

Widening Women's Work in Information and Communication Technology

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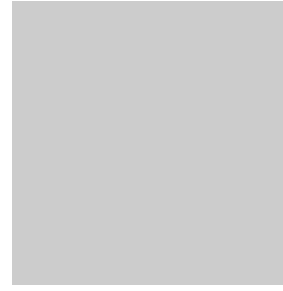
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Introduction

This is the synthesis report of the IST project Widening Women's Work in Information and Communication Technology (WWW-ICT), carried out under the 5th framework programme of RTD of the European Union, in 2002-2004. Research teams in seven countries (Austria, Belgium, France, Italy, Ireland, Portugal and United Kingdom) have carried out biographical interviews and case studies on women in ICT professions. Their conclusions and recommendations address all those "agents of change" who might improve the place of women in ICT professions: organisers of ICT training programmes, career advisers, human resource managers, recruiters, social partners, women's associations, policy makers in the area of equal opportunities in education and the labour market.

1. Contents

This synthesis report presents the initial framework of hypotheses, the methodological options, the key research findings and results, and the conclusions and recommendations. It is designed as a detailed overview of the whole research and refers to other downloadable reports for those who are interested by an in-depth presentation of the research results.

Chapter I – The gender gap in ICT professions

This introducing chapter draws a descriptive approach to gender disparities in ICT professions and occupations. It specifies the way of defining and considering ICT professions. It also provides a quantitative overview of existing gender disparities in employment and education across Europe.

Chapter II – Hypotheses and methodological options

This chapter describes the various dimensions and explicative variables that must be taken into account in order to draw a comprehensive picture of the gender gap in ICT professions. A structured model of interaction of these explicative variables is proposed. The methodological options of the research project are described and justified.

Chapter III – Biographies of women working in ICT

The main conclusions of the biographical interviews are summarised here. After a description of the sample of interviewees, it draws the key

characteristics and varied profiles of women's biographies in ICT. It draws eight clusters of career patterns for women in ICT, based on a multi-criteria analysis of the coded biographical sheets and presents common life story patterns. It comments specific aspects of the male biographies and stresses the common and different points as regards female biographies.

Chapter IV – Women's working life in ICT: case studies in enterprises

The chapter presents a synthesis of the analysis of 14 sectoral overviews and 28 case studies of enterprises in two sectors (computer services and e-publishing) and seven countries. It gives a comparative analysis of work and employment in the computer services industry and the e-publishing industry, with an emphasis on social aspects and gender issues. It also highlights some national and contextual issues related to women's work in these sectors across Europe. It summarises conclusions under two main headings: labour markets; organisational structures and practices.

Chapter V – Lessons from practices trying to attract more women in ICT professions

This chapter summarises and analyses the information gathered on good practices aimed at improving women's place in ICT professions in Europe. It draws some avenues for development and evolution of these practices, stressing the importance of driving forces and mobilising initiators. It gives some methodological recommendations related to quality criteria and evaluation process of good practices in this area.

Chapter VI – Conclusions

The conclusions are presented under four headings: education and training; women's working conditions; labour market and labour relations; women's trajectories.

Chapter VII – Recommendations

Recommendations start from the question: what are the conditions that can make ICT professions and careers more attractive for women? The chapter briefly describes the steps leading from conclusions to recommendations. Then it presents, in a synoptic view, the recommendations, the concerned agents of change, and examples of good practices supporting the relevance of the recommendations. Recommendations are finally detailed according to different European policy areas.

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3. Downloadable project reports

Detailed research reports (English only) are downloadable from the project web site, as well as web versions (English and French) of the awareness leaflets summarising the project outcomes for targeted audiences:

<http://www.ftu-namur.org/www-ict>

D1 – Conceptual framework and state of the art

This report describes the various dimensions of gender disparities in ICT professions and discusses a set of interacting explicative factors. It relies on a state of the art of existing research in this area (September 2002, updated April 2003, English, 156 pp.).

D2 – On-line bibliography

A customised search engine allows for consultation and retrieval of the on-line bibliography (November 2002, updated January 2004).

D3 – Integrated model of explicative variables

A synthesis and schematic document, used as research tool and tested in the empirical phase of the project (September 2002, English, 10 pp.)

D6 – Professional trajectories and biographies

The report starts presenting the conclusions from the biographical interviews, as a 12-pages executive summary. The next chapter analyses more precisely the key characteristics and profiles of women's biographies. The third chapter draws eight clusters of career patterns for women in ICT. The fourth chapter accounts for a more in-depth qualitative analysis of life-story patterns. The fifth chapter comments specific aspects of the male biographies. Annex 1 contains the seven synthesis reports on biographical interviews in each country. Annex 2 summarises the quantitative analysis of the coded biographical sheets and explains the methodology of cluster analysis. Final version: January 2004. Two versions are downloadable in PDF format: full version including the annexes (274 pp.) and "light" version, containing chapters 1-5 without the annexes (68 pp.).

D7 – Case studies of work organisation

The report presents the analysis and synthesis of 14 sectoral overviews and 28 case studies of enterprises in two sectors (computer services and e-publishing) and seven countries. Chapters I and II are respectively devoted to a comparative analysis of work and employment in the computer services industry and the e-publishing industry, with an emphasis on social aspects and gender issues. Chapter III describes the case study analysis in computer services and chapter IV in e-publishing. Chapter V highlights some national and contextual issues related to women's work in these sectors across Europe. Chapter VI presents

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conclusions under two main headings: labour markets; organisational structures and practices. Final version: February 2004. (124 pp., including annexes summarising the main features of case studies).

D8 – Inventory and analysis of good practices

This report summarises and analyses the information gathered on good practices aimed at improving women's place in ICT professions in Europe. After an introductory comment on the definition criteria of "good" practices, chapter I presents a structured overview of collected good practices. Chapter II draws some avenues for development and evolution of these practices, stressing the importance of driving forces and mobilising initiators. The next chapter develops methodological recommendations related to quality criteria and evaluation process of good practices. Conclusions and recommendations are supported by key arguments for the target public. Seven annexes present inventories of selected good practices in Austria, Belgium, Germany, Switzerland, Italy, France and the UK. Final version: February 2004 (118 pp. including annexes).

D9+10 – Conclusions and recommendations

Conclusions are presented under four headings: education and training; women's working conditions; labour market and labour relations; women's trajectories. Recommendations start from the question: what are the conditions that can make ICT professions and careers more attractive for women? The document briefly describes the steps leading from conclusions to recommendations. Then it presents, in a synoptic view, the recommendations, the concerned agents of change, and example of good practices supporting the relevance of the recommendations. Recommendations are finally detailed according to different European policy areas. (Final version, May 2004, 44 pp.)

D12 – Synthesis report

This is the present document, also downloadable in PDF format.

D14 – Awareness leaflets

Three leaflets are published for three target publics: enterprises and their business partners; education and training organisations; women's associations and agents of equal opportunities between women and men. Each leaflet has the same graphic design (with a different colour set) and the same structure, but a targeted selection of arguments and examples. The web versions are downloadable in French and English. Printed versions exist in French, English, German and Italian, they can be sent upon request by e-mail.

The gender gap in ICT professions

Our definition of ICT professions goes beyond the classical computer-related professions and includes new professions related to the Internet and multimedia. Despite this enlargement, women are still poorly represented in ICT professions, and the gender gap is even worsening in several European countries.

In order to examine the gender gap in ICT professions, a definition of these professions is a first necessary step. Yet, as there is no well-established definition, we start defining what we consider as “ICT professions” in WWW-ICT. In a second step, the gender gap in ICT will be closely examined in two interrelated dimensions: jobs and education

1. Mapping ICT professions

Although ICT professions are at the core of several debates and controversies – skills shortage, changing careers, need for new training curricula, creation and destruction of jobs, gender gap, international division of labour – there is no well-established definition of these professions. As recently stated in the final report of the ICT skills monitoring group of eEurope, “There is currently no common definition in existence of the types of skills covered under the banner of ‘ICT and e-business skills’. Industry, government and other official bodies do however have a number of documented definitions in use and use these definitions to derive their own data predictions of the skills shortage” (Go Digital, 2002, p. 10).

As a consequence, the spectrum of existing studies reveals significant variations in the definitions of ICT professions, according to the scope of each study and the motivations of its authors. For instance, studies oriented to the ICT industry will give greater importance to dominant professions in the supply-side of ICT. Studies oriented to the skills shortage will focus on high-level professions. Studies oriented to recruitment and career management will focus on functions rather than

professions. Studies oriented to education curricula will formulate their definitions as degrees rather than occupations; etc.

The purpose of WWW-ICT is to go beyond the classical computer-related professions (system design, programming, implementation, development and maintenance) and to include new professions and occupations linked with multimedia and Internet services, digital graphic design, e-publishing, e-business and e-commerce. This broad approach to ICT professions allows testing the hypothesis whether “new” professions are more or less stamped by gender disparities than the classical ICT professions. Mapping the ICT professions addressed by WWW-ICT will be made in two steps:

- Considering a set of criteria that could be used to define different categories or levels of ICT professions.
- Proposing a typology of professions to be taken into account in WWW-ICT.

1.1 Definition criteria of ICT professions

It is uneasy to distinguish ICT professionals and ICT users, in a context of widespread diffusion and use of ICT.

The first basic question is: how to distinguish ICT professionals and ICT users, in a context of widespread diffusion and use of ICT in all industries and services and in everyday life? There is a general agreement, as well in institutional as academic literature, on a three-layer skills model (Go Digital, 2002, p. 11):

- The ICT skills needed for basic tasks, as a tool for learning and for modern life outside the workplace are often defined as *digital literacy*.
- *E-skills* (or *applied ICT skills* in the terminology of OECD) relate to the ability to use and apply ICT tools in general workplace settings, and to upgrade these skills when business processes and industry structures changes.
- *Professional ICT skills* are needed in the ICT industry and in related jobs in the user industries, in order to create, develop, implement, repair or manage ICT tools (hardware, networks and software).

WWW-ICT addresses the third layer, although there is some openness between e-skills and professional ICT skills, for instance in multimedia design and e-commerce. Openness also comes from vocational training or on-the-job training. The level of skills of ICT professionals is defined by the ESDIS expert group and the European consortium Career-Space (1) as “ICT and e-business specialists, including different education / skills levels – university (3rd level) or technical education (2nd level) or specialised vocational training” (ESDIS, 2002).

(1) ESDIS is the high level expert group on Employment and Social Dimension of the Information Society, set up by the European Commission. Career Space is a consortium of 11 major ICT companies plus EICTA, the European Information and Communications Technology Industry Association. It is working in partnership with the European Commission and the CEDEFOP.

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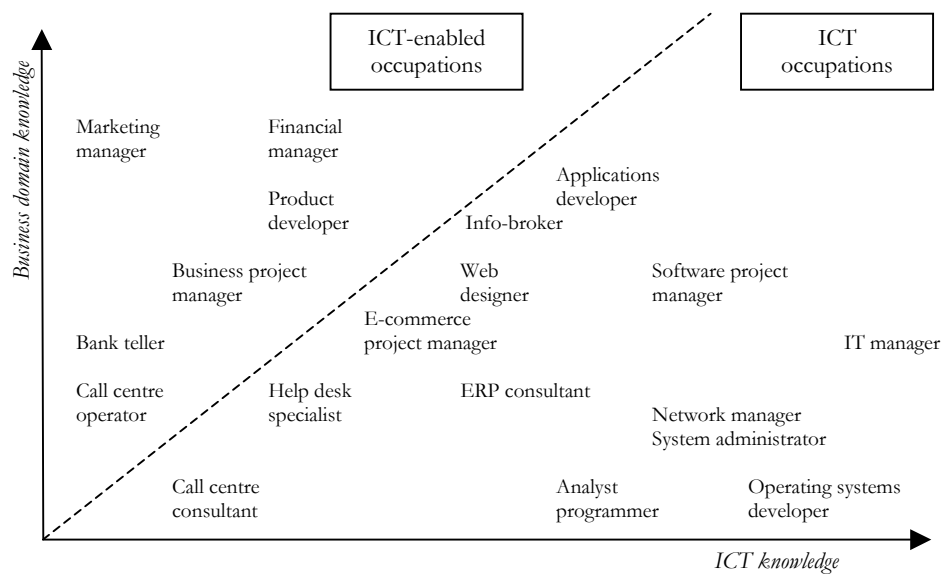
Practically, being a “professional” or an “advanced user” is not so easy to distinguish in many emerging occupations in the information society, as far as technical ICT skills and business skills are more and more intertwined.

ICT professions can be characterised by the predominance of ICT knowledge on business domain knowledge.

Bibby (2000) refers to an American study carried out by Computing Research Association (Freeman P., Aspray W., 1999) in order to go a step further in the distinction between professionals and users. According to Figure 1, professions can be mapped in a two-axes diagram: ICT knowledge and business domain knowledge (knowledge of management practice, industry practice, specific technical practice). The diagonal line separates the ICT-related occupations in two classes, depending on whether ICT knowledge or business domain knowledge is more important. The criterion proposed by Freeman and Aspray is: “If more than half the value created by a worker involves his or her ICT knowledge, then this person is considered to be an ICT worker. If less than half the added value to the work, then we regard the person as an ICT-enabled worker” (Bibby, 2000, p. 13).

Figure 1 has been adapted from the original study of Freeman and Aspray, in order to include a wider range of professions and occupations.

Figure 1
ICT occupations and “ICT-enabled” occupations (examples)



The diagonal line separating both categories in the above graph should rather take the shape of a “grey zone” of increasingly overlapping mix of business domain knowledge and ICT knowledge, which characterises many occupations dealing with information contents more than information processing.

According to this approach, ICT professions can be circumscribed to the occupations characterised by the predominance of ICT knowledge on business domain knowledge. These occupations however cover a range of tasks, from design to implementation and management, as detailed in table 1.

Table 1
Categories of tasks of ICT professionals

Designers	Developers
<p>Those who conceive, design and sketch out the objectives and architecture of an information and communication system.</p> <p><i>Examples:</i> <i>Research engineer; system architect, analyst or engineer; product or service designer; network engineer or designer, etc.</i></p>	<p>Those who specify, construct, implement and test either hardware, network or software components of an information and communication system.</p> <p><i>Examples:</i> <i>System designer, software engineer, programmer, web designer, multimedia integrator, data base designer, ERP or CRM project manager, e-publishing project manager, on-line service designer, etc.</i></p>
Modifiers / extenders	Supporters / tenders
<p>Those who customise, modify, upgrade or extend applications in an information and communication system.</p> <p><i>Examples:</i> <i>Analysts and programmer, database administrator, ERP or CRM consultant, web manager, digital graphic designer, etc.</i></p>	<p>Those who deliver, install, operate, maintain or repair the hardware, network or software components of ICT applications.</p> <p><i>Examples:</i> <i>System consultant, customer support specialist, help desk specialist, maintenance engineer, trainer, network installer and administrator, webmaster, etc.</i></p>

Source: adapted from Bibby, 2000, p. 14

1.2 A map of ICT professions

As a conclusion of this discussion, we can summarise that ICT professions

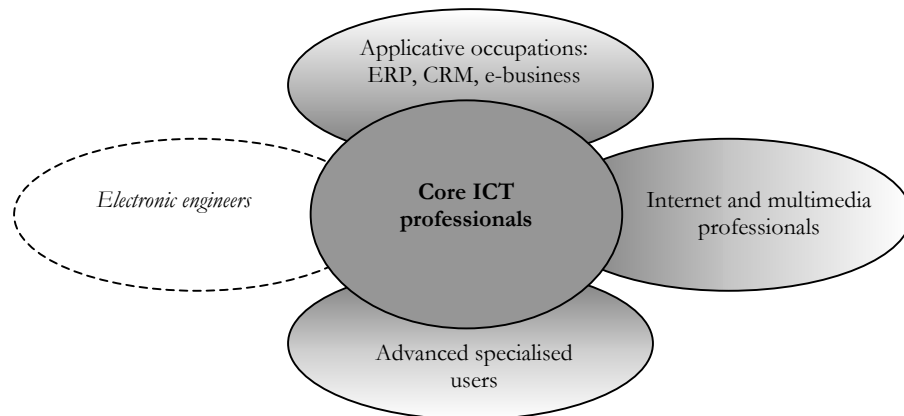
- rely on professional ICT skills in the ICT industry and in the user industries and services,
- are characterised by the predominance of ICT knowledge on business domain knowledge,
- and cover a range of tasks including conceptualisation, design, development, implementation, upgrading, maintenance or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

Taking into account our willingness to address both classical professions and new professions of the Internet, multimedia and e-business, figure 2 provides a map of ICT professions to be encompassed in WWW-ICT and covering four main professional categories:

- *Core professions:* ICT specialists in the areas of networks; software and services; products and systems.

- *Internet and multimedia professionals*: ICT specialists combining graphic, artistic or publishing skills, involved in design, implementation and maintenance of on-line or multimedia products and services.
- *Applicative occupations*: ICT specialists combining applied business skills, for instance in enterprise resource planning (ERP), customer relationship management (CRM), electronic commerce.
- *Advanced specialised users*: help desk consultants, information brokers, desktop publishers, librarians, etc., which should be considered as qualified “information workers” or “symbolic analysts”.

Figure 2
Mapping the ICT professions in WWW-ICT



Our mapping includes both classical professions and new professions of the Internet, multimedia and e-business

One of the main differences between core ICT professionals and the peripheral groups lies in the process of skills acquisition: core ICT professionals are mostly graduates in ICT curricula (at high or intermediate levels), while other groups acquire their ICT skills in a combination with other skills, through mixed curricula: graphic skills, communication skills, business and commercial skills, other professional skills.

