



## REFLECTIONS, PERSPECTIVES AND RECOMMENDATIONS FOR PROFESSIONAL GENDER-SENSITIVE TEACHING, TRAINING AND CONSULTANCY

Barriers and needs of female students following a lifelong career path in Information Communication and Technology (ICT) and the role of change agents in this process.

SUMMARY REPORT - RECOMMENDATIONS

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## FOREWORD

*“An ICT (Information and Communication Technology) qualification opens doors to virtually all industries and there are highly creative, team-focused and technical careers to suit almost everyone. ... Unfortunately many young people, especially young women, still think ICT careers are boring, only for men and limit their career options ... The truth is technology careers are the way of the future and where you can develop a broad base of skills.”*

Information and Communication Technology Minister, Marsha Thomson, Australia, 2004

*“As the work of computer scientists produces socially relevant systems, their gendered view of world finds access to these systems.”*

Cecile Crutzen, 2003

*“Women have technical competences – but they have to fight for the opportunities.”*

Bruck/Geser/Lindner, 1999

Under-representation of women in the Information and Communication Technology (ICT) world is not a new phenomena, but one which seems a very persistent one. In this century women account only for a quarter of the ICT related workforce and are still not equally represented in ICT leadership and management positions. Oddly enough, in the aftermath of the internet hype the situation seems to have worsened again (Millar/Jagger, 2001).

On the political level, the European Union has placed this issue on its agenda and postulates social inclusion and equal opportunities in a knowledge-based society, laid down in the e-Europe Action Plan. The Community Framework on Gender Equality 2001-2005 points out that a knowledge-based society cannot afford to under-utilise the enormous untapped potential of its female professionals and stresses the importance to attract more women into ICT professions.

This is in line with the finding that IT job profiles nowadays require competences such as communication skills, project management expertise and consulting skills, usually reflected as “typical female” core compe-

tences (see [www.e-skills.com](http://www.e-skills.com)). Thus, also on the entrepreneurial level, more consideration should be given to think about reasons explaining this retreat of women from the ICT labour market and looking for potential solutions. Left alone IT companies might invest in on the job training and risk avoidable losses!

Apart from political and economic interests, women themselves should be aware that if they are not present in the core-process of technological development and production, they have no active role and input in creating value of a technology needed for their daily life.

In line with other EU projects, the EU-project PRO::ICT, funded by the Leonardo da Vinci Programme, will tackle the European-wide problem of female under-representation in the ICT world, especially the aspect of improving representation in the ICT core disciplines. Despite former findings it has become evident nowadays that it is no longer a question of women not having access to IT infrastructure or low levels of media competences. It has become apparent that ICT tools have become a part of females` lives as well as male ones. Still, young girls and students do not pursue careers in the field of computing to the same degree as males and retreat again under specific circumstances.

Our particular project approach is to accept that any change with this particular EU wide problem requires identification of the responsible change agents, such as parents, peer-groups, youth workers, teachers, management staff of universities, career advisors, human resource managers and personnel developers who assist young women and female students along the multi-faceted ICT career path. Professional gender-sensitive training and coaching offered by them in the particular relevant phases of a career planning, might increase the chance to raise the number of female employees enter the ICT world and shape its future.

This executive summary is the short version of a main study report, which explores the needs and barriers of female students and their supporting change agents in deciding to follow an ICT career path. However, the study does not focus on the “gender in ICT imbalance” problem in general, but aims to set out blueprints for further practical interventions. Thus the main study can be seen

as a milestone for developing a new collection of professional gender-sensitive training material (download of full version at [www.pro-ict.net](http://www.pro-ict.net)). These materials include sensitivity material, workshop designs, information material about the ICT market and occupations, handbook and guidelines for organisational interventions, and case studies of successful women. This material can be used in practice by the various change agents in interaction with students along their ICT career path. This gender-sensitive training collection and e-learning courses will be publicly available at: [www.pro-ict.net](http://www.pro-ict.net).

The following page lists all project partners and contributors to the study to which we express our thanks as well as to the Leonardo da Vinci, Austrian National Agency, for supporting this project.

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## INTRODUCTION



### THE PROBLEM

For some years Jacqueline Hey has been one of only a few women present at Information and Communication Technology (ICT) industry forums in Australia. “It has certainly changed in the last 10 years,” says Hey, director of the Vodafone customer unit at Ericsson. “Now there are 20 or 25 per cent there. So it’s still not an equal balance, but it’s certainly going in the right direction.” (Careerone, 2004/1).

Representatives from the field of gender research and national labour force agencies reflect on the same picture of an unequal gender balance in computing all over the world. The cornerstone of these reflections can be traced back to three observations:

- Women are generally under-represented in ICT sector employment, counting an average share of 20-30% of the workforce in the European countries in the aftermath of the internet hype. Figures reproduced in this discussion need to be taken with care though because ICT jobs are not confined to the ICT sector, but also in other sectors of economy which use rather than produce ICTs (e.g. finance sector). The weak statistical indication at European level is due to the fact that the categorisation of ICT professions differ from country to country (see Eurostat, data from the Labour Force Surveys (ISCO/NACE) <http://europa.eu.int/comm/eurostat/>, and also see <http://www.ict.org>).
- Women are even more under-represented in ICT core professional occupations and still do not reap the benefit from higher skilled and higher rewarded jobs such as IT professionals and engineers. Data from the United Kingdom indicate that 1999 was a peak year

for women’s employment in the professional areas of ICT occupations (20%), but since then the number declined (Millar and Jagger 2001).

- Women have technical competences and gain enjoyment from working with computers, but still seem to slip away from the ICT career domain. This can be observed by the low participation rate in professional computing courses and academic studies and high number of patchwork careers and drop out rates. Those women who enter the male IT world, do not find working conditions attractive and therefore tend not to follow a continuous ICT career path (Millar and Jagger 2001).

### EXPLANATION FOR THIS PHENOMENA

The research community searching for explanations to this problem has grown rapidly during the last few years involving experts from fields of educational science, psychology and gender studies. The experts have an unanimous agreement that it would be too easy to suggest a single factor explaining the women’s difficult situation (Margolis, 2002). Therefore, we would like to draw attention to three key issues that may have a decisive impact on the career and job situation of women in ICT. In this project these key issues are commonly referred to as the 3M-scheme: mind – match – market:

#### MINDSET

*“There is no female mind. The brain is not an organ of sex. As well speak of a female liver.”*

CHARLOTTE PERKINS GILMAN

<http://www.wisdomquotes.com/001244.html>

Following this quotation one might also say: “Computers have no sex!” Therefore girls should have a fair chance to go for a technology-driven career path and play an active role in a professional IT job. Such a positive mindset towards the female capabilities from a girl’s social environment (e.g. parents, peers, youth workers, educators, IT colleagues) is essential to overcome traditional stereotypes and role models.

## MATCH

The “mismatch” of the more “application-oriented” way of learning and handling ICT of women with existing curricula at schools and academic educational institutions has an impact on the early drop out rates. Present courses were designed by men for men and need to move from “programming oriented” curricula to more “application-oriented” education scenarios. A new match is needed!

## MARKET

The ICT market is a fast changing one and job profiles from the past do not fit those for the present time or the future. A lot of misconceptions about the real job opportunities and evolving mechanism, such as mentoring schemes are simply not known. Thus women are likely to retreat because of lack of professional gender-sensitive coaching and guidance for female graduates at the time when they first enter the “male world” of IT (enrolment and adaptation to a male working culture).

The 3M-approach provides the structure that will be used for categorizing the recommendations at the end of this study and it offers some orientation for the users of the platform to find modules that correspond to specific learning objectives. This also drives the PRO::ICT approach towards a direction that can be used in practise.

## THE PRO::ICT APPROACH AND RESEARCH QUESTIONS

Moving into IT and staying there the ICT career path spans over a ten year period in a woman’s life (approximately from the age of 13 to 23 years onwards). Therefore, choosing a career is one of the most important de-

isions one has to make early in one’s life. Given due consideration and bearing in mind the outlined three influential factors, the PRO::ICT project proposes a solution that would require not only a change in the mindset of a girl/female student, but also of all the persons and organisations involved in the decision process of promoting uptake of an ICT career path. It is only with a focused effort to change peoples mindset, and endeavour to avoid practical mismatches, and prepare the individual for a position in the IT world that there is a good chance for changing or improving the situation.

We propose to introduce professional, gender-sensitive training and consulting along *all stages* of a woman’s professional ICT career. These stages can be described in three main transition phases:

- Development of the idea of a technical ICT career path,
- Enrolment and study on computing courses and at higher academic institutions
- Entry into an ICT company, which is often perceived with a male dominated working culture.

As lots of studies state the influence of parents and teachers in primary schools is very important regarding the development of mindsets of girls and boys as well as the effect of role models. Though to cover this specific period it would need another project, since the factors of influence are multi-various and ask for an approach that involves sociology as well as psychological and educational sciences.

Despite the differences in the educational systems amongst the European countries, the important milestones in planning a career would include the phases previously outlined which can be adjusted to the age of the female students.

