SKILLS FOR THE INFORMATION AGE

SECOND REPORT FROM THE INFORMATION TECHNOLOGY, COMMUNICATIONS AND ELECTRONICS SKILLS STRATEGY GROUP

# **Introduction**

1. We have been asked by the Secretaries of State for Education and Employment and Trade and Industry to develop a national strategy to meet the skill needs of the Information Technology, Communications and Electronics and (ITCE) sector. This work forms part of the remit of the National Skills Task Force in helping to develop a National Skills Agenda and the work of the Information Age Partnership in preparing for the Information Age.

2. This report offers a snapshot of the Group’s developing work programme and identifies a number of areas that it is addressing as a priority***.***  We would like to give partner organisations (TECs, NTOs, employer organisations, professional bodies, HE institutions) an opportunity to comment in time for any feedback to be taken into account in the production of our final report. (Details of where to send comments are provided at the end of this report.)

**Summary**

3. We have identified 5 main themes which will be needed to underpin any national strategy. This report sets out the work we have done to date on each of these themes. It sets out the evidence, as we currently understand it, some preliminary recommendations and issues we propose to consider in the next few months.

**i) An assessment of the skill needs of the ITCE industry**

A better understanding is needed of the skills needed in ITCE jobs now and in the future, so that education and training providers can make better decisions when planning relevant provision and individuals can make better choices about ITCE careers. Our aim is to produce a non-technical assessment of skill needs which places these needs in the context of the general labour market and education and training provision. It will highlight the demand and supply of various ITCE skills and the extent and reasons for skill gaps and shortages.

**ii) A National Skills Framework**

The lack of an agreed and consistent framework for describing the skill needs of the sector is a major problem. We wish to build on work done by AISS - the Alliance for Information Systems Skills - to establish a clear framework which describes the skills and key competences required for different ITCE jobs, the ladder for career progression and the qualifications and training required. Subject to agreement, final recommendations here may include the establishment and maintenance of a single framework for all ITCE-sector relevant occupations.

**iii) The education and training infrastructure**

There are a number of issues here. We would like to know why a large proportion of graduates in IT-related subjects do not go into IT practitioner jobs. We believe there is scope for greater employer involvement in curriculum development in order to ensure that graduates acquire the skills employers need. We also believe that there are far too many different types of IT qualification below degree level currently being offered. We are working with QCA to identify a way forward on this and expect to recommend an extensive simplification of the system.

**iv) Professional and sector bodies**

There are currently 6 NTOs, 4 professional bodies, plus a wide variety of trade associations and other organisations seeking to represent specific sectors of the industry. We have commissioned work to review the roles of these bodies. Our aim is to ensure that there is the capacity within the sector to assess future skill needs and deliver initiatives which make a real impact in meeting skill needs.

**v) Improving the image of the sector**

It is widely perceived by those involved in the ITCE industry that it has a poor image as a career. It appears to be particularly unattractive to women. We believe the problems in attracting young people and women into the industry could be tackled through better careers information and systems to disseminate that information, and we will be making recommendations accordingly.

**Definitions**

4. We have taken as our focus the skills needs for specialist ITCE workers, sometimes called practitioners (in terms of IT if not electronics and communications). That is those responsible for designing, developing and manufacturing ITCE hardware and software, those who run and manage its operation, and those responsible for providing the services needed to implement, exploit and maintain it. We have not looked at the skills needed by the general workforce to enable them to use ITCE (predominantly IT) equipment. The National Skills Task Force has looked at the need for these “IT literacy” skills in its Second Report which was published on 27 May 1999.

5. Estimates vary but it is clear that less than 50% of specialist ITCE workers are currently employed in what can be defined as the ITCE sector (manufacturing or service providers). The remainder are employed in a wide range of “user” sectors with concentrations in finance, transport and distribution and government. Our remit has been to look at the needs of the ITCE sector, but in practice we believe that a full picture can only be obtained by looking at the needs of the relevant occupations across the economy as a whole. The information in this paper is based on this wider conception.

6. The Group takes very seriously its remit to look at the collective skills needed in ITCE occupations. We are well aware of the converging software based technologies in IT, electronics and communications that mean a blurring of the traditional skillsets needed for ITCE jobs. It is our intention to investigate how this can be disentangled to enable a better description of the skills needed across and within ITCE jobs. However, we are in the early stages of our work and the information we have available tends to be segmented into IT, electronics and communications. The focus of this report is mainly on IT skills. A separate report has already been prepared on the electronics sector. This is not to suggest that we believe that the skills needed in IT jobs, in electronics jobs and in communications jobs can be seen as distinct. Our final report in the autumn will look across all three elements of the ITCE sector.