Boundaries are obviously not tight. ICT graduates can get occupations in the peripheral groups or develop their career towards these groups. Professional trajectories of multimedia professionals, applicative professionals and advanced users may also be oriented towards core ICT professions.

Except if they exert an ICT profession, electrical and electronic engineers will not be directly taken into account, for two main reasons. First of all, engineers and gender aspects of the engineer profession are specific research topics, apart from this study. Secondly, electrical and electronic engineers are mainly working in the manufacturing industry, while WWW-ICT will focus on ICT services.

2. Mapping gender gaps in ICT occupations

Understanding the extent of the gender gap in ICT-professions necessarily involves first and foremost conducting an assessment of available quantitative data on women's representation on the ICT labour market and in ICT training.

2.1 Women in ICT jobs

WWW-ICT is concerned with identifying the situation of women in ICT professions and with addressing the ways in which women's under-representation may contribute to the shortage of key professional skills that threatens to handicap the development of the Information Society in Europe.

In general terms, employment in the ICT sector has been growing very markedly across the EU in recent years. In most countries, employment growth in computer services alone was over 10% in 1998 alone (Eurostat, 2001a). By 1998, employment in both computer services and manufacturing stood at 4.3 million, of whom 1.6 million were employed in ICT manufacturing and 2.7 million in ICT services (including about 1 million in telecommunications services) (Eurostat, 2001a). The sector is increasingly dominated by specialist firms, which have taken over the provision of computing services for client companies. Computer services in the EU are dominated by SMEs; 93% of computer services businesses are micro-businesses employing less than ten employees. Despite the predominance of micro-businesses, there is a huge concentration of employment in bigger companies. This is the context within which women are employed in ICT.

It is important to distinguish data on women's employment in ICT sectors, and data on women in ICT occupations.

In order to examine the employment of women in ICT professions, two types of data need to be considered: data on employment in *ICT sectors*, and data on employment in *ICT occupations*. The first ones are related to sectoral employment data (NACE codes), the second ones to occupational data (according to the International Standard Classification of Occupations, ISCO).

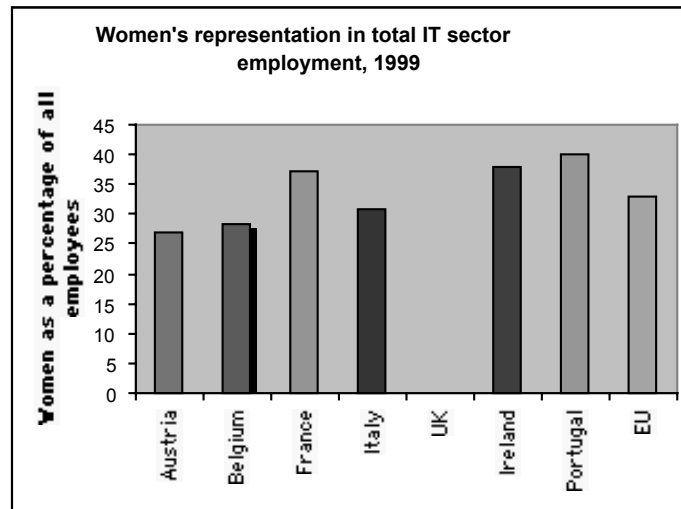
Women's representation in ICT sectors

How these sectors are identified and defined in the first place is an issue for discussion. There are many sectors in which ICT related activity takes place, some exclusively ICT-related (for example, hardware consultancy), others more generic but including ICT activity (for example, office machine manufacturing). In this project, we follow the approach used by Millar (2001) in the STAR project and Vendramin and Valenduc (2002). In the STAR data, the following sectors at the NACE two-digit level are included:

- Computer services and related activities (NACE code 72),
- Telecommunications and postal services (NACE code 64),
- Electronics manufacturing (NACE codes 30, 31, and 32).

The cluster of sectors in which ICT activities take place (according to the STAR project, Millar, 2001) produces the picture of women’s employment shown in Figure 3.

Figure 3
Women’s employment in ICT sectors, 1999



Source: Millar (2001), our tabulation from her data.
UK data not available.

A narrower definition of the ICT sectors (Vendramin and Valenduc, 2002) focuses more precisely on the core ICT activities, at a desegregation level where reliable data are available in some countries only, but where European statistical data are mostly not reliable (2):

- Computer services and related activities (NACE 72),
- Telecommunications and network services, excluding postal services (NACE 64.2),
- Wholesale and maintenance of computer and office equipment (NACE 51.64) (3),
- Manufacturing of computer and office equipment (NACE 30),
- Manufacturing of electronic components (NACE 32.1),
- Manufacturing of emission and transmission devices (NACE 32.2).

The next table includes the only reliable data available from Eurostat (Labour Force Survey), concerning NACE 72 and NACE 30.

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- (2) Eurostat data come from the Labour Force Survey, which is a sample survey conducted every year in a standard and comparable way in all European countries. The size of the sample does however not allow for reliable employment data in the concerned NACE 3-digits sub-sectors.
- (3) In small countries where there is no computer manufacturing (for instance: Belgium), the activity of major ICT firms (IBM, HP-Compaq, Dell, NEC, etc.) is classified under “Wholesale and repair of computer and office equipment”. Employment data of these firms are neither included in NACE 72 nor in NACE 30, which may cause a significant bias in international comparisons.
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Table 2
Evolution 1997-2001 of M/F employment in ICT sectors
in the WWW-ICT countries (*thousands of employees*)

	1997			2001		
	Female	Male	%F	Female	Male	%F
NACE 72: computer services						
EU15	279.9	727.1	28%	531.5	1387.3	28%
Belgium	6.8	20.4	25%	13.3	35.2	27%
France	48.5	119.8	29%	80.0	203.1	28%
Ireland	3.5	6.4	35%	9.6	18.4	34%
Italy	39.4	82.1	32%	67.3	135.5	33%
Austria	3.3	9.0	27%	8.9	22.5	28%
UK	71.3	183.7	28%	119.7	362.3	25%
NACE 30: manufacturing of computer and office equipment						
EU15	118.8	317.6	27%	116.4	280.5	29%
Belgium	1.8	6.1	22%	1.9	7.0	22%
France	14.6	25.4	37%	13.1	28.3	32%
Ireland	8.4	12.6	40%	8.1	13.8	37%
Italy	16.6	43.0	28%	15.4	23.6	39%
Austria	1.9	4.2	32%	1.7	7.3	19%
UK	33.1	103.6	24%	36.3	95.7	27%

Source: Eurostat, data from the Labour Force Survey.
LFS data on Portugal are below the threshold of reliability.
All data on self-employment are below the threshold of reliability.

Occupying less than 30% of ICT sector jobs across the EU, women were significantly under-represented in the sector. Moreover, as Millar's figures show, there were key national differences, with the sectors in France, Portugal, Italy and Ireland having above average representation of women in the sector but Austria and Belgium having slightly below average representation of women. A similar analysis by the European Commission in *Employment in Europe 2001* confirms that employment in high technology sectors is still extremely male-dominated, with some countries (Belgium, Greece, Netherlands, the UK) having gender gaps of over 50% between male and female representation. Also remember that these figure not only concern ICT professions, but all employees in the ICT sector, including clerical or commercial staff.

We are able to look in more detail at the IT sub-sectors within which women are represented using national data from Belgium, the UK and Ireland for 2000 (Figure 8). These show that women are most strongly represented in the data bank and hardware production sectors, and least well represented in the computer maintenance and repair sector. This suggests that the occupational segregation of women within the IT sector persists: women have traditionally been clustered in data entry jobs and in

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hardware assembly work, and these data imply that this continues to be the case. However, it is worth noting that the ICT sector is quite differently constituted in different countries. In Belgium, for example, there is very little computer manufacturing activity, so most ICT jobs are classified as being in the service sector.

Table 3
Changes in men's and women's employment in ICT sectors,
UK, 1997-2000

SIC code and sector	1997		1998		1999		2000		% change 1997-2000	
	M	F	M	F	M	F	M	F	M	F
3002: Computer manufacturing	21542	9133	25630	11999	27824	12981	28278	12217	31	34
7210: Hardware consultancy	12047	4225	7434	5604	10295	7175	10999	7913	-9	87
7220: Software consultancy and supply	139057	54081	131100	90265	145850	100384	162021	110578	17	104
7230: Data processing	17809	10643	23122	15442	23566	17131	31357	21393	76	101
7240: Data base activities	4872	2386	3279	3436	4468	4759	5037	4372	3	83
7250: Maintenance/repair: office machinery etc	21959	7719	17828	7972	19253	8580	17998	8704	-18	13
7260: Other computer related activities	28315	11246	35077	28161	50070	38926	61887	48308	118	330
Total	245600	99433	243470	162878	281327	189937	317577	213485	29	115

Source: UK Office for National Statistics, Annual Business Inquiry, successive years.

Time series data for the UK and for Belgium show how women's and men's employment in the sector has developed during the late 1990s. In the UK, data for selected IT sectors shows that women have gained substantially from employment growth, particularly in the areas of software supply and consultancy, data processing, and other computed related activities (Table 1). Although men made considerably fewer gains (in the case of the hardware consultancy and maintenance sectors, they lost jobs between 1997 and 2000), they still held around 60% of jobs in the sector.

Given that the sector in Belgium is principally composed of service activities, it is worth specifically considering trends in women's non-manual employment in the sector. Time series data for Belgium for 1995 and 2000 show that the proportion of women "intellectual workers" in telecommunications services has increased, despite overall job losses in the sector. The balance of job creation and destruction has been favourable to women in this part of the sector. In computer services, by contrast, despite a doubling of total employment between 1995 and 2000,

the proportion of women has decreased. Job creation in this sector has favoured men at the expense of women.

Table 4
Changes in women's employment in computer-related services,
Belgium, 1995 to 2000

	1995			2000			% Increase	
	Total	F	%F	Total	F	%F	Total	F
Wholesale computer and office equipment (5164)	14595	3701	25.4%	18549	4977	26.8%	27.1%	34.5%
Telecommunication (Belgacom and subsidiaries) (64201)	24854	5053	20.3%	20864	5868	28.1%	-16.1%	16.1%
Other telecom services and cable networks (64202)	2484	583	23.5%	10288	3088	30.0%	314.2%	429.7%
IT system consultancy (7210)	8584	2584	30.1%	13107	3470	26.5%	52.7%	34.3%
Programming and software production (7220)	6377	1607	25.2%	17540	4290	24.5%	175.1%	166.9%
Data processing (7230)	1745	648	37.1%	2766	909	32.9%	58.5%	40.3%
Data banks (7240)	287	128	44.6%	1116	486	43.5%	288.9%	279.7%
Computer maintenance and repair (7250)	379	59	15.6%	1808	309	17.1%	377.1%	423.7%
Other IT-related activities (7260)	70	25	35.7%	166	47	28.3%	137.1%	88.0%
<i>Sub-total computer services (NACE 72)</i>	<i>17442</i>	<i>5051</i>	<i>29.0%</i>	<i>36503</i>	<i>9511</i>	<i>26.1%</i>	<i>109.3%</i>	<i>88.3%</i>

Source: National Institute of Statistics, Brussels (INS)

Only 21% of people working in ICT professions are working in the ICT sector. Others are working in user sectors.

Women's representation in ICT occupations

ICT employment is not confined to the ICT sector, but is spread widely across the European economy. In 1999, for example, only 21% of people working in ICT occupations were working in the ICT sector, as discussed above. The large majority were working in other areas of the economy, in sectors that use rather than produce ICTs. Employees here are more likely to be involved in configuring and maintaining technologies according to the specific needs of their organisations, and this has to be taken into account in discussions of ICT skills and skills shortages (Millar 2001).

Quantitative data on ICT occupations must be handled with care, because they generally come from sample surveys, for instance the European Labour Force Survey (LFS). Sampling small professional groups, such as women in engineering or ICT professions, raises a lot of problems of reliability and interpretation.

One statement is however clear: while women are under-represented in ICT sector employment, they are even more severely under-represented in ICT occupations, making up only 15% of ICT workers across the EU as a whole in 1999 (according to Millar, 2001), 17% of IT professionals in

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2001 (according to LFS data, table 4). The STAR data show considerable variation between the countries covered by WWW-ICT (women held less than 10% of ICT occupations in Austria, against 18% of Portugal), while LFS data are much more homogenous.

While women are under-represented in ICT sector employment, they are even more severely under-represented in ICT professions.

Distinguishing different types of ICT occupations within which women are employed in the different countries is somewhat problematic, as national data on occupations comes from Labour Force Surveys which are sample surveys. Disaggregating by three-digit ISCO or SOC codes generates insignificant numbers, particularly in small countries like Austria, Belgium and Portugal. It is however very clear that women are particularly poorly represented in the occupations with which WWW-ICT is particularly interested – ICT professionals and engineers.

Data from the European Labour Force Survey (1997 and 2001) allow for a comparison between IT professionals (ISCO category 213) and engineers (ISCO category 214), which could be interesting as both occupation groups are considered as highly technical and mainly masculine (Table 5).

Table 5
Evolution 1997-2001 of M/F employment in ICT occupations in the WWW-ICT countries
(thousands of employees)

	1997			2001		
	Female	Male	%F	Female	Male	%F
ISCO 213: information technology professionals						
EU15	180.5	796.7	18%	265.4	1264.8	17%
Belgium	8.5	36.8	19%	8.8	49.7	15%
France	30.0	161.0	16%	50.3	250.3	17%
Ireland				6.0	14.6	29%
Italy	(2.3)	(6.5)	(26%)	(2.0)	9.0	(18%)
Austria	(1.7)	5.3	25%	(1.4)	8.8	(14%)
United Kingdom	56.9	254.0	18%	63.5	351.1	15%
ISCO 214: engineers						
EU15	274.6	2210.3	11%	321.5	2322.0	12%
Belgium	4.9	55.6	8%	(3.8)	47.7	(7%)
France	35.8	362.9	9%	55.0	423.7	11%
Ireland	6.2	31.2	17%	(3.3)	24.9	(12%)
Italy	(6.5)	56.5	(10%)	13.1	70.1	16%
Austria	(1.0)	14.6	(7%)	4.8	14.0	25%
United Kingdom	46.8	496.2	9%	37.0	476.9	7%

Source: Eurostat, data from the Labour Force Survey, calculations FTU.

Data in brackets are considered as poorly reliable by Eurostat. LFS data on Portugal are below the threshold of reliability. All data on self-employment are below the threshold of reliability.

Within the limits of reliability mentioned at the bottom of the table, some findings are interesting. The proportion of women is significantly higher among IT professionals than among engineers in all concerned countries (excepted doubtful data about Austria), which should indicate that informatics is more feminine than engineering as a whole. This statement must be attenuated by the fact that engineers are mainly working in manufacturing industries, where male employment predominates, while IT professionals are mainly working in services and administrations, where there is an overall higher share of women employment.

Comparison between 1997 and 2001 shows a considerable increase in the number of IT professionals in all countries, but a decrease in the proportion of women. The important job creation process between 1997 and 2001 is likely to have been more favourable to men than to women. Other data from the UK confirm that 1999 was a peak year for women's employment in ICT occupations, and that since then there has been some decline (Millar and Jagger 2001). Whilst in 1999 16% of ICT jobs were held by women, in 2000 this had declined to 13%. In the professional areas of computer systems management and computer analysis/programming, women made up about 20% of the UK workforce in 2000. However, women's employment in the latter group declined as a proportion of the whole between 1999 and 2000.

If this trend is more generalised, and persists through into the early years of the 21st century, then the prospects for improving the representation and deployment of women in professional areas of computing and ICT might be severely hampered.

In order to update statistical data, consultation of the results of the STILE project, running in parallel with WWW-ICT, should provide fruitful information and analysis (www.stile.be).

2.2 Women in ICT Education

Women are under-represented in science, technology and engineering education. There are concerns that it is a growing rather than declining problem.

It is widely agreed that, for a variety of reasons, women have traditionally been much less likely than men to participate in science, technology and engineering subjects in schools and colleges. Their under-representation is seen as one of the key reasons why they have not progressed into employment in these areas.

Statistical evidence on the gender gap in ICT education continues to support this picture of women's under-representation in the educational sphere, and there are concerns that this is a growing rather than a declining problem. A Europe-wide analysis of women's place in ICT courses and professions which examined data up until the academic year 1996-97 showed that in the EU overall, women comprised about 27% of mathematics and computer science students, and that this actually represented a drop in their relative participation over the previous two years (STAR project, Millar J., 2001).

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Across the EU, there are important differences. The share of women goes from about 20-25% in Austria, Belgium, UK, to about 30% in France and Ireland, and more than 40% in Italy and Portugal. While in most countries there was a decline in women's enrolment in these courses, in the UK there was a small increase and in Portugal a more substantial one. It is also noteworthy that the enrolment of women on such degree courses is well above the EU average in both Italy and Portugal, though this does not necessarily feed through into the employment sphere.

The proportion of maths and computer science graduates who were women also declined slightly in the four years to 1996-97, when women made up 30% of these graduates across the EU. Again, in Italy and Portugal their representation was particularly high at around 50%, and in Portugal there was an increase from 1993 to 1996-97. In Austria, the UK and Ireland, the representation of women declined during this period, and was in any case at a low level compared with the higher performing countries and with the EU as whole.