**Phase 1:** Developing the idea of a technical ICT career path takes place around the age of 13 years. It is at that age that the first choice for specialisation in educational programmes is available (transition from secondary to tertiary education). At this stage peers have a high impact in forming the students` programme selection.

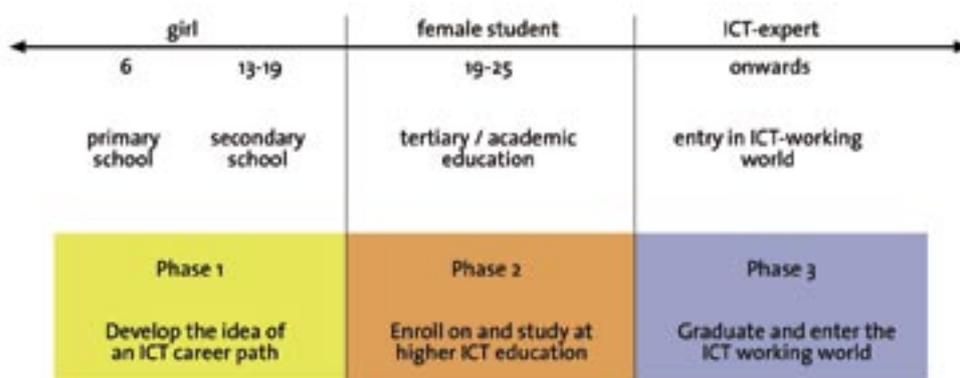
**Phase 2:** Enrolling on computing courses and studying computing courses at higher academic institutions at the age of 19 years (transition from tertiary to university education). Then the alternative choice about further education and/or entrance into vocational training has to be chosen at this stage. Parents, career advisors and image of potential universities essentially influence the decision process.

**Phase 3:** Taking the first steps into what is commonly understood to be a relatively male-dominated working culture may occur from the age of 23/25-27 years when graduating from university. These graduates make the transition from tertiary education to employment and vocational training (transition to work).

All those stages can be carefully directed by change agents, such as teachers, educationalists, career advisors and/or human resource managers who empower girls to stand up for their interests. However, it should be noted that more than one actor is needed to support girls and students especially at the time when they plan their professional life and need to take important decisions.

Our hypothesis is that given these three transition phases, profound and current information about the ICT labour market (anticipation of future development), a good match of female skills and ICT courses and studies and well focused training in the empowerment of girls will meet the challenge of moving more women into highly skilled, high paid IT jobs.

### CRITICAL PHASE IN A LIFELONG CAREER



GRAFIK: The critical phases in a lifelong career path

## RESEARCH QUESTIONS

At the present time little research has been done to highlight these three transition phases. Further, solutions and recommendations have been proposed to address the barriers and needs that change agents need to address when coaching female students along their career path, but these have not yet been carefully implemented across the EU. It has been suggested that it is not only the girl/female student that needs support, but also parents, peers, educators, vocational service, personnel managers in companies who are already aware of the problem.

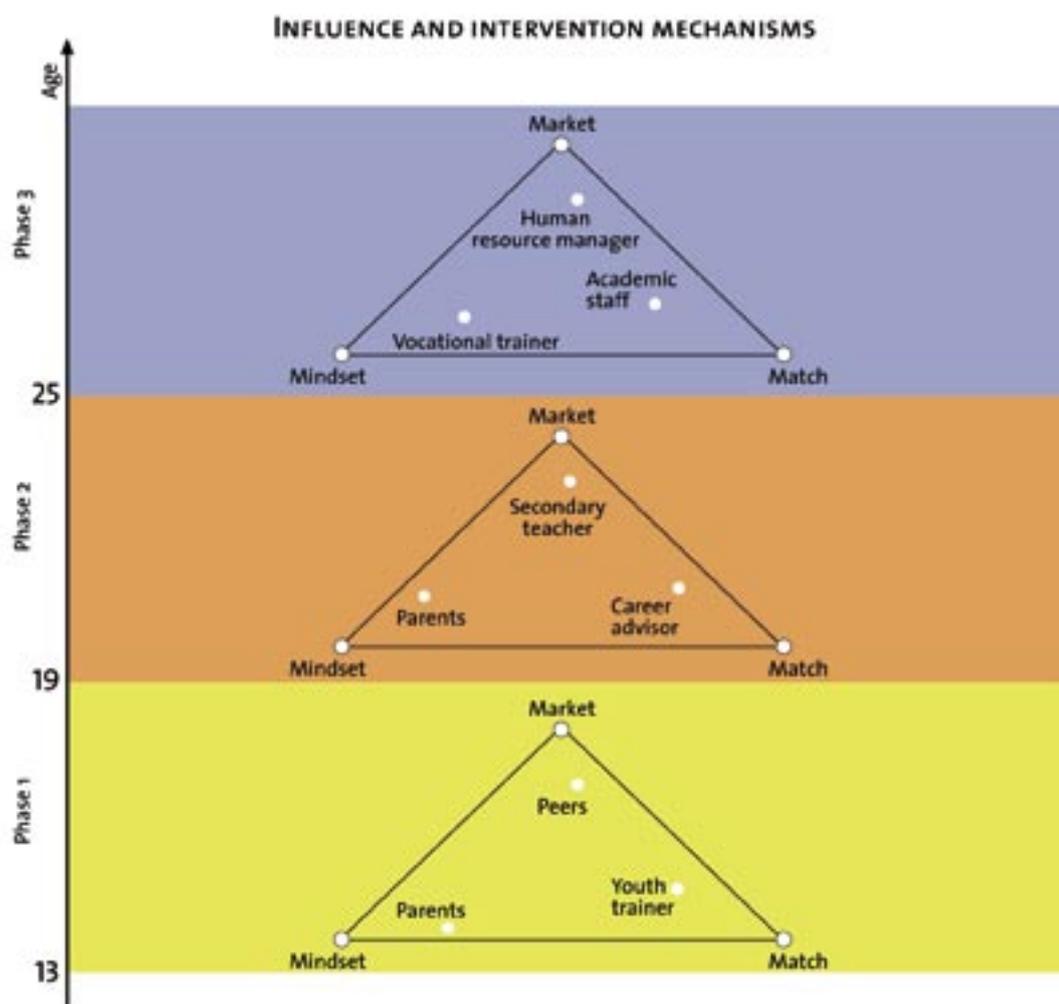
### Some questions for further research are:

What does the IT market offer for occupations and how

does the educational system provide chances for women to fit into these occupations, and why should girls be motivated to go along this path? What empowerment do female employees in ICT companies need to reach jobs at the executive levels?

What does a typical *ICT career path* for a female student look like, and what are the differences to a male one? Why do women have difficulties following a more sequential oriented IT career path? What needs do female graduates have for identifying female role models aligned to the ICT career?

What *type of intervention mechanisms* are useful, and for what purpose? Do we understand fully the role of



Graphic 2 Influence and intervention mechanisms of change agents in the three transition phases to come

the change agents in the three phases of guiding the students? What type of individual support is needed for change agents to coach students at the points of transition from one educational step into the next one and finally into professional life? What recommendations can we provide for them?

Can we observe *general European trends* in relation to the definition of the problems and the elaboration of recommendations especially in relations to the situation that exists in rural areas and the newly reformed countries?

The EU research project called PRO::ICT intends to implement the intervention mechanism not only as an exercise for knowledge gathering, but also as a guide for action. In doing so the study results form the scientific framework for developing a set of training material and modules for different types of change agents. The materials should include sensitivity material, workshop designs, information material about the ICT market and occupations, handbook and guidelines for organisational interventions, and case studies of successful women. This material will then be used in practice by the various change agents in interaction with students along their ICT career path. These gender-sensitive training material and e-learning modules will be publicly available on a web based learning environment at: [www.pro-ict.net](http://www.pro-ict.net).

The previous graphic shows the influence and intervention mechanisms on girls and female students along their way through all three transition phases.

## METHODOLOGY

Following the approach described earlier, the project applied diverse instruments of socio-economic research:

- Desk research - secondary material of studies from the fields of educational, psychological, social and socio-economic research;
- Interviews with girls and students (Austria, UK) representing the three transition phases at all age levels;
- Interviews with change agents from different European countries involved in the three transition phases

such as teachers, educationalists (UK), human resource managers (Austria/Germany/Switzerland/Denmark) and consultants who play a (non-profit-oriented) role in the vocational guidance process (Netherlands/Bulgaria);

The findings relate to the countries involved in the project and thus it is possible to highlight country-specific problems (e.g. low rate of female ICT work force in rural areas e.g. Denmark and Welsh region; vocational career advisory systems in the accession countries or reformed communist countries e.g. Bulgaria).

As a main task the project partners worked on a collection of best practice examples of innovative and process oriented approaches. The latter refers to the pedagogical methods used. The design of the best practise examples should aim at supporting a target group in being able to **set actions** relevant to follow the ICT career path. This includes both a “learning process of orientation” and “education/training to be better qualified” for an ICT career. We are interested in projects aiming at orientation and qualification on ICT careers. The findings from these interviews, secondary study material and international best practice examples provide the basis for supporting recommendations to these change agents, and will guide our work in developing gender-sensitive training material in the future.

