as: academe, asset management, marketing consultancy. The purpose of holding the second session was to examine what had been the 'push' and 'pull' factors that led them into careers outside SET industrial employment. The second Focus Group was held on 23 October 2000.

Section 4.2 sets out the insights gained from one-to-one interviews conducted with representatives of industry, unions, employers, women's groups and other relevant organisations. This is followed in Section 4.3 by an outline of the key issues emerging in the focus group sessions. It should be noted that while the views of the women participating in the focus group meetings cannot be seen to be representative in a statistical sense, they do provide a clear indication of some of the key issues involved in the recruitment, progression and retention of women within the SET industry in Ireland today.

Section 4.4 concludes with a summary of the issues raised by the key stakeholders and focus group participants.

### **4.2 Views from One-to-One Key Informant Interviews**

Seventeen interviews were held with key informants with an interest and/or expertise in issues relating to skills shortages/women and SET. The interviewees ranged from civil servants, to representatives from employer bodies, trade unions, women's groups and other parties.

A summary of these interviews is presented under the following headings:

- Skill Shortages
- Reasons for under-representation of women in SET occupations covering:
  - Career aspirations/expectations;
  - Career/family conflict;
  - Corporate cultures in SET;
  - Male models of management;
  - Women returners;
  - Sectoral variation.

Some interviewees provided further information on key people/organisations/groups who should be interviewed and on references, reports and internal documentation relevant to the study.

#### 4.2.1 Skills Shortages

There was general agreement that SET posts are becoming increasingly difficult to fill; staff turnover is increasing and retention of female SET employees is an area of particular concern. There is evidence of more intensive recruitment from abroad into IT companies (e.g. from India, Eastern Europe), though not from the EU. It is seen to be becoming difficult to attract EU nationals due to accommodation costs and inflation.

Demand for graduate chemical engineers and chemists is rising and companies cannot rely on recruiting the same calibre of graduates as in previous years. It was noted by several interviewees that while women were entering third level in considerable numbers, this was not translating into employment in industry since there were fewer women in many areas required by employers, e.g. engineering. There was a perception that women who enter the industry spend some time and 'tend to leave'. One interviewee noted that in the R & D field women are scarce and it is rare to encounter a woman aged 40 years or older. Women take 'other routes', either they do not enter industry or enter at the bottom of the ladder e.g. as technicians.

#### 4.2.2 Reasons for Women's Under-Representation in SET

##### *Female Under-representation in SET Courses*

Interviewees referred to the pattern seen to be common in most OECD countries, whereby girls traditionally tend to study lower level physics and maths and that this situation has not improved significantly: "It takes a determined student to attempt these [SET] subjects at honours in the Leaving Certificate". Part of the reason for women not applying for posts in the IT sector was thought to be due to experiences in the secondary schools, which carry into third level.

Although it was acknowledged that girls now have better options to enter what were 'traditionally male' areas, this is seen to depend on their knowledge about the future job market, e.g. in fast growth areas like software engineering. The general view, supported by the evidence in Section 2, it was that women are well represented in science, at least through to graduate level. The shortfall in engineering/computer science graduates is seen to relate to some extent to a maths 'turn-off', often reinforced by the lack of encouragement for girls within schools and their home environments. Even though the gender gap may be narrowing, it was stressed by interviewees that engineering is not attracting enough women and there are few role models. Areas such as biology and chemistry continue to attract women while physics and engineering are avoided - due to a "hard hat standing in the rain" image and also due to the fact that there are not enough high calibre science teachers in girls' schools compared with boys' schools.

#### **Career Aspirations/Expectations**

Based on experience and observation of SET employment, a number of interviewees claimed that women look for different things in their career and may not be as 'driven' as men. The observed behaviour of women 'opting out' and 'having a life' were cited as being very important by both male and female interviewees. According to one interviewee, the first problem women face is in relation to politics and bureaucracy: "women are not political animals...their motivation is to do a job they like doing, not for the money or status" while "men will climb to the top and knuckle down, even when they don't like it".

#### **Career/Family Conflict**

While women are demonstrably entering science and computer science careers, it was confirmed that there is still an absence of women at senior management level. In one major IT company this was attributed to the fact men can concentrate almost exclusively on the pursuit of their career whereas:

- fewer women are available or apply for the posts;
- women's biological clock is activated precisely at promotion time when the hard slog is required;
- women who are married/have children seek flexibility to enable them to combine work and family life.

It was claimed that men are more competitive and seek better remuneration in academe and industry while women have a greater tendencies to enter departments such as Quality Assurance where work is more structured and predictable or opt in at the level of laboratory technician. Another conclusion was that "you can't have it all [if you are a woman]".

#### **Corporate Cultures in SET**

There was general agreement among interviewees that it is more difficult for women to enter and succeed in traditional industries where a male culture dominates. As one interviewee stated: women engineers 'have a tough time', due in large part to their small numbers. This would not be the case to such an extent in science based industries e.g. pharmaceuticals, and was not evident in the IT sector where women and men are both better represented, at least at the lower levels. Several individuals singled out areas of manufacturing as very time demanding e.g. production in which "for a woman having kids is out of the question". It is necessary to be 'on-call' (including at home and in the night time) virtually around the clock where continuous shifts are worked, hence there is a lifestyle problem for men and women. Men are more likely to accept these arrangements and demands. This makes it difficult to introduce effective change unless men 'buy in'. Also where flexible work arrangements are available it was observed that 'men are not queuing up'. The long hours culture in SET was referred to as a deterrent. Similarly the laboratory environment was perceived as being a potentially isolating workplace in which the 'token woman' could be marginalised/excluded if she remained in a small minority.

Other areas of SET are seen to be more appealing to women like Quality Assurance (QA) and the pharmaceuticals sector, drawing mainly upon female science graduates and offering working conditions that are more appealing to women than engineering environments. Within the food industry, women are believed to be "the dominant ones in new product development" as well as QA, at least in the under 30 year age group. Another distinction pointed out by one interviewee is in relation to men's and women's different roles in SET - men as managers and women as doers (e.g. laboratory technicians).

#### **Male Models of Management**

Management attitudes were viewed critically by several interviewees, particularly in relation to their lack of awareness of the need for a balanced gender contribution in the business. One interviewee mentioned that organisations have been unable to change and accommodate women as an integral part of the SET workforce, reflecting a traditional and mechanistic

model of work, or as stated by one interviewee, "women refuse to 'shoehorn' their way into a structure that does not fit them". Hence the shift towards flexibility that will be required to retain valuable staff – men and women. Companies need to recognise the gains from 'outside of work time' activities, not least in relation to the retention of valued staff and health/stress issues at work.

### **Women Returners**

The issue of women returners was raised, especially for SET professionals who had exited mainly for family reasons. Re-entry can be difficult for these women since their areas of work will have changed: They 'lose track'. Currently there is no easy way that re-entrants can 'top up' their skills and this will pose an increasing challenge for managers and organisations as more and more positions prove difficult to fill.

### **Sectoral Variations**

According to one interviewee, new IT companies are currently recruiting equal number of males and females and women have been more successful in accessing management posts in these companies (e.g. Lotus, Microsoft, Hewlett Packard) than in traditional food sector/engineering companies. There was a consensus that manufacturing is still perceived as a 'male domain'. Women who are notably succeeding in business are doing so within key growth niches like training, HR, healthcare. Alternatively they set up their own businesses in newer areas such as agri-business and environmental protection. In this way, well-qualified women can experience autonomy in their work and establish their own patterns of working time/place to best suit their personal and professional needs.

#### **4.2.3 Summary**

Key informants emphasised increasing skill shortages in tandem with a continuing pattern of lower levels of recruitment and retention of women in some SET sectors (e.g. engineering). The views expressed by the stakeholders also reflect some of the key findings in the literature review. The main factors influencing women's relatively lower participation, retention and progression within the SET section are perceived to be:

- Continuing negative perception by women of certain sectors, particularly engineering;
- Women's career plans being less single-minded than men;
- Continuing perception of a predominantly male culture and unattractive working environment in engineering and industrial production (long hours, isolation);
- Difficulties experience women in updating their skills after a period of absence from the workforce particularly in the research area; and
- Women choosing aspects of SET employment where they can best balance career/life choices e.g. laboratory work, self-employment.

### **4.3 Focus Groups Views**

#### **4.3.1 Profile of Focus Group Discussants**

Among the 19 women who attended the focus group sessions, 17 completed and returned a short questionnaire setting out their personal and professional details (education/employment and number of children etc.). A summary of these is outlined below:

**Table 4.1 Profile of Focus Group Discussants**

Focus Group Participants	
<b>Highest Degree/Diploma Attained</b>	
Doctorate	9
Masters	3
Degree	4
Diploma	1
<b>Average Working Hours</b>	
< 25 hours	1
25-40 hours	3
41-50 hours	10
<b>Current Employment</b>	
Consultant	5
Senior Analyst	2
Professor/Lecturer	4
Career Break [Chief Technician]	1
Engineering Inspector	1
Freelance Journalist	1
Deputy Director Lab	1
Corporate Development Executive	1
<b>Duration of Current Employment</b>	
< One Year	2
1-5 Years	9
6-10 Years	2
> 10 years	4
<b>Number of Children</b>	
None	9
1 Child	1
2 Children	4
3 Children	3
<b>Average Number of Children: 1.05</b>	

As this table shows, the focus group participants were highly qualified. Eleven of them were working full-time, including four as academics; three were self-employed as consultants. Of the eight women who were mothers, one was working part-time, another was on a career break, two were academics; one was a software consultant working from her home; one worked in a State laboratory and only two worked in the private sector.

#### 4.3.2 Validations of Statements Emerging from the Literature Review

The focus groups provided an opportunity to test the validity of statements that arose from the literature review in Section 3. The statements and level of agreement with them are set out below:

**Table 4.2 Validation of Statements Emerging from the Literature Review**

Statement	Agree	Disagree	Neither/ Don't Know	% Agree
Women are under-represented in SET type employment:	14	1	2	82
Female Graduates from SET type courses are:				
a) <i>More likely to opt out of their specialist fields than men;</i>	9	5	1	53
b) <i>To be engaged in lower levels of employment;</i>	15	1	1	88
c) <i>To earn lower salaries than their male counterparts graduating at the same time from the same faculties;</i>	12	2	3	71
The pattern for women is still one of perceived limited prospects and achievement, when compared with men's higher status and better remunerated representation in higher level SET posts:	12	2	3	71
The corporate climate in most organisations is often less than supportive of women, hence inhibiting them from progressing or remaining in the company:	14	1	2	82
More women than men leave the SET sectors and / or the labour market:	12	2	3	71
Taking up flexible work options can result in a disadvantage for women in the form of a 'flexi-glass' ceiling:	15	0	2	88
Women (even those who work full-time) tend to hold primary responsibility for the maintenance and development of the home, and for childcare:	14	1	2	82
Women tend to be under-represented at the professional and managerial levels in all areas of SET:	16	0	1	94
There may also be gender differences in the career aspirations and expectations of men and women working in the SET field:	14	1	2	82
Women are more often found teaching Science & Technology than practising Science & Technology:	8	3	6	47

There was a strong agreement that women are under-represented at managerial levels and over-represented in lower levels of SET employment; and that opting for flexible work arrangements can be a career disadvantage for women in SET. The majority of participants



agreed that: women are generally under-represented in SET; corporate climates are often less than supportive of women; women hold primary responsibility for household maintenance and childcare; and there may be differences in the career aspirations and expectations of women and men in SET. There was also support for statements that: women earn lower salaries than their male counterparts; and that more women leave SET sectors and/or the labour market. Support dropped to just over half of the participants in relation to: more women opt out of the specialist fields than men; and women are more likely to be found teaching rather than practising SET. Thus the views of the focus group participants provide support for the views of the key informants and the findings from the literature review.

#### **4.3.3 Factors Influencing Women's Entry/Retention in SET**

##### ***Female Representation in SET Education***

Most of the women who participated in the focus groups saw themselves as 'atypical' compared with their male peers at school, college and in employment. The general consensus from the focus group sessions was that the 'die was cast' within the secondary school system, well before entry to the labour market, reinforced by parental and societal expectations of girls' career paths, which differ fundamentally from those of boys.

Some focus group participants mentioned that their love of maths or excitement with the world of science had developed at an early age in contradiction to the internationally reported 'fear of maths' syndrome. However, it was claimed that generally the problems with maths at primary level work their way through into college level science. The consensus view among participants was that primary level mathematics is "the key" to change. Children need more encouragement and support at an early age to feel more numerically confident, thereby confirming the conclusion of the JOC Report on 'Science and Technology' (2000). It was noted by one group that there has been a drop in the standard of maths at third level working back to second and primary school levels. In the latter, maths is being squeezed out by other subjects. They concluded that if maths is 'lost' at primary level, children will be unable to catch up.

Within secondary schools, it was claimed that "most girls don't know what a career in SET is – engineering especially". Unlike languages with a marked oral component and incentive to improve (e.g. by attending the Gaeltacht), with science the equivalent is the laboratory. It was recognised that the facilities/safety provisions are not always available particularly in all-girls schools and also that some teachers may not be able to demonstrate the experimental component of the curriculum.

The current third level curricula, particularly in relation to engineering courses, were seen as less than balanced, with a strong emphasis on purely technical subjects. It was felt that there is the need for complementary 'soft' transferable (e.g. communication) skills to balance the overload of technical skills.

##### ***Career Aspirations / Expectations***

Lack of information on possible SET jobs was identified as a key barrier prior to, and following, graduation. In science there is no well-defined career path. It was claimed that men are 'better at creating their own careers' and can always invoke the 'old boy network' in academe ranging from official 'patronage' to unofficial mentoring.

It was confirmed that a science career route through university is full of practical difficulties – hard postgraduate studies leading to post-Doctoral research, all involving long hours. In science a postgraduate qualification is essential to accessing jobs with good potential for career advancement. This 'long haul' in science was seen as "a very anti-woman career path", especially for couples where both involved in science careers.

### **Corporate Cultures in SET**

As was noted by several women, work experience depends a lot on the organisation a woman enters and the support that it provides. Focus group participants agreed that within the world of work, women tend to be judged on 'what they have done', while men tend to be judged on their potential or 'what they will do'. Participants added that there is "always the perception that a woman will have a baby!". The participants also concurred with the statement, noted in gender and management literature, that "women have to work harder to get to the same level/to achieve the same" (e.g. in promotion). It was noted that women tend to stay on and are more reluctant to move to alternative employment and gain experience. Participants agreed that this could be because 'fitting in' all over again, is too daunting a prospect, hence they play safe and do not branch out.

Isolation emerged as an issue at both the educational and employment levels where an absence of other women within their course programme or section/department of a SET company is a drawback. Being the 'sole woman' can be very lonely.

### **Male Role Models**

Focus group participants pointed out the lack of relevant role models of high profile women in the public arena. There was agreement that family members who had acted as non-official mentors, through inculcating curiosity and a positive 'we knew you could do it' attitude in younger family members were of great importance in motivating girls. Indeed, six out of ten participants of the first focus group had a role model/family member who had specifically encouraged them to break the mould and take up studies in SET.

While it was generally acknowledged that women are well represented in some of the sciences, as was noted in Section 2, it was also pointed out that a clear and generally negative message continues to be transmitted to female students when they see only male staff as lecturers, professors and technical support staff, even in microbiology/genetics where female students and postgraduates predominate.

## **4.4 Conclusions**

The focus group discussions provided additional insights into the issues and barriers that still impede the progress of Irish women in SET careers and industries. The comments portray a less than welcoming domain particularly in the SET labour market. It is evident, particularly from the women who gained SET qualifications, that they regarded this as a 'challenge', often spurred by the encouragement of a family member. However, it was also evident from the profile of women who attended the focus groups that a sizeable proportion had opted for more autonomous work situations in academic life and as consultants. Their impressions of and experiences in SET industry were similar to those presented in the literature review in Section 3 and illustrate some of the reasons for the low representation of women (particularly in engineering) in Section 2.

Even leaving aside the gender issue of this study, there was general agreement that the image of SET was not a very positive one, particularly among young school-leavers. Most interviewees, and focus group members, were concerned about the need for re-imaging SET professions not only in the interests of women, but to attract the highest calibre applicants to third level education and SET careers.

Following these in-depth reviews of the issues and barriers for women in SET, the focus group participants were asked to outline the measures they saw as appropriate in addressing these issues. The results of these have been incorporated into the measures outlined in Chapter 6.

Overall the focus group participants and the key informants provided strong validations of the findings identified in the literature review:

### **Skill Shortages**

- The interviews reinforced the view that there is an acute and growing problem in relation to SET skill shortages and that the issues and barriers acting against women's recruitment and retention in SET must be tackled if these shortages are to be overcome;

### **Career Aspirations / Expectations**

- Some gender differences were recognised as existing in relation to the career aspirations and expectations of women and men entering SET employment, with variations across the three sectors;

### **Education**

- Focus group members confirmed the importance of 2<sup>nd</sup> level education, especially in maths, and the impact of the family and role models in encouraging/dissuading girls from taking up SET studies at third level;
- Discussants were also critical of the third level curriculum particularly in relation to engineering courses where the introduction of soft skills to balance the overload of technical skills was seen to be required;
- The 'long haul' duration of science careers, requiring considerable investment in degree/postgraduate qualifications, was deemed to create particular difficulties for women trying to balance work and family responsibilities.

### **Retention of Women**

- Members of the focus groups referred to their experiences in industry and also described their shift into more autonomous forms of working e.g. in consultancy and academe, suggesting that SET industries are not providing the kind of corporate culture, flexibility and motivation that would encourage more women to enter/remain;

### **Organisational Culture**

- The predominant organisational culture in SET industries was seen to create particular difficulties for women, e.g. long hours culture.

### **Role Models**

- The absence of female role models at both the educational and employment level was seen to mitigate against women choosing SET careers and entering/remaining within SET industries.

Measures aimed at addressing these issues, arising from the literature, interviews, focus group discussions and survey of SET companies, are reviewed in Section 6.

## 5. Survey of Irish SET Companies

### 5.1 Survey Objectives

The objectives of this element of the research were to investigate the level of SET skill shortages experienced in Irish companies; to ascertain the degree to which employers consider that strategies aimed at increasing the representation of women in SET posts could contribute, at least in part, to alleviating those shortages; and to identify the types of measures, and related policies, that have been tried or could be considered, aimed at encouraging women to enter/remain in SET occupations in Irish industry. To this end a postal survey of SET employers was undertaken to examine:

- SET employment, trends by gender, including vacancies;
- recruitment methods and problems experienced in attracting/retaining SET staff;
- strategies to attract and retain women in SET posts;
- availability of flexible working, leave arrangements and childcare supports;
- staff development opportunities;
- adoption of equality/sexual harassment policies;
- specific measures to recruit/retain women in SET and their likely impact;
- new policy initiatives required to encourage greater participation of women in SET posts.

### 5.2 Survey Methodology

The survey was conducted between September and November 2000. A full list of SET companies was obtained from the Forfás database comprising companies in the following Sectors: Food, Drink and Tobacco; Chemicals/Pharmaceuticals; Engineering; Textiles; IT and Internationally Traded Services and Other Manufacturing. Given the small number of large companies (employing 500 or more employees) and the limited number of medium companies (employing between 100 and 499 employees) all of these firms were selected for inclusion in the sample. Given the large number of small companies a sample of 10 per cent of such companies was selected. An intensive follow-up, targeted at medium/large companies where the greatest proportion of employment is concentrated, was carried out to raise the response rate.

The number of companies surveyed is set out below, according to sector and size:

**Table 5.1 Sample and Response Rates by Sector**

Sector	Sample Size	No. Respondents	% Response
Food, Drink and Tobacco	190	22	12%
Chemicals/Pharmaceuticals	169	29	17%
Engineering	348	33	9%
Textiles	47	5	11%
Other Manufacturing	62	22	35%
IT and Internationally Traded Services	176	22	13%
<b>TOTAL</b>	<b>992</b>	<b>133</b>	<b>13%</b>

A detailed questionnaire (Appendix D) was sent out in September 2000 to 992 companies, accompanied with an individually hand signed letter on headed 'Goodbody Economic Consultants' note paper, addressed, where known by Forfás, to the named Human Resources/Training Manager of the company. This letter set out the objectives of the survey and urged the recipients to respond by completing and returning the questionnaire, using a

FREEPOST return envelope. Companies were also given the option of completing the questionnaire on a dedicated web site.

Given the initially low response rate, an intensive follow-up was conducted by telephone, including where possible email messaging of companies with a questionnaire attachment and www site location and/or mailed re-issue of the questionnaire. By end-November following intense follow-up, 111 companies had returned the questionnaire by post and 22 using the Internet. In all, 133 companies returned the questionnaire giving a response rate 13 per cent, which is acceptable for a postal survey.

**Table 5.2 Survey Respondents by Company Size**

	Number of Companies	% of Total Companies in the Sample
Large Companies	20	37 %
Medium Companies	87	14 %
Small Companies	26	8 %
<b>TOTAL</b>	<b>133</b>	<b>13 %</b>

The high response rate of 37 per cent for large companies was particularly satisfactory as it covers 19 per cent of TOTAL employment in these sectors (in firms employing 10 or more). The questionnaires, which had been mailed to Human Resource/Training Managers, were completed by a range of personnel, including chief executives, operations managers and accountants, as set out in Table 5.3.