In order to ascertain whether this picture still holds some years later, we have assembled national data from national educational authorities on the participation of women in Computer Science degree and postgraduate education for the years 1997/98 and 2000/01. These data cover three countries involved in this study: Austria, Belgium and UK. In Austria, the proportion of women among computer science graduate students remains stable from 1997 to 2000, at 9.4%. In Belgium, it slightly decreases from 9.6% to 9.3%. In UK, it increases from 20.2% to 25.5% (4).

The picture is a little more encouraging at postgraduate level. From the very limited data available, we can suggest that there has been some increase in the representation of women in the recent past. In the UK women now make up nearly 30% of computer science postgraduate students, and at the very least, it is clear from our data that at both undergraduate and postgraduate levels, the representation of women in this country has improved considerably since the STAR report was completed. However, in Belgium and Italy, the other countries for which we have our own reliable data, the proportions of women postgraduates are still lower (17 % in Italy, 10% in Belgium), at much the same levels as reported in the STAR project.

In addition to these qualifications, it is important to note that different countries collect data in different ways and covering different phenomena. First, differences in education systems make comparisons

(4) Austria: Statistik Austria. Figures are for total enrolments on Informatics and Telematics courses in Technical Studies. Figures not disaggregated by degree level. Belgium: Council of French Speaking Rectors and Ministry of Flemish Community. Data are collected separately by and for the French and Flemish speaking communities, and there are slight differences in degrees in the two parts of the country. UK: Higher Education Statistics Agency.

between countries (and even within countries) problematic. For example, in Belgium, the French and Flemish Communities offer slightly different ICT courses of different lengths in their universities. In the UK, combined or joint degrees may include informatics or information technology as part of a wider programme of study (for example, “Innovation Studies”), though the approach to information technology may not always be as a technical subject.

In addition to differences in education systems, there are differences in national methods of data gathering and reporting both between countries and over time. These are particularly apparent in relation to employment data, where there are still national differences in coding systems and different rates of adoption of international systems.

2.3 Interpretation of quantitative data: no obvious correlations

Our overview of available statistical data reveals a considerable diversity among European countries in general, among the WWW-ICT countries in particular. Moreover, it does not lead to any clear correlation between the gender gap in ICT professions and various potentially explicative data sets: women’s activity rate, women’s employment share in higher positions, women’s share among ICT students or graduates.

The next tables illustrate the difficulty to establish correlations between existing data. For example, among the seven WWW-ICT countries, there is no one where a high gender gap in women’s activity rate could explain a high gender gap in ICT occupations.

Table 6
Women’s activity rate and women’s share in ICT occupations

	Lower gender gap in women’s activity rate	Higher gender gap in women’s activity rate
Lower % women in ICT	<i>Austria, Belgium, UK</i>	<i>None of the WWW-ICT countries</i>
Higher % women in ICT	<i>France, Portugal</i>	<i>Italy, Ireland</i>

Table 7
Women’s share in ICT degrees and women’s share in ICT occupations

% women in ICT degrees much lower than % women in ICT occupations	% women in ICT degrees slightly lower or equal to % women in ICT occupations	% women in ICT degrees higher than % women in ICT occupations
<i>Austria, Belgium, UK</i>	<i>Portugal, Ireland, France</i>	<i>Italy</i>

The last table indicates that, excepted in Italy, there are less women among the ICT graduates than among the ICT professionals. This is an evidence of the importance of continued education and vocational training in the professional trajectories of women in ICT.

Is representation in education a good predictor of representation in later employment? In some countries, there is some evidence to indicate that relatively high levels of women's representation in ICT courses is matched by similarly high levels of representation in ICT professions (for example, Portugal and to a lesser extent, Ireland), while in others (for example, Italy), there seems to be little connection between substantial proportions of women participating in ICT courses in higher education, and their representation in the ICT labour market. This is probably because of national differences in both the constitution of ICT courses in higher education (for example, the extent of 'management' rather than 'technical' orientation which seems slightly more attractive to women), and equally because of differences in the behaviour and requirements of ICT labour markets in different countries. But in general terms it is also the case that not all ICT professionals learn their skills or move into the ICT labour market via formal higher education in ICT related subjects. Many join the ICT labour market afterwards and through different routes. This may become an increasing phenomenon with the development of some of the more artistically-oriented ICT professions – for example, web design, graphic art, internet publishing, and so on.

Moreover, some methodological issues are also raised by the above discussions concerning statistical data:

- *Difficulty of comparing educational data.* ICT courses in higher education vary both within and between countries, in coverage, length and standard. ICT graduates are often mixed with all engineers or with maths and sciences, despite the considerable enlargement of ICT skills and curricula (business, communication, etc.). As some national statistics agencies do not disaggregate by every possible kind of computing-related course, it is often difficult to make reliable Europe-wide assessments of women's precise location in ICT higher education.
- *Employment and occupational data coding systems remain differentiated.* The persistence of national coding systems again contributes to difficulties in making international comparisons. Even with progressive movement to the international NACE and ISCO systems, and with new revisions of these systems, there are compatibility problems that make time-series analysis and particularly cross-national time-series analysis problematic. Constant technical changes and the need to reflect new ICT activities and professions into coding systems may well perpetuate this problem in years to come.
- *Difficulty of combining sectoral and labour force data – levels of disaggregation.* While sectoral data is collected nationally based on exhaustive data collection, national and European labour force surveys (which contribute to the European Labour Force Survey) are sample surveys. High levels of disaggregation often produce insignificant results using this data, particularly in small countries, and this makes it difficult to build up a nuanced picture of gender divisions in ICT professions,

particularly when differentiating ICT occupations within the ICT sector, as the STAR report recommends.

- *Coding systems need to be constantly revised to take account of new developments in ICT work.* The ICT sector and its activities are constantly changing, in ways that are not always well reflected in sectoral and occupational coding systems. Efforts are underway to develop modifications and new codes which reflect new activities (for example, the IST STILE project is attempting to do this) but there is a danger that ICT research will by definition always be drawing on a dated picture of the ICT sector and labour market as statistical tools struggle to keep pace with real-life developments.

As a conclusion, women now make a large minority of the European labour force, and their labour market participation is growing all the time. The bulk of new jobs being created in Europe are being taken by women. In the context of their growing participation, how, if it all, is this reflected in ICT professional work? The evidence of European-level data, together with our own analyses of selected countries, tells us that the under-representation of women in both ICT education and employment remains significant, and disproportionate to their representation in the labour market as a whole. Women continue to form a maximum of around one-quarter to one-third of ICT students and professionals, though in many countries their representation is much lower than this.

Hypotheses and methodological options

Explicative hypotheses of the gender gap in ICT professions usually refer to three categories: imbalances in education and training; working conditions that disadvantage women and professional careers that support men; cultural factors that reinforce the male image of computer science and gender bias in systems design. Each of these categories of hypotheses is not sufficient to explain gender disparities. Their interaction is the key issue to be understood.

Various dimensions and explicative variables must be taken into account in order to draw a full picture of the gender gap in ICT professions. An in-depth analysis of scientific literature related to these explicative factors is presented in our report D1, *Conceptual framework and state of the art*, and summarised in the first section of this chapter. The second section draws a synthesis of this integrated framework of explicative variables. The third section presents and explains the methodological options of empirical research in WWW-ICT.

1. Hypotheses drawn from literature overview

Studies of gender imbalances in ICT professions mention a series of explicatory factors that we have clustered into five categories.

1.1 Imbalances in education and training

The first category of explanatory factors relates to education and training, which are upstream professional choices operated by men and women. Three statements can be drawn up from chapter I:

- Women are under-represented among the students and the graduates in the field of ICT.

- Imbalance worsened during last years, despite a diversification of the options and diplomas.
- A similar imbalance is observed in the continuous vocational training.

The challenge is thus to understand why computer science and related disciplines are not attractive for women. The problem is not new and the situation seems to worsen. Among the researchers who have long been interested by the issue “women and computer science”, as the working group “Women and computers” of the IFIP (International Federation for Information Processing), one even notes a kind of lassitude to repeat the same statements: in secondary school, girls are less attracted than boys by the scientific and technical branches; they are not directed and do not direct themselves towards ICT professions; secondary and higher education maintains a male image of ICT and ICT specialists. The image that students have of ICT professions is not very precise, it is made of stereotypes picked up in the media, images coming from the leisure use of computer, representations suggested by the parents and coming in particular from their professional context (Balka & al., 2000).

Biases have been identified in primary and secondary education, which do not inevitably exclude girls but systematically support boys.

A series of bias can be identified in primary and secondary education, which do not inevitably exclude girls but systematically support boys:

- The organisation of informatics courses in school leaves a broad place to the male image “The location of the computers in the classes of maths and sciences, the number of students per computer, the practices of the teachers and the management of the informatics clubs contribute to reinforce the relative advantages of the boys” (Webster J., 1996, chap. II). Moreover, it seems that a great majority of informatics teachers are men, whereas women are numerous among the professors of mathematics and sciences.
- In school orientation and curricula advising, ICT professions are not presented in a manner that can attract girls. The organisation of “enterprise days” by schools to support contacts between last year students and the professional world, can contribute to reinforce a male image of ICT professions.
- In secondary schools, informatics is seldom a discipline as such. It constitutes a complementary activity or a teaching support, it is not the subject of a cumulative and progressive training, like languages, mathematics, economics, Latin, etc. The fact that it belongs to the common environment of young people does not necessarily give desire for making a trade of it. The selection criteria in the access to higher studies in the branches related to ICT remain dominated by students’ representation of engineering or technical studies.

For better understanding the determinants of this gender imbalance in ICT professions, it is necessary to study how a series of factors interfere which, taken separately, would undoubtedly not constitute a sufficient explanation, but which, together, produce convergent effects:

- assimilation of informatics with technology, mathematics and physics, rather than management and communication;
- effects of social reproduction, based on the trades and professional choices of the parents or brothers and sisters;
- the role of technological domestic environment;
- the role of leisure use of computer and Internet and their interference with the construction of a study choice or a professional project;
- the image of informatics in the teenagers media (press and audio-visual), the way in which ICT-related characters are introduced like positive or negative heroes in the eyes of girls or boys;
- gender bias of marketing or advertising campaigns for products and services of the information society.

In addition, initial and continued education is based on two types of approaches of the choice of informatics: informatics like a profession or informatics like a competence (i.e. like technological component of another profession). Are gender imbalances more significant in the first approach than in the second? If so, why?

1.2 Working conditions that disadvantage women

Blurring boundaries of ICT jobs can be explained by several factors: work specificity, work organisation, and labour market.

A second category of explanatory factors relates to working conditions. The intensive rhythms of work, the overloaded schedules and frequent overlaps between professional life and private life, which often characterise ICT professionals' working conditions, are very little attractive for women. Such working conditions do not correspond to their professional aspirations and are not compatible with the domestic and family loads that they still mainly assume. Voluntary agreements of flexible work, which would make it possible to better reconcile work and private life, are rare. Moreover, recruitment practices, management of careers and power relations often present a discriminatory dimension with regard to the women.

The ICT sector is characterised by the concept of "blurring boundaries": between employees and independent employment, between professional and private sphere, between professional and private time. Several factors explain this tendency: the characteristics of work, the organisation of work, and the type of labour market.

Characteristics of work

ICT service provision is a complex activity, where important economic interests are at stake. Tasks are time consuming, but it is often difficult, at the beginning of a project, to exactly assess the means, in time and human resources, which will be necessary to the project realisation. However, the ability to estimate and plan work is crucial to control working time. All types of work do not authorise in the same way this capacity of initial assessment (for instance, standard products versus

customised products). More generally, there aren't any clear quality standards for a final product and the customers' requirements often evolve or even change during a project. Moreover, unpredictable difficulties frequently appear during the realisation of a project. Consequently, the management of work is very complex and that has impacts on working time and flexibility, especially in enterprises that have no sufficient staff. Finally, as the profit will be inversely proportional to the means invested in a project, the tendency is often to underestimate the means necessary to the realisation of a project.

Organisation of work

Two key words characterise work in this sector: speed and long hours, associated with unpredictability of working time that make very difficult any attempt of organisation of the private life. The real duration of work, often near 50 hours per week, is a real factor of discrimination with regard to women. Those who are concerned by the longest working times are men without family load. Pressure on time is particularly hard in the case of project work, where pressure of the deadlines and of the group lead to self-intensification of work. The key rule for many companies in this sector is that it is necessary "to be the fastest and the first". Long periods of absence, like maternity leaves, make difficult to return in this type of activity and part-time work does not match with such rhythms of work. In spite of the fact that they generally work much more than the legal weekly duration of work, employees of this sector do not seem to regard that as a real problem. What can trouble them is rather the pressure of the responsibilities, the lack of support of the hierarchy, the lack of clear priorities, the contradictory requests. If the working hours do not appear as a problem, it is because the staff is mainly male, young and without family loads. In the NESY project (Lehndorff S., Mermet E., 2001), the men questioned whom have children generally let their wife deal with the main part of the domestic tasks and the loads related to the children. These men appreciate the flexibility and the autonomy of their work, for example, capacity for earlier return in the afternoon in order to be with the children and then to work over again in the evening, but with a wife who is responsible for all the domestic loads.

Relationships with the customers also determine the working conditions. The consultant who works at a customer has the customer's working conditions. If its mission is paid per hour, working time will be better checked because the customer will pay overtime. In work by project (more frequent), time is not checked, particularly when many people are engaged in a project. Some projects require close cooperation that represents significant times of coordination, generally non planned at the beginning. In order to maximise the time spent to the customer, "peripheral" activities (training, meetings, etc.) are often placed in the evening. Again, part-time work does not match with the availability required by the customers in ICT projects.

A specific labour market

ICT services are composed of a limited number of large companies and of a majority of small companies with few staff. Many large virtual companies are also split into small and medium-sized companies. Large companies have quite structured human resource policies while many small companies are quite unclear in this field.

Long working hours are more frequent in small companies. Trade-union organisations are usually more present in this sector, even if in several countries, some attempts of organisation of these workers are being implemented.

Taking into account their expertise and the recurrent staff shortage, one might suppose that ICT services employees have a significant capacity of negotiation. However, their ability seems without effect on the most problematic working conditions for the women, like working time, because they are mainly young male workers, without children. Such work rhythms are at the origin of a vicious circle. Women who have family loads are rare in ICT departments, but as long as there is so few women with children in these services, there will be no pressure to change the organisation of work and to control working time. Moreover, the motivation of the employees is significant. It is cultivated by the management, which leaves a great autonomy in work and in time sovereignty. Very often, long working hours are not perceived as problematic because employees receive financial counterparts. Some performance-related wage systems take into account the number of hours spent on a project.

All the firms studied in the NESY project have recruitment problems. Nevertheless, the skill shortage is not the only explanatory factor. The proposed job definitions limit the number of potential candidates. The caricatured world of connected dynamic young people is not open to candidates relatively aged (for the profession), with children, and even more if they are women.

This sector is also characterised by a significant mobility; employees are more devoted to their tasks than to their company. Consequently, recruitment and development of staff loyalty are essential. In period of shortage, the challenge is to find a balance between work requirements and employees' satisfaction in order to attract new candidates and to retain those that are already engaged. But this balance does not integrate quality standards of work, in particular as regards management of time, which would be more favourable to the female careers.

Nevertheless, to encounter the shortage, some employers (for example in the Netherlands) introduce less standard forms of employment, like part-time work, in order to attract women. This can contribute to create a context less favourable to long working hours, unpredictability and continuous overload. It also appears that the sector is slowly being organised, with some collective agreements between employers and employees.

1.3 Professional careers that favours men

Careers of ICT professionals have specific characteristics, of which differentiated effects on men and women must be evaluated.

In the new forms of professional trajectory, work relation is based on the development of employability as a counterpart of performance and flexibility.

Several studies show that ICT companies want their staff to be highly devoted to work, to accept all forms of flexibility and to offer total availability to the employer. At the same time, these same companies weaken the guarantees of job security: reorganisations, downsizing, closures and businesses process re-engineering have demonstrated to the workers that competence, performance and availability are not sufficient to ensure job security. As a consequence, the workers must now manage by themselves their employability and career. The expressions “nomadic career” or “boundaryless career” illustrate these new forms of professional trajectory, in which work relation is based on the development of employability as a counterpart of performance and flexibility, whereas the traditional work relation exchanges job security against loyalty. It is of course an optimistic vision that says nothing on the negative aspects of insecurity in these professional trajectories. Are women favoured or disadvantaged by the extension of such nomadic careers? The question is discussed.

- For some authors, nomadic careers present opportunities for women. In network organisations, characterised by the importance of group work, co-operation and distributed information, the relational competences would become advantages. Women would be more efficient than men to develop trust relation in work relations, which constitutes a potential advantage in nomadic careers. Another possible advantage for women would be their greater experience with discontinuity in work. Their professional trajectories are often made of discontinuities, mainly due to family events, while the professional trajectories of men are rather linear. This experience gives women psychological and social resources to face nomadic careers. Moreover, as women are frequently providers of the second wage in a household, they would be freer to explore new professional trajectories (Bender A-F. & al., 2001).
- On the other hand, other sources raise a series of factors which disadvantage women: the problem of geographical mobility, which obliges more often women than men to interrupt their career; disruptions of career, which keep women far from the professional networks and erode their competences; the problem of time investment, which is necessary to develop professional networks (Bailey A-F., 2000).