### The recommendations are done in the 3M-scheme again:

- **Mindset** relates to images, ways of thinking, attitudes and ways of dealing with ICTs, especially with respect to following an ICT career path (for example self-esteem, role models etc.).
- **Match** relates to the transfer of these mindsets to conditions of access and educational environments in the field of tertiary education in ICT (for example curriculum, study environment, study profiles etc.).
- **Market** relates to the move of graduates to recruitment strategies, demands and perspectives on the relevant labour market (job profiles, maternity leave strategies etc.).

# THE ICT LABOUR MARKET AND ITS MATCH WITH EUROPEAN EDUCATIONAL SYSTEMS

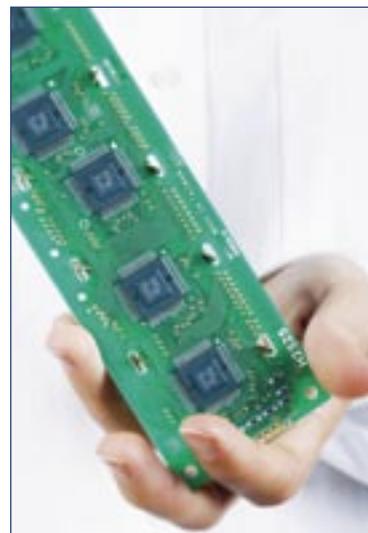
*Novell Asia-Pacific president Rhonda O'Donnell says, there is a decline in the number of women in IT. "There's no real anecdotal evidence, but definitely a feeling that, across the board, there are not as many women," she says. "Some of that is to do with personal choice and some of it is to do with the market." (Careerone, 2004/2)*

## THE ICT WORLD AND OFFERED JOB PROFILES/OCCUPATIONS

As Nina Evans (2003) of Technikon Pretoria/South Africa points out, organisations have undergone significant changes over the past several decades and that very few professions have seen as rapid a change as those in the field of Information Systems and Information Technology. Advances in technology and business methods have changed the ways in which companies operate. The modern ICT sector is fast-paced, tough and competitive and the range of knowledge and skills that must be available to a company has expanded and diversified. Today, employers are looking for potential employees who display a combination of knowledge, skills and attributes such

as agility, innovation and leadership. Along with a solid skills- and academic base, a willingness to learn on the job and to upgrade skills is important. Innovation is vital in the ICT environment and people should be looking at old problems in new ways. This brought about a new set of problematic issues for the ICT industry, where a new type of employee with a different profile of knowledge, skills and attributes is needed. An important trend in research on the skills requirements of IT employees is an increasing emphasis upon interpersonal skills and the ability to communicate with others who are involved in the information systems development process. IT professionals need more than technical skills, as technologies change quickly and many of these technical skills soon become obsolete.

First of all, let us clarify which type of ICT occupations we are dealing with. Since this is a young field of industry it is characterised by lively, dynamic and creative job profiles that are changing fast. However, in this project we are concentrating on core ICT and computing/engineering jobs. The following table provides an overview on the variety of IT jobs categorised in four different fields:



CATEGORISATION OF IT JOBS	
<b>Conceptualisers:</b> those who conceive and sketch out the basic nature of a computer system artefact	<b>Modifiers/Extenders:</b> those who modify or add to an information technology artefact
<i>Entrepreneur</i>	<i>Maintenance programmer</i>
<i>Product designer</i>	<i>Programmer</i>
<i>Research engineer</i>	<i>Software engineer</i>
<i>Systems analyst</i>	<i>Computer engineer</i>
<i>Computer science researcher</i>	<i>Database administrator</i>
<i>Requirements analyst</i>	
<i>System architect</i>	
<b>Developers:</b> those who work on specifying, designing, constructing, and testing an information technology artefact	<b>Supporters/Tenders:</b> those who deliver, install, operate, maintain or repair an information technology artefact
<i>System designer</i>	<i>System consultant</i>
<i>Programmer</i>	<i>Customer support specialist</i>
<i>Software engineer</i>	<i>Help desk specialist</i>
<i>Tester</i>	<i>Hardware maintenance specialist</i>
<i>Computer engineer</i>	<i>Network installer</i>
<i>Microprocessor designer</i>	<i>Network administrator</i>
<i>Chip designer</i>	

ICT professions can be characterised as follows. They

- rely on professional ICT skills in the ICT industry and in the user industries and services
- are described by the predominance of ICT knowledge on business domain knowledge
- cover a range of tasks including conceptualisation, design, development, implementation, upgrading, maintenance or management of ICT systems and tools (WWW-ICT, 2001)

Considering this variety one can easily imagine the difficulties the educational systems are confronted with when trying to match the curricula to these job profiles.

### THE MATCH WITH EDUCATIONAL SYSTEMS

For some years now representatives from gender research and related labour force agencies report a deep gender imbalance in the participation of women in computing around the world. Women are severely under-represented in ICT jobs in all countries and their participation is decreasing. For example, 13% of women were working in ITEC jobs in the UK in 2000 – but this was down from 16% in 1999. One of the main ways of improving the flow of qualified staff into computing-related

disciplines is to encourage a higher take-up of graduate courses in mathematics, science and technology, and more specifically, computer science. Between 25 % and 30 % of all graduates that left their place of learning in 2001 had obtained a mathematics, science or technology-related degree. Of these, the vast majority were male (about 70 %), and this has resulted in a number of initiatives to increase female participation rates in science and technology related studies. The report “Statistics on the information society in Europe” provides several data (European Communities, 2003)<sup>1</sup>. Table 6.3.1a shows that only France, Ireland and Sweden reported that in excess of 30% of their graduates in 2001 were in the disciplines of mathematics, science and technology.

Figures 6.3.1a and 6.3.1b display in more detail the breakdown of mathematics, science and technology degrees, providing information on the proportion of graduates that specifically followed a computing degree course (note that these figures are given as a proportion of mathematics, science and technology graduates and not total graduates). More than one in three mathematics, science and technology graduates in Ireland were computer science graduates. The United Kingdom, Spain and Belgium also reported a relatively high degree of specialisation in computer sciences.

Table 6.3. 1a: Mathematics, science and technology graduates

	EU-15	BE	DK	DE	EL	ES	FR	IE	IT	LU	NL	AT	PT	FL	SE	UK
<b>Proportion of graduates that were mathematics, science and technology graduates (%)</b>																
<b>1998</b>	:	20	19	29	:	22	31	32	24	21	17	33	:	26	26	26
<b>1999</b>	:	:	18	27	:	24	30	:	24	:	17	30	:	30	28	26
<b>2000</b>	26	19	22	27	:	25	31	35	23	15	16	30	18	28	31	28
<b>2001<sup>(1)</sup></b>	:	19	:	26	:	27	:	32	:	:	16	27	17	:	32	27
<b>Mathematics, science and technology graduates, in 2001, by gender (%) (1) (2)</b>																
<b>Male</b>	:	76	71	78	:	69	69	64	63	:	83	79	58	73	67	67
<b>Female</b>	:	24	29	22	:	31	31	36	37	:	17	21	42	27	33	33
(1) BE, data for Flemish community exclude second qualification; PT; ISCED level 5B excludes second qualification. (2) DK, FR, IT, LU, FL, 2000. Source: Joint UNESCO O-OECD-EUROSTAT data collection (UOE) questionnaires on educational finance and on graduates.																

Table 6.3. 1b: Mathematics, science and technology graduates

	IS	NO	CH	BG	CY	CZ	EE	HU	LV	LT	MT	PL	RO	SK	SI	TR
<b>Proportion of graduates that were mathematics, science and technology graduates (%)</b>																
<b>1998</b>	19	13	:	16	:	25	11	16	19	25	:	12	25	21	24	:
<b>1999</b>	16	16	:	16	14	24	19	17	17	27	5	15	25	21	23	30
<b>2000</b>	20	17	:	17	12	24	19	12	16	26	10	15	26	21	23	30
<b>2001<sup>(1)</sup></b>	19	17	:	19	:	23	18	:	12	26	9	14	25	26	20	30
<b>Mathematics, science and technology graduates, in 2001, by gender (%) (1) (2)</b>																
<b>Male</b>	64	75	:	60	69	73	67	77	59	64	74	64	64	68	76	:
<b>Female</b>	36	25	:	40	31	27	33	23	41	36	26	36	36	32	24	:
(1) RO, data exclude second qualification and ISCED level 6. (2) CY, HU, 2000. Source: Joint UNESCO O-OECD-EUROSTAT data collection (UOE) questionnaires on educational finance and on graduates.																

<sup>1</sup> Source: Statistics on the information society in Europe (Data 1996-2002), p.60, 2003 European Communities, Luxembourg

The gender gap is much deeper than it is represented by the figures if one looks at the relative proportions of men and women in the graduate population and the workforce as a whole which means a large number of women finalise their ICT studies and then decide to follow another career path.