**Table 5.3 Job Title of Company Respondents**

	Number of Respondents	% of Total
Chief Executive/Company Secretary	13	9 %
HRM/Training/Personnel Manager/Administrator	83	62 %
Operations Manager	16	12 %
Financial Controller/Accountant	11	8 %
Sales/Marketing Manager	2	2 %
Quality Manager	2	2 %
MIS Manager	1	1 %
Other	5	4 %
<b>TOTAL</b>	<b>133</b>	<b>100 %</b>

### 5.3 Profile of SET Companies

#### 5.3.1 Ownership

**Table 5.4 Nationality of Company**

	Number of Companies	% of Total
Irish Owned Private Company	43	32 %
Irish Owned Public Company	17	13 %
Subsidiary of Overseas Company	66	50 %
International Franchise in Ireland	2	2 %
Other/Non-response	5	3 %
<b>TOTAL</b>	<b>133</b>	<b>100 %</b>

Overall the proportion of Irish public and private companies (including semi-state and co-operatives) was 45 per cent compared with 52 per cent foreign owned and 3 per cent non-responses to this question.

### 5.3.2 Research and Development

Respondents were asked to state the location of any research and development (R & D) functions carried out by their company: in Ireland/EU and/or Non-EU. Seventy-nine companies (59 per cent) had an R & D function in Ireland, of which 44 were Irish public/private companies and a further 32 were overseas companies. A total of 31 companies (23 per cent) had an R & D function in the EU, including 12 Irish owned and 19 non-Irish companies. Of the 35 companies 26 per cent with an R & D function in Non-EU locations only 3 were Irish and the remaining 32 were foreign owned.

## 5.4 SET Employment in Companies

### 5.4.1 Employment by Occupational Level

In order to gauge the potential contribution of women to total SET employment in Irish industry, the questionnaire sought to establish the current percentage of jobs held by women and men, according to the FÁS/ESRI categories used in their surveys of companies. The results are set out in Table 5.5. Hitherto, such data have not been collected with a gender breakdown. The Table shows that women held less than one-quarter of SET jobs in respondent companies.

**Table 5.5 Numbers Employed in SET by Occupations and Gender (n = 105)<sup>1</sup>**

	Total	No. of Women	% of Women
Managers/Proprietors	740	127	17 %
Engineering Professionals	663	88	13 %
Engineering Technicians	684	105	15 %
Science Professionals	121	55	45 %
Science Technicians	186	72	39 %
Computer Professionals	653	203	31 %
Computer Technicians	271	84	31 %
Supervisors in SET	302	114	38 %
Other	824	166	20 %
<b>TOTAL</b>	<b>4,444</b>	<b>1,014</b>	<b>23 %</b>

As the earlier Sections of this report have shown, women tend to be well represented among science graduates. This is reflected in their representation in companies surveyed with 46 per cent of professional scientist posts and 39 per cent of science technician posts held by women in the respondent companies. The survey indicated that female science professionals tend to be concentrated in medium-sized companies. Female science technicians are also mainly located in medium/large companies with two medium sized companies accounting for 39 per cent of the women employed in this category.

Amongst engineers, women's representation falls, mirroring their low participation in engineering at third level and in the labour market generally, with 13 per cent of professional jobs and 15 per cent of engineering technician posts held by women. Female engineering professionals were distributed more widely across small/medium, followed by large companies. One large company employed 48 per cent of women employed as engineering professionals. There were fewer women engaged as engineering technicians in small companies. The major concentration was in 12 medium and 5 large companies, with three large companies accounting for 71 per cent of all female engineering technicians.

<sup>1</sup> The n value is the number of respondents that answered the specific question. However, the percentages used in the Tables refer to the percentage which the number in each table represent of the total potential respondents i.e. 133. (Readers can calculate the equivalent percentage for respondents only, based on the 'n' value in each table).

Among computer related occupations, the representation of women is intermediate, with 31 per cent of technical and computer professional posts held by women. One large IT company respondent employed 64 per cent of the women in this category. Female computer technicians were also more likely to be concentrated in medium and large companies and one medium company accounted for 42 per cent of all the women engaged as engineering technicians.

Compared with women's 17 per cent representation in SET managerial posts, women held 38 per cent of supervisory posts. These women were mainly located in medium and large companies with 48 per cent in one large company.

Across all the companies that responded to this question it is evident that women's representation in SET occupational categories is very variable and in some posts extremely low. Some caution should be exercised in extrapolating from this table since the number of companies providing information on SET employees (105) was small. However, the employment pattern found in the survey does broadly reflect that found in industry as a whole using the 1996 census of population data (see Section 2), with women well represented in science occupations, reasonably well represented in computer occupations and least well represented in engineering occupations.

#### 5.4.2 Vacancies & Recruitment of SET Staff

Further information was sought from respondents on their current SET vacancies. Table 5.6 illustrates the specific number of respondent companies with vacancies by occupational level.

Table 5.6 Current SET Vacancies (n = 105)

	Number	% of Total Employment*
Mangers/Proprietors (n = 25)	58	8 %
Engineering professionals (n = 28)	76	11 %
Engineering technicians (n = 20)	76	11 %
Science professionals (n = 4)	13	11 %
Science technicians (n = 10)	14	8 %
Computer professionals (n = 12)	150	23 %
Computer technicians (n = 13)	20	7 %
Supervisors in SET (n = 10)	19	6 %
Other (n = 11)	82	10 %

\*Total refers to total in Table 5.5

The table shows that most vacancies were for computer professionals, followed by 'other' posts, engineering professionals and technicians. Most SET vacancies (e.g. for science professionals/technicians) account for between 8 and 12 per cent of total employment. The major exception is in relation to vacancies for computer professionals, which represent 23 per cent of total employment in that category among the companies that responded. This study indicates the acute skill shortages in this area.

Respondents were asked to state the total number of SET staff recruited in the last year. Among the 88 companies that had engaged new staff, the total number recruited was 2,299. Respondents were asked to state the educational levels that were required by applicants to fill those posts. As Table 5.7 shows, 47 per cent of all SET recruitment in these 88 companies was of graduates with no postgraduate qualifications while a further 5 per cent held a postgraduate qualification. In the case of 324 recruits no educational levels were specified.

**Table 5.7 Recent Recruitment of SET Staff by Educational Qualifications (n = 88)**

	No. Companies	No. Recruited	% of Total Recruited
Certificate	27	270	12 %
Diploma	50	501	22 %
Undergraduate Degree	69	1093	47 %
Postgraduate Degree	27	111	5 %
Educational level not specified	13	324	14 %
<b>TOTAL</b>	<b>88</b>	<b>2,299</b>	<b>100 %</b>

The companies recruiting postgraduates were located mainly in Engineering, compared with smaller numbers in the Chemical sector and fewer in IT/services. Two-thirds of respondent companies recruiting postgraduates were medium-sized, while one third were small/large. Among companies recruiting graduates the same pattern occurs with most recruitment being in Engineering, followed by the Chemical, IT and Food, Drink and Tobacco sectors. Nearly three-quarters of respondent companies that had recruited graduates were medium sized. At diploma level, there was a more even distribution of Engineering, Chemicals, IT and Food/Drink/Tobacco companies.

#### 5.4.3 Difficulties in Recruitment, Retention and Promotion of SET Staff

Companies were asked if they were currently experiencing difficulties in the recruitment, retention or promotion of SET staff. In total, 56 respondent companies or 42 per cent of the respondents stated that they had problems in SET recruitment. Thirty-eight or 29 per cent had experienced difficulties in relation to retaining staff. In contrast only 8 companies (6%) had experienced difficulties in relation to the promotion of SET staff. The respondents stated the categories of SET staff for which vacancies were most difficult to fill (up to a maximum of three). The results are displayed in Table 5.8.

**Table 5.8 Vacancies by Occupation that are Difficult to Fill (n = 74)**

No. of Mentions	Degree of Difficulty			Total Mentions
	1st	2 <sup>nd</sup>	3 <sup>rd</sup>	
Engineering Professionals	18	14	4	36
Engineering Technicians	16	10	1	27
Computer Professionals	16	6	-	22
Managers/Proprietors	9	4	2	15
Computer Technicians	4	7	3	14
Science Professionals	6	3	3	12
Other	2	2	3	7
Science Technicians	-	-	5	5
Supervisors in SET	3	-	1	4

Among large companies, the posts most difficult to fill were engineering professional, managers, computer professionals and engineering technician/science professional. For medium companies the responses were more diverse: engineering professional, engineering technician, computer professional, managers, science professionals, computer technicians and supervisors (in descending order of demand). In small companies the main demand was for computer professionals and engineering technicians.

A sectoral breakdown of companies suggests that in Engineering/Electronics companies the main demand is for engineering professionals and technicians followed by computer professionals and technicians. In the Chemical sector the main demand is for engineering professionals followed by science professional, engineering technician and to a lesser extent



science technician. In IT companies the demand is predominantly for computer professionals and computer technicians. In Food/Drink/Tobacco the demand is more widely spread across: managers, engineering technicians, science professionals and technicians, computer technicians and engineering professionals.

Overall, the survey shows that respondent companies are experiencing most difficulties in recruiting engineering professionals/technicians and computer professionals and to a lesser extent managers and science professionals.

#### 5.4.4. Recruitment Methods

The preferred methods of recruitment for SET vacancies were found to be private recruitment agencies, newspaper advertisements, followed by personal contacts. Other methods included the use of the Internet and graduate 'milk rounds' followed by state agencies/adverts in trade/specialist journals.

**Table 5.9 Recruitment Methods used in filling SET Vacancies (n = 106)**

	Nos. Using	% of Total Companies
Private Agencies	75	56 %
Adverts in National/Local Papers	73	55 %
Personal Contacts	65	49 %
Internet Web Sites(s)	39	29 %
Graduate Milk Round	29	22 %
Adverts in Trade/Specialist Journals	22	17 %
State Agencies (e.g. FÁS)	22	17 %
Other Method	8	6 %

#### 5.4.5 Location of Recruitment

Seventy-nine per cent of SET staff were recruited from within Ireland in the last year, while 26 per cent of companies had recruited in the EU and 14 per cent from Non-EU countries.

#### 5.4.6 Key Factors in Recruitment

Respondents were asked to rate the most important factors in recruitment and retention. The ratings for these factors are outlined in Table 5.10, along with the percentage of companies that had assigned a rating of 4 or 5 to each factor.

The most important factor for respondent companies in relation to SET recruitment was found to be the availability of applicants with the right skills. This factor was rated highly across all sectors. After that the key factors were 'applicants with the right experience', 'qualifications' and 'career progression'. The importance of applicants with the right qualifications and/or experience was less important in Food/Drink/Tobacco and the IT sector than the Textile, Chemical, 'Other' and Engineering sectors. Career progression opportunities were rated as the most important factor by companies in the Chemical, 'Other' and Food/Drink/Tobacco sectors. It was less important in Engineering and IT.

**Table 5.10 Importance of Listed Factors in Filling SET Vacancies (n = 113)**

	Rating (5 = very important to 1 = unimportant)	
	Average Rating	% rating 4 or 5
Availability of applicants with the right skills (N = 113)	4.14	71 %
Availability of applicants with the right experience (N = 112)	3.71	54 %
Availability of applicants with right qualifications (N = 112)	3.61	53 %
Career progression (N = 111)	3.58	53 %
Wage levels (N = 112)	3.31	44 %
Conditions of employment (N = 112)	3.31	44 %
Competition from other employers (N = 110)	3.12	31 %
Long hours (N = 109)	2.56	15 %
Childcare facilities (N = 108)	2.18	11 %
Other*	2.56	6 %

\*'Other' factors mentioned by 26 per cent of respondents, referred to: plant location; working hours, i.e. shift work basis (hours didn't suit applicants who were also part-time farmers); compensation and benefits package; ability to adapt to the culture within the organisation; 'sexy' technology essential; flexible hours to beat traffic; small teams preferred; training opportunities; reward structure/benefits; company reputation and product produced; learning potential; and 'childcare facilities becoming an increasing factor'.

Wage levels, along with conditions of employment and competition, were rated lower than these factors. Companies in the 'other' category rated wages much higher than in the other SET sectors and conditions of employment were most important in textiles and chemical companies. Childcare facilities were not rated highly as a factor in recruitment in any sector.

#### 5.4.7 Key Factors in Retention of Staff

It was also important to capture the relative importance of certain factors that could influence the retention of SET staff. The ratings for these factors are outlined in Table 5.11, along with the percentage of companies that had assigned a rating of 4 or 5 to each factor. Wage levels are seen to be an important factor, followed by career progression and conditions of employment. Competition from other employers was perceived as a less important factor.

**Table 5.11 Importance of Listed Factors in Retaining SET Staff (n = 106)**

	Rating (5 = very important to 1 = unimportant)	
	Average Rating	% rating 4 or 5
Wage levels (n = 105)	3.90	59 %
Career progression (n = 103)	3.69	50 %
Conditions of employment (n = 103)	3.46	46 %
Competition from other employers (n = 99)	3.53	41 %
Long hours (n = 101)	2.53	11 %
Childcare facilities (n = 102)	1.92	5 %

#### 5.4.8 Trends in SET Skill Shortages

Respondents were asked to state whether they considered that the extent of SET skill shortages was decreasing, static or increasing. Twelve per cent of all respondents stated that they were decreasing, 41 per cent that skill shortages were static and 32 per cent that they were increasing.

#### 5.4.9 Recruitment Patterns by Gender

Information was also sought on whether there had been any discernible rise in the number of women or men applying for, or recruited into, SET posts over the last 12 months. In relation to applications, 17 per cent of respondent companies had experienced an increase in

applications from men and 27 per cent from women. While sixteen per cent had experienced an increase in the numbers of men recruited, this compared with 23 per cent that had recruited more women into SET posts in the last twelve months. This indicates that, at least in a proportion of companies, more women are coming forward at the application stage and more women have been taken on by these SET companies.

A rise in female applicants for SET posts was noted by more than one-quarter of the companies comprising: Engineering, Food/Drink/Tobacco, Chemicals/IT and other (in descending order). Among the 23 per cent of companies that had recruited more women into SET posts the distribution was: Engineering, Food/Drink/Tobacco, Chemicals, IT and other (in descending order).

The reasons given for the rise in female applicants and recruits were that more women were available for work in general and that, through investment in education, there are more women with the qualifications for the posts available. The availability and increased recognition by employers of postgraduate technical conversion courses were seen to have been important factors. It was also considered that women are increasingly recognising that there are better opportunities available and that they have the ability to handle the duties involved.

## 5.5 Strategies to Attract/Retain Women in SET Posts

### 5.5.1 Strategies to Attract/Retain Women in SET Posts

Respondents were asked if the company/plant had used any specific strategies to attract and retain women in SET posts. The responses received from respondent companies are set out below. The findings demonstrate that only a small proportion of the SET company respondents have utilised such strategies to date to attract and retain women in SET. Where such strategies had been introduced respondents were asked to rate the effectiveness of such strategies on a 5 point scale: 1 = ineffective and 5 = highly effective. The three most commonly used strategies apply to women already within the company. (Table 5.12)

**Table 5.12 Strategies Used to Attract /Retain Women in SET Occupations- Internal (n= 98)**

**In-Company Training offered to Women to enable them to compete for higher level SET posts**

Used by 22 per cent of Companies	Effectiveness rating (n = 37)	2.75
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**Work Experience for Women to enable them to compete for higher level SET Posts**

Used by 17 per cent of Companies	Effectiveness rating (n = 35)	2.71
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**Transfer of Women currently employed in Non-SET posts into SET posts**

Used by 14 per cent of Companies	Effectiveness rating (n = 35)	2.76
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22 per cent of all respondent companies offered *in-company training* to women to enable them to compete for higher-level posts. The highest ratings of 4/5 for this strategy were in Chemical/Engineering and IT companies. Medium-sized companies accounted for two-thirds (66-68%) of the respondents that found these strategies to be effective, which is only marginally higher than their representation in the survey (65%).

This was followed by 17 per cent of respondent companies that are providing opportunities for women to obtain *work experience* to enable them to compete for higher-level SET posts. This

strategy was more commonly used in Food/Drink/Tobacco sector, followed by Engineering and Chemicals.

Fourteen per cent of respondent companies were operating a policy of the *transfer of women from non-SET into SET posts*. Use and effectiveness of this strategy was more evident in Chemicals/Engineering followed by Food/Drink/Tobacco and IT companies.

Other strategies that were used by respondent companies related to recruitment from outside the company. As shown in Table 5.13 the most important source being women in similar organisations/sectors, followed by targeted recruitment of 'women returners' and graduates from universities and Institutes of Technology. While the effectiveness rating was moderate (2.3) for attracting women from similar SET employment and graduates, it was lowest for external recruitment of women who had exited the labour market.

**Table 5.13 Strategies Used by Respondent Companies to Attract /Retain Women in SET Occupations - External (n = 98)**

**Actively Seeking and Attracting Women from Similar Organisations or Industries**

Used by (11) per cent Companies Effectiveness rating (n = 25) 2.32

**Targeted Recruitment of Women via Universities/ITs**

Used by (10) per cent Companies Effectiveness rating (n = 27) 2.33

**Targeted Recruitment of SET Qualified and/or Experienced Women who have been out of the Labour Market**

Used by (10) per cent Companies Effectiveness rating (n = 22) 1.66

**5.5.2 Availability of Flexible Working and Leave Arrangements**

Respondents were asked what, if any, flexible work options/leave arrangements and childcare facilities are available to SET staff in their company/plant. The results from the 48 companies (36 per cent) that responded to this question are shown in Table 5.14.

**Table 5.14 Availability of Flexible Work Options for SET Staff (n = 48)**

	No. of Mentions	% in which available
Part-time working	39	29 %
Flexitime	33	25 %
Job-sharing	12	9 %
Special shifts	11	8 %
Flexiplace (e.g. teleworking)	8	6 %
Term-time working	3	2 %

Taking the results together, this table indicates that some form of flexible work options have been tried in a minimum of 36 per cent of all respondent SET companies. Of the possible flexible working options listed, the most commonly available is part-time working (29 per cent) and flexitime (25 per cent). Companies that have made part-time working available were fairly evenly distributed in IT, Chemical, Engineering and Food/Drink/Tobacco companies. Thirty per cent of medium and large companies and 27 per cent of small companies offered part-time working. Flexitime was more prevalent in medium companies in the IT sector followed by Engineering and Chemical companies.

Respondents were also asked to indicate what forms of leave arrangements they provide for SET staff. Nearly two-thirds of all the respondent companies offered some option.

The most commonly available arrangement is for emergency leave (57 per cent), extra unpaid maternity leave (44 per cent), paternity leave (36 per cent), extra unpaid parental leave (21 per cent) and career breaks (8 per cent). Paternity leave was offered in 44 per cent of medium sized companies mainly in the Chemical, IT and Engineering sectors. Extra unpaid maternity leave was also more commonly available in the medium sized companies distributed across the Chemical, Engineering, IT and Food sectors. Career breaks were mainly available to staff in medium sized companies and in each of the Engineering, followed by the Chemical, Food, IT and Textile sectors.

**Table 5.15 Availability of Leave Arrangements for SET Staff (n = 86)**

	No. of Mentions
Emergency leave	76
Extra maternity leave (unpaid)	59
Paternity leave	48
Extra parental leave (unpaid)	28
Career breaks	11
Extra maternity leave (paid)	5
Sabbatical leave	3
Extra parental leave (paid)	1

None of the respondent companies reported having a company based crèche, subsidised local area crèche or financial assistance for childcare. Only one company stated that they provided support for childcare described as a "childcare facility currently being put in place".

### 5.5.3 Staff Development Opportunities

Information was sought on the forms of support available to SET staff undertaking further education, training and/or development. In total, 81 per cent of the respondent companies indicated that they encouraged staff in a one of a number of different ways. The detailed responses are set out in Table 5.16 below.

**Table 5.16 Development Support for SET Staff (n = 107)**

Available to:	Men		Women	
	No. of cos.	(%)	No. of cos.	(%)
Payment/Refund of Fees	103	(77%)	98	(74%)
Time off for Examinations	101	(76%)	96	(72%)
In-Company Training	89	(67%)	84	(63%)
Time off for Study	78	(59%)	73	(55%)
Personal Development Programmes	59	(44%)	56	(42%)
Mentoring Programmes	25	(19%)	22	(17%)
Networking	20	(15%)	17	(13%)
Other	3	(2%)	3	(2%)

Providing staff with assistance to pursue further qualifications/personal development is clearly a priority in a substantial number of respondent companies. Programmes such as mentoring or networking were less common, though used in 15-20 per cent of the companies surveyed. Other supports available were: payment of membership of professional institutes; international assignment (e.g. US); specific job related training courses; team building etc.

Section 5.5 indicates that targeted actions are being taken by a number of companies to attract/retain SET staff, some of which are gender-specific: (in-company training/ work experience strategies), while others are non-gender based: staff development and career advancement measures). Some, such as the availability of career breaks/part-time working/flexitime, indicate a growing acknowledgement of the importance of specific measures aimed at retaining staff.

## 5.6 Adoption of Equality/Sexual Harassment Policies

A total of 28 per cent of the respondent companies had adopted a formally stated and agreed Equality/Diversity Policy and 59 per cent had adopted a policy to combat sexual harassment/bullying at work. This signifies a high level of commitment by those companies to promoting equal opportunities and to an even greater extent to eradicating harassment and bullying at work. Among the initiatives that had been taken to support gender equality were: Equal Opportunity employers, Harassment policy, Diversity Programme, New Opportunity for Women programme, Case Management Team and Management Education.

Many employer companies stressed their commitment to non-discriminatory work practices even when there was no specific policy in place, by statements such as that "all positions within the organisation are non-gender biased", "all applications considered on merit" and "we ensure that female and male members of staff are paid equally depending on their skills and experience". Others mentioned that their managers are aware of EU and Irish laws in this area.