However nomadic careers are not the only challenge for women. In “classical” professional trajectories they are also concerned by what has been called the “glass ceiling”, expression often used to characterise the obstacles faced by women when they reach a certain level in their career. This also concerns other trades than those related to ICT. Moreover, career progression seems to follow rules from which women are

excluded: meetings in the evening, leisure activities only for men, participation in clubs, staying in the office late in the evening. As a result, diverse forms of discrimination go through female careers:

- Women miss contextual and cultural information that is necessary to understand how communication runs in the company.
- Women are underestimated as regards the social and cultural aspects, including as for their own vision of informatics culture.
- Women do not have as many possibilities as men to give their personal definition of professional situations or to present their personal analyses; they are often kept away from strategic decisions.

The same level of education than men and comparable qualifications are not enough to guarantee a woman's career in informatics.

The same level of education than men and comparable qualifications are not enough to guarantee a woman's career in informatics. Others requirements are expected from women; requirements linked to their "natural" social aptitudes that place them systematically in support activities. If they do not do so, they are perceived as not playing their role; but at the same time, these non-technical qualifications are neither recognised nor remunerated, because they are regarded as natural. On the other hand, their male colleagues present their possible relational aptitudes like additional competences, which are profitable for their career.

A survey carried out in Australia on successful strategies of women in ICT professions confirms that the organisational factors are more significant than the technological factors to explain gender discriminations. "Women think that their difficulties rest more on the adaptation to a male organisational culture than women's technological aptitudes" (Pringer R. & al., 2000).

Another recent survey, carried out in Baden-Württemberg, confirms that compatibility between professional life and family life is the most significant obstacle in women's career in ICT professions (Menez R., 2001; Munder I., 2001). People questioned in this survey are the leaders of about 250 companies of the ICT sector. 60% of them think that there are no particular obstacles to women's professional careers; the classical argument of less technological competence is unfounded. Those who identify obstacles to women's careers, classify them as follows:

- The interruptions of career, in particular related to maternity leaves, are regarded as the most significant obstacle, especially by the large companies, because women remain outside of knowledge production within the organisation. To solve this, some companies plan specific training schemes when women are coming back from long leaves for family reasons.
- All what is related to family loads come in the second place, particularly the "limited" flexibility of women. Locational and time flexibility remains two core requirements on behalf of the employers. In small companies (less than 20 workers), flexible agreements more

favourable to women seem easier to conclude. In these smaller companies, women are more numerous as heads of project or in senior position than in the large companies.

- In the third place, we find a lack of attention of the managers for the possible promotion of women, as well as the lack of advices for career orientation. On the other hand, less than 2% of the managers questioned mention a possible lack of technical competences of the women.

The results of this German survey confirm once more that the question of women's careers cannot be analysed apart from employment and working conditions, particularly apart from flexibility and time issue.

1.4 Cultural factors that reinforce the male image of ICT

The male image of ICT is still alive and can be found in the professional culture of many programmers, in the educational sphere and in the design of informatics products.

Cultural factors reinforce the bias already revealed in education, training and working conditions. At the beginning ICT has been associated with a male image, made of power, fighting strategies, capacity of control and domination, potential of destruction, robots. This image is still alive. One finds it for example in the professional culture of many programmers, passionately engaged in the development and the test of their algorithms, working night and day to find the least bug, talking in a jargon and ignoring all that is not technical. This culture is largely unfamiliar for women, who were always even more rare among the programmers than among the analysts.

The history of Apple and the pioneers of Silicon Valley gave space to another component of this cultural universe: the "non conventional" ICT specialist, a mix of Einstein, Woodstock and Wall Street, out of generally accepted ideas, but always male. The dominating culture of the programmer and the non conventional culture of the pioneer can be seen in the image of the "hacker", data-processing pirate always ready to enter illegally into the best protected computers or to submerge the world with infected electronic mails. On the networks as on the oceans, piracy is a male business.

Today, at school age, the ICT culture is build differently for girls and boys. In a caricatured way: for boys we have action, sport and combat games; for girls, we have chat, mailing list, fan-clubs; for the first we have joystick and performance and for the second, keyboard and communication. Even if they are not unfounded, these caricatures risk creating new stereotypes, in which the male and female roles will be confined. The stereotypes derived from ICT-uses influence the market studies on new products and services, as well as the design of these products and services and finally, their marketing image.

This is why some authors argue that it is also necessary to underline cultural opportunities open to women with the new generation of ICT based on the Internet, as well as the new culture created by the networks

and the home computers compared to the traditional image of informatics.

1.5 Gender bias in systems design

The fact that women are not numerous in companies that create and develop ICT systems entails that those are especially developed by men, consequently with forms of creativity and typically male criteria of effectiveness. The computers, the software and the interfaces “man-machine” take male appearances, which dissuades women to choose computer science curricula. This is a vicious circle.

Research teams specialised in the design of human-machine interfaces make a distinction between cognitive capacities that are rather “male” or rather “female”. Roughly presented, women have better verbal capacities, particularly when clarifying their way of thinking. Men have a better space perception and a better visualisation of the representations in 3D, etc. Men want to control technologies and to be obeyed, while women consider technologies as flexible instruments. However, these cognitive differences between men and women also include some stereotypes. Moreover, the difference in cognitive styles inside the same gender is larger than differences between the genders. Consequently, an equilibrated mix of male and female cognitive capacities in the interface design can change the gendered nature of most interfaces. However, the authors of this analysis state that the challenge is not easy (Romanee Peiris D. & al., 2000).

A survey carried out among the students in computer science of the University of East London reveals significant differences between the quality standards allotted to the software interfaces by men and women (Stepulvage L., Turner E., 2001). If the user friendliness of the software interface is important for 33% of the girls and 29% of the boys, its technical performance is important for 21% of them, but for only 3% of girls. On the opposite, the latest appreciate more easiness of navigation procedures (15%/6%), relevance of content (13%/0%) and interactivity (15%/0%).

An older argument, already raised in the eighties, is that women working in the project design and systems analysis are more inclined than men to take into account the concerns of the users and to implement participative methods of systems design. Men prefer to use more formal and less interactive methodologies of development. This argument loses its relevance today, because the cycles of development of projects are increasingly short, the pressure on the deadlines is stronger and methodologies are more formal. Other authors are convinced that a better balance between men and women in interfaces design and software development would make it possible to improve their use by women (Green E., 1994; Klein K., 2001). However, they agree on the fact that the gender bias in systems design is less important than the segregation in education and professional careers.

2. A structured model of interaction between explicative variables

As a conclusion to the description and analysis of the various explicative variables of the gender gap in ICT professions, a schematic model of interaction between these variables is proposed here. This model must be tested, improved and validated through the empirical tasks of the project: biographical interviews, case studies in enterprises, inventory of good practices. The current presentation has to be considered as provisional. It must be understood as a turning point between theoretical analysis and field study.

Explicative variables are grouped into five clusters:

- *Societies and cultures.* Social, cultural and institutional arrangements (gender division of labour, welfare regimes, gender equality environment, childcare provision etc.) are the key elements of an overall background in which other spheres are interacting.
- *Family and domestic sphere.* Family structures and women's roles vary across countries and welfare regimes, but overall women continue to take primary responsibility for domestic labour, including childcare and other caring functions.
- *Educational sphere.* Girls and women are under-represented on IT courses in school & beyond. In the past, girls were discouraged from & reticent about participating in S&T subjects. Boys were encouraged to dominate classes & use of computers. Boys develop exploratory interest in computing (games); girls have utilitarian approach.
- *Labour market sphere.* Women more likely to be in 'non-standard' employment: part-time work, freelancing, teleworking from home. Benefits include increased ability to balance paid work with domestic responsibilities. Disadvantages include loss of training, learning, development & career opportunities. Labour market regulation affects extent and terms of non-standard employment.
- *Organisational sphere – organisation structures and practices of ICT work.* Working conditions and working time not family friendly, therefore IT employment is rejected or prematurely quitted. Few role models exist for women in senior IT positions. Gender regimes in organisations signal 'women's jobs' and 'men's jobs'. Women over-represented in low- paid areas of IT. Women's skills undervalued when utilised in IT projects.

The next figure gives a graphic representation of the interaction between these spheres, while tables 8 to 12 present a more detailed list of explicative factors and variables in each sphere.

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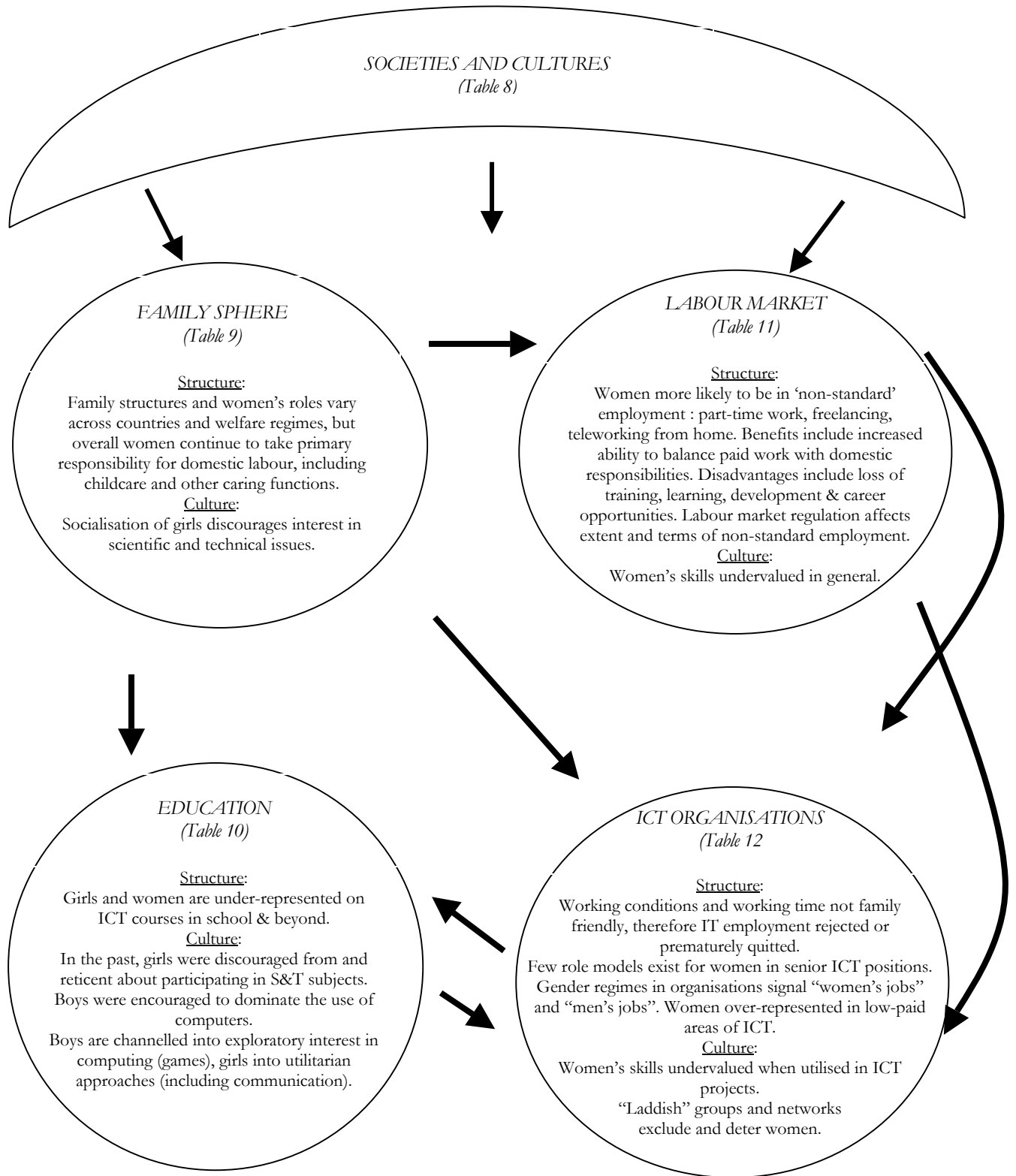


Table 8
Explicative variables: social and institutional arrangements, cultural background

<p><u>Gender division of labour and cultures</u> in different countries have consequences for the terms on which women participate in the labour market.</p>	<p>These shape the acceptable spheres of work of women and men and their accorded value, power relations and dependencies between men and women, the cultural construction of marriage and motherhood and unpaid domestic labour, the acceptability of women in paid work, the construction of welfare regimes.</p>
<p><u>Welfare regimes</u> also affect the extent and terms of women's labour market participation.</p>	<p>Welfare regimes shape the level and affordability of childcare and social protection, which are important for women's labour market participation in general.</p>
<p>The structure, functions and institutions of <u>education and training systems</u> affect both women's participation in the labour market and their general access to scientific and technical knowledge.</p>	<p>The constitution and institutional arrangements in education systems – for example, single sex schools, the organisation of science and technology education, the nature of vocational training systems – are important for women's ability to access ICT skills and knowledge (See also below).</p>
<p>Labour markets and <u>labour market regulation</u> affect the types of jobs women and men do and the terms on which they do them.</p>	<p>Labour markets vary across many dimensions (national, regional, firm-based) and affect the availability of particular jobs, the availability of working arrangements such as part-time work. The terms and conditions of employment (modified by labour market regulation) affect the viability of labour market participation for women (and others with constraints on their participation). (See also below.)</p>
<p>The <u>gender equality environment</u> varies across countries and shapes the context within which companies employ women.</p>	<p>National legislative approaches to gender equality and equal opportunities (for example, legislation on equal pay, sex discrimination, sexual harassment) shape the behaviour of institutions and firms and the sanctions which are used by the state to modify that behaviour. They also affect the space open to women to occupy 'non-traditional' roles and to progressing through organisations and careers.</p>
<p><u>Technological cultures</u> affect understandings of ICT work, who does it and what status it is accorded.</p>	<p>Different European countries have different orientations to scientific, engineering and technological work. In some environments, there is considerable ignorance and/or misunderstanding about what is involved in ICT work. Gender cultures of technological work also vary: in some countries (e.g. the former socialist countries), it is considered normal for women to become engineers or computer scientists.</p>
<p><u>Interest in ICT and attitudes towards ICT</u> may take different aspects for men and women, or different forms of expression.</p>	<p>Women try to integrate technologies in their specific fields of interest, to use them as tools considering the contributions computers can make to these fields.</p> <p>It is not only technical or other special interests that are motivating women in their work, but for them an understanding of the wider context in which computers are used is important.</p> <p>Women are often critical of men's strong identification with and immersion in computers. Their view can be characterised by the notion of ambivalence – a combination of pleasure with and pride in computing with distance from men defining their life around it.</p>

Table 9
Explicative variables: family and domestic sphere

Family structures and domestic division of labour	Women continue to take primary responsibility for unpaid domestic labour, childcare and other forms of care. This limits their labour market and occupational choices, but is particularly hard to reconcile with the working rhythms of ICT work.
Socialisation	<p>Socialisation of girls discourages interest in science and technical issues from young age (for example, through toys, films, books, songs, which emphasise and reinforce ‘feminine’ and ‘masculine’ roles & behaviour). This results in rare opportunities for them to gather experiences with computers and as a consequence leads to disadvantages when they try to enter educational programmes.</p> <p>However, there is no behaviour or meaning that is universally associated with masculinity or femininity. There are as many different women’s standpoints and experiences as there are individual women. Women have a range of socio-cultural influences on them and respond in a range of individual ways.</p>
Role models	<p>Role models of using computers use to be masculine – fathers and boys.</p> <p>Nevertheless, mothers’ competence in handling computers and other technical devices at home seems to have a positive influence on their daughters. Male family members can also play an important role in introducing their daughters to technical activities from a young age. Moreover, Internet is becoming a new medium and a meeting place for girls.</p>
Home computing	<p>The uses to which computers are put in the home may not be those which appeal to girls. Computer games may be alienating to girls because of their content and gender role assumptions. The physical location of the computer in the home may also be important for girls’ sense of ‘ownership’ and access.</p> <p>However, mothers are increasingly using computers at work and at home, and it encourages girls to do it too.</p>

Table 10
Explicative variables: educational sphere

<p><i>Within the school system:</i></p> <p>Behaviour of teachers</p> <p>Orientation of boys and girls to computing</p> <p>Changing orientation of girls pre- and post-adolescence</p> <p>Negative image of computing</p> <p>Lack of career orientation</p> <p>Absence of positive role models</p>	<p>Teachers treat boys and girls differently. Boys dominate teacher attention, classes & use of computers. Teachers reinforce the view of technical subjects as suitable for boys rather than girls. However, supportive teachers are very important in building strength and self-confidence in women, which in turn help them to enter computing work.</p> <p>Boys develop exploratory interest in computing (games); girls have utilitarian approach (use computers for tasks). However, girls may also enjoy computers and good career advisors can influence their orientation towards ICT curricula.</p> <p>Girls lose interest in S&T subjects in early adolescence despite outperforming boys at pre-adolescence.</p> <p>Image of computing as 'nerdy' and of computer scientists as solitary and asocial. The dominance of boys reinforces this image.</p> <p>Among girls, lack of career orientation to & understanding of career possibilities in ICT sector.</p> <p>In general, lack of positive role models for girls.</p>
<p><i>At post-school and university level:</i></p> <p>The nature of vocational education and training affects women's access to technical skills in general</p> <p>Women are under-represented on ICT courses in colleges and universities.</p> <p>Women are socially marginalised by their male counterparts.</p> <p>Sexual harassment</p> <p>Among those who enter ICT courses, there are high drop-out rates</p>	<p>Women may be channelled into particular types of vocational education and training rather than others, and particularly away from technical areas. They are more channelled into tertiary and services curricula. However, women professors are very influential role models for women studying ICT subjects at university.</p> <p>Women are under-represented on ICT courses, which both creates a scarcity of role models for other women and makes for male dominance of courses, which further alienates potential women students. Nevertheless, women who undertake ICT studies and later ICT work are particularly powerful people: they describe themselves as strong, driven, ambitious, mathematical, logical and competitive.</p> <p>Women are often singled out, ignored, not taken seriously or patronised, particularly where they are in a very clear minority.</p> <p>In some work environments (no only ICT, of course), sexual harassment is treated as "normal".</p> <p>There are high drop-out rates among women, who experience ICT course environments as hostile to them, and can make them loose interest and self-confidence. But those who choose ICT courses usually succeed as well, and often better, than male students.</p> <p>Some studies found that Asian women studying abroad (e.g. in the USA) are more likely to persist than their American colleagues having a different motivation (namely choosing ICT courses for economical reasons rather not out of interest in computers).</p>