On the other hand, as Hans Peter Müller, Bayerisches Zentrum für Ost-West Managementtraining, points out, people who reach executive positions in new media professions often follow career paths that are “multicoloured and tortuous”. One experience that people with patchwork careers share is that they had all worked with computers particular either in private or at work (Müller, 2000). An important factor that shapes such interests is how females and males experience IT. PRO::ICT interviews conducted by University of Wales Lampeter, United Kingdom (2004), indicate existing differences:

*“Females see IT as a tool to aid preferred subjects, i.e. word-processing English essays, and do not see it as a stand alone subject.” (Female teacher). When asked what they (students 19+ onwards, UWL -interviews) felt IT is most like 9% of the females felt it was a language, 73% of females felt it was more a qualification, and 18% felt it was more of a tool. This is in stark contrast with the males who agreed 100% that IT is more like a tool.*

Educational preparation may assist in developing a more balanced notion of IT (in particular of males) as well as an interest and specialisation in one or more of the different IT job categories in Table 2 (for examples of each category see Table 1). Freeman and Aspray (1999) suggest that different levels of educational preparation are appropriate for the different categories. Adapting their work from the US to the European educational system, it may be possible to suggest that the typical educational preparation for IT jobs in each of their four categories is likely to be as follows.

With respect to these reflections there should be a closer view on female life patterns in the ICT world and their need for gender-sensitive training and coaching from change agents.

	High school	Higher technical education	First degree	Masters degree	Doctorate
Conceptualisers	o	o	c	f	f
Developers	-	-	c	c	o
Modifiers	-	o	c	c	o
Supporters	o	f	c	-	-

Table 2: Levels of educational preparation  
Key: unlikely (-), occasional (o), common (c), frequent (f)

### FEMALE LIFE PATTERNS IN ICT

Taking a look at the initial attempts into starting a career path in ICT at an advanced level (higher vocational or academic level), it is reported that females predominantly work in one of the following mentioned professional areas as:

- Producers (‘developers’) of software
- Intermediaries who render ICT services to the business community, government, etc.)
- End-users, e.g. in financial services, education, governmental institutes.

Research indicates that young women frequently start with a database oriented occupation. In the beginning, shortly after graduation, they predominantly use their technical-oriented knowledge of programming and system analysis. In the above-mentioned categories they work at the beginning of their careers mainly as producers or developers of software. Generally, after two to four years of working experience in ICT, they prefer to change to the category of intermediaries in which they combine their ICT knowledge with professional personal competences e.g. oral and written communication skills, negotiation skills, advising/coaching skills. From this perspective, a gender segregation in ICT occupations has occurred since the beginning of the nineties. Women predominantly work as intermediaries and/or as end-users. The proportion of women in ICT in these categories is much higher, approximately 50 percent, than in the category of producers (VHTO 2003).

Other statistics indicate that one fourth of women in ICT professions work as a system or network controller. For men this percentage is relatively higher: 43.3%. Another fourth of women work as an IT analyst or designer. 14% of women compared to 7.6% of men work as an ICT consultant. More women than men work as helpdesk workers.



Gender Disparity in ICT jobprofiles  
 Comment: This research is based on 1981 respondents who were working in ICT professions in the Netherlands, source: Tijdens, K. (2003)

	Numbers	%	Female	% Female	Male	% Male
Unit/cluster/team leader	43	2,2	14	2,5	29	2,0
Programmer	102	5,1	29	5,2	73	5,1
Systemanalyst	28	1,4	6	1,1	22	1,5
Application controller	41	2,1	25	4,5	16	1,1
Application/software-developer	15	0,8	4	0,7	11	0,8
Application/software-tester	6	0,3	4	0,7	2	0,1
Consultant	186	9,4	78	14	108	7,6
Helpdesk worker	114	5,8	62	11,1	52	3,7
Project leader	31	1,6	13	2,3	18	1,03
System or network controller	757	38,2	141	25,3	615	43,3
System designer	10	,5	3	0,5	7	0,5
IT-analyst/designer	577	29,1	144	25,8	433	30,5
Other categories	71	3,6	35	6,3	36	2,5
Total	1981	100	558	100	1422	100

The changed entry qualifications in ICT opened up opportunities for women to enter ICT professions, but, women still face the glass ceiling if they want to fulfil managerial IT professions (Van den Brekel, et al./1999).

Choosing a career is one of the most important decisions one has to take early in one's life. Today, more than ever, knowing one's own strengths, weaknesses, preferences, skills, interests, values and personality type is critical in taking control of one's career. However, the career path of the successful ICT worker is currently very topical and seems to be different from five years ago. In the past the typical career path of an ICT professional was linear - from programmer to systems analyst to project manager to ICT manager. In a sense the lower level ICT jobs are rapidly disappearing and the requirements for ICT professionals are becoming more demanding in multiple dimensions, particularly in the areas of business functional knowledge, interpersonal and management skills. It is crucial for learners to be informed about

the different career options in the ICT field and that they base their career choice upon this information.

Women enter ICT through a variety of routes. Taking into account different personal situations and work environments, it is not possible to define clear-cut trajectories. The EU-project "WWW-ICT" analysed women's life contexts and found eight different patterns to women's life cycles (WWW-ICT 2002):

## WOMEN`S ICT CAREER PATTERNS

### 1. Straight careers in ICT

Some of the careers are moved by strong interest in mathematics and the sciences and, in some cases, looking for a field with good job prospects. They follow a clear career model, and strive to reach the top. These women accept the conditions for success in ICT, including long hours, stressful working conditions, a competitive environment and (in some cases) hierarchical structures.

### 2. Combining art with technology

In these careers, it is not technology that is in the foreground ,but a passion for art and/or journalism, with ICT entering later as an important tool and skill. As ICT becomes an integral part of their work, women develop a strong passion for both fields and perceive no boundaries between work, family and social life, and personal inclinations. [...]

### 3. From the margins to a field of opportunities

There are life stories in which ICT is strongly connected with moving out from one's milieu and/or region - a rural background (Austria), an area with limited job opportunities (the South of Italy) or ethnic background (UK) - into promising and relatively secure jobs. This choice in some cases means rebelling against their home environment but in most of the cases staying emotionally attached. The entries into ICT result vary: getting interested in IT at school, taking an engineering or computer science degree, or encountering IT in their first jobs. However, the interest in working with technology does not become a passionate interest.

### 4. Building one's own environment

Some stories show a strong will and skill to shape their own environment so that it fits their idea of good work and a good life. This is a theme in their accounts which they address explicitly as 'building'. These women define themselves through the content of their work. Some of them come from supportive families and have chosen supportive partners, some of them have a strong engagement for women in ICT.

### 5. Good work but limited ambitions

Several biographies exhibit rather 'normal', unexciting patterns. These women have good qualifications and good work and feel competent in their work, but other important life perspectives (having more time for their family, hobbies) emerge from their histories, together with few professional ambitions.

### 6. Being open, having not yet arrived

These are examples of women who had a good start into working life but it is still open where they will go in the future. They take up opportunities where they are offered and are not always sure where to go. Most of these women are still quite young.

### 7. Struggling but not giving up

In some of the life stories constraints and how women succeed in overcoming them play a dominant role. These constraints vary from lacking qualifications and/or a degree to suffering from adverse working conditions and problems in managing work and family life. But they can also suffer from limited perspectives in their region, perceived as more penalising when they received a good education or accumulated an interesting skill profile. After a relatively bad start into working life, they do succeed however in overcoming obstacles.

### 8. Fragile or broken careers

In some cases women do not succeed in coping with the constraints they encounter. We have several cases of women who did not have a good start into working life, due to lack of qualifications and/or degree, unsatisfactory working conditions, limited job possibilities, having made a wrong career step or simply not liking to work in ICT. But they lack motivation and realistic alternatives. In some cases they feel discouraged and having failed with unfulfilled ambitions.

Source: EU-Project WWW-ICT, 2002;( Deliverable Nr.6; pp-44-58)