Two companies were developing a policy and three other companies explained why they felt no need to introduce an Equality/Diversity policy since "the company does not discriminate on any grounds" and "no formal policy, but excellent equality culture". One respondent mentioned that "women are not available for the [SET] roles (they do not apply)".

## 5.7 Measures to Address SET Skill Shortages by Recruiting/Retaining Women

In response to SET skill shortages, respondents were asked, from a given list, what strategies they would consider adopting in the future to specifically help to recruit/retain female SET staff. The responses to these possible strategies are set out in Table 5.17.

The findings indicate that there is a reasonably strong level of support for the adoption of specific strategies to assist in recruiting/retaining women in SET. Of the strategies listed, targeted recruitment was the most popular strategy, indicated by 38 per cent of respondent companies, followed by the creation of career paths for women in SET (25 per cent) and the availability of training specifically for women in SET (22 per cent). The key sectors supporting targeted recruitment, career paths, training and upgrading were Engineering/Electronics, Chemicals and Food/Drink and Tobacco. Other strategies, such as the provision of childcare, were considered less attractive by respondent companies.

**Table 5.17 Potential Strategies (n = 63)**

Strategy	No. of Companies per cent of Total	
Targeted recruitment of women into SET posts	51	38 %
Creation of career paths for women in SET posts	33	25 %
Training specifically offered to women in SET posts	29	22 %
Upgrading of predominantly female SET posts	22	17 %
Provision of childcare facilities	13	10 %

When asked about the potential impact of such strategies on the alleviation of current skill shortages, 20 per cent of respondents indicated that such strategies would have a significant impact, 33 per cent 'some impact', 17 per cent 'little or none'.

Among the respondents who considered that such strategies could contribute significantly, the individual reasons cited were that it would create "a larger pool of people to choose from", "help to rectify current gender imbalance" and "encourage a more diverse workforce". Others stressed that they operated a "gender blind" approach where only qualifications were important, while others referred to positive attributes that they saw in women employees whom they believed to be: "as capable as anyone to undertake roles", "more loyal employees" and representing "a huge pool of knowledge available after the children have grown up".

Some emphasised a pragmatic solution to skill shortages by attracting women back, opening up the market place and providing key staff with retraining.

These responses suggest an awareness of the positive potential of encouraging additional female SET staff as a means of addressing skill shortages, and contributing to greater diversity in the workplace.

Among the companies that believed such strategies could "contribute to some extent" there was a strong message that additional supports would need to be put in place, if the strategies were to work. Three of these respondents referred to the need for childcare supports to entice back SET professionals. Another mentioned that women who have been out of the workplace for long periods "would need to build up their confidence to understand that they can be a benefit to the company". Another respondent stated that the government would need to make it financially viable for women to stay/return to the workforce.

Other companies stated that the majority of applicants for SET posts were male, that the nature of their current work environment was "not attractive to female applicants...the work environment needs to be changed to attract more female applicants" or that there were not enough female graduates with the necessary background/skills.

These responses indicate a view that, for strategies to work, there must be complementary measures e.g. in relation to confidence building, childcare, and changes in the working environment.

For companies who believed that such strategies could contribute only "a little" to alleviating SET skill shortages, many emphasised that there was a lack of women SET graduate applicants. Others again referred to the male dominated industries in which they worked, the fact that turnover was low, there were no problems retaining staff, or that the problem was in the company's geographical location. Others stressed that they recruited the best people for the job regardless of their sex or that they practised "total equality".

## **5.8 New Policy Initiatives to Increase the Representation of Women in SET**

In relation to whether new policy initiatives were required to encourage greater participation by women in SET sector, nearly half 47 per cent of the respondents sought supporting action at government level and 35 per cent at EU level. Respondents were asked to describe the policy initiatives they would like to see implemented. The responses in diminishing order of importance were childcare (17 responses), education (14 responses), taxation (9 responses), family friendly employment (6 responses), encouragement of women into SET (5 responses) and government incentives to employers (4 responses).

Respondents that suggested changes in the educational system to support greater participation of women in SET occupation made the following comments: "greater participation is needed from females in engineering/technical courses at University/3rd level" and noted the need for "an initiative to develop the way engineering is taught at 2nd level to encourage more participation". A number of respondents stressed that more effort was needed at primary level to introduce science as a subject and to promote a technical career path at Leaving Certificate, with more promotion of SET subjects in secondary schools. The role of teachers was also mentioned: "Secondary Career Teachers/Officers are weak on the deployment of Science students" thus the need to "recruit a high standard of science/technology teachers in girls schools to enthuse and encourage the study of science and technology". Other respondents referred to the need for "an Awareness Programme through 2nd/3rd level institutions of what is available and necessary for such career" and better career information and subject options in girl only schools. Other comments relating to education were the need for free education to be available for those studying part-time or at night - men as well as women; grant aid for further education; and extension of programmes similar to IBEC's 'Business and Education Links Programme'.

## 5.9 Summary of Key Points Emerging from the Survey

The key findings emerging from the survey show that in respondent companies:

### Women in SET Occupations

- Women's level and type of representation in SET respondent companies is similar to that found in Industry generally (as described in Section 2). Women's representation was lowest as engineering professionals, engineering technicians, and SET managers/proprietors, followed by computing professionals and computer technicians. Women were better represented as science professionals and science technicians.
- Skill shortages in SET are perceived to be most acute among engineering professionals and technicians, and among computer professionals. Relatively few companies had reported any recruitment/retention problems with science professionals/technicians. This complements the findings of the Expert Group on future skill needs.
- The responses indicate that a number of companies are already experiencing difficulties with SET staff recruitment, particularly among engineers and computer professionals. This also accords with the views of the Expert Group.
- The three key factors in relation to recruitment of SET staff were found to be: availability of applicants with the right skills, experience and qualifications and career progression. Retention of SET staff was seen to be a less critical issue than recruitment for respondent companies.
- More than one-third of the companies surveyed already offer flexible working options, mainly through part-time working/job-sharing and flexitime. Emergency leave was most common leave arrangement available, followed by extra-unpaid maternity leave, paternity leave and career breaks. No companies reported having a company based crèche, subsidised local area crèche, or provided financial assistance for childcare. A total of 37 companies had adopted an Equality/Diversity Policy compared with 78 that had adopted a policy to combat sexual harassment/bullying at work.
- A number of respondent companies had already adopted strategies specifically to recruit/retain women in SET occupations. The most common strategy was to offer in-company training, followed by work experience opportunities and the transfer of women from non-SET into SET posts. The transfer of women from non-SET to SET posts, and in-company training strategies received the highest effectiveness ratings by companies. To date, targeted recruitment of either female graduates or potential women returners who were out of the labour market, have been used by only one-tenth of the respondent companies, with limited perceived effectiveness to date.
- In terms of potential future measures, targeted recruitment of women was seen to be the most appealing potential strategy for attracting/retaining women into SET posts (38 per cent of companies), followed by the creation of previously non-existent career paths for women in SET, and the availability of training for women in SET. In terms of the potential impact of these strategies in alleviating current skill shortages, nearly half the respondents saw such interventions as making a positive contribution.
- Nearly half of the respondents believe that new complementary policy initiatives are required at government level and over one-third at EU level. The type of policy initiatives referred to were: childcare supports/subvention, educational reform from primary to tertiary levels, tax concessions, family-friendly arrangements for employees, encouragement of women into SET, Government incentives to employers.

Ensuring the Retention of Women

Ensuring a corporate Culture that is

Women in SET occupations



- Respondent companies considered that the government needed to play a key role in the implementation of these initiatives, a stance that reinforces the views of the Expert Group.

## 5.10 Conclusions

The findings clearly indicate that a significant minority of SET companies have considered, tried or would be amenable to the adoption of specific gender-related measures aimed at addressing skill shortages in SET occupations.

Respondent companies anticipate that the bulk of SET skill shortages will occur among engineering and computer science professionals and technicians, as was forecast by the Expert Group.

The survey also indicates that such employers believe that complementary supportive measures are required by government to encourage good practice in this area. These measures are discussed further in Section Six.

## 6. Review of Measures and Initiatives to Increase the Representation of Women in SET Occupations

### 6.1 Introduction

The earlier Sections of this report have indicated that there are significant differences in the participation rate of women and men in SET careers and related occupations and that these vary according to sector (Science, Engineering and Computer Science) and occupational level. In accessing third level SET courses, there is continuing evidence of a preference for Science over Engineering/Computer science by girls. This does not appear to be accounted for by poor Leaving Certificate examination performance. While traditionally girls were less likely to have studied higher level Leaving Certificate (LC) mathematics, this pattern is not evident in 1999. As shown in Section 2, unpublished CAO data indicate that female school leavers accounted for 45 per cent of those taking LC higher level mathematics, and of these 83 per cent got grade C or above, compared to 81 per cent of boys. This points to the influence of other wider societal factors influencing girls' career choices.

Once girls enter third level SET studies, the literature suggests that there are aspects of the learning environment, curriculum, teaching and communication methods that tend not to motivate girls to opt for SET careers, especially in industry, after graduation.

As stated above women's representation in the SET labour market in 1996 has been found to vary by sector and level of occupation, with computer operators (62% female), laboratory technicians (54% female), natural scientists (46% female), chemists (39% female), followed by biological scientists (34% female). Women's participation in computer software occupations and particularly in engineering occupations was found to be lower. A sizeable number of women holding science and engineering qualifications in 1996 were found not to be in the labour force.

Evidence from other parts of the study, particularly through the focus groups discussions, interviews and the survey of companies, point to a number of barriers currently limiting women's advancement within SET employment. These can be attributed to: different career expectations, inhospitable organisational cultures, as well as to the problems associated with reconciling work and family life. Lower female retention has been also attributed to the corporate culture prevailing in SET companies – of long hours, lack of female role models/mentoring and a climate that not only does not recognise and value women's contribution equally but may also be hostile towards their entry and advancement.

In this Section of the study we review the type and range of measures that have been tried, aimed at encouraging the greater participation of women in SET occupations while in Section 7 we draw these findings together with our own conclusions to present a series of recommendations aimed at addressing SET skill shortages through actions aimed at encouraging greater participation of women in SET careers.

### 6.2 Approach to Review of Measures

The findings outlined in earlier Sections point to the need for measures at different levels within companies to encourage greater recruitment and retention of women in SET and to ensure that the corporate culture values the diverse contributions and skills of all their workforce. The research has indicated that **'direct'** interventions at company level are required relating to:

- Encouraging Recruitment of Women into SET Occupations
- Ensuring the Retention of Women in SET Occupations
- Ensuring a corporate Culture that is conducive to the recruitment and retention of Women in SET occupations.

In addition to these direct measures, '*indirect*' actions aimed at broader cultural, sectoral and institutional issues are required to provide support, information and monitoring of women's representation in SET. Such indirect actions are required relating to:

- Recruitment/Retention Policy Measures
- Targeting Women Returners
- SET Promotion and Monitoring

The 'direct' measures relate to initiatives aimed at increasing the recruitment, retention and promotion of a women that have been tested in SET companies. The 'indirect' measures relate to the type of actions that social partners and government have tried in order to support SET companies and women returners, as well as to address longer-term issues relating to SET education and awareness raising.

Section 6.3 outlines the methodology used to identify appropriate measures and the rationale for including certain company 'cases'.

While scientifically evaluated research on the effectiveness of each of these measures is desirable, such evidence is scant to non-existent. In the absence of formally evaluated research on specific measures, the effectiveness of the measures presented in Sections 6.4 and 6.5 have been assessed in terms of the extent to which they have continued to be used, adapted and/or extended by companies. Hence the measures are assessed in terms of:

- Have they been tried?
- Have they been replicated/extended?
- Have they been found to contribute to meeting business needs as well as to raising women's participation in SET?

Fuller information on the company-based initiatives is available in Appendix E.

Section 6.5 goes on to address the accompanying 'indirect' measures that have been introduced either more generally in relation to supporting the greater participation of women in the labour force in Ireland, or more particularly in relation to SET employment in other countries.

Overall the research findings point to the need for an integrated holistic approach with a focus on employment but also recognising the need for complementary interventions in education, as well as support by Government and the Social Partners for initiatives at the individual company level.

### 6.3 Methodology

In examining measures aimed at raising the level of women's representation in SET employment and contributing to alleviating SET skills shortages the consultants drew upon:

- recent reports on SET skills needs (Section 1);
- statistics on the pattern of women's employment in SET (Section 2)
- a review of literature on women's representation in SET (Section 3);
- interviews with key informants (Section 4);
- focus groups sessions with women who have SET qualifications (Section 4); and
- a survey of companies in SET sectors to ascertain their views on what measures could best be introduced to meet the study objectives (Section 5).

In seeking practical and implementable measures that would meet the objectives of the study, it was important to *provide indicative examples of good practice* from experience in Irish companies as well as documented initiatives in the EU where available. These examples of company experience (Appendix E) were identified by interviewees, focus groups, Steering

Group members, and from the available Irish literature, including EU projects. In considering cases for inclusion, it was important to achieve a balance of experience among employers of women in SET in private/state companies, high/low technology and indigenous/multinational companies, and to encompass initiatives that were not driven solely by the availability of EU (e.g. NOW/LEONARDO/ADAPT) project funding.

The underlying emphasis in Section 6 is to supplement the proposals and recommendations of the Expert group in relation to SET skill shortages by outlining a range of gender specific measures that have been tried to encourage a higher representation of women in SET employment. Many of these measures have been tried to date with the objective of achieving greater gender equality. Whilst it would be preferable to review measures that have not only been adopted but evaluated scientifically, such ideal and academically rigorous examples do not generally exist. Some of the measures considered are innovative and thus have received funding through EU pilot programmes, while others have become a hallmark of 'good practice' in companies seeking to promote equality of opportunity between men and women.

The case companies illustrated here should be regarded as demonstrating how and where such measures could work successfully in Irish SET companies and thus contribute to business needs.

## 6.4 'Direct' Measures Aimed at Attracting and Retaining Women in SET

### 6.4.1 Recruitment Practices

#### *Targeted Recruitment into SET*

Companies that seek to fill existing and future SET skill shortages have recognised the need to pursue active recruitment into those posts, drawing upon internal and external sources of labour and skills. A relatively small number of Irish companies recognise that this requires specific affirmative actions to ensure that women and men have equal opportunities in recruitment, selection and promotion, particularly in SET. Such affirmative action measures have been used as a tool to ensure that all *qualified* SET internal and/or external applicants have equal access and opportunity to compete based on ability and merit. Affirmative action measures, envisaged and supported under the Employment Equality Act 1998, encourage female (or male if they are under-represented) applicants, targeted recruitment, offer training and/or work experience opportunities for those groups who are under-represented (in this case women in SET posts).

The survey and interviews conducted for this study demonstrate that there is still some confusion over the term positive action<sup>1</sup> (which is legal) as distinct from the term positive discrimination (which is illegal). Further action could be taken by the Equality Authority to educate SET employers about this important distinction and how they could adopt measures, similar to those outlined in the company cases in Appendix E, to improve efficiency and competitiveness in their companies.

In Aer Rianta (Case One) affirmative action took the form of targeted recruitment to attract more women to enter occupations where they are currently under represented. Hewlett Packard (Case Two) has run two Back-to-Work Programmes to encourage women into the company. Other affirmative action measures have been supported under the EU NOW/ADAPT and LEONARDO programmes. Three of Ireland's largest food companies (Case Three) – Golden Vale Plc., Green Core Group Plc., and Kerry Group Plc. that participated in a project called the WITS Food Industry NOW Project, sought to maximise the potential of their female professional SET recruits through a Management Development Training Programme (including coursework and a mentoring scheme) for women and through

<sup>1</sup> Positive action is legal and allows intervention to raise the representation of a group e.g. men or women, who have hitherto been under-represented in an occupation/post. It is distinct from the term positive discrimination, which is illegal, whereby an employer seeks single-sex recruitment or the setting of quotas for the numbers of each sex.

increasing awareness of equality issues within the three companies. In all there were 50 female participants, of whom at least half were engaged as scientists and technologists.

The aims of the recruitment and other measures introduced by Aer Rianta (Case 1) were: better deployment of human resources using the fullest pool of staff with the required competencies; to demonstrate to other employers the benefits of investing in their female staff; and to establish a corporate culture in which employees can expect to be valued and developed to their fullest potential. The experience of Aer Rianta demonstrates that pro active recruitment measures are appropriate in achieving a higher representation of women by targeting women into posts where previously there had been few, or even none. Further measures were subsequently introduced to improve the ratio of women in management and to create career paths for women in secretarial posts.

Generally these programmes have been found to be successful in terms of increasing the recruitment of women into SET employment and in assisting companies to maximise the utilisation of available human resources in support of business objectives.

#### 6.4.2 Retention Practices

For women already in SET employment the major emphasis is on measures aimed at retention and/or up-skilling of staff. Such measures have included:

- Mentoring Programmes
- Support for Participation of Women in Education and Training
- Promoting Work/life Balance through:
  - Flexible Working and
  - Leave Arrangements
  - Childcare
  - Other Working Practices.

##### **Mentoring Career Development Programmes**

Formal mentoring programmes aimed at preparing women for senior positions are important since in many workplaces informal mentoring is the norm. A mentor is a sponsor, enabler and more senior or leadership figure that acts as a role model. It is well recognised that women lack mentors and that they also need to learn how to act as mentors. Such programmes targeted at women worked well in Aer Rianta on a pilot basis. Further mentoring in Aer Rianta will involve women and men male and female mentors and mentees. This measure has also been used in the – WITS Food Industry NOW Project (Case 3) and was found to have contributed to "significant personal and career development for the participants". The use of mentoring also "enabled senior managers to observe the skills of participants and to understand the issues facing them".

##### **Participation of Women in Education and Training**

Some women in SET companies do not hold the formal qualifications necessary to apply for SET posts. Companies, such as LOTUS, offer inducements such as sponsored places on conversion courses linked to universities (part-time diploma/degree/postgraduate qualifications). Amdahl has a long tradition of creating and advertising career pathways within the company with opportunities to upgrade/(re)train (e.g. from operatives to technician; and technician to professionals). Other companies, including Bausch and Lomb offer internships and bursaries to support full and part-time studies in third level institutions and accelerated access to third level programmes. These type of in-company or external education/training courses can be targeted at specific groups including women under-represented among SET employees at specific grades/occupations.

Targeted education and training measures were used in the WITS Food Industry NOW Project (Case 3) aimed at training managers in the concepts and applications of equality/diversity in the workplace. Other mechanisms aimed at inducing the greater uptake

of third level places, particularly targeted at women were: to offer sponsorship for mature students; pre-university study courses linking companies and Universities/Institutes of Technology.

Some companies have focused on forging links with Universities/ Institutes of Technology. Using this approach, companies have succeeded in delivering customised courses/modules that fit the needs of industry and simultaneously accommodate the development needs of staff in SET. One such example is shown in the WITS Food Industry NOW Project (Case 3) in their Diploma in Management – a development opportunity for women working in the Irish food industry, supported under the EU NOW (New Opportunities for Women) Programme. The consortium that devised the programme stressed that international research showed that learning the skills and techniques of management could be accelerated for women in single sex programmes, that women working in non-traditional areas can benefit from the opportunity to network with other women, and that it is EU policy to support women's access to management and decision making positions.

Hewlett Packard (Case Two) is currently developing a joint Information Technology Certificate Programme with Athlone Institute of Technology. It is envisaged that this will involve some distance learning whereby the students involved will utilise the company's laboratory facilities instead of those at Athlone Institute of Technology. The company has also run a continuing education programme to fund employees who pursue formally recognised qualifications, from certificate through to Master's degrees. The main Programmes: NOW, SURP (Continuing Education Programme) allow for funding of programmes where employees wish to undertake a formally recognised qualification. In 1999, 22 per cent of their Ink-Jet Business Staff undertook formal education, funded by Hewlett Packard. Of these, 60 per cent took Certificate level, 20 per cent Diploma, 12 per cent Degree and 8 per cent Masters level Education. These courses chosen broke down as 38 per cent in Technical/Engineering, 19 per cent in IT, 38 per cent in Business areas and 5 per cent in the area of Quality Assurance. There are no gender specific data available for course participation.

The SET employers surveyed in this study indicated there is a recognition that measures such as financial/other supports for continuing education (e.g. payment of fees, study time); training programmes (single sex, or mixed); formally devised joint programmes with Universities/ Institutes of Technology leading to a formal qualification, can contribute to meeting skill requirements; improving lifelong learning and can work in an Irish context. Such measures have been piloted, replicated and institutionalised as 'good practice' in a limited number of companies to date, as a way of meeting the company's business objectives. The payback for companies can be significant but no research has been undertaken to systematically assess the effectiveness and return on investment to companies arising from these measures.

#### **Promoting Work/life Balance through Flexible Working and Leave Arrangements**

Demand for flexible working arrangements to accommodate a more diverse range of employees' were initially sought by the Employment Equality Agency. In 1996 the Agency argued that such initiatives bring potential benefits to industry in term of:

- Recruiting quality employees;
- Retaining effective employees;
- Motivating staff to higher levels of productivity;
- Reducing levels of employee stress;
- Reducing levels of sick leave/absenteeism;
- Improving the company's reputation/image; and
- Improving co-operation between social partners.