**Our Vision**

7. This sector is an important component of national economic growth in its own right. In 1996 the ITCE sector as a whole had a turnover of £92.4 billion with an added value of £42.7 billion. This equates to 6.5% of UK GDP and with recent typical turnover growth rates of around 10% per annum we can expect this to grow. ONS figures show that since 1996 the software and services industry has increased its turnover by 60%. In addition the sector provides key enabling technologies which are vital to almost all other parts of the economy and on which they depend for their competitive edge, indeed survival – hence the widespread demand for ITCE skills through the economy.

8. For example, growing access to and use of the Internet is beginning to change the way business is conducted, not just through e-mail but also through purchasing on the web, supply chain management and integrated order management. Together with other technologies, ITCE is becoming the economy’s major driver. These powerful forces will result in the emergence of a true Information Age.

9. A national strategy must deliver the skills that the country needs to ensure that we make the most of these new technologies in generating wealth and employment. We think the best approach is through making the education and training market and labour market work better, and in particular to work better together, and by having a base of skills which can be built on quickly in response to changes in demand. However, we are also convinced of the need to have the capacity to draw out the implications of changes in technology and other factors for the likely future demand for skills and to make this information widely available to all those concerned with education and training.

# **The Nature of the Problem - IT Skill Needs, Shortages & Gaps**

10. Employment of IT practitioners is difficult to estimate. The Labour Force Survey suggests that the UK currently has just over 750,000 people employed in these occupations in 1998. Other analyses suggest the LFS under-estimates the numbers employed (as it excludes some categories of IT workers) and that employment exceeds 1 million. All sources show recent substantial growth in employment in IT practitioners averaging well over 10% per annum between 1996 and 1998.

11. Many expect employment levels to continue to grow at similar rates into the early years of the next millennium. One analysis suggests that by 2006 the total number employed will be in the region of 1,600,000. However, the current level of extraordinary employment growth is being fuelled by growing use of the Internet and Intranets, and, in the short term, Economic and Monetary Union and the Year 2000 date change problem. Employment growth levels may subside once work on these latter two business needs have been completed. Nevertheless employment growth is still expected to be very buoyant as activity is then expected to focus on projects which have been crowded out by the Year 2000 remedial work.

12. The flow of people from the education and training system with IT qualifications is substantial and growing. In 1996/97, 8,600 students graduated from higher education with a degree in IT or related subjects. This was a 300% increase on 10 years previously. However, we have some concerns about the future quality of people working in the sector. As IT systems become increasingly complex the sector needs to attract and compete for the top end of the ability range of entrants. The number of applications to Electronic Engineering has fallen by 11% this year compared to a rise of over 20% for Computer Science and other IT-related degrees, which admit students with A level grades 15% lower than the average for all subjects. It is essential to increase the numbers and quality of students on IT courses who are suitable for, and choose to enter, employment in the industry. We also wish to look at ways of increasing the flow of people qualified to NVQ level 3 and above entering the sector, through enhancing provision in FE and Modern Apprenticeships.

13. The “Skills 99” report\* shows that a key source of recruitment to the sector is graduates from non-IT courses. Many employers actively seek a mixed intake, using employability, interpersonal skills and aptitude as the critical elements of the recruitment decision. Nearly two-thirds of graduates working as IT practitioners do not have IT-related degrees, and this proportion is increasing. This makes “conversion courses” and other induction training for those coming into the sector extremely important.

14. There has been a significant, but variable, response from the private sector to deal with the current shortfall in IT skills. For example, Logica have entered into a joint venture with the University of East London to offer short training to people with no experience of basic IBM mainframe skills. They expect to recruit up to 100 people a year through the scheme. The Spring Group are running a training programme which was originally intended to train 2,000 people as IT specialists. It has attracted a very high level of interest (over 22,000 applicants) but has had to be slowed down because employers are reluctant to take on staff with only 3-4 months experience. 170 people were recruited and trained in the first year. Many companies have continued to recruit non-IT graduates and put them through their own IT training programmes, and employers such as IBM have made a substantial contribution to alleviating the shortage of IT skills by in-house training and offering training courses to customers.