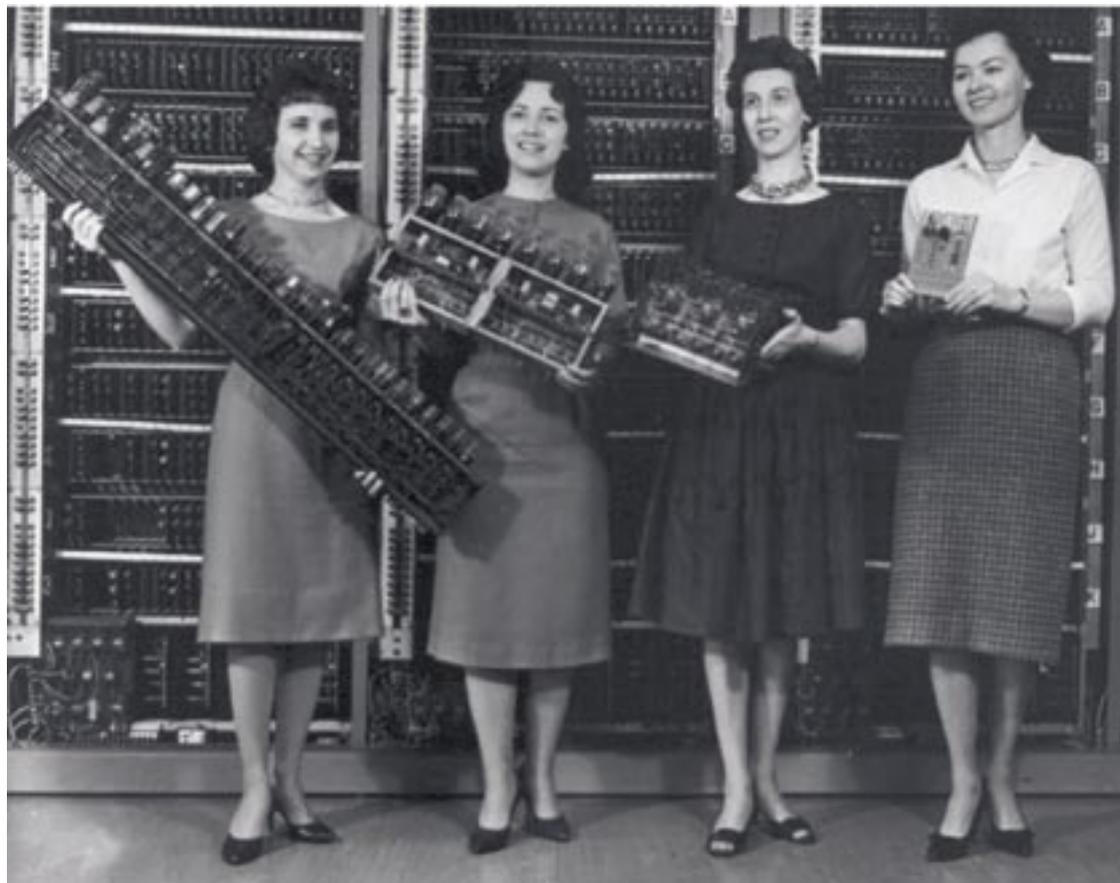


Abb. 1: "U.S. Army Photo", number 163-12-62. Left: Patsy Simmers, holding ENIAC board Next: Mrs. Gail Taylor, holding EDVAC board Next: Mrs. Milly Beck, holding ORD-VAC board Right: Mrs. Norma Stec, holding BRLESC-I board (source: [http://ftp.arl.army.mil/ftp/historic-computers/jpeg/first\\_four.jpg](http://ftp.arl.army.mil/ftp/historic-computers/jpeg/first_four.jpg) [190504])

## WHY ARE FEMALE ICT PATHS DIFFERENT?

The purpose of this section is to summarise the main explanations that have been put forward that relate to barriers and needs of females, and the under-representation of females in the IT industry. A number of pilot studies were conducted with students at school and university and with teachers in school and university to ascertain what barriers and needs exist for females/men confronted with unconventional career choices. A number of best practice recommendations from various authors are proposed to explain how these barriers and needs may be overcome at school and university. As yet there are no statistics to demonstrate the success or failure of these recommendations.

So what are the reasons for this under-representation? It is of course unreasonable to point at one or two tangible issues that contribute to this factor. The research on the reasons for the gender imbalance in ICT has some tradition already. As an example, as early as 1993 and

before that time many authors were proposing reasons that should be carefully addressed at school and university level. It is perhaps because little attention was paid to these reasons that we are confronted with this problem today. For example, Gill and Butler (1993) explained that females tend to:

- Show greater organisational commitment than men in similar IT roles.
- Possess critical skills – a combination of technical, managerial and business skills. Very useful as regards being the hybrid worker.
- Focus on the application of technology rather than the technical bits.

Thus women see themselves as being useful in IT careers from another perspective to men. Women find they are more suited to the application of computers rather than possessing programming or technical competences.

These issues were further examined by Joy Teague (1997). She reviewed the reasons for the under-representation of females in computing:

- Girls have the perception that an IT career is highly technical or means work done in isolation.
- Girls believe they do not have the ability to work in or study computing.
- Girls believe it is too mathematical.
- Computing careers, as girls perceive it does not interest them.
- Parental and peer pressure often encourages girls to take up conventional courses or careers.
- Stereotyped advice.
- Lack of role models.
- Negative classroom experiences.

An Industrial Society report “dot bombshell” (2002) suggests male domination of UK businesses continues in the New Economy, men dominate in Internet start-ups, men control venture capital and investment decisions, women face greater obstacles to raising capital, are more restricted by family responsibilities and suffer from certain stereotypes. Research from MORI (2001) for e-skills national training organisation suggests that young girls regard IT professionals as male, nerdy, work obsessed and boring; and the research also reveals that young mothers take an equally negative view of IT as socially alienating and corrupting, for example driven by stories of the paedophile abuse of Internet Chat Rooms. There is a need for communicating positive messages about IT, of advice and guidance about the reality of working in IT and role models and mentors who influence attitudes and opinions over the years to come. Another report which was published by Labour Force Survey for the Women and Equality Unit Gender Briefing (August 2003), highlights key facts and presents women work patterns in the UK.

For example:

- Of those women in employment, 43% of them work part-time. Part-time working is much more common for mothers: two-thirds of women with children under 5 who are in employment work part-time (67%).
- Overall, 61% of working mothers with children aged

under 16 work part-time, compared with just 7% of working fathers.

- Women are paid less than men on average nearly £3 less per hour.
- Women are significantly less likely than men to work as managers or senior officials.
- If females expect that they may be a failure at some subject they tend not to show any interest toward the subject.
- Women may feel discouraged to take up technology-based subjects because they think they may find the values in that workplace or career structure somewhat distasteful.
- Around two thirds of women in employment work in either ‘public administration, education and health’ or ‘distribution, hotels and catering’. By comparison, men’s employment is more evenly spread across the industrial sectors.

Further, Debbie Clayton and Teresa Lynch (2002) provided reasons they identified as contributing to the under-representation of females in computing courses:

- False perception of what a career in IT entails
- Courses and careers in computing require a strong mathematics background
- Women are not encouraged to study computing
- Tendency of females to follow a stereotyped career
- Women have less access to computers than men.

Marc J. Natale (2002) suggests that “females tend to be turned off due to the male stereotypes and marketing associated with games and thus begins the gender gap”. Additional studies by Phoenix Moorman and Elizabeth Johnson (2003) suggest “Computing continues to be closed to females, if not by physical barrier, then by social misconception. Women in computing still perceive themselves as strangers in a strange, male dominated land”. There are a number of issues associated with these misconceptions and two interesting approaches to understanding these misconceptions were discussed in a paper by Joshi and Kuhn in (2001). They examine self-concept and career values of IS professionals. They examined “the attitudes, values, and beliefs that underlie the attraction to ICT as a career choice, and specifically gender differences in these factors and their relative impor-

tance". They explain that "The ICT and management literature suggests two beliefs that may affect an individual's attitudes towards an ICT career – self-efficacy and work value congruence". Self-efficacy here refers to an individual's perceptions about her computer related abilities. Self-efficacy has an importance influence on choice of and persistence in careers. Low self-efficacy is expected to lead to negative attitudes towards IS as a career.

Work value congruence is explained as the instrumentality of the occupation for attaining outcomes valued by the individual. A female may value certain outcomes e.g. job leading to increased income and providing intellectual challenge, but be dissuaded if she values social interactions and perceives that the IT career might lead to isolated work. They also explain the image of IT careers. "The IT profession suffers from a negative image and this is due to its perceived similarity to computer science and associated stereotypes. The concerns highlighted by the above authors including Patricia Gill and Janet Butler (1993) and Joy Teague (1997) seem to be expressed in similar vein by students at school and university in Wales in 2004. These issues obviously raise the equality agenda – but they also impact directly upon business competitiveness and productivity. The "E-Skills national training organisation" (UK) says an extra 1 million IT workers will be needed over the next five years. While these jobs are going vacant, contracts are lost, projects delayed and service levels compromised. More than just practical solutions are needed. There is a need to improve the image of IT for girls and women to appreciate the potential of IT. The business culture mitigates against women's recruitment into and retention within ICT employment. Better careers advice is needed to show the exciting and valuable path of IT opportunities.

The gender gap also finds its roots in structural barriers deriving from the ICT companies themselves. An Australian survey on women in ICT professions states that "women think that their difficulties rest more on the adaptation to a male organisational culture than women's technological aptitudes" (Pringer R. & al., 2000, quoted in: Vendramin 2003: 60). Structural barriers can be e.g. men oriented working conditions and lack of work-life-balance, low career prospects in ICT companies, mascu-

line culture and hostile working environment, unequal remuneration and/or demanded social competencies is not valued .