The specific working time measures currently being applied in industry cover the following:

**Working Time Arrangements**

Job-sharing  
Flexitime  
Flexiplace  
Part-time working  
Term-time working

In Aer Rianta (Case One) job-sharing, flexitime, teleworking have all been successfully introduced. Hewlett Packard seek 'An environment that encourages employees and managers to work together to achieve common company objectives for business success, while creating opportunities for balancing work with other life activities'. In practice, the company offers a range of flexible work options: flexible workweek, flexible start times, working from home, time in lieu, part-time working/job-sharing and shift options. LOTUS and Aer Rianta have also introduced home-based or teleworking to facilitate requests from staff for such arrangements.

The response of companies to this study suggests that there is support for the introduction/extension of this measure in SET sectors. All of the companies that had introduced 'family friendly' measures have retained them, and in many companies they have been extended. In Hewlett Packard options aimed at promoting harmony between work and family life have increased and improved, as needs have changed. Each year, as part of Hewlett Packard's Business Initiatives, 'Work Life Harmony' is allocated to a Senior Manager to sponsor. This Manager then works with a team of people to review current strategies and propose any changes that are required due to new legislation, changing needs of employees and the changing demands of their business.

The Programme for Prosperity and Fairness (2000) committed the social partners to a flexible working arrangement promotion campaign. Though not confined to SET employment, a day (1 March 2001) was assigned nationally to further family friendly arrangements within all companies, and to assist them to think imaginatively about what flexible options they could offer to their employees.

The range of leave options that companies have introduced to facilitate existing and future staff included:

**Leave Arrangements**

Career Breaks  
Maternity Leave  
Paternity Leave  
Adoption Leave  
Parental Leave  
Compassionate/Bereavement Leave  
Emergency Leave  
Eldercare Leave  
Care for People with Disabilities  
Sabbatical Leave

The following arrangements are available to staff in Aer Rianta (Case One): Career Breaks, Anticipatory Leave, Maternity Leave and Paternity Leave. In Hewlett Packard (Case Two) personal leave of absence for 6 weeks to 12 months is available to deal with domestic personal issues; in addition to bereavement leave, community service leave, paternity leave, special personal leave, *force majeure* leave, parental leave, adoptive leave are also available.

Based on the experience of companies such as Aer Rianta and others outside SET (Humphreys 2001), including the Irish Civil Service (Humphreys, Drew and Murphy 1999), the

research indicates that in order to maximize the benefits and minimise any costs to industry, flexible work practices need to:

- be promoted and used by managers as well as staff;
- be introduced and managed by trained HR/Personnel Department staff;
- be advertised widely in staff newsletters, brochures, and leaflets;
- be supported with information e.g. calculations of take home pay when job-sharing etc. and established networks for employees on employment breaks to 'Stay in Touch';
- stress the benefits from such practices to employers (lower turnover and recruitment costs) and employees (lower stress and higher productivity);

No quantifiable evidence is available to assess the outcomes/benefits from these actions within Irish companies. International experience however, indicates the type of benefits that can arise. Glaxo Wellcome R & D actively sought to minimise the loss of experienced female scientists through a range of positive actions, including encouraging female candidates, ensuring a 'gender check' in selection, and providing childcare supports and flexible working. By introducing these measures, the company considers that they have reduced unwanted staff loss and have increased the percentage of women returning after maternity leave from 40 per cent in 1988 to almost 90 per cent in 1994. In addition, women's representation amongst senior staff managers and research managers has increased from 19 per cent to 28 per cent between 1990 and 1994 (DTI/Opportunity 2000).

#### **Childcare**

Aer Rianta (Case One) was the first company in Ireland to open a nursery for its employees. In addition, the company runs summer camps for 3 weeks for children aged 3-8 years. Other companies, including Telecom Eireann (and in the non-SET sector, Universities, Bank of Ireland) have followed this lead in response to demand for company-based childcare from their employees.

Yet other companies have adopted different approaches in response to the preferences of their own employees. Hewlett Packard (Case two) have an arrangement with a local crèche to hold places for the children of their employees. In a survey conducted among the company's staff, they found that most employees preferred to seek childcare close to their own homes as opposed to their workplace. Other employers advertise for childcare places in women's homes to encourage women to enter or remain in their company.

Along with 'Family Friendly' policies, childcare was identified as "a cornerstone of future social and economic progress" by the Programme for Prosperity and Fairness (2000: 6). The demand for affordable childcare was reiterated in the focus group discussions, interviews and among some survey respondents. There is growing evidence that Irish companies are recognising the need for childcare support to parents through measures such as: sharing centre-based childcare facilities with other local employers; buying places in existing childcare service; helping to establish a group of local family daycarers (childminders); providing business expertise to help local childcare services improve their quality (e.g. budgeting, personnel policies); creating lists of reliable services available locally and lobbying government for subsidies towards childcare. To date no formal evaluation of such measures has/could be undertaken since most are still in the early or pilot phase.

#### **Other Working Practices**

Apart from the measures outline above a number of additional forms of action have been used by employers:

- Promoting 'quality' part-time employment opportunities e.g. at management level;
- Provision of career guidance/planning to SET and other staff;
- Supporting combinations of flexible working arrangements e.g. career breaks, followed by job-sharing on return to employment; phased retirement through part-time employment; mixed place working (home/workplace);



- Flexible long-term and short-term leave arrangements for carers (of children, the elderly or of people with a disability/illness);
- Recruitment to shorter working hours (e.g. 30-32 per week) for new recruits and phased in, over a period of time, for existing employees;
- Tax/social welfare advice on the implications for individual and dual earners of adoption of these options.

A key success factor in these measures relates to the emphasis on the economic benefits of such initiatives to the employer. Apart from advertising flexible working time and leave arrangements, the results of these initiatives indicate that potential SET staff need to be convinced that well defined career paths exist and that the company is prepared to invest in training/education/development to promote women and men into existing and future posts. This requires a commitment by the company to valuing the staff that avail of such forms of flexible working to eliminate any negative associations with the 'invisible glass ceiling'.

#### 6.4.3 Corporate Culture

A number of contributors to the study, in focus groups, interviews and in the survey of SET employers, pointed to aspects of corporate culture in some SET sectors/companies that could be alienating to women employees. This is particularly the case in engineering where women's representation is lowest, and also in functional areas across SET such as production. Hence a number of companies have introduced measures to address this issue. These include:

- Demonstrated Management Commitment to Equality/Diversity in the workplace
- Managing Diversity
- Networking
- Equality Audit/Reviews

##### ***Demonstrated Management Commitment to Equality/Diversity in the workplace***

A number of companies have recognised the vital importance of senior management commitment to the potential success of any measures that might be introduced. This approach has been emphasised by the social partners and leading companies. An example of this approach can be found in Aer Rianta's stated commitment to achieving equality in a range of areas with a programme of measures (see Case One, Appendix E), aimed at redressing the gender imbalance that existed at management and professional level. Another example can be seen in LOTUS Development Ireland where a similar commitment was signalled in the 'Operating Principles' that underlie the company's core values:

#### **LOTUS Operating Principles**

Commit to excellence  
Insist on integrity  
*Treat people fairly; Value Diversity*  
Communicate openly, honestly, and directly  
Listen with an open mind; Learn from everything  
Take responsibility; Lead by example  
*Respect, trust, and encourage others*  
Encourage risk taking  
Establish purpose before action  
Work as a team  
Have fun.

Such approaches have the advantage of demonstrating that companies are serious about valuing their employees and that they have, or are open to, putting in place mechanisms – policies, procedures and practices – to ensure equality. The value of this approach was

recognised in the WITS Food Industry NOW Project (Case 3) in which no prior EO/Diversity policies existed. As shown in the survey in Section 5, 28 per cent of the SET companies surveyed had adopted some form of equality policy while others are considering or preparing to do so.

### **Managing Diversity**

Creating awareness among staff of gender difference can be important in helping companies to enforce merit-based practice. Diversity programmes have been successfully introduced into Irish companies e.g. Hewlett Packard and in Lotus with their Fair Play Programme. Such programmes help companies to adjust to differing employee needs and to value differences among the SET workforce.

Based on the qualitative findings of this study, there are perceived benefits to be derived from adapting and extending management styles, particularly in technical fields where managers have not been exposed to 'soft' or 'people management' skills during their education/career in SET. Research, development and piloting for the MIDAS Project (Case Four) showed that a range of key competencies are required to manage diversity at senior management level. The competency model that evolved from this study puts a balanced emphasis on demonstrated leadership; strategic vision; change management; people management; developing self and others; commitment to diversity and the business; managing relationships and knowledge of diversity. Among SET professionals, technical competence is assumed, given the education and work experience specifications for such posts. However there would appear to be a gap in relation to management skills. This gap was specifically addressed in relation to women in SET in the food industry (Case Three) where general managerial needs were emphasised.

### **Networking**

Networking among women in SET is seen as one of the most effective methods of supporting women in employment. As stated at the Women in Science conference in Brussels 1999, 'networks of women help, support and empower members in their careers'. They also help inform, encourage and motivate girls and young women to choose scientific subjects. These internal and external networks can provide databases of role models and mentors for individuals and organisations that require them. In Ireland Women into Technology and Science (WITS) was established to encourage more women into SET and to provide a support network through which members would have a framework for interaction and as members of which they could attend public lectures/seminars and conferences. Similar activities are provided by networks outside Ireland including the UK based:

- AWISE Association for Women in Science and Engineering
- EWSF Edinburgh Women's Science Forum
- WES Women's Engineering Society
  - WIC Women into Computing
  - WISE Women into Science and Engineering
  - Women Chemists' Committee of the Royal Society of Chemistry.

SET networks can contribute to reducing the isolation felt by some women in SET employment. They can also encourage women to participate in decision-making processes and in influencing scientific institutions and their corporate cultures. In addition, 'networked' women in SET posts have collectively campaigned to ensure that women have access to, return to and progress within scientific careers, for example by lobbying their employers for family friendly policies. Finally across the EU women in SET have lobbied both nationally and internationally and taken part in policy debates, involving both genders, in order to improve the gender balance in SET research and research policy, as well as the position of women in science and science policy generally. The importance of networks is also acknowledged by the European Commission by an initiative in 1999 to establish links with Europe's existing networks of women scientists. The objectives were to enhance their participation in the 5th Framework Programme and to provide women scientists with information and opportunities to contribute to scientific research.

### **Equality Audit/Reviews**

One mechanism for assessing and monitoring companies is due to be extended into private sector companies by the government, through the Equality Authority, using Equality Review/Audits. Such audits provide the opportunity to have gender equality data analysed impartially by an independent reviewer/auditor and for advice and support to be given on issues aimed at rectifying gender imbalances and improving policies, procedures and practices in relation to achieving equality. The use of Equality Review/Audits can supplement internal auditing, monitoring and review of all gender related statistics. Aer Rianta developed an Equal Opportunities monitoring system in 1995.

## **6.5 Indirect Measures Aimed at Attracting and Retaining Women in SET Occupations.**

### **6.5.1 Introduction**

'Indirect' measures are supporting measures, introduced at sectoral or governmental level aimed at augmenting, promoting and encouraging the adoption of 'good practice' within individual companies. These are dealt with in terms of supports for: recruitment/retention; for women returners to SET and the labour market; and for promoting a more positive environment for SET. In this Section of report, we review the use of such measures to date.

### **6.5.2 Recruitment/Retention Policy Measures**

The type of measures that have been tried to date have been in the following areas:

- Encouraging Women into SET Employment
- Childcare
- Second Chance Entrants
- Promotion of Flexible Family Friendly Work Arrangements

#### **Encouraging Women into SET Employment**

During the 1990s a number of UK companies made a concerted effort to promote women in industry through the Opportunity 2000 initiative. With the support of the UK Department of Trade and Industry, SET companies such as Rank Xerox, GlaxoWellcome, Unilever and Esso UK actively encouraged women into higher level positions in management with a view to improving business competitiveness through the talent and skills of their workforce. This involved encouraging women in to science, engineering and technology occupations.

In addition to emphasising an attractive work environment and career prospects, governments (e.g. Germany) have adopted policies aimed at providing funding to younger/older women who would not otherwise have been able to select/transfer/progress in SET careers. The success of such financial measures (mainly aimed at women into Academe) has been demonstrated through the Daphne Jackson Programme in the UK and HISPII and HISPIII programmes since 1990 in Germany (see below).

The IEI and WITS, together with schools, have successfully piloted a day (7/4/01) to 'Take your Daughters to Work' under the STEPs Initiative to promote SET careers among girls. Imaginative modes of communication that could be developed in this area include:

- Media campaigns
- Open days
- Exhibitions
- Advertisements/media launches
- Web sites

aimed at women's magazines, portraying positive and diverse role models, stressing the positive aspects of SET careers and utilising WITS material on women's achievements in SET.

### **Childcare**

As the survey of companies in Section five shows, SET employers have to date not introduced measures to provide workplace crèches or financial assistance for private/locally based crèches. However, a small number of respondents to the survey, along with focus group discussants and interviewees sought a broader range of childcare supports from their SET employees. Government policy, through the National Childcare Strategy (2000), has sought to expand childcare provision within the formal economy, by offering financial inducements and tax concessions to childcare providers, rather than paying subsidies to users or allowing childcare to be tax deductible. Further support will be available under the National Development Plan to encourage additional childcare facilities through a new Capital Grant Scheme available to independent childcare service providers. In its budget of December 2001, the Government allocated additional resources for child benefit to all parents.

### **Second Chance Entrants**

Given the deficit in women's representation in SET and recent demographic changes in Ireland, there will be a continuing reduction in the number of school-leavers seeking third level places. One growing source of additional undergraduate students is through targeting 'second chance' entrants including women. Many of these require pre-entry bridging courses to facilitate their entry in to SET programmes. According to Scottish experience (Cronin et al. 1999), women are more likely to complete such courses and are more likely to proceed to university than men. It was recognised that students who succeeded on these courses were generally highly motivated, but that female students were more likely to opt for courses leading to health sciences or primary teaching in preference to science. Further inducements, such as bursaries, might be possible to target women into engineering and computer science specifically.

### **Promotion of Flexible Family Friendly Work Arrangements**

Since 1982, Irish Governments have supported 'work sharing' and leave arrangements in the civil and public service, initially as a job shedding measure (Drew 1990). Flexible working arrangements are now recognised as a way of retaining staff particularly now that recruitment is becoming more difficult and the pool of potential and actual applicants is falling. While the Government has been more successful in promoting 'family friendly' measures in the public sphere, the response from private industry has been much slower. From the survey responses there is a signal that companies would welcome support – to motivate and/or reward employers who promote 'work/life balance' through flexible working and leave arrangements.

The Irish Government has already given its support for such measures by making provision for the promotion of family friendly arrangements under the PPF aimed at encouraging employers to provide family/friendly working conditions, particularly for employees with caring responsibilities (male and female). Since companies recognise that there could be a 'cost' in making available flexitime, part-time/job-sharing arrangements, term time working and other family friendly initiatives, support by government and the social partners is considered critical if higher levels of adoption across SET companies is to be achieved.

#### **6.5.3 Targeting Women Returners**

Women who have left the labour market totally for some period of time, often for family-related reasons represent a significant pool of SET skills (most notably in science) in Ireland, according to the Census data presented in Section 2. A number of measures in this area have also been tested in Ireland and/or internationally. These include:

- Recruitment of women returners into SET careers
- Establishment of a Women Returners Network
- Continuing education opportunities for women returners with SET qualifications
- Financial supports for qualified women returners.

#### **Recruitment of Women Returners into SET Careers**

Employers can exert a strong influence on potential job seekers by stressing the range of working conditions that will appeal to them. The survey of SET companies in Section 5 showed that only 10 per cent of employers had targeted recruitment at women who had been outside the labour market. For women who have had only limited or fragmented attachment to employment, some form of transition may be essential. FÁS have recognised this need and responded by running 'Return to Work' courses targeted at women, for several decades. The FÁS Employment Fair in 2001 is an example of such a promotional measure to attract older persons, including women returners back into the labour market.

The Case of Hewlett Packard demonstrates the effectiveness of back-to-work initiatives in that this measure has been used for two programmes of company recruitment and investment in new staff. Depending upon the qualifications held or acquired, these programmes include confidence building and career planning in addition to technical up-skilling and updating.

#### **Establishment of a Women Returners Network**

Key supports have been found to be needed by women returners to assist them in accessing information about job prospects and working arrangements in companies. To assist women in accessing employment and companies seeking female labour, the Women Returners Network (WRN) operates in the UK, in association with the GROW Trust. Since 1992 they have established a database that helps employers to become 'family friendly'. In addition this database assists individuals to answer questions relating to work and training options. Access to the database by potential women returners is via a telephone helpline and also via the WRN website: <http://www.women-returners.co.uk> No such network for returners exists in Ireland.

#### **Continuing Education Opportunities for Women Returners with SET Qualifications**

The Expert Group identified a range of skill shortages and forecast demand for people with higher-level SET qualifications through to post-doctoral level. For women returners to contribute to meeting these skill/qualification demands, supports are required for women who might take time off to study for Degree/Diploma/Masters and/or Doctoral qualifications. Such supports are available to staff in companies such as LOTUS, including company (or joint sponsorship) in the form of grants/reduced rate loans.

#### **Financial Supports for Women Returners**

A positive action measure to help women returners into scientific careers was successfully established in the UK through the Dorothy Hodgkin Fellowship Programme. Though not restricted to women, the programme encourages women to apply and has proved very significant for women scientists. The fellowships offer a salary for four years, research expenses grant, alongside part or full-time appointments and some funds for 'family support' (such as short term childcare) as well as career advice, mentoring and networking opportunities. Also in the UK, the Daphne Jackson Programme assists women seeking to return to a scientific career and is regarded highly as an intervention supporting women (ETAN 2000, DTI/Opportunity 2000 1995).

A similar initiative was introduced in 1990 in Germany under the HSPII Programme (now replaced by HSPIII for 1996-2000). The objective was to design promotion procedures (for doctoral level studies) to suit women's needs, to provide systematic information and to develop specific measures for women scientists (such as those promoting re-entry). The intention was to raise the number of women available at doctoral level to that pertaining among women graduates - c. 40 per cent. In the long term the programme hoped to ensure

that there would be a sufficiently large number of women candidates for academic chairs that became vacant in the 1990s. In 1998, more than 10,000 women scientists received funding under the programme and the "initial effects on appointments can now be seen" (ETAN 2000: 129). There are no more detailed statistics published on this initiative.

The HSPIII programme also provides performance related parameters and has abandoned age limits, introduced of flexible working hours, child care supplements to fellowships, as well as measures to support the re-entry of women into science after a family phase, and contract fellowships, for example to women on parental leave. The HSPIII Programme is seen as the most important mainstreaming action to implement equality in science (ETAN 2000). While filling academic SET chairs by ensuring a better gender balance is not the objective of this study, the principle behind the HSP Programmes is an interesting one that could be replicated in Ireland to meet higher level skill shortages (requiring Masters, Doctoral or Post-Doctoral qualifications in SET fields), identified by the Expert Group.

#### 6.5.4 SET Promotion and Monitoring

In addition to measures aimed at targeting women returners into SET careers, other actions aimed at promoting SET occupations to girls and women have been introduced. These interventions are dealt with under the following headings:

- Awareness Raising
- Data gathering/monitoring
- Representation in SET Decision-Making
- Industry/Education Measures
- Implementing ETAN
- Encouraging Girls into Engineering/Computer science.

##### **Awareness Raising**

The recent launch of the national media campaigns involving the Institute of Engineers Ireland and the Department of Education and Science is an example of a joint initiative between the government and a professional institution. It provides a model for similar campaigns and joint efforts to attract more girls into computing and physics. It is too early at the present time to assess the success of this measure in Ireland.

##### **Data gathering/monitoring**

The importance of collecting and monitoring SET statistics is recognised and promoted by the European Commission. Several projects commenced in 2000, with support by the Commission aimed at mapping existing data on women in scientific employment in the EU Member States and designing and collecting statistical indicators on women in science. In a Council Resolution of May 20 1999 Member States were invited to take action on gender balance in SET and to set up a national Steering Committee to monitor progress at national level, in defining gender(ed) indicators and in the gendering of national statistics. Under the Program for Prosperity and Fairness (PPF), a co-ordinated strategy involving the relevant Government Departments, the Equality Authority and the Central Statistics Office is developing a system for the collection and dissemination of disaggregated statistics on women in the labour market.

##### **Representation in SET Decision-Making**

At EU level, ETAN (2000) has called for: a minimum of 30 per cent of both genders on EU key committees and panels by 2002 and 40 per cent by 2005; gender balance in nominations for EU scientific committees; an increased number of women at grades A1-A3 in the Research Directorate-General; and funding available only for meetings where there are a sufficient number of women speakers. Similar demands and commitments have been made in relation to Irish government agencies/committees, seeking representation of no less than 40 per cent of either gender in the government nominees on such bodies. To date the impact has been extremely uneven and as with data relating to education and the labour market, greater

monitoring of progress towards meeting declared EU and government policy in pursuing gender balance in SET decision making, is required.

#### **Industry/Education Measures**

A major focus of the Expert Group was to extend and expand third level courses to ensure that a pool of science, engineering and computer science graduates would be available to meet demands for SET skills. As the Hewlett Packard and food company cases show, collaboration between industry and the education sector is an effective way of up-skilling the pool of existing employees. The government, through the Department of Education and Science could proactively encourage this co-operation further by allocating further funding to such programmes, with the requirement that not less than 40 per cent of either gender availed of course uptake. In this way, specific skills needs could be addressed while ensuring that the measure would reduce rather than contribute to the under representation of women in SET. A further measure could be to waive fees on graduate SET programmes provided that wo/men were not less than 40 per cent of those taking such courses.