15. The US has helped to address IT shortages by extending the visas of international students who take degrees in US universities. Arrangements in the UK are different - work permits are issued for skilled people to do a specific job on the basis of an application from their employer. Where the employer is unable to recruit a suitably qualified resident worker a permit will normally be issued. We understand that in recent years over 3000 work permits were issued each year to IT personnel. Where an identified skills shortage exists an application for an overseas graduate with specialist skills will be given sympathetic consideration.

16. We believe that structural change in the ways businesses operate and use ITCE equipment is a more important driver in the demand for ITCE skills, particularly in the software and services industry, than short term cyclical movements in the economy. The table below shows how the real output of the software and services sector, while not immune to the economic cycle, has continued to grow despite periods of negative economic growth.

**Table: Output of the Software and Services Sector**

|  |  |
| --- | --- |
|  | **Real output % growth year on year** |
|  | Software & Services | GDP |
| 1987 | 2.0 | 4.2 |
| 1988 | 11.3 | 4.9 |
| 1989 | 12.9 | 1.8 |
| 1990 | 9.0 | 0.3 |
| 1991 | 5.2 | -1.9 |
| 1992 | 9.7 | -0.3 |
| 1993 | 4.0 | 2.0 |
| 1994 | 15.9 | 4.0 |
| 1995 | 14.3 | 2.4 |
| 1996 | 16.1 | 2.2 |
| 1997 | 16.5 | 3.1 |
| 1998 | 18.0 (est) | 2.8 |

 *Source: Office for National Statistics*

17. Not all jobs in IT have grown and there have been some marked differences in the rate of growth between particular jobs. Recent years have seen a fall in the number of operator jobs consistent with the shift to automated operation and the increased use of computers by non-specialists. There has been a small increase in the numbers employed as managers and (hardware) engineers. Over 60% of the recent substantial increase in employment of IT practitioners has been in software engineer and analyst/programmer jobs. This reflects business needs to install new (e.g. network) systems (fuelled by economic growth and the spread of Internet technologies) and to prepare existing systems or develop new systems for the Year 2000 date change and launch of EMU.

***\*Skills 99 - Report to the Department of Trade and Industry by AISS and IT NTO***

18. In line with this the numbers of IT practitioners employed in the IT services sector has increased by around 65% between 1996 and 1998 while IT employment in financial and other business services has increased by a third. Employment growth in other sectors of the economy (manufacturing, transport and distribution, government etc) has been much more modest.

# **Progress and study required**

**Issue: To understand better the skills needed in ITCE jobs now and in the future so that education and training providers can make better decisions when planning relevant provision and individuals can make better choices about ITCE careers.**

19. It is difficult to translate the employment trends set out above into a coherent understanding of the skills needed in ITCE jobs and whether these skill needs are being met. Much of the research we have seen suggests that there are genuine skill shortages as defined by the National Skills Task Force in its First Report ie “shortages in the accessible labour market of the type of skill being sought and which leads to a difficulty in recruitment”. Many surveys of IT jobs, in particular, suggest that recruitment and retention problems have become increasingly acute over the past 2 years. Press reports continue to show the growth in earnings for skilled professionals in ITCE jobs to be well above the national average. The New Earnings Survey showed an increase of 9.7% for the software and services industry between April 1997 and April 1998.

20. The NCC annual survey of Salaries and Staff Issues reported in 1999 that perceived skill shortages for most types of staff had increased with problems seen as worsening most sharply for technical support and network staff and system developers. We have commissioned further work to clarify our understanding of the skill problems affecting the IT sector. This will build on the large volume of material already available on this issue including the summary of evidence available in “*Skills 99*”, and will include consultation with representative bodies and key players from the ITCE industry. The aim is to produce a non-technical assessment of skill needs which places these needs in the context of the general labour market and education and training provision. Important questions that this assessment will address are:

1. What are the skills needed in the ITCE sector? In what volume? To what extent are skills sets inter-changeable?
2. Will these skill needs be met? If not why not?

21. We will include these findings in our final report in the summer. We will also be looking at longer term arrangements for assessing future skill needs. What is needed is a sustained capacity to look ahead at the likely technologies in a rapidly changing sector and to infer what the skill requirements might be. We accept however that in such a rapidly changing environment it will not be easy to make accurate predictions, and that it will be equally important to ensure that skilled staff have the broader base of skills they need to be able to adapt to changing requirements.