Table 11
Explicative variables: labour market sphere

<p><i>Women are discouraged or prevented from entering ICT jobs because:</i></p> <p>ICT working conditions are antithetical to family and domestic life</p> <p>"Women's skills" are undervalued in the labour market.</p> <p>They have poor awareness of the career possibilities in ICT.</p>	<p>Women often take "non-standard" employment – part-time work, freelancing, teleworking from home – in order to balance home and work responsibilities. But non-standard employment is not usual in science, engineering and technology jobs at professional levels.</p> <p>"Women's skills" are undervalued in the labour market, underpaid and under-rewarded. Although communications skills are increasingly valued in discourse, they are not financially rewarded, nor do they form the basis for promotion. However, there is an increasing demand for such "women's skills".</p> <p>Moreover, some studies show that in dynamic networks of the kind that are formed mainly by small companies in turbulent and complex environments women's contributions tend to be perceived as resources.</p> <p>Career possibilities in ICT do not have high profile, due to newness of ICT.</p>
<p><i>Women are prevented from or unlikely to reach senior levels in ICT work because:</i></p> <p>They are clustered in non-professional areas and in junior grades</p> <p>They often work in insecure jobs with poor prospects</p> <p>They are more responsible for avoiding the problems associated with long working hours and the invasion of work into family life</p> <p>They drop out of senior positions</p>	<p>Where women do enter ICT work, they are over-represented in non-professional occupations such as data entry and clerical areas, from which there are no occupational routes to professional jobs.</p> <p>They are over-represented in casualised and precarious jobs, in outsourced activities and generally in areas where labour market progression is poor or non-existent, and training and employee development may be poor.</p> <p>Senior jobs in ICT are not generally family-friendly in terms of working hours and other conditions, and women are often forced to opt out of promotion into such jobs.</p> <p>As in other sectors, women in senior positions often drop out of the labour market altogether when they experience the difficulties of reconciling long hours of work with the needs of their dependants.</p>

Table 12
Explicative variables: organisational structures and practices in ICT work

<p>The <u>conditions of work</u> are incompatible with domestic responsibilities.</p>	<p>ICT jobs tend to be incompatible with domestic demands – they are typically full-time, with long hours, and locationally flexible (sometimes work is done at client’s premises).</p> <p>However, ICT company practices are not systematically worse than those in many other organisations.</p>
<p><u>Organisational cultures</u> in the ICT sector are hostile to women.</p>	<p>There is a “masculine culture” of computing work consisting of language, images, working methods and working relationships, which women are both excluded from and find off-putting.</p> <p>ICT companies incorporate informal networks of men who have out-of-hours gatherings, which tend to exclude women.</p> <p>Stereotypes remain prevalent and hinder women in their careers. They include: women being less capable than men; not aggressive enough to rise to the top; too emotional and intimidated by stressful environments; putting their personal lives before their work; being less serious about their careers than male colleagues.</p>
<p><u>Labour processes</u> in professional ICT work do not maximise women’s skills or opportunities for “making their mark”.</p>	<p>Much ICT work is done in project teams. Women’s teamworking (communicational, relational, interpersonal) skills generally financially unrewarded in organisations, and carry no status (despite being rhetorically valued).</p> <p>Women are sometimes assigned to less technical, low status functions (such as helpdesk management) in teams, regardless of their technical expertise.</p> <p>Women show a tendency towards working more consistently, and stamping out difficulties before they become real problems.</p>
<p>Formal <u>organisational policies and practices</u> have a major impact on women’s recruitment, progression and retention in professional ICT work.</p>	<p>Equality policies and practices (interviewing, recruitment, performance & promotion criteria, harassment, and discrimination policies) are part of wider organisational approaches to the inclusion and promotion of women employees.</p> <p>Flexible working arrangements are more conducive to female employment and progression.</p> <p>Organisational role models of women in senior positions are infrequent.</p> <p>There is considerable persistent male prejudice against employing and promoting women in science, engineering and technology. Among male colleagues and peers, there is persistent ambivalence and fear about the advancement of women.</p> <p>Companies lack experience developing women with potential Management lacks experience in working with women.</p>

3. Methodological options

3.1 Methodology of biographical interviews

The aim of a biographical interview is to develop an understanding of a person's biography or trajectory – her development as based on opportunities, choices, and individual coping strategies. Crucial concepts are:

- *Developmental tasks* that pose themselves in particular phases of one's life and/or in particular professions/work organisations (e.g. juggling the demands of work and private life, planning a step in one's career)
- *Individual coping strategies* in relation to given structures – enabling factors and constraints
- *Detours and their implication* for the person's biography – paths in a career that a person takes in order to prevent exclusion, find new points of entry, avoid exposure to particular expectations, etc.
- *Transitions* – changes of field of work, occupation, life situation, etc. that allow a person to redirect her biography, define new challenges, find better opportunities, etc.
- *Life themes* (Thomae 1996) – topics that emerge in the women's own accounts as crucial for understanding their choices

The focus of our interviews was on the women's work biographies, with an understanding that these are inseparable from their identity and concept of a good life. Silvia Gherardi's narratives of "women travellers in a male world" come closest to this notion of biographical interviews, the concepts that shaped her reading of the women's narratives being "the presence of a common plot, the outsider, the journey, the unexpected encounter with the different" (Gherardi 1996, p. 190).

The most common method for unravelling biographical information is the narrative interview. Although parts of the interview may be pre-structured, in particular those that concern information about the cornerstones of a person's biography, most of the interview is conducted in an open way. They are what Flick (1995) calls episodic interviews with a strong narrative character. The main idea is to stimulate a person to tell "stories" – significant episodes in her life that illustrate the whys and hows of important events in her biography and the role of relevant others in these events. Normally the interviewee covers several topics in her narration in her own sequence.

A good narrative interview also allows for a certain amount of reflection, supporting a person to remember, to make connections, to evaluate, regret or rejoice. The role of the interviewer is to stimulate, listen, and eventually suggest additional topics that help cover all the relevant points in the interviewee's biography.

The project partners agreed on a set of criteria for selecting interviewees:

- Covering all ages, not only young workers.
- Covering all levels of qualifications, not only highly qualified workers and a variety of job profiles.
- Considering a diversity of firms (small as well as large companies).
- Covering a diversity of status (salaried, self-employed, full-time, part-time, etc.).
- Covering city and countryside as well as different regions (in the Italian case, both the North and the South; in the French case Ile-de-France, Aquitaine, Picardie and Limousin).

The idea behind conducting interviews with a small number of men (five in each country) was to pair at least some of the profiles (as defined by age, qualifications, job category, employment status), looking for similarities and differences.

3.2 Methodology of sectoral and enterprise case studies

Case studies were conducted in seven EU member states: Austria, Belgium, France, Ireland, Italy (north and south), Portugal and the UK. 28 company case studies were conducted, spanning two sectors in which ICT professionals are employed – computer services providers (in NACE 72) and electronic publishing (e-publishing, covering publishers of newspapers, journals and magazines, book publishers and other specialised publishers). In each country, two ICT services and two e-publishing organisations were studied. A small number of case studies with branches across countries were selected, in order to show country and cultural differences within organisations.

The purpose of the case studies was to gather qualitative data on the organisation of work for IT professionals and their experiences of working in these professions. Two main methods were used to collect this data:

- *Interviews with key informants.* Interviews with human resources personnel and (where relevant) trade union or workers' representatives covered the firm's organisation of work, working time, recruitment, training and employee development practices, equality practices, and the culture of the organisation; interviews with IT professionals covered the training and development opportunities they enjoyed, the detail of their work processes, and their perceptions of the gender relations of the organisation.
- *Participant observation of IT professionals.* In each case study organisation, the researchers observed a short part of a normal working day of informants, a small number (1-2) of meetings involving informants and focussing on organisational issues, and a small number of

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meetings involving client relationships or the development of a product.

The problems generally associated with case studies relate to the representativeness of the cases, and in the second place to the objectivity of the approach.

The case study is of descriptive nature and relies on information collected on the field, often even directly through the actors of the “social fact” observed. Detractors of the case studies see them only as descriptive approach, which attempts to describe all the complexity of a concrete case without any “general” purpose. According to circumstances, the case study aims to establish a diagnosis of an organisation or to make an assessment of it, in order to prescribe solutions or changes within the organisation.

The case study is not conceived like a method but rather like an approach, of an exploratory nature. The case study approach has its interest as an exploratory exercise, associating other methods: participating observation, semi-directive interview, documentary method, etc. In sociological research, the case study is an empirical investigation, which analyses a contemporary phenomenon in its context, where the limits between the phenomenon and the context are not definitely obvious, and in which multiple sources of information are used. Through the study, one observes how a context formats a fact or an event.

A key methodological issue is that of the representativeness of a small number of cases and the objectivity of the case study approach. In the WWW-ICT project, the goal was to uncover the organisational practices and individual experiential dimensions of IT work in certain settings, and to evaluate their implications for women’s inclusion in this work, rather than to collect representative survey data. Our concerns, in other words, were with the cultural rather than the calculable. In addition, we were able to collect and analyse data covering a larger number of cases and with a quantitative dimension through the biographical interviews. Consequently, we are able to combine quantitative and qualitative data analysis through these two methodological approaches.

What the case study approach lacks in representativeness, it makes up for in-depth and detail of data collected. The case studies enabled us to examine the detailed organisational policies and practices of ICT services and e-publishing companies, as well as the experiences of and responses to these practices by employees in these companies. Participant observation of meetings and daily work routines both contributed to the depth of data collected, and allows for informants’ accounts to be scrutinised in the light of actual practice.

3.3 Methodology of analysis of good practices

Data on fifty-nine practices have been collected so far in seven countries by each project partner (UK, Austria, Germany, Switzerland, Belgium, France, and Italy).

Diversity, exemplarity and visibility of the practices, rather than exhaustiveness, were selection criteria.

The collected data set is not designed to be exhaustive. It firstly aims at showing the various ranges of initiatives that have been taken in the chosen countries with regard to women and ICT, with a view to bridging both gaps in gender and skills in the labour market for ICT-related professions.

It was more relevant for the project to base the selection on criteria such as exemplarity or diversity rather than to strive for, as this would not have made results any more consistent. The initiatives were thus selected as illustrative or comparative examples (the widely implemented ones) and sometimes as innovative and exemplary ones. Another selection criterion was their visibility and viability.

These practices were sought at various levels in each country:

- at the level of companies, including initiatives undertaken by sectoral or local employers associations;
- in the education and training system, including high schools and universities, vocational training, further education, re-training or reinsertion for the unemployed;
- by public institutions carrying out policies for vocational training, ICT promotion, labour market management or the promotion of equal opportunities;
- at the level of non-profit associations.

The proposed definition of what is a “good” practice is borrowed from the glossary compiled by the BEEP project (Best e-Europe practices, another IST project under FP5). Following BEEP, a good practice is “the use of a method, tool, technology etc. which is generally regarded as *practices which are good for learning*, i.e. practices which either achieve their own objectives and/or have a beneficial impact on their environment, or (and more importantly) provide useful learning experiences which are likely to stimulate creativity, ingenuity and self reflexivity on the part of the user” (<http://www.beep-eu.org/content/glossary>)

A good practice has two important qualities: usefulness and learning dimension.

According to this definition, the criteria for selecting a practice from a range of initiatives are:

- the use of tool, a method, or a technology (in our case, “tool” also includes non material tools, such as awareness campaigns, training curricula, etc.);
- the purpose being to reach specific aims: achieving its objectives or improving their environment or stimulating the user;

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- the use as a learning instrument for others: not necessarily to be transferable, but at least to teach lessons and experiences.

The most important parts of the description are, on the one hand, the usefulness and effectiveness of the practice (usefulness assessed in comparison to the aims assigned to the practice, to the difficulties that the practice is designed to overcome), and, on the other hand, the learning dimension.

Moreover, a certain number of minimum criteria must be satisfied in order to be included in the corpus (IfGH, 2002):

- Currently implemented: the action is still in place, or is likely to be carried out again.
- Clear aims: the action has clearly identifiable goals and aims.
- Geared towards a target audience: the type and form of the action, and its implementation conditions, are suited to the target audience.
- Documentation: the success and/or development of the action are recorded via tracking or assessment data.

The national context needs to be taken into consideration when one analyses good practices in a given country. National specifications sometimes explain the use of a given tool over another one. For instance, in Belgium and in Austria non-profit associations play an important part in vocational training and reinsertion on the labour market. Good practices derived from the non-profit association are thus more relevant than in countries where they do not play this kind of role, but merely one based on awareness.

Biographies of women working in ICT

Biographies are a means of understanding women's trajectories into ICT occupations. Although biographies are marked by personal, cultural and national specificities, common trends, profiles and life styles can be distinguished. Career paths and personal trajectories reveal a series of opportunities for women as ICT professionals.

This chapter presents the main conclusions of the biographical interviews. After a description of the sample of interviewees, it draws the key characteristics and varied profiles of women's biographies in ICT. It draws eight clusters of career patterns for women in ICT, based on a multi-criteria analysis of the coded biographical sheets and presents common life story patterns. It comments specific aspects of the male biographies and stresses the common and different points as regards female biographies. More detailed data can be found in the downloadable D6 report.

1. Description of the sample

This section presents key data asked for in each interview, in order to describe the sample of interviewed women. The description covers personal data, job, company size and level of qualification.

Age, partners and children

Twenty interviews were led in each partner country, including at least 15 women: a total of 140 interviews, under which 33 of men. The majority of women we interviewed are between 31 and 40 years old, the youngest is 22 and the oldest 55. 79 (74%) of the 107 women live in a partnership. Only 43 (40%) of them have children. The overall average number of children is 0,69 but it differs notably from country to country. The low number of women with children could be explained by the average low age of informants. Most of the young women in the sample do not have children.

Jobs, tasks and companies

The informants work in many different jobs in ICT. They work in small as well as big companies on different levels of the hierarchy. Some are self-employed (11 of the informants), some work in non IT companies but in IT jobs within an IT department of e.g. a bank or insurance company.

26 informants are project managers; but it does not mean that they have responsibility for personnel. Most of them (17 cases) work in large companies. 24 informants work as developers. Their work mainly consists of programming, which sometimes also includes analysing and testing the software and/or quality assurance. 19 are in leading position 13 work in web design (web designer, graphic designer and Internet journalist), mostly in small companies (7 women). 12 women work in support positions, they do server/network administration or work as helpdesk operators. A common job title for these tasks is “IT specialist”. 10 work in marketing and finally, 3 are ICT teachers.

Figure 4
Tasks and company size

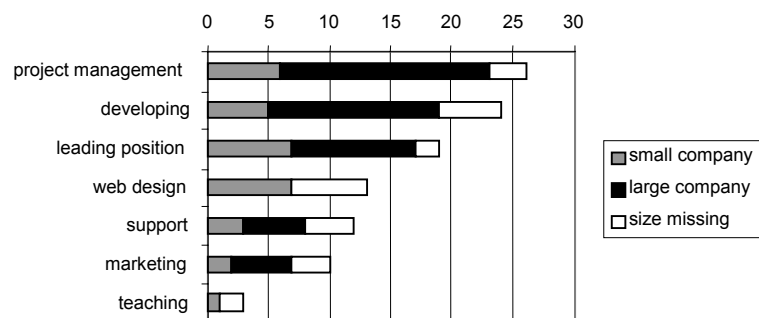


Table 13
Tasks and company size (in the order of frequencies), n = 107 women

	small company	large company	size missing	total
project management + middle management	6	17	3	26
developing / programming	5	14	5	24
leading position / university + single-person company in IT	7	10	2	19
web design + graphic designer / Internet journalist	7		6	13
support / administration / helpdesk	3	5	4	12
marketing / public and business relations	2	5	3	10
teaching	1		2	3
total	31	51	25	107

The majority of informants entered the ICT sector from the start. Of the 30 women who have worked in another area before moving into ICT, eight are French. A common pattern here was to first explore different (non ICT) jobs in the form of short internships.

Inter-company mobility within the ICT sector is rather low. 69 women changed their job/employer not more than once in their career – some of them are quite young. Altogether 38 women changed their job/employer twice or even more often during their career.