The ICT sector is often characterised by long irregular and non- predictable working hours, "blurring boundaries" between the professional sphere and the private sphere, between professional working time and recreation time (see Vendramin 2003:57) – that lead to difficulties for women balancing work and family load. Given the background of the wide-spread rules in the ICT sector "being always the fastest and the first" the according work rhythms leaves little space to private related constraints. Numbers of studies show evidence of poor access by women to flexible and family friendly working arrangements within the sector :

- Gewirtz & Lindsey (2000, quoted in Moreau 2003:126) showed in their study among women ICT professionals, that "68% say(ing) that they're worried about the stress of the around-the-clock lifestyle and the lack of work/life balance...".
- A survey, carried out among 250 ICT companies leaders in Baden-Württemberg (Germany), highlights low reflections on that issue: 60% of the respondents think that there are no particular obstacles to women's professional careers. Consequently, a lack of attention of the managers for the possible promotion of women, as well as the lack of advice for career orientation was found. (Menez R., 2001; Munder I., 2001; in: Vendramin 2003:61)

The still dominating culture of ICT is usually associated with a male image and hand down the idea of an ICT related professional world where "the young, dynamic and connected men are kings". Changing this attitude needs a joint effort of various types of change agents. Especially human resource managers and open-minded managing directors can decided to change such structural barriers. You can find more details to the role of human resource managers in the PRO::ICT full report on [www.pro-ict.net](http://www.pro-ict.net).

## 2.5 THE ROLE OF CHANGE AGENTS AND THE NEED FOR MORE FOCUSED GENDER SENSITIVE SUPPORT

Given the multi dimensional reasons for the gender imbalance, the role of change agents can be seen as a network made up of various strategies and points of interventions. In general, public and political authorities appear to lack the appropriate knowledge concerning how to induce a change in the present situation. “Change” always needs support at the individual and organisational level, and as a consequence the importance to offer gender sensitive support for female students and female workers in ICT companies can not be stressed enough. Only change agents who are well sensitised in guiding and training all relevant groups will be able to encourage more girls and women on their ICT career path.

By consulting with a combination of change agents we can have a better understanding of the characteristics, traits and personalities that accompany and influence girls and students in career planning (e.g. parents, peers, teachers, vocational career advisors, youth trainers and human resource manager). Following an initial analysis of the PRO::ICT interviews and consulting findings from some recent studies, the table below summarises the needs of females for support, and how the change agents can play an active role in that. It is possible that the change agent will remain the same throughout some years to come. (e.g. parents), however the focus of the supported issue may differ from one phase of career planning to the other. Therefore, in the following table the role of change agents is described for the main issues and does not comprise a comprehensive list.

Issue	Role of change agents
<b>Self-concept</b>	Increase the personal self-confidence of the female students, to choose the ICT career path. Mentoring and guidance of female students following this path.
<b>Role models</b>	Overcome the negative notion that women are unable to compete with men in the field of ICT. This could be attained by means of compiling and presenting “true stories” of women who have gained success and respect as ICT professionals.
<b>Attitudes of parents</b>	Extended information for parents on ICT/new media courses is important, because parents have a large influence on the attitudes of their children. Stereotypes on ICT may be passed on in a negative way.
<b>Image of ICT</b>	Look at the image of ICT education and professions. Discourage the view that ICT is a male-dominated area. Females should believe that the role of ICT is to improve the quality of life. Beware of the attractiveness of interdisciplinary education and professions in ICT for female and male students.
<b>Gender-sensitive education environment</b>	Arrange an environment that provides girls with guaranteed access to the necessary equipment (hardware and software) as well as form a gender-sensitive learning culture in the classrooms, promoting collaboration and cooperative learning groups.
<b>Experience gap</b>	Girls have often done less hands-on exploration of the computer. They need support in computing to gain knowledge of how computers actually work.
<b>Job profiling</b>	To match interests of women and skills needed for jobs available in an IT context; detailed job profiling is needed perceiving market changes as fast as possible.
<b>Gender-mainstreaming in the consultancy process</b>	Attention should be given consulting processes which take account of the gender-mainstreaming issues, taking into account the ICT biography of the women.
<b>Introduce gender mainstreaming in IT companies</b>	To improve the working conditions for women and men, gender-mainstreaming is to be introduced in IT companies. Be aware that change agents need empowerment for doing such.
<b>Application and the assessment process</b>	Care of gender-sensitive issues in tests, assessments, different application designs etc. improves the chances for women to get a job that meets their skills and interests.

Table: Recommendations for change agents in training and consulting girls and females on their ICT career path

## RECOMMENDATIONS FOR CHANGE AGENTS IN THE TRANSITION PHASES



Gender-sensitive training is a rather new approach in educational science and career consultancy, especially in the field of computing education. This section will describe in more detail the role of the change agents in the three phases of considering an ICT career, the career planning and findings about the agents' needs to improve their support or consultancy process along the ICT career path in the computing industry. The recommendations are described in the mode of learning objectives to give a concrete idea of the directions to follow.

### PHASE 1: DEVELOP THE IDEA OF A TECHNICAL ICT CAREER PATH

During the pre-adolescence period around the age of 13 to 19 young girls think about their future in terms of what career path they might choose. Right at that point the first choices for specialisation in educational programmes are due (transition from lower secondary to higher secondary and then tertiary education, taking special higher advanced courses, make a decision for another type of school, etc). Peers have a high impact of forming the future role model and influence personal decisions. In this orientation phase the training objective with students, their parents and peers is to develop the

idea that a professional career in the ICT world is a real option for their future. Female students should become aware of their options to gain leadership positions in the ICT world by careful planning. They should be informed that they do not have to fight alone, assistance is provided in this process by change agents.

Society and public opinion as a whole fail to combat the prejudice and stereotypes, imposed and developed throughout the years that women are not capable of attaining high goals and professional realisation in the ICT field. Female students experience difficulties in their professional orientation in the ICT branch because they have built up psychological barriers. They underestimate their capacities and usually lack self-confidence, even when their achievement are equal to those of their male colleagues. Change agents can be trained in sensitising girls, parents and peers in dissolving misconceptions about ICT careers/job profiles and opting for an unconventional career.

The following table summarises the recommendations in respect to the change agents and the needs of the young female students, using the 3M approach again:

PHASE 1	Needs of students (13-19 years)	Change agent to support this need	Learning Objectives/Recommendations
<b>MINDSET</b>	<b>Self concept Low self-esteem</b>	<b>Secondary teacher Career advisors</b>	Develop self assessment tools for the students to test their personality and computing skills.
			Students discover their skills and reflect on their possibilities with reference to computer skills (digital port folio).
		<b>Secondary teacher Youth workers</b>	Learned helplessness: create situations where students change their view of this approach: I really can help myself!
			Students find another attitude toward failures: to work on problems and take mistakes as a chance to learn (encourage students to take the challenge).
			Students learn how a computer system works (and experience that they can “tell the machine how to work”).
			Students learn about modifying their role and career choice.
	<b>Role models Case Studies – Success Stories</b>	<b>Secondary teacher Career advisors</b>	Students meet role models, with whom they should to keep in further contact.
			Students meet older students who support them as tutors.
		<b>Secondary teacher</b>	Students learn to know about career paths of women who could be role models.
			Students learn how to manage family and job affairs, as they listen to “female success stories”. Teachers learn to organise a project on meeting successful women in ICT companies for their students.
<b>MATCH</b>	<b>Gender-sensitive education environment/ Innovation of curricula</b>	<b>Secondary teacher Vocational counsellors</b>	Students experience current developments in the labour market.
			Students learn about another image of ICT workers: it requires a portfolio of skills, not only IT skills.
			Students learn that ICT also can be a tool, related to very different jobs.
			Students learn about the variety of aptitudes necessary for ICT careers.
			Students detect skills they already have, that are helpful to go for an ICT career.
			Students have to gain IT competences in a fun-orientated way at an early age.
		<b>Secondary teacher</b>	Role models: How good are they in mathematics?
			Students experience ICT in combination with other disciplines (ICT and economics; ICT and arts) e.g..
			Teachers are sensitised to arrange an atmosphere in the classroom that is free of anxiety (to make mistakes, to get no pejorative comments etc.)
			Teachers are to be sensitised to promote individual processes of learning.

Table: Recommendations for Change Agents: Transition phase 1 (13 – 19 years)  
In this table the term students refers to female students!



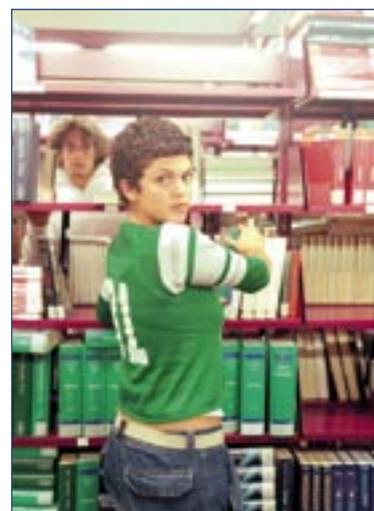
PHASE 1	Needs of students (13-19 years)	Change agent to support this need	Learning Objectives/Recommendations	
<b>MATCH</b>	Gender-sensitive education environment/ Innovation of curricula	Secondary teacher	Students learn about the ICT career path.	
			Students are confronted with a Web design learning tool.	
			Students and teachers work on criteria for possibly mentoring persons	
		Secondary teacher Youth workers	Teachers learn to find criteria how to deal with the role model approach working with their students.	
		Youth workers Parents	Students shall get a chance to test games boys usually play!	
		Secondary teacher Youth workers Peers	Students discover ways to build peer groups (alumni, tutoring), supporting each other working on computers.	
	Sufficient equipment/ access	Vocational counsellors	Vocational counsellors become aware of methods of gender sensitive teaching.	
			Secondary teacher Youth workers Parents	Students get assured access to use the equipment (e.g. girls' hours).
			Secondary teacher School management	Students at an early age shall get the opportunities for computing and tinkering at school. Schools should provide sufficient equipment for all students to use.
	Communication aspects	Secondary teacher	Students gain experience in using communications tools.	
		Secondary teacher Youth workers	Students experience internet community, building their own platform.	
	Image of ICT company culture	Secondary teacher	Students experience that ICT is highly creative working field.	
Students learn about the stereotype of the image they have of IT companies.				
<b>MARKET</b>	Information about the ICT Labour Market (Occupation & Skills)	Secondary teacher Vocational counsellors	Students learn about ICT companies that exist in their neighbourhood.	
	Inaccurate perception of computer careers	Secondary teacher	Students become aware of their images of people working in ICT companies.	
			Students work on clarifying the different images they are confronted with.	
	Job profiles	Secondary teacher Vocational counsellors	Match personal traits to various job profiles on an ICT base. Students learn about the different wording used in describing job profiles.	
Secondary teacher Youth workers		Students will learn about women working in ICT companies by producing a video.		