**Issue: To put in place a clear framework which describes the skills and key competences required for different ITCE jobs, the ladder for career progression and the qualifications and training required.**

22. The lack of an agreed and consistent framework for describing the skill needs of the sector is a major problem. Without such a framework much of what is said about the skill needs of the sector refers to particular languages or software packages rather than the associated skills. We firmly believe that the skill needs of the sector can only be tackled once such a framework is in place.

23. We have been impressed by the work undertaken by the Alliance for Information Systems Skills (AISS) – a coalition of twenty or so NTOs, Trade Associations and professional bodies – to develop a clear framework which describes the skills and key competences required for different jobs, the ladder for career progression and the qualifications and training required. We believe that this work should be supported as a priority as the lack of such a framework undermines the effectiveness of many of the useful skills initiatives taken by others in the sector. We have commissioned a study which seeks to extend this framework to encompass services, telecommunications, electronics and other IT-related sectors.

**Issue: Does the content of IT-related and electronic engineering courses adequately reflect employers’ needs? How can this be done while at the same time preserving the objective of HE to provide students with a broader education?**

24. Practitioners working in the IT sector are well qualified. Over 70% of IT practitioners are qualified to NVQ level 3 or higher and nearly 40% are graduates. The number of students graduating from HE with IT-related degree level qualifications (including those with joint degrees) has increased by over 1,700 to around 10,000 between 1994/5 and 1997/8.

25. Despite this expansion there are still frequent reports that there are not sufficient numbers in the labour market with the IT skills needed. However, it has been drawn to our attention that of the 265,000 graduates in the labour market with degrees in IT only 100,000 are working in IT practitioner jobs – though some may be working in ancillary jobs such as marketing which draws on their IT experience. It is true that many will hold joint degrees with qualifications in other subjects relevant to other careers – though only 60% of those with single subject IT degrees work in IT. This seems wasteful for a sector with such a reported acute shortage of skills – particularly as two-thirds of graduates working in IT practitioner jobs hold no HE qualifications in IT.

26. We intend to look into this issue further. Why do so many people who seemingly possess the IT skills needed in the labour market not work in IT jobs? Is this because they do not have the skills employers are looking for? If so, is this because HE institutions are not imparting the skills IT graduates need in the labour market? There may be two possibilities:

1. IT graduates do not have the necessary skills and experience on the latest IT developments.
2. IT graduates lack the key skills necessary to function in today’s customer oriented labour market.

Alternatively, it may be that IT graduates, for whatever reason, simply choose not to work in IT (see para 35 onwards).

27. We wish to look at whether HE institutions should or could provide graduates with the skills and experience to be able to work on the latest IT application or software language. Many would argue that the role of HE is to provide the platform on which these skills can be developed through working life. It is the job of employers to provide these seemingly more job-specific skills. On the other hand in an industry as fast-moving as IT, employers only see individuals as employable if they have these up-to-date skills. This is why industry-standard (proprietary) software qualifications (e.g. Microsoft and Novell) are so popular. We believe HE could explore the extent to which the use of proprietary software for illustrative and other learning purposes can be aligned with and support employers’ short term needs, without compromising course objectives or academic values. The more widespread use of collaborative ventures between HE and IT suppliers might also be explored to assure access to the latest equipment and practices.

28. There appears to be no general agreement between HE institutions delivering courses in electronics, computer science and/or information systems, and employers over the necessary attributes of new graduates. We have commissioned work to identify best practice in this area and we will be making specific proposals for action in our final report. We believe HE should collaborate with employer and professional bodies to ensure that undergraduates and HE staff understand the importance attached by employers to generic skills attainment. We believe Universities should use their constructive relationships with employers to inform curriculum renewal.

29. The AISS Industry/University Interface project is seeking to encourage greater employer involvement in IT course content. We believe employers could take a more prominent and active role in accrediting courses run by professional institutions. BCS and IEE find it difficult to get industry involvement in this. Employers should also be involved in the current QAA process which is looking at University course content.

30. Higher Education institutions also need to maintain effective links amongst themselves. Many Computer Science departments already have such links. We will be considering whether there might be a need to spread best practice and support local links with a national employer/education and training provider forum operating through or in collaboration with the relevant NTOs.

**Issue: How to simplify the present plethora of IT qualifications other than degree level and ensure they are aligned with the relevant occupational standards.**

31. The First Report for the National Skills Task Force noted that course and qualification structures can constrain participation in learning. We have heard reports that potential learners and employers are confused by the myriad of qualifications available in IT. There are over 100 Awarding Bodies currently offering IT qualifications. In total there are estimated to be some 800 IT qualifications which fall within the remit of the Qualifications and Curriculum Authority – i.e. below HE level. This system needs simplification to ensure that learners and employers understand what IT qualifications are certifying. We also need to ensure that courses offered enable employers and individuals to pursue the skills they need.