The companies in which the majority of our sample (41 cases) works are part of the ICT sector, in the areas such as software, consulting, system house or IT services. 15 women work in web design companies, 9 in companies with a focus on hardware, another 9 in telecommunication companies or Internet providers. 13 women work at universities or in schools or other educational institutions. Finally, 18 women work in companies that are not part of the ICT sector and here in special ICT jobs or in ICT departments. This includes banks, insurance companies, political parties, trade associations, a broadcasting corporation, and a steel trace.

Working hours

Most of our informants work full time as measured by their actual working time; only eight women work less than 35 hours a week (see Table 6). 59 of our informants (55%) work between 35 and 45 hours a week; 75% of those in developing. Mainly women in leading positions work very long hours. Of the 25 women who work between 45 and 60 hours a week, seven are in leading positions and all four with regular working hours of 60 hours and more. There is no correlation between working hours and the type of company the women work in. Informants working in ICT companies as well as those in user companies (non ICT companies) show the same tendency towards long working hours.

Education and qualification

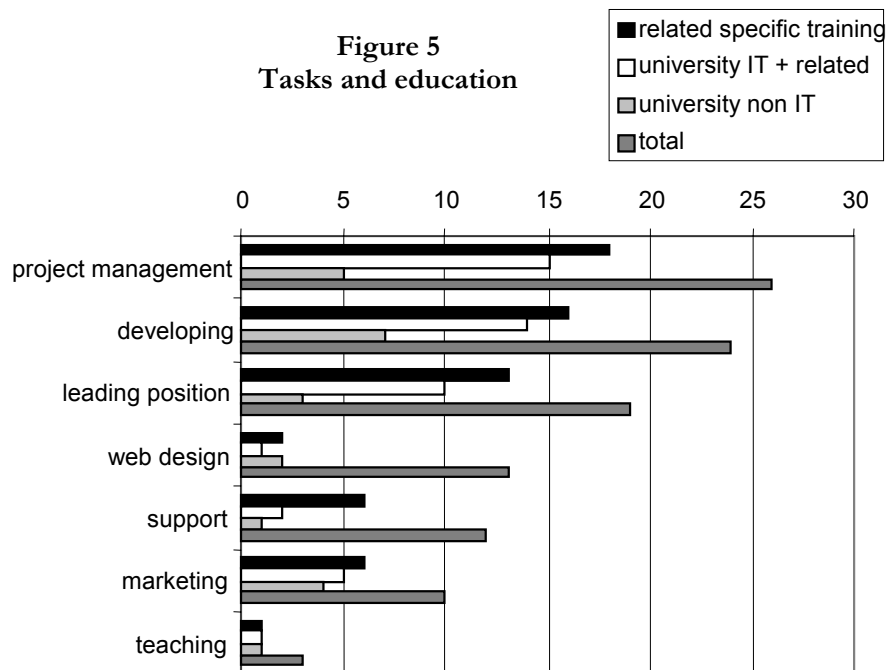
Of 107 informants 62 have a formal initial education in an area related to ICT; 47 of them a university degree in ICT (and 20 of those have a degree in informatics) or in related subjects like physics or mathematics. Overall there are 48 women in our sample who have a university degree in ICT or related subjects. 23 of our informants have university degrees in non ICT subjects.

The table below shows the relationship between education and job category. Percentages are given for the women in each task category to make them comparable, although absolute frequencies are quite low. Nevertheless we can see that especially informants working in project management have related specific training (69% of the women in project management). Figures are also high for women in leading positions (68%) and in developing (67%). Women working in web design often do not have related training in ICT (only 15%). 58% of the women project managers and developers have a university degree in IT or a related subject. This also applies to 53% of the women in leading positions and for half of the women in marketing (5 cases). Another four of the women in marketing have university degrees in other subjects, but also seven of the women in developing hold non IT university degrees.

Table 14
Tasks and education – frequencies and percentages, n = 107 women

	Specific training	University IT related	University non IT	Total per task
project management + head of internal department	18	15	5	26
	69%	58%	19%	100%
developing / programming	16	14	7	24
	67%	58%	29%	100%
leading position / university + single-person company in IT	13	10	3	19
	68%	53%	16%	100%
web design + graphic designer / Internet journalist	2	1	2	13
	15%	8%	15%	100%
support / administration / helpdesk	6	2	1	12
	50%	17%	8%	100%
marketing / public and business relations	6	5	4	10
	60%	50%	40%	100%
teaching	1	1	1	3
	(33%)*	(33%)*	(33%)*	100%
total	62	48	23	107
	58%	45%	21%	100%

* the percentages are not considered as the overall number of persons in teaching is too small



2. Key characteristics and profiles

This section presents the major findings – only focused on female informants – from the seven national reports on biographical interviews, discussing them in the light of the initial assumptions of the project (chapter II). They account for the great diversity of biographies and their (national, cultural) context but also look at common patterns.

2.1 Background and the influence of the family

The assumption that attachment to computers begins at an early age does not apply to the sample of interviewed women.

The assumption that attachment to computers begins at an early age does not apply to our sample of women. There are several stories of informants having liked tinkering, using tools, and preferring technical toys as young girls. Especially among Italian informants there are several who mention early interest in computers and parents offering them a computer as a present. But the majority of informants did not get in touch with computers at an early age.

Some women received special encouragement from their parents to go into the sciences and technology. Often it was the father's scientific or technical background or interest, who strengthened informants' affinity to technical things. In these cases the father (in some also an older brother) was an important role model. Some fathers had attractive jobs, such as architect or industrial designer.

There are numerous cases of women (especially in Austria and in the South of Italy) whose mother had a strong influence on the daughter's personal development and career choice. These mothers are described as role models – strong, admirable, and supporting, expecting their daughter to be strong and independent. These mothers' backgrounds differ – some are teachers, others homemakers, and only a few work in the area of math/science, 'naturalizing' mathematical and/or technical skills. There are several cases of mothers who run their own business, representing a strong incentive for their daughters to get independent. This resonates with research stressing the importance of the mother as a role model and source of encouragement for girls (e.g. Huang et al. 1999, Hapnes/Rasmussen 2000).

There are also family circumstances that do not remotely signal a career in ICT. In many cases the fact that parents encouraged their daughter to make their own decision, respected their choice and trusted in it was mentioned as the most important support. Families often passed on to their children the importance of getting a good education and to be able to maintain themselves. In a few cases (in Belgium) informants had to fight against the expectations of their family to enter a more traditional career.

Some informants come from backgrounds with limited educational ambitions and opportunities (rural, ethnic). They enter ICT through

indirect routes, work in related areas or auxiliary professions, and use ICT to break out from a narrow path.

2.2 Influence of the school

Some, but not all, of our informants excelled in math and/or sciences. In the UK, a considerable part of women with careers in ICT comes from all female secondary schools. In countries such as France, school grades are important in regulating access to a career in science/technology.

Teachers were influential only in a few cases. Then it was the math teacher who opened informants' eyes to computing as a career option.

Some of our older informants went to school at a time when no computers were available, and in many cases first contact with ICT was at university level. Some of the younger women had computers at home, provided by the father, an older brother, in a few cases the mother, or they bought one from their pocket money.

There are very few stories of negative experiences at school.

There are very few stories of negative experiences in school, of being confronted with gendered attitudes. Though, some of those informants who went to a technical secondary school, mention the strange experience of being one of a few girls.

2.3 Personal attributes – relationship to technology

Many of our informants report to have been determined to overcome difficulties from an early age on and they like to solve problems. Some describe themselves as fighters against difficult odds. Some of the highly successful women characterize themselves as shaping their own environment. They are ambitious but also engaged, critical, and self-conscious, defining themselves through what they accomplish in their work.

Women like the technical side of ICT.

They like ICT, often the purely technical side of it, because it requires problem solving and giving shape to a solution. Another part of the successful women embarked on a straight career in ICT and strive to the top, accepting the tough conditions – hierarchical structures, stress, competitiveness, sometimes even fighting.

Technology, in particular ICT, is attractive to a large part of our informants, for several reasons:

- It is challenging work, offering the opportunity for learning and perfection, and for being creative.
- It is fascinating, satisfying the urge to “solve riddles and generally the curiosity to get to the bottom of things”.
- Being able to work with customers, translating their needs into software or a web site – this may even include a care-taking aspect.

- It is an open world, with a wide horizon.
- It offers jobs in a respectable area and status.

Even those women, who have left the ICT sector maintain this positive relationship to ICT, either teaching ICT skills or creating their own web site.

Assimilation of informatics with technology, mathematics and physics is not a disadvantage.

Assimilation of informatics with technology, mathematics and physics is not a disadvantage. For many of our informants ICT is attractive precisely because it requires analytical and problem solving skills and they experience this as a source of creativity. There seem to be two major entry routes in ICT for women, either through mathematics and the sciences, or through an application area. Different types of girls benefit from different approaches to teaching ICT skills – a more mathematical one or one based on software packages.

We did not find evidence of women contextualizing their interest in computers in other areas such as medicine (Margolis et al. 2000) or of appreciating computers via the contributions to society they make. However, a few informants distanced themselves from the love stories some of their male colleagues have with computers.

2.4 Entry routes into computing

Entry routes into computing are very diverse.

Entry routes into computing are diverse and, as mentioned already, early contact with computers is not a determinant in choosing ICT as a career. Many informants learned to use a computer rather late and most of them used a variety of resources to acquire the necessary skills – from formal school-based training to learning on the job and complementary special training courses. The great diversity of entry routes into computing confirms the need for innovative cross-disciplinary curricula (Cedefop, 2001).

Most of our informants had their first job in the ICT sector. 20 (of 107) women studied informatics at the college or university level (computer science, information sciences, software engineering, information systems), some in combination with management, and some have degrees that include some informatics (e.g. cryptography). Another frequent route into computing is (technical) mathematics. To those who love math and analytical thinking a job in computing offers something applied and practical. A series of informants chose subjects that would obviously lead into computing and ICT work, such as physics. A strong interest in electrical engineering, as in the example of a woman fascinated by robotics, is rare.

Other informants have degrees in other subjects, such as economics, journalism, marketing, chemical engineering or biology, and environmental studies. Some of our informants have a background in art, graphic design or journalism, which they later combine with ICT into

successful careers as illustrators, digital graphic designers and web designers.

There are several cases of women working in tourism, regional planning or graphic design, who discovered the Internet and web design. These women developed their skills either by self-learning or by attending a training programme. There are a few cases (in France) of informants for whom Internet and web design skills offered the opportunity to invent their own area of expertise and job in their work organization.

Another part of the women followed a work-based route into ICT, from secretarial or clerical work, tourism, librarianship or accounting. Several women started out as teachers of math, history, accounting or adult teaching. A common career step is to move from more technical work, including project management, into marketing and customer-relationships.

There are examples of women who drifted into computing by chance.

There are also some examples of women who drifted into computing by chance, having eliminated other choices and learning about ICT in one or another way. In some cases it was an internship or temporary employment that brought them into contact with ICT.

For some women computer science is a “ticket to economic opportunity”. This holds true in particular for women living in economically deprived regions and women with an ethnic background and has been described by Margolis et al. 2000. Some of the informants from Italy, for example, motivate their choice of ICT with the job opportunities in the field. Getting an education in engineering and ICT is seen as the most reasonable way to optimise their chances on the labour market. Job security is a strong consideration especially for women from the South.

2.5 Job histories and trajectories

As the women entered ICT through a wide variety of routes and occupy a diversity of jobs, there are no clear-cut trajectories.

There are no clear-cut trajectories.

The majority of informants have technical careers, starting, for example, in software development and processing to the position of team leader or entering management. Others work in operating or support functions. There are also several careers in management and marketing, starting from assistant positions with managerial tasks. Some women entered a university career or work in research institutions.

Careers in web design and Internet journalism (14 of 107 informants, two of them team leaders and one web design manager) differ from those in software development. They are easier to enter, because they are less technical, with skills in areas such as journalism or graphic design serving as entry points. They are much more restricted as regards skill development and career options.

A number of women have what we call ‘re-orientation careers’. They typically felt that their present work did not offer enough challenges and opportunities for learning and, while e.g. looking for additional training, discovered ICT. A large proportion of those who entered ICT from other professions or fields of work had several jobs before.

A large proportion of women entered ICT from other professions or fields of work.

In some countries (notably Portugal and France), women’s job histories are not a result of a conscious career choice but of following the opportunities that present themselves. The women engage in an extended period of search, moving through several small jobs, before they start constructing a career.

Careers in large organizations – 51 of 107 informants work in organizations with more than 100 employees – differ markedly from those in small or middle-sized ones. Large organizations have a strongly-developed internal labour market. Openly advertised job opportunities and a wide pool of jobs to apply for have been a key to the development of women who work in such organizations. What keeps women in these organizations is the opportunity to always do new things in different fields and with different people.

Smaller companies – 31 of 107 informants work in organizations with less than 100 employees, some of them very small companies – offer the possibility to acquire a broad range of skills through learning on-the-job. Hierarchies in these companies are rather flat and there is a limited range of jobs and areas of expertise available. A career here means to move on to other companies and types of work.

Within the software industry, inter-company mobility is seen primarily as a way of acquiring new knowledge and growing in one’s profession.

Within the software industry, inter-company mobility is seen primarily as a way of acquiring new knowledge, of increasing one’s experience and grow in one’s profession. When we look at women’s careers within the ICT sector, 45 have their career within one company (some of our informants are too young to have had the opportunity to move on), 24 have changed company within the sector once, and 38 several times. Although “nomadic careers” are not the norm in ICT today, there is some evidence of successful women in the field changing company, also several times, in order to broaden their opportunities. Living in a metropolitan area with a large and diverse labour market (such as e.g. in Milano, London or Dublin) facilitates inter-company mobility.

We also have some examples of broken careers, with women suffering from the fact that they have not finished their degree or of few and limited job openings in the region or they find out that ICT is not the field they want to stay in. This experience is sometimes coupled with the feeling of failure and lack of courage.

Especially among the youngster of our informants, careers are still open. They had a good start in working life, love their job, and are hard-working. But they are considering other attractive options such as continuing their formal education, going into marketing or training or even more remote alternatives (e.g. artistic ones).

Although the women in leading positions in general like their work, are ambitious and see themselves as successful, there are a few cases, four of them from the UK, in which several negative characteristics coincide. One woman, of Asian origin, works as a director of information and technology services in an international catering association. She has enormous difficulties in organizing child care and gives a rather negative evaluation of her work situation – low pay, lack of support, high levels of stress, high work loads as well as the lack of career possibilities. She does not feel too comfortable with ICT and would like to change employer/job. Another UK informant, whom we described as ‘struggling’, embarked on an impressive research career after an extremely difficult start in life, but is very unhappy with her situation at university, feeling mobbed. A third one, general manager in a software company, left her career as a history teacher, which she still sees as her ‘real’ career, out of the need to earn money. A Portuguese woman with a good career in a large international computer company, feels in the right field but complains about high levels of stress, high work loads, role overload, and having to be totally available. One of the Irish informants is a successful manager but expresses that the (right) choice of a family has somehow compromised her career. She also complains about the lack of support, a high level of stress, and the lack of career possibilities.

2.6 Self-employment as a strategy

Several informants are or have been self-employed, building their own software house, web agency or training academy (and some consider this as an option). The main motivation of these women is to shape their own work environment and to be their own boss.

There are two Austrian cases of “university spin-offs” where the women (in one case together with a male colleague) took a particular software product as the basis for founding a company, the main idea being to further develop and sell the product and to carry out projects in cooperation with industry. In both cases special loans and counselling were available. One of the women acts as director of finances and software development while her associate is responsible for project acquisition. The other woman kept her university employment. She describes herself as the ‘technical mastermind’ of the company which is managed by her brother. Both women have a strong computer science background.

There are several cases of women who have founded a web agency together with their husband or father. Their roles vary. A French woman with a background in law and experiences in a series of jobs in the political administration bought a web agency together with her husband. Each of them has their own clients and is responsible for project acquisition and management. In the case of a woman with a background as laboratory technician and some ICT skills, it is the husband who directs the group which their small web agency joined and who is responsible for project acquisition and programming, while she took over

the administrative tasks including the web. In another case it is the father who helped his daughter set up a web agency together with an associate partner who is responsible for the technology while she takes care of the rest, including HR. The young woman has some management skills but no degree.

Another structure is that of a company within a company, such as in the case of a Belgian woman with a strong background in computing, who first went freelance in order to be able to spend more time with her children and now owns and manages an independent development team of 12 (male) employees within a company “as a good mother”.

Several of our informants work as freelancers, for a variety of reasons. For those with a background in art, journalism or graphic design it is almost a ‘natural’ solution. They have built good relationships within the designer community and can make a living. In other cases going freelance offered the opportunity to have more flexibility and time for children and family. We did not find evidence of “blurring boundaries” between employees and independent employment though.

2.7 Tasks, skills and job profiles

IT job profiles

- *Network administration*

This is a low level job in the IT sector, requiring occupational training but not necessarily a degree. Network administrators have to know how to set up, configure, and maintain a network (on a Linux or Windows basis), install software on computers, define and handle policy issues, make back-ups (or even provide a solution for back-ups), and handle break-downs.

- *Development*

Developers do the programming of software, on different levels of technical complexity. For this they need to know several programming languages, be able to learn new ones quickly, be able to work on different platforms, and use a wide range of development tools. Even when working on a well-defined and limited task, programming is not completely routine and often requires finding a solution to a specific problem. Programming tasks may range from databases, to user interface design, to business processes. The work of developers may include writing up a specification, finding a solution to a specific request from a client, searching for errors and handling them, software maintenance and trouble-shooting. Developing may require working in the client company.