## PHASE 2: ENROL ON AND STUDY AT COMPUTING COURSES AND HIGHER ACADEMIC INSTITUTIONS

In the adolescence period around the age of 18 to 19 years students have to make the choice concerning further education and/or entrance into vocational training. They have to enrol on computing courses and higher academic institutions at the transition phase from tertiary to university education. Parents, career advisors and the image of potential universities or potential employers essentially influence the decision process.

There is a substantial lack of cohesion between the education offered and the requirements of the labour market in some EU countries with respect to the capacities of the candidates, but not all. Universities often do

not provide for development and acquisition of relevant capacities. As a result, female students meet with the disappointment of failure to get certain jobs, because of improper preparation. In this phase support should be given in selecting the relevant ICT courses and academic education needed for matching the expectations of the IT market/job profile with the skills and competence of the student. How should the best type of education be selected and how should future job options be anticipated? What can academic staff do to assist girls in better managing the enrolment phase? Training objectives for teacher and academic staff may be, how can a change of curricula influence the likelihood to attract more female students, how can the way of teaching support women in class?



PHASE 2	Needs of students (19-25 years)	Change agent to support this need	Learning Objectives/Recommendations
<b>MINDSET</b>	<b>Self-confidence</b>	<b>Vocational counsellors</b>	Vocational counsellors are trained to support female students in taking up unconventional careers.
			Female clients are ensured that they are capable of making unconventional career choices.
			Female clients overcome the negative notion that they are unable to compete with men in the field of ICT.
	<b>Role models Case Studies – Success Stories</b>	<b>School management</b>	Female teachers in ICT courses, especially in rural or remote areas, should be employed.
<b>Academic staff</b>		To provide role models females are to be asked to return to the university to talk about their working experiences.	
		Students are provided with meaningful perceptions of computing careers.	
<b>MATCH</b>	Gender-mainstreaming in the consultancy process	Vocational counsellors	Vocational counsellors learn how to conduct consulting processes which take account of the gender-mainstreaming issues.
			Vocational counsellors are made aware of gender-mainstreaming issues.
			The counsellors take into account the ICT biography and history of their female clients.
	VCs competences are not enough known to target groups.	Vocational counsellors	The services need to be promoted in schools and universities.
Improving the career service	Vocational counsellors	More ICT skills are be provided to vocational counsellors.	

Table: Recommendations for Change Agents: Transition phase 2 (19 – 25 years)  
In this table the term students refers to female students. “VCs” stand for Vocational counsellors

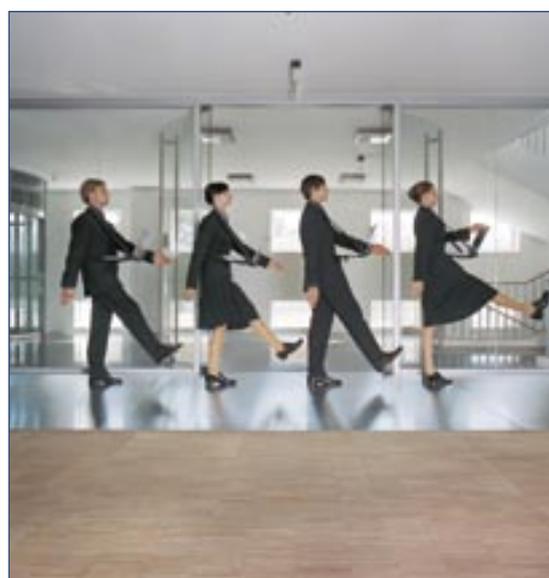
PHASE 2	Needs of students (19-25 years)	Change agent to support this need	Learning Objectives/Recommendations
<b>MATCH</b>	<b>Improving the career service</b>	<b>Vocational counsellors Academic staff</b>	Vocational counsellors and academic staff provide a career information pack containing videos, interactive software on computing career options, pen portraits of recent graduates, course information, eye catching posters.
			Train the vocational counsellors to contact with training providers
	<b>Attract students to university computing courses</b>	<b>Academic staff</b>	Encourage females to enrol on pre-university courses to provide them with the pre-requisite skills to enrol on computing courses.
			The criteria used in admissions should be broadened to be more flexible.
			Ensure that any interview panel includes females so as not to lower self-esteem during the interview process.
	<b>Educational environment</b>	<b>Academic staff</b>	Develop staff activities to examine the different learning styles amongst students.
			Establish networks through the use of email. Highly effective in communicating and supporting students, especially in remote locations or difficulties due to family commitments.
			Students are introduced to applications such as spreadsheets, graphics and design applications, logic and programming at an early stage (take away the fear of what is generally perceived to be the learning of a new language).
			Students are encouraged to learn through exploratory approaches.
			Promote IT as a tool that can be used for work and leisure such as communication, education and improving life quality (to meet the associations of it being male-oriented or targeted at the young).
Request societies in IT and computing to consider alternative names for hardware peripherals (e.g. the current word mouse or joystick is very anti-female).			
Students are encouraged to try computer games that involve skills and strategy.			
Students are taught relevant skills that provide up-to-date job opportunities.			
<b>Non-professional VCs</b>	<b>Vocational counsellors</b>	The capabilities of non-professional youth workers in vocational counselling is improved.	
<b>Strategies to keep computing courses interesting for female students</b>	<b>Academic staff</b>	The definition of IT is be broadened and the various skills and roles of an ICT career communicated.	
		Group work and cooperative learning is encouraged.	
		Practical examples of IT or computing in the workplace should be shown.	

PHASE 2	Needs of students (19-25 years)	Change agent to support this need	Learning Objectives/Recommendations
<b>MATCH</b>	Strategies to keep computing courses interesting for female students	Academic staff	The benefits of good salaries, job security, flexible working hours, opportunities to work from home and job satisfaction should be highlighted.
			Students should be told about initiatives in the workplace.
			Offer different types of software (user friendly, communicative).
			Students are engaged in interesting and challenging projects.
			Provide more practical classes associated with the theory.
			Re-entry students are encouraged.
			Provide bridging opportunities to re-entry (conversion) graduate students.
			Develop strategies to inform undergraduate students about rewards and study opportunities.
			Develop strategies to make recruitment contacts in a positive way.
			Provide undergraduate females with exposure to computing research.
			Review department's publications for text/images containing messages that may discourage applicants.
			Raise staff awareness where academics discuss their research with students (cooperation with industry).
<b>MARKET</b>	Job-profiling	Vocational counsellors	The vocational counsellor learns to perceive the market changes as quickly as possible.
			Mentoring between companies and students shall be organised by professional VCs; professional courses via email dialogues.
			Network opportunities with local and national job agencies and employers are provided.
			Provide more appropriate ICT specific career guidance to highlight the breadth of careers available that require intensive and less intensive use of computers.
	Job application	Vocational counsellors Academic staff	Equip females with contacts to ensure positions in the professions.
			Create awareness and knowledge about the existence of IST companies. Students learn about global, national and global companies and their purpose.
Job application	Vocational counsellors Academic staff	Provide workshops to improve graduates interview and job seeking skills, to help females overcome problems with self-promotion, undervaluing their skills, undervaluing their abilities.	

PHASE 2	Needs of students (19-25 years)	Change agent to support this need	Learning Objectives/Recommendations
<b>MARKET</b>	<b>Statistics and market information</b>	<b>Vocational counsellors</b>	Vocational counsellors learn how to search for and interpret information and statistical figures
			Local and national government authorities shall be encouraged to provide regularly updated statistics on women in ICT.
			Vocational counsellors learn methods to gain and provide detailed information on the ICT labour market.

### PHASE 3: GRADUATE FROM UNIVERSITY AND ENTER THE ICT WORLD

Taking the first steps into what is generally perceived to be a male dominated working culture finally taken at age 25-27 or when graduating from university, or moving from tertiary education to employment and vocational training (transition to work). It is therefore important to postulate on how to dissolve misconceptions of the working culture and support activities for women. How should graduates be prepared for this step e.g. apprenticeship, alumni network? How should a company be marketed as “women friendly employer”? How should mentoring schemes, equal payment schemes be introduced and how can companies be regarded as equal opportunity employer?