32. We believe that there are far too many different types of IT qualification below degree level currently being offered. We are working with QCA to identify a way forward and expect to recommend an extensive simplification of the system. We are also interested in the role that proprietary qualifications can play in the system and the links between these and other qualifications. We believe that formally providing guidance on the role of these qualifications would help all parties.

**Issue: How to ensure the respective roles of professional and sector bodies reflect the changing skill needs of the ITCE sector and, in particular, the complex interrelationships between different skills caused by convergent technologies.**

33. ITCE professional and sector bodies play a range of roles in helping the sector identify its skill needs, quality assuring the qualifications which are established for the sector, representing the sector with government and better enabling links between the sector and the education system. We are concerned about whether this is being done as effectively as it could be. There are 5 NTOs currently representing the ITCE sector, several professional bodies plus a wide variety of trade associations and other organisations seeking to represent specific sectors of the industry (Annex C lists these organisations).

34. We have commissioned work to review the roles of professional institutions, NTOs, trade associations and other bodies in meeting the skill needs of the sector. We shall be looking at the capability of these organisations to:

• address skills issues effectively given the increasing inter connections between the skill needs of different parts of the sector due to converging technologies;

• deliver initiatives which have a real impact on the sector;

• maximise employer support and involvement; and

• provide a credible and useful assessment of the sector's skill needs.

It is vital that the interests of the sector are represented in the most effective way. We expect to be able to make specific recommendations in our final report.

**Issue: How to ensure that young people better understand ITCE careers through better careers information and systems to disseminate that information. How to improve the image of the ITCE sector as a career, particularly to women.**

35. There is evidence that many students feel they are not sufficiently well informed to make the right choice of course or subsequent career. Moreover, it is widely perceived by those involved in the ITCE sector that it has a poor image as a career. Its status is perceived as being inferior to many of the professional occupations and too many people, particularly women, see IT as being too technical, insular and impersonal (“techy” and “nerdy” are phrases frequently used). We believe there is a mis-understanding about the importance of IT across the population as a whole. It is too often seen as being the cause of problems rather than as the solutions to them. IT “failures” such as the Year 2000 date change problem receive much more media attention than IT “successes” such as 24-hour cash machines. We under-estimate and under-promote the importance of IT and with this the rewards of IT careers.

36. The sector is particularly unattractive to women. Of the 750,000 people working as IT practitioners only 25% are women. Furthermore this proportion is falling – women accounted for 29% of IT employment in 1994. This reflects the fact that female employment in IT is concentrated in operator jobs where employment is falling – women occupy 60% of these jobs. Female employment in the professional end of the IT labour market is therefore even lower than the 25% for the sector as a whole. Female employment is particularly low in software and computer engineering.

37. Related to this women are substantially under-represented on HE IT-related courses. Only 25% of applicants to IT-related HE courses are women and only 20% of acceptances come from that sex. The UK has one of the lowest proportions of females studying HE Maths/Computer Science courses in the European Union - see annex D.

38. We believe the problems in attracting both young people and women into the industry could both be tackled by improving the information made available on IT careers. There is clearly a misunderstanding about what working in the IT industry is like. We believe the industry can help by establishing links with schools and explaining to careers teachers and to young people, particularly girls, the skill needs and nature of work in the IT sector. The number of truly technical jobs in IT is quite small. In many cases what is needed are skills in teamwork, influencing, oral and written communication and intellectual ability. Moreover, some potential recruits may not be aware that ITCE occupations can lead on to more general management rather than limiting individuals to technical work for their whole career.

39. We are particularly impressed with the work being done by the Worshipful Company for Information Technology in better explaining IT careers to young people. We are also interested in Microsoft’s Skills 2000 website and the role it could play in raising awareness of what IT careers have to offer. Campaigns like the BBC Webwise could also be used to provide information. We aim to find out more about these developments and others like them. It is important that we identify good practice in this area. We aim to develop proposals in our final report to help ITCE employers secure the best talent through, for example, better careers information and advice and by identifying areas where employers could help themselves through more flexible employment and training policies.