- *Project management*

There are several levels of responsibility within project management. We could speak of a “project management work family” including different level of responsibility and of ICT technical skills.

- At a lower level managing means being the leader of a small team in charge of a specific set of tasks. The team leader communicates with the overall project manager, articulating open questions and problems on the one hand, with team members, explaining and distributing tasks and helping them to find a solution on the other hand. Team leaders may have to define milestones and detailed specifications, review and integrate the technical documentation, and implement configuration and change management procedures. They may be in contact with the client organization.
- At a higher level project management includes project acquisition – to negotiate and specify requirements with client organisation, carry out a feasibility study, make a cost estimate, and write up a project offer. A project manager cooperates with technical specialists in the team or a technical leader in defining work packages, tasks, and dependencies. She has to draft a detailed work plan, distribute tasks, define milestones, schedule and re-schedule tasks, and assess project progress. Project managers typically act as boundary spanners between team and client, organizing presentation meetings with clients, negotiating requirement changes and communicating them to the team. They are responsible for their project budget, the quality of the product, timely delivery, and project documentation.

- *Project communication*

This is a new role we found in small companies, e.g. within multimedia production. The project communicator acts as a boundary spanner or mediator between people in a development team (e.g. graphic designers and programmers), developer and client organization (e.g. talking to clients about needs, products, and solutions), and project partners (in the case of cooperation projects involving several networked companies). The role of communicator may include designing marketing strategies, participation in project/client acquisition, (participation in) proposal and report writing, project presentations (e.g. describing the product for users), and research (looking for new or similar products, development tools, etc. in the Internet).

- *IT management*

IT managers typically are leaders of a department. They are responsible for the organization of work within the department, sometimes including human resource management, for planning, budgeting, and implementing projects, and for reporting to top management. Within IT managing a department may require to build up competencies and teams in new application areas (e.g. Enterprise Resource Planning, e-commerce, e-learning, Manufacturing Execution Systems) and/or to organize the transition to a new technical regimes (e.g. from single applications to integrated systems, from host to client-server solutions).

Internet & multimedia job profiles

Depending on the size of the company, there is an overlap of roles and tasks, with the resulting hybrid job profiles. Anyway, from our case studies, IT skills (“core ICT professional skills”, D.1) result less necessary to the work, which more often concerns with the utilisation of IT applications, especially in on-line publishing and in small internet and multimedia companies which tend to outsource the more technical tasks, concerning e.g. system architecture, hardware configuration, and database connections, to external partners.

▪ *Design and Programming*

- *Web graphic designer*: These are people responsible for the media-specific design of a web site. They need to combine skills in graphic design (this may include an artistic aspect) with knowledge of the rules of web design, including its technical implementation. Web design requires negotiating the design with web developers or programmers and being able to define technical details of the implementation.
- *Web developer*: Sometimes programming (HTML, flash script, etc.) is done by a specific professional, sometimes it is included in tasks of the graphic designer.

▪ *Production and Publication*

- *Web production manager*: Web production managers combine classical management skills with special knowledge of multimedia production. They are responsible for marketing, project acquisition, project planning, budgeting, quality control, and timely delivery. In small companies they may have to be competent web graphic designers being able to define a design concept and review designs.
- *Web publisher/content strategist/information specialist*: These are people responsible for concept design (this includes content and navigation). They create scenarios and define the content of a web site. This requires journalistic skills and experiences.
- *Internet journalist*: The basis of the work of internet journalist are journalistic skills, mainly interviewing, research, and story writing. The work of editing information in the Internet is often supported by special authoring software, including Photoshop. It consists of editing text and images and making links to other web sites.

Other job profiles

- *Teaching* (3 cases): Two female informants teach computer science (one in a private school, one in a secondary school, both in Italy). Another woman works as ICT trainer at a regional educational institute in France.

2.8 Organization of work

Work in ICT is organized in the form of projects. There are few examples of solitary work, as most work in software development and web design is team-based. Whereas in web design this reflects the need for a variety of skills – graphic design, programming, content production, video and sound, etc., work in software development is based on a well defined division of labour. Depending on the system’s architecture, different sets of functionalities are distributed to different modules, with defined interfaces, and different teams being responsible for the development of those modules. In large projects, tasks such as testing and system integration (re-composition) are carried out by specialists. Despite this division of labour, developers need awareness of the overall project design and arch of work to be able to do their work.

Work in ICT is based on projects. In web design, project teams include a variety of skills. In software development, teams reflect a well defined division of labour.

Being part of a software development team requires to cooperate and align the work with others, distributing tasks, discussing coding practices, producing and controlling bug reports, change requests and design changes, and creating and managing different versions of a system. This also implies helping each other when it comes to special problems requiring a particular skill. Teamwork is a genuine practice in software development and not just, as argued by the FLEXCOT project “a rhetorical and motivational tool” superimposed on a reality of “very narrow, repetitive series of tasks” (FLEXCOT, 2000). We did not find evidence of a tailorised work organization in informants’ accounts of their work.

There are two types of teams to be found in ICT work: (i) teams in which members have complementary skills and collaboratively work on a common task; (ii) teams where people work independently but have to align their work with the work of others.

Being a member of a good team is an important experience and also value for our informants. They not only enjoy the personal side of working with friendly and supporting colleagues but also appreciate the support they get in a good team for creating a high quality product and for developing their own skills. This resonates with the findings of Von Hellens et al. (2000 and 2001) that women ICT professionals see the mix of technical, human and organisational skills as the most positive aspect of computing.

Companies emphasise the need for self-management and responsibility.

In particular in the smaller companies, there is a limited internal hierarchy. Companies emphasize the need for self-management and responsibility. In the foreground are the quality of the product and the meeting of deadlines. Most of our informants appreciate the space that this gives them in how they and their team organize their work. Managers are visible and close. As a few cases show, a negative personal relationship can lead to the decision to leave a job.

Our findings do not allow to distinguish between large and small organisations as offering more or less opportunities for women, as suggested by previous research.

There are several examples of company take-overs, outsourcing, and organizational restructuring. Some of the informants who have experienced this have found their age to be a major factor in their vulnerability to redundancy (notably in the UK). In general, the de-localisation of work from core organisational premises to back offices, call centres, offshore facilities and remote subcontractors is not as widespread as suggested by recent European socio-economic research (EMERGENCE), nor is teleworking.

2.9 Working conditions

People working in ICT have to cope with high workloads. In Belgium and the UK a large part of the informants finds long working hours a definite draw-back of jobs in ICT. In the other countries few informants complain about long working hours and stressful working conditions. This may be related with the fact that many of our informants (34) are young and have no children. Only in some cases informants work long hours (50-60 hours) regularly. Overtime is in general not paid in the ICT sector.

Working time arrangements are in many cases rather flexible, hence individualised. There is a tacit agreement to balance long hours versus flexible arrangements.

As found in several European research projects, working time arrangements are in many cases rather flexible (52 of 107 informants), hence individualised, and there is a tacit, unspoken agreement to balance long hours versus the flexibility to arrange them.

Our findings do not confirm in general that intensive rhythms of work, the overloaded schedules and frequent overlaps between professional life and private life, which often characterise the working conditions of ICT professionals, are very little attractive for women. To the majority of informants applies what Gerwitz and Lindsey (2000) formulated: "They are willing to spend more time working if they can have flexible hours or work at home and have their success tied to performance rather than face time in the office".

However, long hours, including availability during evenings and weekends, are a problem for working mothers (in particular for those without a supporting partner) and few companies and/or colleagues generously adapt to the need to reduce or regularize working hours when children are young.

Moreover, in the ICT sector it is difficult to get part-time work accepted. For the women who negotiated a part-time arrangement, this often does not have an effect on their overall workload but negative consequences for their salary and their career.

The rhythm of work is dictated by project deadlines and completion of project tasks.

The pattern and rhythm of work is dictated by project deadlines (sometimes aggressive ones) and emphasis is on completion of work (rather than on hours). Also working directly with a client creates special commitments and the need to be available. This applies in particular to support work. ICT work is often unpredictable, due to the fact that requirements have not been well defined and/or are changing and evolving over the course of a project.

There is a difference between the older, more stable companies and start-ups as regards working hours, with the latter strongly relying on the willingness of people to cope with excessive demands. Women working in very small companies and as freelancers describe “working like mad” as the normal and (in general) accepted situation. For the informants it is not uncommon to work at home during evenings or weekends, e.g. when the children are in bed, either reading e-mails and continuing an unfinished job or working on a training programme.

In particular in the area of web design and project management there are cases of women reporting not being paid adequately in relation to their competences, responsibilities, and workloads. Complaints about inadequate salaries are particularly frequent in Italy (6 cases).

2.10 Private situation

79 of our female informants live in a partnership and only 43 have children. Of the 38 informants who are young (up to 30) 34 have no children. There are examples of women (e.g. in Belgium) who are divorced and with several children. For them managing timetables is extremely difficult. One woman consultant who needs to travel a lot abroad, is without children.

In some countries (notably Portugal and France), women are mainly (and sometimes exclusively) responsible for the family and in these cases private life and obligations shape and limit their career paths. In France several informants followed their husbands, trying to find work in a field where they would not be an obstacle to his career.

Informants from Italy with small children often have a good support network. Women who had the experience of maternity leave did not find it difficult to get integrated when returning to work. For some, instead of representing an obstacle, maternity leave was a positive occasion for starting something new.

Some of the successful women (notably in Austria and in Italy) have supporting partners who take over a major part of childcare and household responsibilities. There are a few examples of a partner encouraging the career of the wife in ICT.

2.11 Work culture

Our findings do not support the view that women generally find hostile work environments in engineering firms. There are cases of supportive work cultures as well as those of exclusionary and unsupportive ones. No clear pattern emerges, with work cultures being organization-specific, location-specific, and even team-specific.

As regards the unsupportive work cultures, there are some cases of women with children for whom the culture of the workplace (managers, male and female colleagues) makes their personal situation very difficult. Other negative experiences are related to company strategies, such as restructuring and outsourcing.

A mentor's presence seems to influence women's careers.

30 of our informants mention a mentor – a person whose influence and support has had a positive influence on their career. Female and male managers/bosses, professors, fathers, and older brothers acted as mentors. Their main role was to support the woman's career development, opening doors, suggesting career moves, and being supportive. There are several cases of women who were asked to follow their boss into a new project, a new area of work or new company

2.12 Gender issues

Women tend to deny discriminations and difficulties unless they become evident. However, 30 women report feeling disadvantaged and 28 talk about being faced with prejudices, to 18 out of these women both applies. There are cases of 'sexist and racist humour' to which our informants react in different ways, sometimes also addressing them openly.

Although balances between technical and non-technical tasks may be gendered, the gendering of work in the ICT sector is not as marked as suggested by previous research.

In some companies there is a gendered division of labour, in particular in the lower hierarchy jobs. There are gendered lines between development and network-related tasks, most pronouncedly in the telecommunications industry, which has its roots in electronic engineering. These lines also seem to be more pronounced in web agencies and in multimedia companies, where the more technical jobs (programming) are almost exclusively done by men. In software development there are some cases of women who are not included in project acquisition activities, e.g. in cooperation projects with industry, assuming customer prejudices against women. This is a clear disadvantage for them. Although balances between technical and non-technical tasks may be gendered, the gendering of work in the ICT sector is not as marked as suggested by previous research.

Among some of the Austrian women in particular there is a high awareness of gender issues and these women engage in activities supporting women in the field, for example training courses.

There are women who enjoy working in (almost) male environments and who feel that they even benefit from their visibility. There is another group who feels uncomfortable in (almost) male environments. Furthermore, there is a difference between older women, who experienced a lot of hostility (when their numbers were increasing) at a time, when diversity was not contemplated, and younger ones whose technical background and competence and familiarity with male environments help them adapt and be accepted.

2.13 Training and learning, development and progression

Learning is an integral part of working in software development and web design. The possibilities for training depend on the size of the organisation. Whereas big software companies, including banks, offer formal training programmes, small work organisations rely on self learning and peer group support. However, as a result of the crisis in the ICT sector, also the large companies reduced their budget for training.

Learning is an integral part of working in software development and web design.

In small companies, the team and/or informal network of colleagues becomes the training ground, with people benefiting from informal coaching, from talks by team members, and from the many specialized web sites in their field. These kinds of learning are an integral part of the work and highly appreciated characteristic of a supportive work culture.

Training is a scarce resource on the lower levels of the job hierarchy, more so than in the more qualified areas of work. The lack of training opportunities has in some cases become a critical issue for women who interrupted their career.

Career advancements are based on individual performance and are individually negotiated

Except in some of the very large companies, career advancements are based on individual performance and are individually negotiated. 20 women mention the lack of career possibilities in their company. These are women who work in web design, project management but also some women in leading positions. 20 informants do not feel sufficiently supported in their work.

There are some cases of discriminatory development and progression practices (notably in the UK and Ireland). Women report on mixed experiences with e-learning, some are rather critical (Belgium), others positive (France). Providing training courses in ICT (for women) is an attractive career perspective for some of the informants.

3. Career patterns for women in ICT

This section describes the sample of 107 women not only in terms of single variables but identifies groups of informants that have some characteristics of educational background, job, and work experience in common. A cluster analysis was used to help identify these different career patterns.

Cluster 1: chance careers

Many women in Cluster 1 are quite young (under 30). They come from a diversity of educational backgrounds, mostly non-IT degrees. Many of them encountered ICT and job opportunities in the sector 'by chance'. Some of them, especially women from the UK, started to work in clerical jobs before moving into the ICT sector. While a few have jobs in multimedia and online-journalism, the majority works in web design and developing. The fact that jobs in web design tend to be low paid may be the reason, why some women in this cluster judge their salaries as not adequate.

About half of the women in Cluster 1 have grown up with boys, some of them come from the countryside, and many of them have been attracted into ICT by the opportunity for a job and for professional development.

Cluster 2: open careers with strong IT background

Women in this cluster are also predominantly young and, in contrast to those in Cluster 1, most of them got their (initial) training in ICT. Almost two thirds of them even have a university degree in IT or in a related subject. Most of them have positive job experiences and some already have quite successful careers. Nearly half of them mention a mentor, who helped them or still supports them. In this cluster we also find some of the young women we describe as 'open and not yet having arrived' in our life story patterns, especially the Austrian informants, but also women from Belgium and Italy.

Cluster 3: consolidated careers

Women in this cluster have similarities with those in Cluster 2, but they are older (between 31 and 40) and already more advanced in their careers, with more professional experience. All of them have ICT related education and nearly all of them have a university degree. This is a group of highly qualified and successful women with what we call 'consolidated' careers. Nearly two thirds of them work in project management. These are mainly women in leading positions, some of them satisfied with their present position but some of them very ambitious. Only one third names caring responsibilities for young children. Some have very straight careers, e.g. university careers of Austrian women or other straight careers towards management positions of Belgian or British women.

Cluster 4: women in leading positions

The women in Cluster 4 are on the average older than the women in the other groups (41 and older). They have reached leading positions, including higher level project management. Nearly all of them have straight careers with an IT background, many hold a university degree. What is remarkable is the high proportion of supporting partners the women refer to, many of them working in a field close to theirs. This evokes men who are understanding and helpful concerning their partner's work situation (and not necessarily share family responsibilities). Among the women in this cluster we also find a number of self employed

women, some heading their own company (Austria), but also directors (France, Portugal) and heads of department.

Cluster 5: reorientation careers

In Cluster 5 we mainly find women who at some point re-oriented their career towards ICT, coming from a diversity of educational backgrounds. Many of them entered the ICT sector because an opportunity opened up. Nearly all of these women have university degrees in non-IT subjects, one worked as a kindergarten teacher before. The women in this cluster also have a great variety of jobs and skills. Some are working as web designers, some in marketing, and two in project management. Many women in this group have caring responsibilities for young children.

Cluster 6: mobile careers

Most of the women in Cluster 6 can be described as mobile in the sense that they have had several jobs in the ICT sector. Especially some French women show a special kind of mobility – they follow their husbands and look for a new job in a new region. These women also mention the support of their partners, some of them especially the career support. Many of the informants in this cluster have an arts background. This led them into jobs in journalism (France), multimedia (France), and technical writing (Ireland). Quite a few of them mention being disadvantaged. In this cluster we find some of the women with ‘broken or fragile careers’.

Cluster 7: low hierarchy jobs

In this small cluster we find women who express feeling disadvantaged. Some have low qualifications and all of them work in low hierarchy jobs in support and developing. They do not feel comfortable in their jobs, complain about low pay and they do not have flexible working time. They tend to feel insecure and entered the ICT sector ‘by chance’.

Cluster 8: good careers with some constraints

Most of the women belonging to Cluster 8 have an IT background (9 of 10), some of them also a university degree, and they are technology-oriented. Many of these women are ‘struggling’ against adverse conditions, such as lack of job opportunities in the field (Italy), low salaries (Italy), mobbing (UK). One of these women feels unhappy in her job and therefore wants to leave it for having a family (Ireland). However, some of the women in this group have good jobs and good careers and most of them high IT related qualifications.

4. Life story patterns

The categories we use in our analysis of life story patterns are not theory-based but empirical, grounded in the material itself. The patterns we describe are based on a comparative analysis of all 107 female biographies, taking into account national/cultural differences. They offer a particular view onto the professional trajectories and biographies across

these differences (which are described in detail in the national synthesis reports in D6), trying to reach some common conclusions. They provide a specific reading of the very rich and varied material.