PHASE 3	Needs of students (23/25+ years)	Change agent to support this need	Learning Objectives/Recommendations
<b>MINDSET</b>	<b>Role model</b>	<b>HR Manager</b>	HR managers learn how to promote the change of role models of female ICT career paths. HR managers learn about the importance of presenting women successful in ICT professions.
	<b>Awareness raising</b>	<b>HR Manager</b>	HR managers learn how to raise awareness of society in respect to gender equality especially in the ICT sector.
<b>MATCH</b>	<b>Implementation of gender issues</b>	<b>HR Manager</b>	HR managers need to learn how to implement gender-mainstreaming (GM)
	<b>Where to get empowerment for introducing gender mainstreaming in the company?</b>	<b>HR Manager</b>	How to be a change agent as a HR manager (supervision)?

Table: Recommendations for Change Agents: Transition phase 3 (23/25 + years)  
In this table the term students refers to female students.  
“GM” stands for Gender-mainstreaming;  
“HR” stands for Human Resource Manager

PHASE 3	Needs of students (23/25+ years)	Change agent to support this need	Learning Objectives/Recommendations
<b>MATCH</b>	Developing a better Working culture and environment	HR Manager	HR managers need to learn how to change the working culture and improve the quality of the working place to recruit and to keep female ICT staff, restructuring the work.
		Company management	Part-time and/or flexible working arrangements for women/men in executive positions. Models of maternity leaves that are attractive for women in executive positions. External support providing material/financial support in terms of GM implementation for the company.
	Economic value	HR manager Company manager	HR managers need to learn about the economic value of GM: Where and how do I learn about funding public initiatives to implement GM. HR managers learn about the additional values when they 'bring the female staff into the boat'.
	Working Culture in ICT Skills	HR Manager	HR managers learn that provision of IT skills is important. HR managers work on a list of "tips and tricks" for the dialogue with the internal stakeholders.
<b>MARKET</b>	Raising the rate of female applications	HR Manager	The HR managers need to learn how to formulate job announcements, which are read by female students (e.g. list of ICT-related journals, which are favoured by women i.e.)
	How to attract high profile female candidates	HR Manager	HR managers need to learn where to advertise for new jobs? HR managers need to gain detailed information on the ICT labour market.
	Increasing the quality of the application and the assessment process	HR Manager	HR managers and the company need to know about gender-sensitive issues in job announcements, tests, assessments, etc. and learn to develop a different application design.
	Diversity	HR Manager	HR managers need to be made aware that male/female work teams improve the innovation/market chances of products. HR managers shall learn about analysis of the company/unit in terms of gender issues.
	Support women employees in the networking activities	HR Manager	HR managers need to know about existing women networks and need to provide support to women to find the networks – internal and external.
	Optimising the entrance into a company	HR Manager	HR managers learn how to design first steps.
	Marketing gender main-streaming activities	HR Manager	HR managers can learn how to market their GM activities.



# CONCLUSIONS: CHANGE NEEDS A CHANCE- NEED FOR MORE PROFESSIONAL GENDER- SENSITIVE TRAINING AND CONSULTANCY

## PRO::ICT DATABASE - EUROPEAN COLLECTION OF GENDER-SENSITIVE TRAINING MATERIAL

We now take a look back at our initial hypothesis that given the three transition phases,

- profound and current information about the ICT labour market (anticipation of future development),
- a good match of female skills and ICT courses and studies and
- well-focused training in the empowerment of girls will contribute to meet the challenge of moving more women into highly skilled, high paid IT jobs. Change needs a chance!

The findings of the study strengthen the idea of providing support for the change agents in all transition phases in the first place. Those who may be able to induce a change, need more support in how to design and provide interventions! Thus, keeping the recommendations in mind, we propose to professionalize the training and consulting activities in the relevant phases of a girls` career planning. One important step towards this aim is to provide relevant inputs and resources for change agents. Thus, one of the project result is a collection of innovative, gender-sensitive training material which should be used in practice by the various change agents in their daily working environment.

This collection of gender-sensitive training material includes approximately 50 descriptions of sensitivity material, workshop designs (including e-learning courses), information material about the ICT market and occupations, handbook and guidelines for organisational interventions and case studies of successful gender-sensitive training activities. The change agents can either use pre-defined workshop programmes customised to specific learning objectives. However, it is also possible to select single training items and create a tailor made training programme as to the specific needs of the learner group.

Besides the training material description, the PRO::ICT database offers also the material for download and with this service we hope to encourage usage on an Eu-

ropean-wide scale. The gender-sensitive workshop programmes and e-learning courses will be publicly available on a Web-based learning environment at: [www.pro-ict.net](http://www.pro-ict.net).

## NAVIGATION SYSTEM AND SERVICES OF THE PRO::ICT DATABASE

Potential users can navigate through the database by a practical search mask. Main search criteria are:

- Type of transition phase in which the students find themselves and/or
- Type of training material a change agent might find useful to meet the learning objective and/or
- Type of change agent involved
- Type of language of the material description

Users have the options to use one or more of these criteria to retrieve material.

	Development of an ICT career path (Age 17-19)	Enrolling and studying at higher ICT education (Age 19-25)	Graduating and working in the ICT world (Age 27 onwards)
Self assessment tools	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Gender equality / Gender equality	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Workshop programmes	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Handbook & guidelines	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Information about the labour market	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Case studies	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Case studies and studies	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Change agents:  Search

Language of material:  Search

**STEP ONE:**

SELECT THE PHASE OF LIFE IN WHICH YOUR FEMALE STUDENTS ARE.  
THINK OF THEIR LEARNING OBJECTIVE(S)!

**Classification of Phases:****1. Develop the idea of an ICT career path (age 13-19)**

In this orientation phase the training objective with students, their parents and peers is to develop the idea that a professional career in the ICT world is a real option in their future. Students become aware of their options to gain leadership positions in the ICT world by careful planning. They are informed that they do not have to fight alone, assistance is provided to them in this process by change agents.

Change agents can be trained in sensitising girls, parents and peers in dissolving misconceptions about ICT careers/job profiles and opting for an unconventional career.

**2. Enrol on and study ICT higher education programmes (age 19-25)**

In this orientation phase the training objective with students, their parents and peers is to develop the idea that a professional career in the ICT world is a real option in their future. Students become aware of their options to gain leadership positions in the ICT world by careful planning. They are informed that they do not have to fight alone, assistance is provided to them in this process by change agents.

Change agents can be trained in sensitising girls, parents and peers in dissolving misconceptions about ICT careers/job profiles and opting for an unconventional career.

**3. Entry in the ICT working world**

(23/25 onwards)

Once graduated women need to manage the first steps into the ICT job world. How can school managers, human resource managers and staff help to dissolve misconceptions of the working culture and support activities for women? How can graduates be prepared for this step e.g. apprenticeship, alumni network? How should a company be marketed as “women friendly employer”? How should mentoring schemes, equal payment schemes be introduced and how can companies be regarded as equal opportunity employer?

**STEP TWO:**  
CUSTOMISE YOUR INDIVIDUAL TRAINING ACTIVITY. YOU WILL FIND VARIOUS TYPES OF TRAINING MATERIAL APPLICABLE FOR THE SELECTED PHASE AND LEARNING OBJECTIVE(S).

Classification of training material	Description
1. Self assessment tools (personality/skills/course/job profile)	Tools for assessing personal preferences, skills and choice for ICT courses.
2. Sensitivity material for issue "Gender & ICT"	Gender-sensitive games, videos, songs, books which can be used in any sort of training setting; a collection of success stories of women "who made it" and different links where to find further examples.
3. Workshop Programmes (including online learning)	Here you can find different training designs that you can use in practice. This may involve interactions with you and girls and students directly and range from one hour presence workshop to two weeks online training. You will also find programmes that train change agents in improving their career advisory process.
4. Handbook & Guidelines	Guidelines for introducing new organisational schemes supporting women to follow an ICT career path, e.g. mentoring, gender sensitive trainings, alumni programmes, change of curricula.
5. Information about the IT Labour Market (Occupation & Skills)	This section provides information about the future ICT market, change of job profiles, needed skills, and links where and how to find information per country; research results about the special roles of woman in IT; career portals.
6. Case Studies	In this section you will find case studies that describe experiences with gender-sensitive interventions and activities conducted in enterprises, schools and universities.
7. Communication and other sources	This section provides a collection of magazines and news addressing the issue of working in an IT company and useful for placing advertisements, related Web links, discussion forums and network information.

**STEP THREE:**  
SELECT THE TYPE OF CHANGE AGENT (S) WHO IS (ARE) INVOLVED IN THE INTERACTION WITH THE STUDENTS. YOU WILL BE PROVIDED WITH INPUT MATERIAL FOR YOUR TRAINING OR CONSULTING PROCESS.

Classification of change agents					
Parents/Peers	Educator (Teacher in schools and universities)	Career Advisor/ Vocational Counsellors	Youth Trainer/ Gender consultant	School and University management	Human Resource Manager



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