#### **Implementing ETAN**

A key recommendation by the ETAN team (ETAN 2000) was to mainstream gender equality into the Sixth Framework Action Programme and into Member State programmes that fund science and technology. The report also seeks support for female and male scientists, 'one time grants' to provide innovative funding for women, resources for networks and other initiatives. While the main focus of the ETAN report relates to women in academe the report also places a strong emphasis on the need to: eliminate the gender pay gap, monitor and review women's representation in industry, and provide financial incentives for the equality agenda.

#### **Encouraging Girls into Engineering/IT**

Opportunity 2000, since its inception in 1991, sought to improve women's employment opportunities. By 1995 it had 300 organisations signed up, representing 25 per cent of the UK workforce. It extended its agenda beyond employment to working with employers to encourage girls into SET, by school/industry links, providing a mobile technology laboratory, (the WISE Bus), sample engineering courses and conferences aimed at girls. Although driven by industry, the Opportunity 2000 initiative represents a model that could be adapted for Irish conditions with support from the Social Partners and Government.

## **6.6 Conclusions**

This Section has sought to outline the range of measures that have been introduced to date aimed at addressing SET skill shortages and the under-representation of women in SET posts. It has shown that the measures currently being applied are extremely diverse, while some are non-SET sector specific, others are pertinent to SET employers only.

In relation to active *recruitment practices*, there is evidence from the survey and company cases that proactive measures have been tried by some companies and have been deemed potentially useful by others. However, in order to effectively address SET skills shortages and raise the level of women's participation a more concerted and SET – specific approach would appear to be required.

Examples of *targeted recruitment of women returners* are limited among the SET companies surveyed and from interviews conducted for the study. This suggests that employers may not be fully aware of the size and educational calibre of the pool of women with SET qualifications that have exited from the labour market. Support for affirmative action or for campaigns (such as Opportunity 2000) to attract/retain women in SET have not yet been tried in an Irish context. Specific supports for women returners into SET, such as a specific network, a database of 'good practice' companies, 'second chance' educational programmes and

financial supports for women continuing in education, do not as yet exist in Ireland, though such measures have been successfully introduced in other member states.

The review indicates that a wider range of measures aimed at *retention*, rather than recruitment have been tested to date in Irish companies. As the survey of SET companies showed, there is evidence of commitment to the development of existing SET staff among such companies. Measures to link into *educational programmes* at University/Institute of Technology level have been piloted, e.g. under EU supported programmes. Examples of *family friendly practices* are evident: The PPF commitment to developing family friendly practices supports such measures and signals that moves towards *promoting work/life balance* are likely to accelerate and be more widely adopted over the next 12-24 months. Despite the availability of tax incentives to childcare providers, there is no indication that the majority of SET employers have actively sought to provide in-company *childcare* facilities, though there is a shift by some companies towards establishing links with community-based childcare, most notably in the IT/electronics sectors.

Other retention measures, including *gender proofing of selection and promotion procedures* and developing *career planning and mentoring programmes* to assist staff in advancing within companies and initiating changes in the corporate culture, have been tried in a small number of companies. To disseminate the positive experiences of companies a *'good practice' model* is needed to assist other SET employers in the adoption/extension of these practices and in subsequent *benchmarking and auditing*.

In relation to *promotion and monitoring of SET employment* such measures are still at the initial or pilot stages in most EU States. It is envisaged that gendered SET statistics will be available in the future. Representation (at >30 per cent) of women on SET-related decision-making bodies is sought across the EU and has not yet been achieved in Ireland.

There are positive examples of measures to promote *industry/education linkages*, including the Accelerated Technician Programmes though most have not as yet been gender specific. A further recent joint initiative by the Department of Education and Science and the Institute of Engineers Ireland is aimed at *raising the level of female engineers*, by addressing the campaign at schoolgirls.

Overall the review of measures has indicated that a number of measures have been tested in Ireland and elsewhere aimed at encouraging greater recruitment/retention of women into SET employment. However, it has also revealed that such actions to date have been limited in scale and scope and have not as yet been formally evaluated. A concerted and co-ordinated strategy aimed specifically at addressing skill shortages through targeted actions to increase recruitment and retention of women into SET occupations has not yet been developed or implemented in Ireland or indeed elsewhere. Drawing on the limited experience of measures to date, outlined in this section of the report, and on the other findings of the study, we outline the key elements of such a strategy in the final section of the report – Section 7.



## 7. Findings, Conclusions and Recommendations

### 7.1 Introduction

The final section of the report presents the overall findings, conclusions and recommendations arising from the analysis. It reviews the context for the study; that of increasing skill shortages and the growing policy focus on the adoption of specific initiatives aimed at addressing such shortages. Section 7.2 presents the key findings of the report covering forecast skill shortages, the pattern of women's employment in SET, the key factors influencing women's participation in SET occupations, and an outline of the key measures that have been examined, aimed at addressing women's under-representation in SET occupations.

Section 7.3 presents the main conclusions arising from this analysis. In coming to the conclusions the report draws upon the:

- statistical analysis of women's participation in SET occupations and related educational programmes (Section 2);
- review of national and international literature (Section 3);
- views of key stakeholders and of women with SET qualifications (Section 4);
- experience of SET employers (Section 5);
- review of measures to address women's under-representation in SET (Section 6).

Having presented the main conclusions, Section 7.4 outlines our recommendations aimed at developing a strategy and related actions for the recruitment, retention and promotion of women in SET occupations.

### 7.2 Key Findings

#### 7.2.1 The Potential Role of Women in Addressing SET Skill Shortages

Section 1 highlighted the findings from the Expert Group that the most acute SET skill shortages are occurring among engineering/computer professionals and technicians. This indication of excess demand for engineers/computer professionals and technical staff has been reinforced by the survey responses presented in Section 5.

The earlier Sections of this report have also highlighted the continuing, if slowly improving, under-representation of women in SET sectors and occupations. Section 2 specifically showed the relatively high levels of women with science qualifications, compared with very low and moderate levels of women with engineering and computer science qualifications respectively. It also illustrated the degree of segregation in SET occupations where women are more likely to be employed as associate professionals (e.g. as technicians in science and engineering and as IT programmers) than as professionals (engineers, software specialists or managers). This pattern was also clearly discernible in the survey of SET companies.

Section 2 also showed that there are a substantial number of well-qualified women, mainly with science qualifications, who were not in the labour market in 1996 and who could be potential returners to the SET sector.

In considering the type and applicability of measures required to address skill shortages through raising female representation, it is critical to consider each of the three sectors of SET separately. It is in engineering that women form the lowest proportion of professionals and technicians. This minority pattern is replicated among women holding engineering qualifications and in the proportion of female undergraduate places in engineering. Since the pool of women with engineering qualifications in non-SET employment is small, it is unlikely that labour market related measures addressed at women *alone* could have a dramatic or immediate impact on this sector. Rather, shortages in engineering point to the longer-term

need to attract more girls into engineering as a career, and to the need to ensure that women who have studied engineering can access the terms and conditions of employment that will encourage them to remain within the SET sector.

These constraints do not exist in science where there are a substantial number of women with science qualifications not in the labour market, plus an additional pool of qualified women in non-SET employment. This potential labour supply far exceeds the forecast demand for science professionals and technicians envisaged by the Expert Group. This points to the need to explore the possibility of offering re/up-skilling opportunities to such women scientists in areas of identified skill shortages in engineering and computer sciences.

Skill demands in the computer software sector remain high. Employment patterns in Section 2 indicate that a larger number of women than men do not hold third level qualifications. However, the relatively high level of female participation on postgraduate computer science degree courses, suggests an awareness and willingness by women to take up studies in this area. This points to the potential to re-skill/up-skill women with SET qualifications to fill likely skill needs in the computer software area, and possibly also in engineering.

### 7.2.2 Key Factors influencing Women's Participation in SET Occupations

Having identified gender related differences in the participation of women and men in SET, Figure 7.1 presents a summary of the key factors found to influence the existing pattern of women's participation in SET, drawing on all elements of the study. This highlights the need for a comprehensive and coherent range of actions to address identified barriers to women's participation in SET at all levels - educational, entry into employment, and retention and progression within employment.

Figure 7.1 Summary of Key Factors Influencing Women's' Participation in SET Occupations

**Access to Third Level Education**

*Career Choice:* on-going preference for science and computer science over engineering; and

*Cultural:* Sex role stereotyping; Lack of female role models.

**Experience at Third Level Education**

*Curriculum:* Limited or no emphasis in curriculum on 'soft' skills, particularly in engineering;

*Communication Styles:* Gender differences;

*Expectations and Aspirations:* Gender differences; and

*Learning Environment:* Male oriented.

**Entry into Employment**

*Sectoral Differences:* More women employed as scientists and computer scientists than engineers and at technician/computer operator level than as professionals.

*Segregation in the Labour Market:* Women more likely to be employed at lower levels.

**Progression in Employment**

*Career Progression:* Nearly one-quarter of women with science degrees are employed as secondary teachers in 1996 (45 % in 1986)

*Career Planning:* Women may prioritise favourable working conditions (flexible working time and leave arrangements)

*Career expectations:* Women within SET may perceive a 'long haul' and careers that often create difficulties fitted in with women's other life choices;

*Potential Pool of Women Science Graduates:* Mismatch with skill shortages hence up-skilling /conversion by education/accredited training into computer science or specialised engineering niches;

*Potential Pool of Women Engineers or Computer science professionals:* There is no potential pool to fill forecast skill gaps;

*Work Practices:* SET industry perceived to be a non-supportive workplace environment with a lack of family friendly work practices; However the survey indicates a significant minority of SET companies have flexible working options, additional leave arrangements, and that a number have equality policies; and

*Culture:* Corporate culture is perceived to be hostile; with lack of recognition of women's contribution; long-hours culture and lack of mentors and role models.

### 7.2.3 Measures Tested to Address Women's Participation in SET

Section 6 outlined the measures that have been adopted to raise the participation of women and/or at to promote equality of opportunity between women and men in SET employment. A range of such measures have been tested, although not always in Ireland. Neither has their implementation been confined to SET sectors. Rather they represent a range of actions that have the potential to support women in contributing to the alleviation the SET skill shortages.

The type of measures that have been introduced to date are summarised below:

1. Targeted Recruitment of Women with SET qualifications

2. Targeted Retention Practices

- Mentoring Programmes

- Support for Participation of Women in SET Education and Training to up-skill/re-skill or undertake conversion courses.

- Promoting Work/life Balance through:

- Flexible Working and Leave Arrangements
- Childcare
- Other Working Practices.

3. Addressing Corporate Cultures to make companies more women friendly

- Demonstrated Management Commitment to Equality/Diversity in the workplace
- Managing Diversity
- Networking

4. Supporting Sectoral or Government Level Measures aimed at:

- Encouraging SET career choices for girls/women
- Support for work and family balance
- Targeting women returners

5. Non-gender specific measures aimed at meeting SET skill shortages

- Conversion Courses
- Employee up-skilling
- Full-time Education
- Improved Completion Rates
- Recruitment from Abroad
- In-Company Training
- Accelerated Learning Programmes
- Modularisation of Programmes

6. Promotion and monitoring of Women's Participation in SET Careers-including measures aimed at:

- Awareness Raising
- Data gathering/monitoring
- Representation in SET Decision-Making
- Industry/Education Measures
- Implementing ETAN
- Encouraging Girls into Engineering/Computer science.

Overall the review of measures indicated that a number of such measures have been tested in Ireland and elsewhere aimed at encouraging greater recruitment/retention of women into SET employment. However, it has also revealed that such actions to date have been limited in scale and scope and have not as yet been formally evaluated. A concerted and co-ordinated strategy aimed specifically at addressing skill shortages through targeted actions to increase recruitment and retention of women into SET occupations has not yet been developed or implemented in Ireland or indeed elsewhere.

These measures are summarised in Fig. 7.2.

### 7.3 Overall Conclusions

The available statistics indicate a gendered pattern of employment and related qualifications in the SET sector. Women are and continue to be under-represented in the engineering area at all levels. Women have reached a numerical balance in science qualifications and are accessing employment at all levels within the scientific area. In the Computer Software industry a higher proportion of women than men do not have third level qualifications and women are underrepresented at manager and computer analyst level. A significant number of women with science degrees are not currently in SET employment or in the labour market.

This employment pattern has implications for the extent to which, and the specific way in which, women with SET qualifications can address SET skill shortages. In relation to engineering the statistics indicate that there is no current 'pool' of women with engineering qualifications. Increasing women's participation in engineering can only be achieved through longer-term measures aimed at encouraging/ supporting more girls to pursue engineering qualifications at third level. There may also be some scope to convert/up-skill women with other qualifications, including science, into engineers. However, this is likely to require considerable negotiation with the IEI and to have a limited impact in volume terms in the short to medium term.

In relation to the Computer Software area, existing measures aimed at encouraging men and women to convert/up-skill leading to computer software qualifications could be used as a basis for specifically targeting women, either already in the labour market, already in IT at non-graduate level or out of the labour force with/without qualifications. This could best be achieved through the introduction of measures targeted at women and tailored specifically to the needs of these different target groups.

In the science area, there is already a gender balance at undergraduate level. Initiatives however may be required aimed at encouraging more women to:

- a) Access post-graduate qualifications either after graduate level or later.
- b) Remain within the SET sector rather than to progress to other careers or to withdraw from the labour market.

Such measures are likely to require a range of approaches – both directly in terms of the provision of financial resources to support women accessing further education – and indirectly through encouraging employers to adapt the environment within their company, to make it more attractive to the retention and progression of women employees with SET qualifications.

In relation to specific measures, experience to date does not provide a clear basis for an effective strategy or strategies in this area. It does indicate however:

- a) An increasing recognition of the potential of such measures to address skill shortages.
- b) a willingness by employers to test a range of measures aimed at encouraging women with SET qualifications to enter, remain in, or progress within the SET sector.

We would conclude that if such measures are to be developed and utilised in a way that can seriously address skill shortages in SET, a coherent strategy must be developed and implemented. This will require state support to drive the strategy and is most likely in our view to succeed with the backing of Forfás and of the Expert Group on Skill Shortages.

Our detailed recommendations on such a strategy are outlined below.

## 7.4 Recommendations

Building on the findings and conclusions as summarised above, the following section presents the study's recommendations.

The recommendations are presented below in terms of:

- a) Overall strategy.
- b) Specific measures required to implement the strategy.

### 7.4.1 Overall Strategy-A Women in SET Strategy

As referred to above a co-ordinated strategy is required to encourage women to enter, remain and progress within the SET sector. Such a strategy can play an important role in addressing identified skill strategies within this sector.

The Women in SET strategy should bring together a range of complementary measures and related actions covering the following key areas identified in the research:

1. Development of an agreed plan of action to encourage girls/women to pursue/convert to an SET qualification. This to be investigated by Forfás in conjunction with the relevant institutional bodies and third level institutions.
2. Review and development of an agreed range of specific actions to encourage /support women to enter, remain and progress within the SET sector. Such a package of measures could build on the work of the Expert group, bringing a gender focus to their work, and could be piloted in Ireland but with a relevance throughout the EU.
3. Development of a concerted range of supportive actions by government aimed at encouraging women with qualifications to remain within SET industries or to return to such industries. This to be led by Forfás in conjunction with relevant government departments, state agencies educational institutions and the relevant professional bodies. This should build on the type of gender equality measures proposed by the EU and in the National Development Plan (e.g. gender mainstreaming and monitoring, family friendly initiatives etc.)
4. Support for further research aimed at identifying the factors that:
  - influence girls career choices at the present time; and
  - would encourage more women (and men ) to remain within SET industries.

Section 7.4.2 provides details of the specific measures proposed and table 7.1 provides a summary of these recommendations.

### 7.4.2 Detailed Recommendations

#### 1. Agree a Plan of Action to encourage Girls/Women into SET

- *Promotion Campaign for Women into Engineering/Technology*

This would involve a partnership approach between companies, relevant professional bodies and Universities/Institutes of Technology targeted at girls in secondary schools, employed women with SET skills and potential women returners (Section 6.5.2).

- *National Campaign to Raise Entry and Retention Levels of Women in SET*

This would involve an awareness-raising campaign in association with professional bodies such as the Institute of Engineers, Universities/Institutes of Technology, Dept. of

Education, including use of multi media, promotional literature, www sites, SET company/school and third level linkages, open days, talks, videos etc. (Section 6.5.4).

## **2. Develop a Co-ordinated Range of Actions aimed at encouraging Recruitment / Retention/Progression of Women in SET Posts**

- **Target women with SET qualifications into SET industry through recruitment campaigns using:**

- Industry/University /IT linkages,
- www sites, advertising,
- promotional literature

stressing that women are actively sought (Section 6.4.1).

- **Target Development Opportunities for education and accredited training at existing Female staff**

Companies should develop and implement positive action programmes, with external expert support, for existing female staff to enhance their SET skills and qualifications and to correct gender imbalances in SET posts (Section 6.4.2).

- **Support for Up-skilling of Women with SET qualifications**

The Expert Group identified a range of skill shortages and forecast demand for people with higher-level SET qualifications through to post-doctoral level. For women with SET qualifications to contribute to meeting these skill/qualification demands, supports are required for women to upgrade/update their existing skills or to re-skill in other areas of SET.

For women to play a specific role in meeting identified skill shortages in SET, supports will be required for three separate target groups:

- Women with science qualifications that are interested in/have the potential to move into other areas within SET, particularly from Science to Engineering and Computer Software.
- Women working at technician/ computer operator level that are interested in up-skilling to professional level in all three areas of SET
- Women with SET qualifications currently employed in other sectors or not in the labour force.

a) *Women with science qualifications that are interested in /have the potential to move into other areas within SET, particularly from Science to Engineering and Computer Software.*

Entry into engineering, which was identified as experiencing skill shortages among professionals and technicians, is constrained by the requirement that engineering degree programmes must be of four years duration and only in exceptional circumstances will 'Admission with Advanced Standing' be granted to the third year of a four year degree programme. However individuals with an engineering related degree (e.g. in physics or computer science) who can demonstrate that they have acquired the skills and knowledge of a graduate engineer over a minimum of three years working in the industry may be considered for membership of the Institution of Engineers of Ireland (IEI). This is not an easily accessed entry route at the present time. However its potential as a targeted action aimed at encouraging more women into engineering could be pursued with the IEI.



Further opportunities for qualified women graduates are available, and could be extended under the Post-Graduate Skills Conversion Programme which has been running in Irish third level institutions providing student places on Information and Communications Technology (ICT) courses in response to the skill needs identified by the Expert Group. Additional proposals for the inclusion of new IT related courses (hardware, software, IC Design and Multimedia) were sought by the Higher Education Authority under this programme in June 2000. Such programmes should be reviewed with a view to targeting women specifically to pursue such courses through positive action in areas where women are currently under represented.

*b) Women working at technician /computer programmer level that are interested in up-skilling to professional level in all three areas of SET.*

Given the finding that a significant number of women are at technician level in the scientific area and that women are less likely to have a third level qualification if working in computer software, consideration should be given to targeted actions aimed at encouraging more women to progress to higher levels within SET employment. This may require a range of actions including the type of supportive and financial measures outlined below. From both a gender equality and an industrial development perspective we would recommend that Forfás establish a working group, in association with the SET industry, the relevant representational bodies and organisations such as WITS to agree a range of measures aimed at encouraging more women to progress within the SET sector. These recommendations would then be put forward to government to ensure the availability of the necessary funding.

*c) Women with SET qualifications currently employed in other sectors or not in the labour force.*

In addition to the measures outlined above further action should be considered aimed at encouraging women with SET qualifications back into SET employment. A targeted promotional campaign could be undertaken aimed at encouraging such women to re enter and providing specific courses with recognised qualifications aimed at updating their skills after a period of absence from the SET sector. The working group referred to above could also address this issue and put forward workable recommendations to government.

- *Make Available Bursaries/Fellowships and Grants/Loans*

Bursaries/Fellowships and Grants/Loans should be established to encourage women to pursue the type of programmes outlined above. These could be developed in co-operation between the industry, the educational system and other interested parties. (Section 6.5.3).

- *Establish a Women in SET Network*

Modelled on the Women Returners' Network (WRN) UK, a women in SET network should be established, in association with the GROW Trust UK, Social Partners and women's organisations (Section 6.5.3). This network would promote the type of SET opportunities proposed above to the three target groups- women wishing to convert existing SET qualifications into areas of skill needs, women wishing to up-skill from technician to professional level, and women with SET qualifications wishing to re-enter SET employment.

### 3. Development of a Range of Supportive Actions at Company Level

A range of supportive actions aimed at promoting good practice in this area should be adopted by SET employers, with support from the relevant state agencies-particularly at the start up stage. This would include the following:

- *Gender proofing of recruitment, selection and promotion procedures and practices through training of all personnel involved in:*

- advertising,
- short-listing,
- interviewing and
- selection of staff (Section 6.4.1).

- *Promotion of Career Planning for Women in SET to support women's advancement within the company and SET posts by the provision of:*

- mentoring programmes,
- career planning information/courses (Section 6.4.2).

- *Promotion of work/life balance involving the adoption/extension of family-friendly working time:*

- Flexitime
- Job-sharing
- Flexiplace
- Part-time working
- Term-time working

and leave arrangements:

- Career Breaks
- Maternity Leave
- Paternity Leave
- Adoption Leave
- Parental Leave
- Compassionate/Bereavement Leave
- Emergency Leave
- Eldercare Leave
- Care for People with Disabilities
- Sabbatical Leave (Section 6.4.2).