**Further work**

40. This report sets out our initial assessment of the current and future skill needs for specialist ITCE workers. In the coming months we will be building on this in our wider programme with a view to producing our final report and advising on the development of a skills strategy for the ITCE sector in the UK. Our continuing work programme and final recommendations will reflect the cross-over between the different strands of the ITCE sector, in recognition of the convergence of technologies and skill needs which is occurring. We will also be looking at how skills shortages in the UK compare with those in other countries, and whether there is anything to be learnt from strategies which have been adopted elsewhere.

41. Partner organisations are invited to contribute comments in writing by 25 June 1999 at the latest. The final report will be published in the autumn.

***Written comments on this report can be sent to:***

The ITCE Skills Strategy Group Secretariat

DfEE

Room W1120

Moorfoot

SHEFFIELD

S1 4PQ

***Or comments can be e-mailed to:***

skillsinfo.consultation@dfee.gov.uk

**ANNEX A**

**Information Technology, Communications and**

**Electronics Skills Strategy Group**

**Terms of Reference**

The group is remitted to advise the Secretary of State for Education and Employment and the Secretary of State for Trade and Industry on the development of a national strategy to meet the skill needs of the Information Technology, Electronics and Communications (ITCE) industry - including those IT professionals who work outside the IT sector.

In particular the group is remitted to advise on:

• the current and future specialist skill needs of the ITCE industry and the extent to which those skill needs are currently being met and will continue to be met;

• the roles of employers and the public and private education and training system in delivering the skills needed in the ITCE industry and whether those roles need clarification or change in order to improve the delivery of those skills;

• the roles of the sector bodies which are responsible for helping the industry identify its skill needs and whether these roles need clarification or change;

• ways of making careers in the ITCE sector more attractive, for example to women and young people, including the provision of better careers information and advice.

The group will report jointly to the National Skill Task Force and the Information Age Partnership and ultimately to both the Secretaries of State for Education and Employment and Trade and Industry.

**ANNEX B**

**Information Technology, Communications and**

**Electronics Skills Strategy Group**

**Members**

|  |  |  |
| --- | --- | --- |
| **Name** | **Organisation** | **Position** |
| Alan StevensChair | Electronic Data Systems Limited | Director |
| Sharon StuderDeputy Chair | 3 COM Corporation, Europe LimitedSkills Task Force member | Vice President |
| Anselm de Pleave | Electronic Data Systems Limited | Adviser to Alan Stevens |
| David Brown | Motorola Limited | Chairman |
| David Burrows | Microsoft Limited | Manager, Skills & Services |
| Bob Duncan | Electronic & Software Services NTO | Chairman |
| Colin Flint | Solihull College | Principal |
| Wendy Hall | Southampton University | Professor of Computing |
| Kevin Harden | Lloyds - TSB Group | Head of IT Central Services |
| Gillian Langford | Teacher Training Agency  | Professional Officer of ITT |
| John Leighfield | Alliance for Information Systems Skills | Chairman |
| Bob Nelson | BBC | Controller, Development & Training |
| Anne Russell | ITNTO | Chief Executive |
| Judith Scott | British Computer Society | Chief Executive |
| Keith Telford | IBM United Kingdom Ltd | Economist |
| David Thomas | BT | Head of Leadership Capability |
| Peter Waller | Spring Group Plc | Director, Corporate Development |

**ANNEX C**

**List of representative bodies**

NTOs

Skillset - the NTO for Broadcast, Film,Video and Multimedia

TVSC - the Telecommunications Vocational Standards Council

ESS NTO - the Electronics and Software Services NTO

IT NTO - the Information Technology NTO

EMTA - the NTO for Engineering Manufacture

Professional bodies

The Engineering Council

The Institution of Electrical Engineers (IEE)

The Institution of Incorporated Engineers (IIE)

The Royal Academy of Engineering (RAE)

British Computer Society (BCS)

Institute for the Management of Information Systems (IMIS)

Telecommunications Managers Association (TMA)

Trade Associations

Computer Services and Software Association (CSSA)

Federation of the Electronics Industry (FEI)

The Association for the Instrumentation, Control and Automation Industry in the United Kingdom (GAMBICA)

Printed Circuit Board and Interconnection Federation

British Radio and Electronic Equipment Manufacturers Association (BREMA)

Livery Companies

Worshipful Company of Information Technologists

Cross-Sectoral training bodies

AISS - the Alliance for Information Systems Skills

**ANNEX D**

**SKILLS 99**

**Proportions of Female Maths/Computer Science Students**

**in EU Member States (1997)**

(Source: UNESCO)