- *Childcare Supports*

Utilising fiscal incentives from the State, employers should consider investing in childcare provision at company and community level and/or pay parental allowances towards childcare costs (Section 6.4.2).

- *Equal Opportunity/Valuing Diversity Policies*

CEOs, or equivalent, should clearly demonstrate a commitment to Equal Opportunity /Valuing Diversity policy and practice. This would involve training of managers/staff to promote understanding and company-wide support, and facilitating networking both internally and externally (e.g. WITS, WISE) (Section 6.4.3).

- **Gender Monitoring/Auditing/Review**

Existing human resource information systems should be adapted to generate regular internal audit reports on women's representation and progression within the company and should be supplemented with external auditing/review to assist companies in identifying gender imbalances and to provide practical suggestions for changes in policies, procedures, practices as well as monitoring of women's progress (Section 6.4.3).

Although these recommendations are aimed at individual companies, the development of a 'Good Practice' Model for SET companies could involve other appropriate groups such as WITS to advise on the detailed dimensions of the Model.

#### 4. Supportive Actions by the State

State agencies can play a key role in getting the above recommendations implemented and particularly in initiating the proposed Women in SET Strategy. They can also provide a number of specific inputs to assist the industry to adopt good practice in this area. This would include:

- *Setting up a Database of 'Good Practice' for SET (and non-SET) companies*

Building on the proposed supportive actions at the company level outlined above, resources should be allocated by Forfás or another relevant agency to develop and promote a good practice model for the SET employers involved. (Section 6.5.3).

- *Ensuring Gender balance in SET Decision Making Bodies/Committees*

Bearing in mind existing Government policy and the recommendations of ETAN, specific action should be taken to ensure that not less than 40 per cent of either women or men are represented on key SET decision-making bodies (Section 6.5.4).

- *Monitoring of National SET Gender-Related Statistics*

Building on the gender statistics database proposed under the PPF and the NDP, women's representation and progression in SET should be monitored: within the secondary and tertiary education, and within and outside the labour market in order to ensure that appropriate action can be taken by the State if the objectives of this study are not being achieved. (Section 6.5.4).

- *A Mainstreaming Gender Equality into SET*

In accordance with ETAN recommendations it is further recommended that the position of women in academe be closely monitored and reviewed in Irish third level institutions (Section 6.5.4).

- *Establishment of a Monitoring Committee to Oversee Women in SET*

In order to ensure that the statistical monitoring recommended above is more than an academic exercise it may be necessary to set up an Expert Committee to monitor and report on the implementation of the Women in SET Strategy and on the achievement of a more equitable gender balance in SET employment (Section 6.5.4).

**5. Research**

Support for further research is required aimed at updating existing research and at identifying the factors that currently:

- influence girls career choices; and
- would encourage more women (and men) to remain within SET industries.

The aim in drawing up these recommendations has been to reinforce the need for a holistic and multi-agency based approach to the issue of women's under-representation in SET, aimed at addressing the current skills shortage in those sectors. Companies can contribute to the dual objectives of raising women's representation and addressing skill shortages, but this requires the support of other agencies at SET sectoral level, of the Social Partners and of key organisations as well as Government support in promoting the widespread adoption of these measures.

A summary of the recommendations is set out in Table 7.2.

Table 7.2 Summary of Recommendations

Recommendation	Target Group	Responsibility for Implementation	Experience to date
<b>1. Education</b>			
<i>Promotion of Women into SET Education</i>	School leavers and Women Returners	SET Companies, HEA, CHUI, HEA, Dept. of E & S Uni/Its/FÁS	Needs to be targeted at skill shortages hence an emphasis on Engineering and IT related courses. Could build upon existing IEI/Dept. of Education and Science Campaign but with a particular emphasis on positive action for women.
<b>2. Recruitment</b>			
<i>Targeted Recruitment into SET –Positive action to encourage girls/women to enter SET occupations in Industry</i>	Women with SET qualifications	SET Companies Dept. E,T & E, Forfás, Social Partners, Uni/Its/FÁS	Piloted in UK under Opportunity 2000 but not developed in SET companies surveyed – though viewed positively as an option.

<b>3.Retention/ Progression/Returners</b>			
<b>Targeted Education/Training and Development</b>	Women in SET and non-SET occupations	SET Companies, Forfás, HEA, CHUI, HEA, Dept. of E & S Uni/lts/FÁS	Piloted by 'Model Employers' Sought by Expert Group on a gender-neutral basis, and implemented by HEA under Post-Graduate Conversion Programme in response to Information and Communications Technology (ICT) Forfás should review the operation of these programmes and advise on their development, with a particular focus on providing conversion, up-skilling and re-skilling for women in three specific groups-those operating at lower levels within the relevant SET sector, those with qualifications wishing to move to other SET sectors with more opportunities, women with SET qualifications not currently in the SET sector.
<b>Provision of Bursaries, Grants etc. specifically targeted at women in areas where they are currently underrepresented</b>	Women wishing/having the potential to, re-skill/up-skill within the SET sector	SET Companies in conjunction with relevant government departments, state agencies, representative bodies	Tested in the UK and Germany and on a non-gender specific basis in Ireland.
<b>Networking</b>	Existing and potential employees	SET companies WITS and international networks	Low cost but highly supportive measure using existing networks for women in SET in Ireland and abroad.
<b>Promote Mentoring/ Career Planning</b>	Female employees in SET	SET Companies With advise from relevant agencies	Piloted by 'Model Employers' SET employers may be less aware of retention issues and need support and 'models' for such a measure.
<b>Gender proofing and monitoring HR practices</b>	Female applicants/recruits/applicants for promotion to/in SET	SET Companies With advise from relevant agencies	Establishment of 'Good Practice' but new in most Irish companies.

<b>Managing Diversity Policies</b>	Employers	SET Companies With advise from relevant agencies	Piloted by 'Model Employers'.
<b>Childcare</b>	Existing and potential employees	SET Companies with state support	Piloted by 'Model Employers' and funding support available under National Development Plan. Involves major infrastructural investment on-site though arrangements with local providers could bridge gap.
<b>Establish Returners Network</b>	Women returners	SET Companies, Forfás, WITS, Social Partners	WRN UK Model is likely to be extended and adapted to an EU Returners Network. Could work in Ireland with institutional support for establishment and maintenance.
<b>4. Supporting Measures</b>			
<b>Establish Database of 'Good Practice' for SET (and non-SET) companies</b>	Women returners and potential SET employees and employers	SET Companies Social Partners Local Employment Service GROW Trust	Modelled on GROW Trust this would require adaptation to Irish conditions and legislation and provide examples of good practice for employers and 'flexible' employers to potential employees/returners.
<b>Gender Balance in SET Decision Making Bodies/Committees</b>	Policy Makers and Women SET Experts	Government Departments State Agencies	Sought under EU and national policy (not less than 40% of either sex) but proving difficult and uneven to implement especially where specific expertise is required.
<b>Monitoring of National SET Gender Statistics</b>	Policy Makers and Women SET Experts	Dept. Eq & LA R CSO	Sought under EU and national policy to provide adequate statistics – in progress and may need to be reviewed to ensure adequate focus on SET.
<b>Mainstreaming Gender Equality into SET</b>	Policy Makers and Women SET Experts Women in SET employment/education	ALL Relevant Departments	Sought under EU and national policy to increase women's representation - in progress and may need to be reviewed to ensure relevance to SET sector.

<b>5. Research</b>			
<i>Carry out research on factors influencing girls career choice at the present time</i>	2nd Level Girls	Forfás, Dept. of E&S	Provide up to date information on how career choices are made by girls leaving school at this time.
<i>Carry out research on factors influencing women in their decision not to remain in SET industry</i>	Women with SET qualifications working or having worked in SET industry	Forfás	Provide up to date information on how career choices are made by women with SET qualifications.



## Bibliography

- Adam, A. (1998), *Artificial Knowing Gender and the Thinking Machine*, Routledge, London.
- Breen, R., (1986) Subject availability and Student Performance in the Senior Cycle of Irish Post-Primary Schools, Dublin: ESRI, Paper 129.
- Broverman, I.K., Vogel, S.R., Broverman, D.M., Clarkson, F.E., and Rosenkrantz, P.S. (1972), 'Sex-role stereotypes: A current appraisal', *Journal of Social Issues*, 28, 2, pp. 59 – 78.
- Brush, S. G. (1991) 'Women in Science and Engineering', *American Scientist*, Vol. 79, pp 404– 419.
- Byrne, E.M., (1993) *Women and Science – The Snark Syndrome*, London: Falmer Press.
- Callan, T. & Farrell, B., (1991) *Women's Participation in the Irish Labour Market*, Dublin: National Economic and Social Council, Report 91.
- Callan, T. and Wren, A. *Male-Female Wage Differentials: Analysis and Policy Issues*, Dublin: ESRI.
- Campbell, G. (1996) 'Bridging the Ethnic and Gender Gaps in Engineering;', *Research Letter*, National Action Council for Minorities in Engineering (NACME), Vol. 6, No. 1, pp. 1-11.
- Carroll, C., (1996) 'Survey and Audit of Equality Practices in the Irish Dairy Industry' Dublin: Employment Equality Agency
- Central Statistics Office (1995) *Census of Population of Ireland 1991, Vol. 7, Occupations*, Dublin: Stationery Office.
- Central Statistics Office, (1995), *Census 1991 Volume 6 Occupations*, Stationery Office, Dublin.
- Central Statistics Office, (1998), *Census 1996 Volume 7 Occupations*, Stationery Office, Dublin.
- Central Statistics Office, (1999), *QNHS, Second Quarter 1999*, CSO: Dublin.
- Central Statistics Office, (2000), *QNHS, Second Quarter 2000*, <http://www.cso.ie>
- Clegg, S., and Trayhurn, D. (1999), 'Gender and Computing: Not the same old problem', *British Educational Research Journal*, Vol. 26, No. 1, 1999.
- Commission of the European Communities, (1999), *Communication from the Commission: "Women and Science" Mobilising Women to Enrich European Research*, Brussels: European Commission.
- Cockburn, C. and Ormrod, S. (1993), *Gender and Technology in the Making*, Sage, London.
- Collin, F. (1998) 'Sharing knowledge to share the world?' *Women and Science Conference Proceedings*, Brussels, April 28 – 29 1998, pp. 39 – 48, Science, Research and Development, Brussels: European Commission.
- Colosimo, A. and Dewandre, N. eds (1999) *Women and Science: Proceedings of the Conference Brussels, April 28-29 1998*, Luxembourg: European Commission.
- Commission of the European Communities, (1996) *Incorporating Equal Opportunities for Women and Men into All Community Policies and Activities*, Brussels.
- Committee on Women in Science, Engineering and Technology, (1994), *The Rising Tide A Report on Women in Science, Engineering and Technology A Report on Women in Science, Engineering and Technology*, HMSO, London.
- Conwell, E. M. (1992) 'Promoting Science and Engineering Careers in Industry', In: *Science and Engineering Programs: On Target for Women? The National Research Council (NRC)*.
- Coughlan, A., (2000) *Family-Friendly/Work-Life Balance Policies*, Dublin: IBEC.
- Cousins, M. (1996) *Pathways to Employment for Women Returning to Paid Work*, Dublin: Employment Equality Agency.
- Cronin, C. and Roger, A. (1999) 'Theorising Progress: Women in Science, Engineering, and Technology in Higher Education', *Journal of Research in Science Teaching*, Vol. 36, No. 6, pp 637 – 661, 1999

- Cronin, C., Foster M., and Lister, E., (1999) 'SET for the Future: working towards inclusive science, engineering and technology curricula in higher education', *Studies in Higher Education*, Volume 24, No. 2, pp. 165 – 182.
- CWSE, (1994) 'Women Scientists and Engineers Employed in Industry: Why So Few?' The Committee on Women in Science and Engineering (CWSE) of the National Research Council, National Academy Press.
- Davis, C. S., Ginorio, A. B., Hollenshead, C. S., Lazarus, B. B., Rayman P. M., (1996) *The Equity Equation - Fostering the Advancement of Women in the Sciences, Mathematics, and Engineering*, San Francisco: Jossey-Bass Publishers.
- Department of Education and Science, (1999), *Statistical Report 1997/98*, Stationery Office: Dublin.
- Department of Social, Community and Family Affairs, (1999) *Report of the P2000 Working Group on Women's Access to Labour Market Opportunities*, Dublin: Stationery Office.
- Department of Trade and Industry (1995), *Making the Most: Women in Science, Engineering and Technology, Building a Workforce for Sustained Competitiveness*, HMSO, London.
- Drew, E. (1990) 'Who Needs Flexibility? Part-time Working...The Irish Experience', Dublin: Employment Equality Agency.
- Edwards, P. (1990) 'The Army and the microworld: computers and the policies of gender identity', *SIGNS: Journal of Women in Culture and Society*, (16), pp. 172 – 197.
- Employment Equality Agency (1996) *Introducing Family-Friendly Initiatives in the Workplace*, Dublin: EEA.
- Employment Equality Agency (1998) *Equality and Diversity in the Workplace, Evaluation Report*, Dublin: Employment Equality Agency.
- EOC (NI), (1999) 'What Science Engenders – Boys, girls and the teaching and learning of primary science' Equal Opportunities Commission: Northern Ireland.
- Erkut, S. (1983). 'Exploring Sex Differences in Expectancy, Attribution, and Academic Achievement', *Sex Roles*, 9, (2), 217-231.
- ETAN Expert Working Group, (2000) *Science Policies in the European Union: Promoting Excellence Through Mainstreaming Gender Equality*, Luxembourg: European Commission.
- European Commission, (2000) *Draft Minutes of the First Meeting of National Civil Servants Women and Science – Helsinki 29-30 December 1999*, Brussels.
- European Council, (1996a), *Draft Council Recommendation on the Balanced Participation of Women and Men in the Decision-Making Process*, Brussels.
- European Council, (1996b), *Draft Council Recommendation on Mainstreaming Equal Opportunities for Men and Women into the European Structural Funds*, Brussels.
- European Network "Women in Decision-Making", (1996), *European Action Plan 1996-2000*, Commission of the European Communities, Brussels.
- Evetts, J. (1996), *Gender and Career in Science and Engineering*, Taylor and Francis, London.
- Expert Group on Future Skills Needs, (1998), *The First Report of the Expert Group on Future Skills Needs*, Forfás: Dublin.
- Expert Group on Future Skills Needs, (2000a), *The Second Report of the Expert Group on Future Skills Needs*, Forfás: Dublin.
- Expert Group on Future Skills Needs, (2000b), *Report on e-Business Skills of the Expert Group on Future Skills Needs*, Forfás: Dublin.
- Expert Working Group on Childcare, (1999) *National Childcare Strategy*, Dublin: Stationery Office.
- Felder, R., Felder, G., Mauney, M., Hamrin, C. and Dietz, J., (1995) 'A Longitudinal Study of Engineering Student Performance and Retention: Gender Differences in Student Performance and Attitudes' *Journal of Engineering Education*, April, pp. 151-163.
- Feldman, S. D. (1974) *Escape from the Doll's House*, New York: McGraw-Hill.

- Gash, V. and O'Connell, P.J., (2000), *The Irish Graduate Market: A Six-year Follow-up Survey of Third Level Graduates from 1992*, ESRI: Dublin.
- Gornik, V. (1981) 'A mind of her own', *In These Times*, 4 – 10 November, pp. 12 – 15.
- Government UK, (1994), *Women in Science, Engineering and Technology: Government Response to the Report, The Rising Tide*, HMSO, London.
- Hall, R.M. and Sandler, B.R. (1984) *Out of the Classroom: a chilly campus climate for women?* Washington DC: Association of American Colleges.
- Hannan et al. (1983), *Schooling and Sex-Roles*, ESRI: Dublin.
- Hannan, D. et al. (1983) 'Schooling and Sex Roles: Sex Differences in Subject Provision and Student Choice in Irish Post-Primary Schools', Dublin: Economic and Social Research Institute.
- Hannan, D., and Boyle, M., (1987) *Schooling Decisions: The Origins and Consequences of Selection and Streaming in Irish Post-Primary Schools*, Dublin: ESRI, Paper 136.
- Hannan, D., Breen, R., Murphy, B., Watson, D., Hardiman, N., and O'Higgins, K. (1983) *Schooling and Sex Roles: Sex Differences in Subject Provision and Student Choice in Irish Post-Primary Schools*, Dublin: ESRI, Paper 113.
- Hannan, D., Smyth, E., McCullagh, J. O'Leary, R. and McMahon, D. (1996) *Coeducation and Gender Equality: Exam Performance, Stress and Personal Development*, Dublin: Oaktree Press.
- Harding, S. and O'Barr, J. (1975), *Sex and Scientific Inquiry*, Chicago: The University of Chicago Press.
- Harman, J. (1999) *Equality and Diversity in the Workplace*, Dublin: Employment Equality Agency and Institute of Personnel Development Ireland.
- Higher Education Authority, (1999) *Student Statistics 1994/5 and 1995/6*, Dublin: HEA.
- Higher Education Authority, (2000), *First Destinations of Awards Recipients in Higher Education (1998)*, Higher Education Authority (HEA): Dublin.
- Hughes, G., McCormick, B. and Sexton J.J., (2000), *FÁS/ESRI Manpower Forecasting Studies: Occupational Employment Forecasts 2005*, FÁS/ESRI: Dublin.
- Humphreys, P., Drew, E., and Murphy, C. (1999) 'Gender Equality in the Civil Service', Dublin: Institute of Public Administration.
- Humphreys, P., Fleming, S. and O'Donnell, O. (2000) *Flexible Working in the Public Service*, Dublin: Institute of Public Administration.
- Institution of Engineers of Ireland, (2000) *Solving the Shortage of Engineers Problem: Submission to Government*, Dublin.
- IPCMF/IBEC (2000), *Educating a Skilled Workforce*, IPCMF: Dublin.
- Irish Times*, 'Hundreds of primary teachers unqualified' (2000) *The Irish Times*, Monday, September 4, 2000.
- Isis Research Group, (1999) *New Mothers at Work – Identifying the needs of new mothers in the workplace*, Dublin: Employment Equality Agency.
- Johnson, J., McKeown, E., Cowan, P., McClune, B., and McEwen A., (1999) *What Science Engenders: Boys, Girls and the Teaching and Learning of Primary Science*, Belfast: Equal Opportunities Commission.
- Joint Committee on Education and Science on Science and Technology (JOC) (2000), *First Draft Report of the Joint Committee on Education and Science on Science and Technology*, Houses of the Oireachtas, Dublin: Stationary office.
- Kahle, J.B. (Ed), *Women in Science*, London: Falmer Press.
- Keller, E. F. and Longino, H. E. eds. (1996), *Feminism and Science*, Oxford University Press, Oxford.
- Kirkup, G., Janes, L., Woodward, K. and Hovenden, F. eds. (2000), *The Gendered Cyborg*, Routledge, London.

- Kramarae, C. (1988) *Technology and Women's Voices*, London: Routledge and Kegan Paul.
- Lane, N. J., (1997) 'Women in Science, Engineering and Technology: The Rising Tide REport and Beyond' in Maynard, M. *Science and the Construction of Women*, UCL, London.
- Lykke, N. and Braidotti, R. eds. (1996), *Between Monsters Goddesses and Cyborgs: Feminist Confrontations with Science, Medicine and Cyberspace*, Zed, London.
- Mahony, K. & Van Toen, B. (1990) 'Mathematical formalism as a means of occupational closure in computing – why 'hard' computing tends to exclude women', *Gender and Education*, (2), pp. 319 – 331.
- Matyas, M.L., (1985a) 'Factors Affecting Female Achievement and Interest in Science and in Scientific Career', in: Kahle, J.B. (Ed), *Women in Science*, London: Falmer Press.
- Matyas, M.L., (1985b) 'Obstacles and Constraints on Women in Science', in: Kahle, J.B. (Ed), *Women in Science*, London: Falmer Press.
- Maynard, M. ed. , *Science and the Construction of Women*, University College, London.
- McCaffrey, M. and Underwood, G. (1990) 'Gender differences in a co-operative computer-based language task', *Educational Research*, 32 (1), spring, pp. 44 – 49.
- MIT, (1999) *A Study on the Status of Women Faculty in Science at MIT*, Mass: Massachusetts Institute of Technology.
- Monitoring Committee, *First Progress Report on the Implementation of the Recommendations of the Second Commission on the Status of Women*, Stationery Office, Dublin, 1994.
- Monitoring Committee, *Second Progress Report on the Implementation of the Recommendations of the Second Commission on the Status of Women*, Stationery Office, Dublin, 1996.
- Monitoring Committee, *Third Progress Report on the Implementation of the Recommendations of the Second Commission on the Status of Women*, Stationery Office, Dublin, 1999.
- Mulhern, F., Morgan, V. and Rae, G. (1996) *Girls, Boys and Exam Results: A Northern Ireland Perspective*, Belfast: Equal Opportunities Commission.
- National Competitiveness Council, (2000), *Statement on Labour Supply and Skills*, Forfás: Dublin.
- National Research Council (NRC) (1982) *Summary Report 1981 Doctorate Recipients from United States Universities*, Washington, DC: National Academy Press.
- Nolan, W. (1999), *The Irish Pharmaceutical and Chemical Manufacturers Federation (IPCMF) Survey on Expenditure and Human Resources*, IPCMF/IBEC: Dublin.
- Opportunity 2000/Department of Trade and Industry (1995) *Making the Most: Women in Science, Engineering and Technology*, London: HMSO.
- Organisation for Economic Co-operation and Development (OECD) (1997) *Education at a Glance*, Paris: OECD.
- Power, C. (2000) *Science Education in Crisis*, Dublin: RDS and Esat Telecom.
- Preston, A.E. (1994) 'Why Have All the Women Gone?' A study of xxxx of women form science and engineering professions" *The American Economic Review* 84(5) 1446.
- Purcell, K., Hogarth, T and Simm, C. (1999) *Whose Flexibility? The Costs and Benefits of 'Non-Standard' Working Arrangements and Contractual Relations*, York: Joseph Rowntree Foundation.
- Radford, J. ed. (1998) *Gender and Choice in Education and Occupation*, London: Routledge.
- Rees, T., (1992), *Women and the Labour Market*, London: Routledge.
- Remick, H. and Miller, K. (1978) 'Participation rates in high schools mathematics and science courses,' *The Physics Teacher*, May, pp. 280 – 282.
- Rose, H. *Love, Power and Knowledge: Towards a Feminist Transformation of the Sciences*, Polity, London, 1994.
- Rosser, S. V. (1993) 'Female-Friendly Science: Including Women in Curricular Content and Pedagogy in Science', *The Journal of General Education*, Vol. 42, No. 3, pp 191– 220.

- Ruane, F. P. and Sutherland J.M. (1999), Women in the Labour Force, Employment Equality Agency, Dublin.
- Schiebinger, L. (1999), Has Feminism Changed Science?, Harvard University, Cambridge Mass.
- Second Commission on the Status of Women (1993), Report to the Taoiseach, Dublin: Stationery Office.
- Siann, G. (1997) 'We can, we don't want to: factors influencing women's participation in computing', in: Lander R. and Adam A. (Eds) Women in Computing, Exeter: Intellect Books.
- Spertus, E. (1991), Why are There so Few Female Computer Scientists?, Unpublished Report, 1991.
- Stage, E (1992) 'Interventions Defined, Implemented, and Evaluated', In: Science and Engineering Programs: On Target for Women? USA: The National Research Council (NRC).
- Stolte-Heiskanen, V. et al. Ed. Women in Science: Token Women or Gender Equality, International Social Science Council, New York, 1991.
- The Economist, (1992) 'Women in management: The Spare Sex', The Economist, 28<sup>th</sup> March.
- The Industrial Society, (2000) Mothers versus Men, Why women lose at work, London: Industrial Society.
- UNCSTD, (1995) 'Missing Links: Gender Equity in Science and Technology for Development', Gender Working Group, UN Commission on Science and Technology for Development (UNCSTD).
- UNESCO, (1995) The Scientific Education of Girls: Education Beyond Reproach, London: UNESCO/FNCU.
- Vockell, E.L and Lobonc, S. (1981), 'Sex-role stereotyping by high school females in science', Journal of Research in Science Teaching, 18, pp. 209 – 219.
- Weedon, K. (2000) 'Is there a flexi-glass ceiling?' San Francisco Work/Life Conference 2000-08-30.
- Wennerås, C., and Wold, A., (1998) 'Sexism in evaluation of women scientists', Women and Science Conference Proceedings, Brussels, April 28 – 29 1998, Science, Research and Development, European Commission, pp. 39 – 48.
- Wickham, J. and Murray, P. (1987) 'Women in the Irish Electronics Industry', Dublin: Employment Equality Agency.
- Women in Technology and Science (WITS), Submission to the Science Technology and Innovation Council, WITS, Dublin.
- Women's Unit, (2000) Women's income over the lifetime, Women's Unit, Cabinet office, London: HMSO.
- Working Group on Childcare Facilities for Working Parents, (1994), Report to the Minister for Equality and Law Reform, Dublin: Stationery Office.

**Appendix A**

**Tables relating to Chapter 2**

**Table 1 Specific SET Occupations according to Gender in 1986 and 1991**

Specific Occupations	1986			1991		
	Number Male	Number Female	Female % of Total	Number Male	Number Female	Female % of Total
Physical Scientists	1,016	219	18 %	1,304	587	31 %
Physical Science Technicians	2,861	2,457	46 %	3,871	1,273	25 %
Engineers	5,707	137	2 %	7,463	609	8 %
Technologists	249	12	5 %	247	29	11 %
Biological Scientists	33	13	28 %	49	31	39 %
Other Life Scientists	1,541	372	19 %	1,723	448	21 %
Life Sciences Technicians	306	280	48 %	1,603	1,718	52 %
System Analyst/Programmers	2,776	1,091	28 %	5,548	2,146	28 %
Computer Operators	988	2,952	75 %	1,681	3,684	69 %

Source: Central Statistics Office 1995

**Table 2a Gender and Regional Distribution of Scientific and Technical Workers 1996**

Region	No. of Women	No. of Men	Total	% of Women
Dublin	2,623	10,246	12,869	20 %
Border	540	1,903	2,443	22 %
Mid-East	591	2,906	3,497	17 %
Midlands	287	1,067	1,354	21 %
Mid-West	587	2,797	3,384	17 %
South-East	521	2,146	2,667	20 %
South-West	1,161	4,846	6,007	19 %
West	709	2,389	3,098	12 %
<b>Total</b>	<b>7,019</b>	<b>28,300</b>	<b>35,319</b>	<b>20 %</b>

Source: Census of Population, Vol. 7, Occupations, 1998

**Table 2b Gender and Regional Distribution of Computer Software Workers 1996**

Region	No. of Women	No. of Men	Total	% of Women
Dublin	3,991	7,483	11,474	35 %
Border	321	432	753	43 %
Mid-East	655	1,243	1,898	35 %
Midlands	202	265	467	43 %
Mid-West	517	735	1,252	41 %
South-East	337	479	816	41 %
South-West	740	1,125	1,865	40 %
West	409	664	1,073	38 %
<b>Total</b>	<b>7,172</b>	<b>12,426</b>	<b>19,598</b>	<b>37 %</b>

Source: Census of Population, Vol. 7, Occupations, 1998

**Table 3 SET Workers according to Gender and Age Group 1996**

Age Group	No. Women	No. Men	Total	% Female
<b>SCIENTIFIC &amp; TECHNICAL</b>				
15-19	38	175	213	18 %
20-24	1,585	4,170	5,755	28 %
25-34	3,544	10,402	13,946	15 %
35-44	1,327	7,472	8,799	18 %
45-54	409	4,162	4,571	9 %
55-64	102	1,748	1,850	6 %
65+	14	171	185	8 %
<b>Total</b>	<b>7,019</b>	<b>28,300</b>	<b>35,319</b>	<b>20 %</b>
<b>COMPUTER SOFTWARE</b>				
15-19	157	145	302	52 %
20-24	1,610	2,343	3,953	41 %
25-34	3,385	5,877	9,262	37 %
35-44	1,427	2,746	4,173	34 %
45-54	484	1,056	1,540	31 %
55-64	101	248	349	29 %
65+	8	11	19	42 %
<b>Total</b>	<b>7,172</b>	<b>12,426</b>	<b>19,598</b>	<b>37 %</b>

Source: Census of Population, Vol. 7, Occupations, 1998

**Table 4 SET Workers according to Level of Education 1996**

<b>Age Group</b>	<b>No. Women</b>	<b>No. Men</b>	<b>Total</b>	<b>% Female</b>
<b>SCIENTIFIC &amp; TECHNICAL</b>				
Primary	16	123	139	12 %
Lower Secondary	65	491	556	12 %
Upper Secondary	688	3,801	4,489	15 %
Certificate/Diploma	2,474	9,383	11,857	21 %
Degree or higher	3,694	14,070	17,764	21 %
Not stated	82	432	514	16 %
<b>Total</b>	<b>7,019</b>	<b>28,300</b>	<b>35,319</b>	<b>20 %</b>
<b>COMPUTER SOFTWARE</b>				
Primary	109	105	214	51 %
Lower Secondary	689	424	1,113	62 %
Upper Secondary	2,468	2,552	5,020	49 %
Certificate/Diploma	1,626	3,190	4,816	34 %
Degree or higher	2,210	6,041	8,251	27 %
Not stated	70	114	184	38 %
<b>Total</b>	<b>7,172</b>	<b>12,426</b>	<b>19,598</b>	<b>37 %</b>

Source: Census of Population, Vol. 7, Occupations, 1998

**Table 5 Specific Occupations held by Wo/Men aged 15 years and over with SET Qualifications in 1986.**

<b>Engineering Qualification</b>	<b>No. Men</b>	<b>% of Men</b>	<b>No. Women</b>	<b>% of Females</b>
Occupation				
Service/Commerce/Clerical	386	4 %	18	4 %
Admin, Exec., Manager	1062	10 %	19	4 %
University Lecturer	489	5 %	21	5 %
Teacher	98	1 %	11	3 %
Engineer	4,745	46 %	122	30 %
Scientist	191	2 %	6	2 %
Other	3363	32 %	213	52 %
<b>TOTAL</b>	<b>10,334</b>	<b>100 %</b>	<b>410</b>	<b>100 %</b>
<b>Science Qualification (inc. Computer Science)</b>				
Occupation				
Service/Commerce/Clerical	544	8 %	259	7 %
Admin, Exec., Manager	975	14 %	96	3 %
University Lecturer	841	12 %	216	6 %
Teacher	1,697	24 %	1,564	45 %
Engineer	22	0 %	4	0 %
Scientist	931	13 %	357	10 %
Other	2086	29 %	1,018	29 %
<b>TOTAL</b>	<b>7,096</b>	<b>100 %</b>	<b>3,514</b>	<b>100 %</b>

Source: CSO, Census of Population 1986, Vol. 8, Education, Scientific and Technological Qualifications, Table 23,



Table 6a Fe/Male UG Representation in SET University Courses in 1999

University	University			Science	Engineering	
	No. Female	No. Male	% Female	No. Female	No. Male	% Female
UCD	886	671	57 %	251	771	25 %
UCC	694	447	61 %	116	465	20 %
NUIG	866	616	58 %	107	561	16 %
TCD	852	581	60 %	190	574	25 %
NUIM	543	408	57 %	na	na	na
DCU	383	351	52 %	63	381	14 %
UL	286	315	48 %	151	1019	13 %
Total	4510	3,389	57 %	878	3,771	19 %

Table 6b Fe/Male UG Representation in SET University Courses in 1999

University	Computing and IT		
	No. Female	No. Male	% Female
UCD	na	na	na
UCC	106	275	28 %
NUIG	58	93	38 %
TCD	168	370	31 %
NUIM	22	50	31 %
DCU	170	397	30 %
UL	280	718	28 %
Total	804	1,903	30 %

Source: Unpublished Data, Department of Education and Science (2000)

Table 7a Fe/Male Postgraduate Representation in SET Studies in 1999

University	Science			Engineering		
	No. Female	No. Male	% Female	No. Female	No. Male	% Female
UCD	197	194	50 %	25	119	17 %
UCC	158	190	45 %	14	60	19 %
NUIG	158	134	54 %	27	83	25 %
TCD	208	245	46 %	33	101	25 %
NUIM	44	58	43 %	na	na	na
DCU	71	114	38 %	8	65	11 %
UL	51	38	57 %	24	80	23 %
<b>Total</b>	<b>887</b>	<b>973</b>	<b>48 %</b>	<b>131</b>	<b>508</b>	<b>21 %</b>

Table 7b Fe/Male Postgraduate Representation in SET Studies in 1999

University	Computing and IT		
	No. Female	No. Male	% Female
UCD	39	33	54 %
UCC	88	103	46 %
NUIG	54	65	45 %
TCD	48	112	30 %
NUIM	53	72	42 %
DCU	42	91	32 %
UL	99	155	39 %
<b>Total</b>	<b>423</b>	<b>631</b>	<b>40 %</b>

Source: Unpublished Data, Department of Education and Science (2000)

**Table 8 Female Representation on SET UG Courses in IT in 1999**

	No. Female	No. Male	Total	% Female
Civil Engineering	35	411	446	8 %
Mechanical	22	292	314	7 %
Electrical/Electronic	76	790	866	9 %
Other Engineering	30	266	296	10 %
Science	1,124	726	1,850	61 %
IT	1,204	1,105	2,309	52 %
<b>Total</b>	<b>2,491</b>	<b>3,590</b>	<b>6,081</b>	<b>41 %</b>

Source: Unpublished Data, Department of Education and Science (2000)

**Table 9 Fe/Male Representation in SET UG Courses in ITs by Award in 1999\***

	First Year		Second Year		Third Year		Fourth Year	
	Degree	Cert/ Diploma	Degree	Cert/ Diploma	Degree	Cert/ Diploma	Degree	Cert/ Diploma
Engineering	186 (35)	533 (51)	152 (19)	288 (24)	178 (10)	227 (12)	195 (12)	0 (0)
Science	74 (99)	183 (318)	75 (98)	113 (177)	82 (113)	95 (128)	89 (147)	15 (44)
IT	77 (48)	410 (563)	47 (31)	250 (325)	80 (30)	156 (144)	59 (30)	0 (0)

\*Female students in each cell in brackets

Source: Unpublished Data, Department of Education and Science (2000)

**Table 10 SET Subject Choice in Leaving Certificate by Girls/Boys in 1997/98**

<b>Subject</b>	<b>No. Girls</b>	<b>No. Boys</b>	<b>Total</b>	<b>Girls as % of Total</b>
<b>Maths</b>	63,503	59,903	123,406	51.5 %
<b>Applied Maths</b>	373	1,867	2,240	16.7 %
<b>Physics</b>	4,990	14,681	19,671	25.4 %
<b>Chemistry</b>	7,349	6,942	14,291	51.4 %
<b>Physics and Chemistry</b>	814	1,882	2,696	30.3 %
<b>Agricultural Science</b>	958	5,191	6,149	15.6 %
<b>Biology</b>	39,726	20,805	60,531	65.6 %
<b>Engineering</b>	625	11,520	12,145	5.4 %
<b>Technical Drawing</b>	1,112	15,631	16,743	6.6 %
<b>Computer Studies</b>	19,099	14,200	33,299	57.4 %
<b>Total LC Students</b>	<b>63,838</b>	<b>60,118</b>	<b>123,956</b>	<b>51.5 %</b>

Source: Unpublished Data, Department of Education and Science (1999)

**Table 11 Proportion of Girls Achieving Leaving Certificate Grades**

	<b>Grade Achievement</b>						
	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>	<b>E</b>	<b>F</b>	<b>No Grade</b>
<b>Mathematics</b>	58.4 %	53.4 %	50.6 %	47.1 %	45.0 %	40.7 %	27.2 %
<b>Science</b>	43.4 %	41.0 %	40.6 %	39.3 %	31.4 %	24.9 %	11.1 %
<b>Technology</b>	50.0 %	37.2 %	33.3 %	31.7 %	29.7 %	29.8 %	44.4 %

Source: Department of Education and Science (2000)

## Appendix B

### List of Interviewees

Una Halligan, Hewlett Packard  
Vera Mortell, Golden Vale  
Claire O'Malley, Lotus  
Mark Kelly, IBEC  
Mary Kelly, National Women's Council of Ireland  
John Hayden, Higher Education Authority  
Matt Moran, Pharmaceuticals Section, IBEC  
Mary Beggan, FAS  
Daniel Hickey, ISME  
Brian Merriman, Equality Authority  
Marie Mulholland, Equality Authority  
John Dolan, Dept. of Education and Science  
Sheila Flannery ex-Aer Rianta, Irish Productivity Centre  
Pat Delaney, Small Firms Association, IBEC  
Kathleen Quinlan, Enterprise Ireland  
Clare O'Connor, UCD, MSF, WITS  
Dick Kavanagh, Industry Research and Development Group, IBEC

## Appendix C

### List of Focus Group Participants

#### Focus Group 1

Helen Hughes, National Road Authority/WITS  
Jane Grimson, Dept. of Computer Science, TCD/IEI  
Margaret Magee ESB International  
Mary Mulvihill, Journalist  
Una Parsons Consultant  
Jane Eustace, Quality Assurance Tester  
Emma O'Sullivan, Junior Interactive Media Developer  
Geraldine Cahillane, Biochemist in Clinical Research  
Leonora Bishop, Biotrin  
Rita Dempsey, Dept. of Biology, NUI, Maynooth

#### Focus Group 2

Sheila Willis, State Forensic Laboratory  
Alva DeVoy, KBC (Finance)  
Linda Doyle, Dept. of Engineering, TCD  
Joan Garahy, Goodbody Stockbrokers  
Naimh Harty Consultant CAD  
Aoife Foley ESB International  
Carol O'Sullivan, Dept. of Computer Science, TCD  
Ena Walsh, Health and Life Science Consultancy  
Theresa Hogan, TCD/Career Break

## Appendix D

### Science, Engineering and Technology (SET) Skills Survey

#### Company Profile

Q.1 What is the title of the individual completing the questionnaire? (TICK ONE ONLY)

- <sub>1</sub> Chief Executive  
<sub>2</sub> HRM/Personnel Manager  
<sub>3</sub> Operations Manager  
<sub>4</sub> Financial Controller  
<sub>5</sub> Other \_\_\_\_\_ (PLEASE SPECIFY)

Q.2 What sector does the company operate in? (TICK ONE ONLY)

- <sub>1</sub> Food, Drink, Tobacco  
<sub>2</sub> Chemical/ Pharmaceuticals/ Healthcare  
<sub>3</sub> Textiles  
<sub>4</sub> Engineering (including electronics, mechanical etc.)  
<sub>5</sub> IT and Internationally traded services (including Information & Communication Technology)  
<sub>6</sub> Other \_\_\_\_\_ (PLEASE SPECIFY)

Q.3 Which of the following best describes your company? (TICK ONE ONLY)

- <sub>1</sub> Irish owned private company  
<sub>2</sub> Irish owned public company  
<sub>3</sub> Subsidiary of overseas company  
<sub>4</sub> International franchise in Ireland  
<sub>5</sub> Semi-state  
<sub>6</sub> Co-operative  
<sub>7</sub> Other \_\_\_\_\_ (PLEASE SPECIFY)

Q.4 Please tick the locations of any R&D operations carried out by your company:  
(TICK AS MANY BOXES AS NECESSARY)

- <sub>1</sub> Ireland <sub>2</sub> EU <sub>3</sub> Non-EU

Q.5 How many people does your company employ in total in the Rep. of Ireland? (TICK ONE ONLY)

- <sub>1</sub> 1 - 19 <sub>2</sub> 20 - 99 <sub>2</sub> 100 - 499 <sub>4</sub> 500 +

#### Current Science, Engineering and Technology (SET) Skills Profile

Q.6 Are you completing this questionnaire for your *entire company* <sub>1</sub> OR a *specific plant*? <sub>2</sub>

If plant only, how many people in total are employed in this plant?

How many people (in total) has your company/plant recruited for SET posts in the *last year* in all its branches in the Republic of Ireland? (See Question 7 for categories of SET posts): 1

Of these recruits, what number (approx.) had achieved each of the following levels of education?

Certificate:  Diploma:  Degree:  Postgraduate:

Q.7 Please indicate in **COLUMNS A AND B** in the Table below, the number of men **AND** the number of women currently employed for each SET category. Please enter the number of vacancies for each category, if any, in **Column C**. Please indicate in **Column D** the estimated total number of SET staff you expect your company to employ, by category, in *12 months time*.

VACANCIES ARE DEFINED AS UNMET DEMAND FOR LABOUR WHERE THE POSTS ARE CURRENTLY UNOCCUPIED, AVAILABLE IMMEDIATELY AND WHERE THE COMPANY IS SEARCHING FOR WORKERS.

	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>
<b>Occupational Categories</b>	<b>Total Male Staff</b>	<b>Total Female Staff</b>	<b>Total Current Vacancies</b>	<b>Estimated Total staff in 12 months time</b>
<b>1. Managers/Proprietors</b> e.g. production, R & D, computer systems				
<b>2. Engineering professionals</b> e.g. electrical / electronic/ chemical				
<b>3. Engineering Technicians</b> e.g. electrical/electronic, plastics				
<b>4. Science Professionals</b> e.g. physicist, chemist, biologist				
<b>5. Science Technicians</b> e.g. R & D, lab technicians				
<b>6. Computer Professionals</b> e.g. graduate software engineers				
<b>7. Computer Technicians</b> e.g. programmers, systems analysts, technical support				
<b>8. Supervisors of science / technology /engineering staff</b>				
<b>9. Other</b>				

If you completed the 'Other' category, please describe the post(s) to which it applied:

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Q.8 Is your company/plant currently experiencing any difficulties in relation to SET staff in the following areas: (TICK ANY APPROPRIATE BOX)

<sub>1</sub> Recruitment      <sub>2</sub> Retention      <sub>3</sub> Promotion



Q.9 Of the 8 SET occupations defined in Q7, please rank the categories for which vacancies are most difficult to fill (TO A MAXIMUM OF 3 CATEGORIES, '1.' BEING THE CATEGORY WHOSE VACANCIES ARE THE MOST DIFFICULT TO FILL).

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_

Q.10 What method(s) of recruitment are you using to fill your current SET vacancies?  
PLEASE TICK ALL THAT APPLY:

- |  |  |
|--|--|
| <input type="checkbox"/> <b>1</b> Adverts in national/local papers<br><input type="checkbox"/> <b>2</b> Adverts in trade/specialist journals<br><input type="checkbox"/> <b>3</b> State agencies (e.g. FÁS)<br><input type="checkbox"/> <b>4</b> Internet website(s) | <input type="checkbox"/> <b>5</b> Private agencies<br><input type="checkbox"/> <b>6</b> Personal contacts<br><input type="checkbox"/> <b>7</b> Graduate milk round<br><input type="checkbox"/> <b>8</b> Other method |
|--|--|

IF YOU TICKED 'OTHER METHOD', PLEASE SPECIFY: \_\_\_\_\_

Q.11 What locations has your company/plant used to recruit SET staff, for posts that exist in Ireland, in the last 12 months? (TICK AS MANY BOXES AS NECESSARY):

- 1** Ireland   
  **2** EU   
  **3** Non-EU

Q.12 Please assess the importance of the following factors in filling your company/plant's SET vacancies:

(CIRCLE ONE ONLY FOR EACH LINE)

*5 = very important to 1 = unimportant*

Availability of applicants with the right practical skills	5	4	3	2	1
Availability of applicants with the right qualifications	5	4	3	2	1
Availability of applicants with the right experience	5	4	3	2	1
Competition from other employers	5	4	3	2	1
Long hours	5	4	3	2	1
Wage levels	5	4	3	2	1
Conditions of employment	5	4	3	2	1
Career progression	5	4	3	2	1
Childcare facilities	5	4	3	2	1
Other reason	5	4	3	2	1

PLEASE SPECIFY: \_\_\_\_\_

Q.13 If you indicated in Q.8 that you have difficulties in retaining SET staff, please rank the categories for which staff are most difficult to retain (TO A MAXIMUM OF 3 CATEGORIES, '1.' BEING THE CATEGORY WHOSE STAFF ARE THE MOST DIFFICULT TO RETAIN).

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_

Q.14 Please assess the importance of the following factors affecting retention of SET staff:  
(CIRCLE ONE ONLY FOR EACH LINE)  
5 = very important to 1 = unimportant

Wage Levels	5	4	3	2	1
Conditions of employment	5	4	3	2	1
Career progression	5	4	3	2	1
Competition from other employers	5	4	3	2	1
Long hours	5	4	3	2	1
Childcare facilities	5	4	3	2	1
Other reason	5	4	3	2	1

PLEASE SPECIFY: \_\_\_\_\_

Q.15 Compared with one year ago, would you say that your company/plant's SET skill shortages are:

- 1 Decreasing**     
  **2 Static**     
  **3 Increasing**

Please give reasons for your answer:

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Q.16 Has there been any discernible rise in the number of women or men applying for, or recruited into, SET posts, in the last 12 months? (TICK ANY APPROPRIATE BOX)

- |              |                                       |                                      |  |
|--------------|---------------------------------------|--------------------------------------|--|
|              | Men                                   |                                      | Women  |
| Applications | <input type="checkbox"/> <b>1 Yes</b> | <input type="checkbox"/> <b>2 No</b> | <input type="checkbox"/> <b>3 Yes</b> <input type="checkbox"/> <b>4 No</b> |
| Recruitments | <input type="checkbox"/> <b>5 Yes</b> | <input type="checkbox"/> <b>6 No</b> | <input type="checkbox"/> <b>7 Yes</b> <input type="checkbox"/> <b>8 No</b> |

If you ticked any box, what would you see as the reasons for this increase/ these increases?

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### Strategies to Fill SET Posts

Q.17 Has your company/plant used any of the following strategies to attract and retain women in SET posts? If yes, please indicate the effectiveness of each strategy you have used by CIRCLING ONE NUMBER only. **NOTE:** 5 = VERY EFFECTIVE TO 1 = INEFFECTIVE

(a) Transfer of women currently employed in non-SET posts by your company into SET posts:

- 1 Yes**                     
  **2 No**

EFFECTIVENESS RATING:                      5      4      3      2      1

(b) Targeted recruitment of women recruits via Universities/ Institutes of Technology

- 1 Yes**                     
  **2 No**

EFFECTIVENESS RATING:                      5      4      3      2      1

(c) In-company training offered to women to enable them to compete for higher level SET posts

<sub>1</sub> Yes <sub>2</sub> No

EFFECTIVENESS RATING:            5      4      3      2      1

(d) Work experience for women to enable them to compete for higher level SET posts

<sub>1</sub> Yes <sub>2</sub> No

EFFECTIVENESS RATING:            5      4      3      2      1

(e) Actively seeking and attracting experienced women from other similar organisations or industries

<sub>1</sub> Yes <sub>2</sub> No

EFFECTIVENESS RATING:            5      4      3      2      1

(f) Targeted recruitment of SET qualified and/or experienced women who have been out of the labour market

<sub>1</sub> Yes <sub>2</sub> No

EFFECTIVENESS RATING            5      4      3      2      1

Q.18

Please tick which, if any, flexible work options below are provided in your company/plant for SET staff:  
(TICK AS MANY BOXES AS NECESSARY)

- Flexitime <sub>1</sub>
- Job-sharing <sub>2</sub>
- Part-time working <sub>3</sub>
- Term time working <sub>4</sub>
- Flexiplace (e.g. teleworking) <sub>5</sub>
- Special shifts <sub>6</sub>
- Other <sub>7</sub>

PLEASE SPECIFY: \_\_\_\_\_

Q.19 Please tick which, if any, leave arrangements below are provided in your company/plant for SET staff: (TICK AS MANY BOXES AS NECESSARY)

- Career breaks <sub>1</sub>
- Sabbatical leave <sub>2</sub>
- Extra maternity leave (paid) <sub>3</sub>
- Extra maternity leave (unpaid) <sub>4</sub>
- Paternity leave <sub>5</sub>
- Extra parental leave (paid) <sub>6</sub>

Extra parental leave (unpaid) <sub>7</sub>

Emergency leave <sub>8</sub>

Other <sub>9</sub>

PLEASE SPECIFY: \_\_\_\_\_

Q.20 Does your company/plant provide support for childcare for SET staff?

<sub>1</sub>

Yes

<sub>2</sub> No

If 'Yes', what form does this support take? (TICK AS MANY BOXES AS NECESSARY)

In company crèche <sub>1</sub>

Subsidised Local area crèche <sub>2</sub>

Financial Assistance <sub>3</sub>

Other <sub>4</sub>

PLEASE SPECIFY: \_\_\_\_\_

Q.21 Does your company/plant encourage SET staff to undertake further education, training and/or development?

<sub>1</sub> Yes

<sub>2</sub> No

If Yes, are the following forms of support available to men and women SET staff?  
(TICK AS MANY BOXES AS NECESSARY)

	<i>Men</i>	<i>Women</i>
Payment/refund of fees	<input type="checkbox"/> <sub>1</sub>	<input type="checkbox"/> <sub>1</sub>
Time off for study	<input type="checkbox"/> <sub>2</sub>	<input type="checkbox"/> <sub>2</sub>
Time off for examinations	<input type="checkbox"/> <sub>3</sub>	<input type="checkbox"/> <sub>3</sub>
In-company training	<input type="checkbox"/> <sub>4</sub>	<input type="checkbox"/> <sub>4</sub>
Personal Development Programmes	<input type="checkbox"/> <sub>5</sub>	<input type="checkbox"/> <sub>5</sub>
Mentoring programmes	<input type="checkbox"/> <sub>6</sub>	<input type="checkbox"/> <sub>6</sub>
Networking	<input type="checkbox"/> <sub>7</sub>	<input type="checkbox"/> <sub>7</sub>
Other	<input type="checkbox"/> <sub>8</sub>	<input type="checkbox"/> <sub>8</sub>

PLEASE SPECIFY: \_\_\_\_\_

Q.22 Has your company/plant adopted a formally stated and agreed Equality/ Diversity Policy?

<sub>1</sub> Yes

<sub>2</sub> No

If 'Yes', what initiatives have been taken in relation to supporting gender equality in SET posts?

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Q.23 Has your company/plant adopted a policy to combat sexual harassment/bullying at work?

<sub>1</sub> Yes

<sub>2</sub> No

Q.24 In response to skill shortages, due to difficulties either/both in recruitment or retention of SET staff, would your company/plant consider any of the following strategies to combat existing and/or future shortages: (TICK AS MANY BOXES AS NECESSARY)

Targeted recruitment of women into SET posts

<sub>1</sub>

Training specifically offered to women in SET posts

<sub>2</sub>

Creation of career paths for women in SET posts

<sub>3</sub>

Upgrading of predominantly female SET posts

<sub>4</sub>

Provision of Childcare Facilities

<sub>5</sub>

Other

<sub>6</sub>

PLEASE SPECIFY: \_\_\_\_\_

Q.25 What impact do you think strategies to attract/retain women in SET posts in your company/plant can have on the alleviation of current skill shortages? (TICK ONE BOX ONLY)

Can contribute a lot <sub>1</sub>

Can contribute to some extent <sub>2</sub>

Can only contribute a little <sub>3</sub>

Cannot contribute at all <sub>4</sub>

Please give reasons for your answer

\_\_\_\_\_

\_\_\_\_\_

Q.26 Do you consider that new policy initiatives are required at government or EU level to encourage greater participation by women in SET posts?

Government level <sub>1</sub> Yes

<sub>2</sub> No

EU level

<sub>3</sub> Yes

<sub>4</sub> No

If you ticked 'Yes' to any of the above, please describe the policy initiatives you would like to see implemented:

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**Thank you for your time.**

## Appendix E

### Company Cases

According to Conwell  successful intervention programs within industry (1992) have one or more of the following characteristics:

- High-level support, up to and including the CEO level; (e.g. Case One)
- Mentoring initiatives that are institutionalised and continuing; (e.g. Case One/Two)
- Internal women's self-help and networking group; (e.g. Case One)
- A corporate culture that permits job options such as flexitime, part-time working, job sharing, and work at home; (e.g. Case One/Two/Three)
- Efforts to create gender sensitivity in the workplace, training programs on diversity and gender-related issues, and making managers accountable for these; (e.g. Case One/Two/Three)
- Programme evaluations that keep data on recruitment and retention rates, and attitudes of women toward their work. (e.g. Case One)

Sample successful programs are described below. These cases are from contrasting sectors: airport management (Aer Rianta) and IT/Electronics (Hewlett Packard), three indigenous food sector companies (Golden Vale, Greencore, Kerry Group) and An Post. Each of these employers have been faced with the imperative to engage and retain the highest calibre staff. In the interests of brevity and utility the case studies are presented as short illustrative 'cameos' of the uptake/implementation of measures proposed by this project.

### Case One Aer Rianta – The Irish Airport Authority

#### **“Achieving equality in employment between women and men and to increase the visibility of women in decision making”**

In 1997 women were 31 % of the total (1,800) workforce compared with 27 % in 1982. There were recognisable problems of under- representation of women in traditional male areas: management, airport fire/police, craft trades, professionals (e.g. engineers, architects), operatives and technical/supervisory positions. Conversely women were over-represented in: clerical, retailing, catering and cleaning posts.

Aer Rianta's awareness of Equal Opportunity issues can be traced back to the then Assistant Chief Executive of Administration and Personnel, Derek Keogh's commitment to action "we are not long fingering the problem by treating it as something which will have to wait until the world changes...We are going to.....take action within our own sphere". To this end an Affirmative Action Co-ordinator was appointed in 1982 on a contract basis. The Affirmative Action Programme identified barriers to the advancement of some employees, especially female employees, and concentrated on attitudinal change, training, examination of procedures and statistical analysis of staff information.

The aims of the measures introduced by Aer Rianta were: better deployment of human resources using the fullest pool of staff with the required competencies; to demonstrate to other employers the benefits of investing in their female staff; and to establish a corporate culture in which employees can expect to be valued and developed to their fullest potential.

- Equal Opportunity Policy
- Affirmative Action Programmes (Personal Development, Secretaries/PAs)
- Family Friendly Policies and Practices (Flexitime, job-sharing, career breaks,
- Anticipatory Leave, Maternity/Paternity Leave, Teleworking
- Corporate Values supporting a 'people orientation'
- Selection and Promotion Procedures targeting gender imbalances
- Mentoring for Women
- Dublin Airport Workplace Nursery
- After School Care
- Women's Networking Programme
- Women in Management Programme
- Sexual Harassment Policy and Anti-Bullying Programme

Case Two HEWLETT-PACKARD  
"Attracting Women into the Technology Industry"

**WORK LIFE**

HP has developed options and made provisions that can better allow its employees to achieve a degree of harmony between work and family life. Over the past five years, these options have been increased and improved as needs have changed. Each year, as part of HP's Business Initiatives, Work Life Harmony is allocated to a Senior Manager to sponsor. This Manager then works with a team of people to review current strategies and propose any changes that are required due to new legislation, changing needs of employees and the changing demands of our businesses.

*Childcare*

HP has an agreement with a local Crèche to hold a number of places for HP employees. Several surveys have been conducted and results found that most employees preferred to seek childcare close to their homes as opposed to close to their work place.

The original Strategy was titled Work Life Balance. This title was changed in 1998 to Work Life Harmony as it was decided that 'harmony' reflected the art of 'combining' rather than separating. In the summer of 2000, a Strategy Team was formed to look at Work Life Harmony at HP. This group was made up of Managers of different functions within the Company, including HR, Production and Infrastructure departments. Their function was to look at the current vision of Work Life Harmony at HP, review current policies and introduce and update new policies. The following is from a document detailing options available in HP today in relation to flexibility in the workplace.

**Work Life Vision:**

'An environment that encourages employees and managers to work together to achieve common company objectives for business success, while creating opportunities for balancing work with other life activities'

*Create, promote and support more flexible work options/practice*

1. Personal Leave of Absence Policy
2. Variable Work Schedule
3. Part-time Working
4. Job-Sharing
5. Shift Work Options

Personal Leave of Absence Policy allows leave of between 6 weeks and one year for people to deal with domestic personal issues that may arise. The policy has recently been extended to allow leave for employees who wish to take time out to travel. This is available for a maximum of 3 months. This is included in our Exceptional Leave Policy, which provides for the following, other types of Leave

*Variable Work Schedule*

By using Performance Management processes and by having clearly defined objectives, this allows employees autonomy in managing their work and some flexibility about how they achieve their tasks:

- 39 hour week, however there is flexibility to work a shorter day, one day per week, by adjusting the other days
- In the event that an employee works hours in excess of 39 hours, they can take a day off, once per month with Supervisor/Manager approval
- Flexible Start Times



- Working at home
- Time in Lieu
- Part-time working
- Job-sharing
- Shift work options

**Development and Continuing Education**

We have operated two main Back-to-Work Programmes to encourage women back into the workplace. The main Programmes are: NOW, SURP (continuing Education Programme) allows for funding of programmes where employees wish to undertake a formally recognised qualification. In 1999, 22 per cent of our Ink-Jet Business Staff undertook formal education, funded by HP. Of these, 60 per cent took Certificate level, 20 per cent Diploma, 12 per cent Degree and 8 per cent Masters level Education. These courses chosen broke down as 38 per cent in Technical/Engineering, 19 per cent in IT, 38 per cent in Business areas and 5 per cent in the area of Quality Assurance

**Case Three**  
**WITS Food Industry NOW Project**  
**Golden Vale, Greencore, Kerry Group Plcs.**  
**“Equal Opportunities for Sustained Development in the Food Industry”**

Conscious of the lack of data on women working in private industry and coinciding with the commencement of an equality audit of the Irish dairy industry by the then Employment Equality Agency WITS (Women in Technology and Science) identified career development as a critical issue for many of its existing and potential members. WITS decided to establish a consortium of companies to address the issue. A consortium of companies and WITS applied for funding under the EU NOW (New Opportunities for Women) Initiative and was successful in two successive applications covering the period 1995 to 2000. Project partners

The project was jointly promoted by WITS, and three of Ireland's largest food companies, Golden Vale Plc, Greencore Group Plc and Kerry Group Plc, employing over 10,000 staff in Ireland, of whom approximately 200 were women in science and technology. The Irish Food industry was chosen for a number of reasons including;

- It is Ireland's largest indigenous industry, thereby allowing us to pilot initiatives that could then be replicated and transferred to other indigenous industries
- It is a scientific and technological industry, and the majority of its senior managers have an SET background.

The companies recognised that women comprised 50 per cent of the graduate pool from which they recruited potential senior managers. Their experience was these women were not progressing as fast as men through the company structures and they wanted to ensure that they fully tapped the talent of any individual recruited. In this way the companies saw the project as a way of maximising the potential of their female professional recruits.

### **Project Aims and Objectives**

The fundamental objective of the project was to increase the participation of women scientists and technologists in management and decision-making in the participating companies through:

Management Development training for women in the target group

Increasing awareness of equality issues within the company structures. As the project progressed, it became apparent it was imperative to first lay down fundamental equal opportunities / diversity policies and procedures, which would benefit all staff. The main reasons for this were

In the absence of a formal Equal Opportunities / Diversity (EO/D) strategy, initiatives relating only to women in science and technology risked operating in a vacuum, and potentially being discontinued after the end of the project.

The companies, and their staff were more comfortable with an inclusive equal opportunities / diversity strategy, than one which targeted a specific subgroup (women SET) in isolation.

The Employment Equality Act 1998 was a key driver for the companies to implement best practice in the area.

For the final two years of the project, the emphasis was on EO/D policy development and training of managers in practical EO/D skills. The programme of Management Development training for women continued, but was opened to women from all disciplines.

### **Project Actions**

#### **Management Development for Women**

Working with UCC and UL, the project team devised a Diploma in Management for women working in the Food Industry. The main features of the programme were:

- Coursework;
- In Company Mentoring Scheme;
- Completion of in-company project.

Three courses were run, with over 50 participants. The first programme was confined to women scientists and technologists. Subsequent programmes involved women from other disciplines - notably finance and administration, however at least half the participants were always from an SET background. The reasons for broadening the base of participants was:

- To increase the pool of;
- To increase the number of women in management as a whole;
- Inclusiveness; and
- Company Impact.

*Key outcomes of the programme were:*

- Significant personal and career development for the participants;
- It highlighted the issue of management development for women within the company;
- It produced potential role models for the future;
- Through mentoring and in-company projects it enabled senior managers to observe the high skills of the participants, and also to understand some of the issues facing them; and
- The programme was highly regarded in the companies.

#### **Equal Opportunities / Diversity policy development and Training**

At the start of the project, none of the participating companies had any formal EO/D policies in place or on the agenda. Without such structures and systems in place, it was not possible to create a culture where staff were recruited, selected and promoted objectively on merit as opposed to through an "old boys" network. The project worked with senior management, especially in the HR Departments to draw up such policies, and to ensure that managers had the skills required to implement them. This involved establishing project teams in each company, who undertook to draft policies in the areas of:

- Equal Opportunities / Diversity in general;
- Dignity at work - combating harassment and bullying;
- Fair recruitment and selection;
- Appraisal;
- Training and Development; and
- Work / Life balance.

This led to each company producing an integrated strategy for managing diversity, and its inclusion in the mainstream of company practice. Following negotiation and acceptance of these policies, the next step was training for managers. This combined awareness training, with the development of skills such as fair interviewing, dealing with complaints of harassment and bullying etc. Over 300 managers received formal training.

The outcomes of this strand of the project were:

- Publication and wide circulation of diversity oriented policies and procedures;

- Increased awareness throughout the companies of the importance of objective systems of people management, and some reduction in perceptions of only certain posts as being "suitable jobs for a woman";
- Increased skills base throughout the companies in implementing the new policies, particularly in recruitment and dignity at work; and
- Initiation of a number of flexible work options, and standardisation of such options throughout each individual company.

**Impact of the project on Women in SET**

The overall impact of the project on women in SET was extremely positive. Recruitment of women to traditionally "male" jobs increased, and women were promoted into more senior roles. Because of its initial focus on women in SET, the Diploma was constantly seen as the "WITS course" which kept the issue of women in SET to the forefront. Having set in place EO/D structures which impact on all staff, the way is now clear for further initiatives which target specific areas where women are underrepresented such as SET and senior management.

**Case Four AN POST**

**“Seeking Competitive Advantage through Diversity Management”**

The MIDAS Project was funded under the EU ADAPT Human Resource Initiative and is promoted by An Post in collaboration with a consortium representing: An Post, IBM (supplier), Dept. of Social, Community and Family Affairs (Corporate customer), IBEC and ICT (employer body and trade union representative), Údarás na Gaeltachta (Regional State Agency) and University College Dublin (educational institute).

The overall aim of the MIDAS project was to identify strategies that contribute to competitive advantage through valuing and managing diversity in a consortia of organisations.

The MIDAS Project competency model identified the following underlying competencies of managing diversity at senior management level:

- Demonstrated leadership;
- Change management
- Strategic vision;
- People management
- Developing self and others
- Commitment to diversity and the business
- Managing relationships
- Knowledge of diversity.

A crucial contribution to this MIDAS Project was in mentoring - seen as one of the most powerful developmental approaches available to individuals and organizations.

**Case Five      Microsoft European Product Development Centre**

**“Equality and Diversity in the Workplace”**

The NOW Project (1996-98) jointly sponsored by the Employment Equality agency and the Institute of Personnel and Development in Ireland worked with First Active and Microsoft to:

- implement best equality and diversity practice;
- develop a model of best equality and diversity practice which would be transferable to other organisations.

It was recognised that the benefits to organisations implementing equality and diversity include:

1. The potential to recruit employees from diverse backgrounds
2. Retention of effective employees
3. Diverse contributions from employees
4. The development of a positive working environment
5. Improved understanding of customer needs
6. Compliance with equality legislation

The measures undertaken under the auspices of this programme related to:

1. Equality/Diversity audits
2. Recruitment and selection
3. Staff development
4. Dignity and respect at work
5. Work/life balance
6. Equality and diversity policies
7. Positive action
8. Equality/Diversity training initiative
9. Implementing Equality and Diversity initiatives

(Fisher 1998)