Two of the patterns describe specific types of trajectory, the focus of the next patterns is on different strategies and the last two patterns reflect the experience of constraints and how women respond to them.

Straight careers in ICT

Some of the careers are moved by strong interest in math and the sciences and, in some cases, looking for a field with good job prospects. They follow a clear career model, and strive to 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

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. Accidentally, all three women who combine art with technology come from Italy.

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 passion.

Building one's own environment

Some informants' 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.

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.

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.

Struggling but not giving up

In some of the life stories constraints and how women succeeded 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 suffer from limited perspectives in their region, perceived as more penalising when they received a good education or accumulated an interesting skill profile. Anyway, after these bad start into working life, they succeeded in overcoming obstacles.

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 motivating and realistic alternatives. In some cases feeling discouraged and having failed and/or with unfulfilled ambitions.

5. Male biographies

This section describes the 33 male informants' profiles, based on key data covering age, family status, job/tasks, and education. The emerging profiles together with an analysis of the narrative interview material allow a cautious summary evaluation of male biographies.

5.1 The sample of male profiles

Age, partners and children

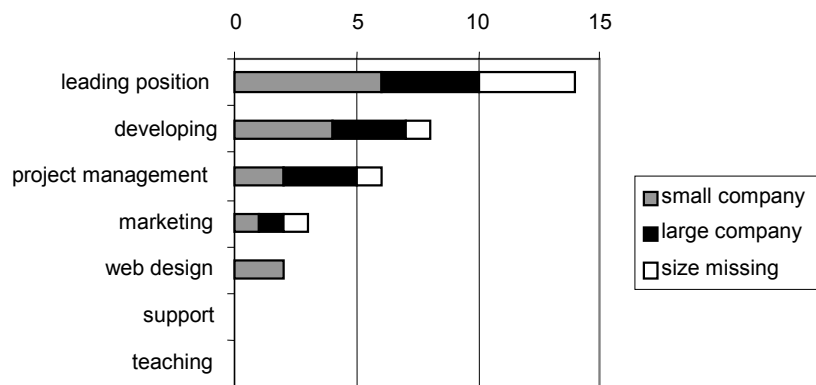
The men interviewed are on average 38 years old. Most of them (21 men) are between 31 and 40; 27 of male informants (82%) have a partner and eleven have no children. The male informants have on average 1.1 children, 1.8 in Belgium.. Most of the men with children have at least one child who is still under 14. Only two of the interviewees in Belgium and two in the UK have grown up children.

Jobs, tasks and companies

14 of the male informants are in *leading positions*, seven of them self-employed or company owners (Figure 6). Three of the self-employed

men have founded their own company, either alone or with a partner/associate. Four of the cases are single-person start-up companies. Eight of the male informants work in developing, four of them in small companies. One of them is a self-employed contractor and currently works for a US bank. Three men work in marketing, two in web design; they are both in small companies. None of the male informants works in support or teaching. Overall there are nine self-employed, seven in leading positions, one developing IT security systems and the last one built his own web design company.

Figure 6
Tasks and company size for male informants, n = 33 men



The majority of men’s companies (15 cases) are in the ICT sector, in the area of software, consulting, system house and IT services. Three of the men work in hardware companies, five for telecommunication companies and Internet providers, and one at a university. One man works as web master, web designer and “digital animator” together with some friends in his own company. Six of the male informants work in non IT companies; 24 have been working in ICT from the start; 9 had other jobs. While in 18 cases the men still work with their first employer, 15 changed job/employer more than once.

Education and qualification

23 of the men have related specific initial training in ICT; 17 of them a university degree in ICT or related subjects; 5 men have a university degree in a non IT subject: one in geology, one is in marketing and one in law.

5.2 Male biographies: are they different?

Male and female biographies in computing and ICT do not radically differ. However, men seem more mobile and at the same time less passionate and ambitious than our female informants. The women we interviewed have more articulate lives and other important interests beyond computing.

Men's entry routes into computing are often through science subjects but there are also several re-orientation careers, with the men coming from economics, business, ethnology, law, and even clothing design. Building one's own work environment is a particularly strong motive amongst men (6 out of 33). In most cases this resonates with being on their own and primarily accomplishing themselves. Being independent is a motive that we did not find in this form in women's biographies. For some of the men working in ICT is an extension of their hobby. These men have a bricolage approach to technology (tinkering instead of analysing) and (in one case) to developing their own company.

Men's entry routes into computing go often through science subjects, or as an extension of a hobby.

Inter-company mobility seems to be more taken for granted by men and several of our informants held a number of highly qualified and interesting jobs

The family and in particular fathers play a different role in men's biographies than in women's ones. Fathers (or grandfathers) appear in these stories as much admired 'images' – the mechanical engineer, the entrepreneur, the lawyer, the garage mechanic, the father who installed the first computer in his firm – rather than parents who encouraged or gave support. While a number of women mentions that they stand back so that their partner can have a career, the men (with a few exceptions) typically refer to their partners as being available in the background, taking care of the children and/or also giving professional advice.

As a consequence, while for the women work-life balance is a topic (whether they have children or not), this is not the case for male informants.

Women's working life in ICT: case studies in enterprises

Work organisation is a key factor for understanding women's working life in ICT professions. Case studies of enterprises allow for a better understanding of recruitment, employment conditions, careers, skills, working time and work-life balance of women as ICT professionals, in various organisational contexts.

This chapter provides an analysis of the case studies of work organisation in ICT services and e-publishing, conducted in the seven European countries covered in the WWW-ICT project. In each country, two case studies were conducted in each sector, making a total of 14 ICT services case studies and 14 e-publishing case studies. The first section of the chapter draws an overview of both concerned sectors and a short description of the studied firms. The second section summarises the research findings on women's employment: recruitment, careers, status, learning process, position on the labour market. The third section presents the main findings concerning organisational structures and practices.

1. Overview of the studied sectors and firms

Case studies are carried out in two sectors: computer service providers (belonging to the ICT-producing sector) and the e-publishing sector (belonging to the ICT-using sectors). The sector of computer service provision covers the hard core of ICT professions; this choice also allows for comparisons with other studies, often limiting ICT professionals to those working in this sector. In the sector of publishing and electronic publishing (including the new on-line and multimedia information services), the new web-related and network-related professions are more frequent than the classical computer professions and preliminary assumptions (chapter II) suggest that they are less "gendered".

The computer service sector

Computer services is a sub-category of the economic sector known as computing and related activities, which also covers hardware manufacturing, telecommunications and computer wholesale activities. In the European industrial classification system, computer services is represented by NACE code 72, representing the following activities:

- 72.10 IT system consultancy
- 72.20 programming and software consultancy
- 72.20 programming and software production
- 72.30 data processing
- 72.40 data banks
- 72.50 computer maintenance and repair
- 72.60 other IT activities (5).

Sales and employment in computer services far outweigh those in computer manufacturing, in all of the seven countries covered by this study.

Within the computer services (NACE 72) sector, the market is dominated by firms engaged in software consultancy and supply. The size and nature of these firms varies. In most countries, however, the sector is made up of small companies with less than ten employees. Some of these small firms tend to specialise in niche products like development tools, applications software, network software, or sector-specific applications.

Until two or three years ago, the story of the computer services sector in Europe was one of continuous and remarkable growth, in both market and employment terms. During the past two or three years, however, the computer services sector has undergone a dramatic downturn. There has been a decrease in spending on ICT by organisations, with the exception of the public sector. The dot.com crash took place, and this, coupled with a slump in general business confidence, has considerably slowed economic and employment growth in the sector. Companies have had to restructure, and some have closed down. Others have been merged or taken over. Paradoxically, large companies seem to have been particularly vulnerable to this process. Many companies are relocating or outsourcing their IT service functions to other parts of the world.

The e-publishing sector

The precise definition of the “e-publishing sector” is fraught with difficulty. This difficulty arises from the problem of identifying exactly

(5) Although the NACE classification is commonly used throughout the EU, some national systems often present subtle differences. For example, the Italian National Statistical Bureau (ISTAT) classification for software and IT services omits the category of computer maintenance and repair. In the UK, the Standard Industrial Classification SIC-92, is in operation. Here, computer services is identified by code 72, with the following sub-sections: 72.1 Hardware consultancy; 72.2 Software consultancy and supply; 72.3 Data processing; 72.4 Data base activities 72.5 Maintenance and repair of office, accounting and computing machinery.

what e-publishing consists of, and which organisations are involved in it. At its most obvious, the term refers to the publication of material through electronic media, yet this very process involves activities which go beyond the province of conventional publishing. Moreover, e-publishing activities are carried out in such a wide range of organisations and indeed sectors that they cannot straightforwardly be mapped onto the mainstream publishing sector. The activities and processes connected to e-publishing are also constantly evolving as ICT infrastructures and media evolve. The complexity and fluidity of the sector besets any attempt to characterise, describe, and analyse with precision the activities conducted within it, or at least to be sure that the term e-publishing has a commonly-understood meaning.

Although the conventional publishing industry is one of the key drivers of e-publishing in most countries, there are national differences. In Austria, book publishers are insignificant players (largely because the Austrian market is dominated by German publishing houses), whereas they are important players elsewhere. In most countries, however, it is the print media, particularly newspapers, which have been decisive in electronic publishing, placing online first small sections, then entire papers, and subsequently organising and presenting information in entirely new ways for online readers, including in specialised or personalised ways for niche markets.

Other organisations from outside the conventional printing and publishing sectors are also important for e-publishing. The public authorities in Austria have been instrumental in the development of e-publishing by placing information in the public interest online. In Austria, France and Italy, small Internet start-up companies are particularly identified as key players in the development and distribution of online content, often moving into the terrain of larger publishing companies. In Ireland, computer media reproduction provides a major source of e-publishing employment. This is a function of the importance of ICT manufacturing and services in Ireland, and of its status as a gateway to European markets for US multinationals in the ICT sector. In the UK, the BBC has been one of the main drivers with its BBCi online information service. Indeed, there has been considerable convergence of activities between companies as they have moved into electronic publishing, such that it has become more difficult to talk of “publishers” or “media organisations”. Increasingly, organisations from across conventional sectoral boundaries are involved in e-publishing and are moving into new markets in order to do so.

Overview of enterprise case studies

The next tables (15 and 16) summarise basic information on the case studies carried out in each country. Enterprises have been anonymised.

Table 15
Case studies in ICT services

Country	Company	Turnover in €	Total workforce (% female; % female in technical jobs)	Company structure & organisation of work	Employment Status of Workforce
Austria	A1: Large multinational software company	477m in 2001-2002	3500 in Austria (16%; 10%)	Hierarchical structure. Project working	3228 full-timers (92% of workforce). 97% of men and 69% of women work full-time. 272 part-timers (8% of workforce). 3% of men and 31% of women work part-time.
	A2: Small IT service provider	3.38m in 2002	40 including freelancers (25-30%; data not available)	Flat structure, permanent teams	30-35 permanent employees; 5 freelancers.
Belgium	B1: Large computer services company	No information	670 in Belgium (23%; data not available)	Flat hierarchy; flexible work organisation including job rotation	18 women out of staff of 670 work long part-time (4 days). Other employees are full-time and work long hours (evenings, weekends).
	B2: Small internet services enterprise		30 (no data available)	Condensed hierarchy (few levels); project teams of 3	Some part-time employees – all women with children. Freelancers also used.
France	F1: Website creation company	116m in 2002	17 (40%; no data).	Short hierarchies through project managers	100% full-time.
	F2: Small software company	No information	8 employees (of these 1 is female, a placement student in a technical role)	Flat structure. One of two partners manages company. Work organised by project assigned to each employee.	50% of staff are permanent; 50% are students on placements. All are employed full-time and work long hours. Freelancers are used where work cannot be handled in-house.
Ireland	IR1: Medium-size software company	Company made \$28m loss in 2002	250 in Dublin (20%; no information).	No information.	Most staff on full-time contracts.
	IR2: Medium-size courseware and e-learning company	\$43m in 4 th quarter of 2003, but net loss of \$270m	270 (35%; no information)	Project teams of writers, editors and consultants.	All staff on full-time contracts; part-time working and job sharing abolished.
Italy	IT1: Large software house in North-Central Italy.	48.5m in 2002	610 (38.7%; no information)	Project teams of 4-6 people.	Mainly permanent full-time employees.

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	IT2: Medium-size software house in S. Italy	4.5m in 2002	73 (8%; 5.5%)	Hierarchical decision-taking but autonomous project-based work.	All employees full-time.
Portugal	P1: Large multinational computer service company	265m in 2002	737 (31%; 24% of 'technicians' which excludes 'people managers' who may be IT professionals)	Hierarchical with global decision-taking implemented locally. Day-to-day work organisation varies according to area of the company and product.	No information.
	P2: Knowledge management and solutions company	153m in 2001 for wider group of which P2 is part.	31 (55%; 43%)	Work organised into functional departments, some working exclusively for single client company.	Most employees permanent and full-time.
UK	UK1: Large multinational IT service provider	\$86bn in 2001 for global company	50,000 (28%; no information)	Global and regional structure, with departments in UK company organised by client base	Different types of flexible working arrangements are available, but no information on numbers of employees taking them up.
	UK2: Small software company	No data.	25 (3 women = 12%; 1 in technical role = 4%)	Flat hierarchy of directors and departmental managers. Work organised by software release.	All staff full-time except one part-time administrative employee.

Table 16
Case studies in e-publishing

Country	Company	Workforce numbers	Company structure & organisation of work	Employment Status of Workforce
Austria	A3: Online journal	Total of 70.	Flat structure; externalised editorial work	23 employees; 47 freelancers.
	A4: Two companies - Database Company and Architecture Archive	4 in Database: 1 woman, 3 men. 22 in Archive.	Flat structure in both. Work self-directed.	1 employee; 3 freelancers in Database company. 17 employees; 5 freelancers in Archive.
Belgium	B3: Multimedia Section of Press Group	9: 1 woman, 8 men.	Flat hierarchy. Continuous process working.	5 employees of whom 2 are part-time; 4 freelancers.
	B4: Business Communication and Web Publishing Firm	7: 3 women, 4 men.	Flat hierarchy. Mixture of freelance and salaried culture. Autonomous working.	In addition to 7 core staff, 7 freelancers collaborate regularly with company.

France	F3: Digital Content Distributor	540: 39% female, predominantly in sales and communications.	Flattened hierarchy and new 'network structure'. Work organised into temporary project teams.	
	F4: Online newspaper group	26 of whom 12 are female.	Matrix organisation operating across publishing titles. Work organised around a weekly production cycle	
Ireland	IR3: Online part of Irish broadcaster	35: 16 female, of whom 1 is a technician and others are editorial and sales staff.	Work organised around rhythm of news production	Workforce of 35 are core staff but freelancers are also used.
	IR4: Online newspaper	Total of 30. Women are predominantly in commercial function and absent from technical and editorial functions.	Work is organised around continuous process of news production.	Freelancers are used for editorial functions.
Italy	IT3: News and information internet company	34, of whom 10 female. In web section, 6 staff (50%) female. Product managers 100% female. In technical area, 2 staff (20%) female.	Formal and traditional organisational structure but daily work is organised into teams and projects. Staff rotate between tasks when they move between projects.	45% of workforce 'quasi self-employed'.
	IT4: Multimedia publisher and editing service	59, of whom 39 are female. 35 of these work in editorial functions, only 1 in a technical function.	Work organised along six product lines, within which projects are carried out.	63% of staff are 'quasi self-employed'. 2 part-time staff.
Portugal	P3: Online newspaper	19 employees, of whom 9 are female and in editorial positions.	Informal organisation.	
	P4: Online edition of weekly newspaper	3 journalists and some trainees.	Informal and flat organisation. Work organised minimal due to small size of organisation.	
UK	UK3: Network of online newspaper sites.	100 core staff.	Each site has own editorial team. Work managed very autonomously and informally, according to rhythm of daily online publishing and more frequent site updating.	Large pool of freelancers employed in editorial and production roles as required.
	UK4: Online professional journal and business information publisher	13,000 employees worldwide; 1300 in UK.	Hierarchical organisation. Project teams are organised within product lines. In IT, there are permanent teams as well as project teams for particular tasks.	In addition to employees, company employs freelance staff to fill particular editorial requirements.

2. Women's employment and labour market

2.1 Entry to the labour market

Traditionally, ICT professionals have entered the ICT sector with degrees or similar qualifications in computer science or electronic engineering. The case studies show that most professionals still do so, though a small but growing proportion enter technical occupations through clerical, project management or sales and marketing routes. This may work in favour of women without technical qualifications but with other desired personal qualities, such as communications skills, in the longer-term. The case study data do not, however, shed light on this issue at present.

ICT professionals working in e-publishing are as likely to enter with previous work experience as with formal vocational qualifications. Editorial professionals enter the work with a background in journalism, literature, humanities or social sciences, and do not require IT knowledge to enter this employment.

There is a move towards private certification within the IT sector, for example, through supplier-based training and examinations. This raises questions of how competence recognition is to be handled across the sector where differing curricula are in operation and different competences, or competence labels, are created.

For most companies, the problem of women's under-representation in ICT professions stems primarily from the fact that they are under-represented in the pool of graduates who first apply for jobs.

Case study organisations in both sectors recruit IT professionals through a variety of channels, including specialist recruitment agencies, graduate job fairs, traineeships and placements, open advertising and, to a declining extent, through word of mouth. A few case studies persist in using sexist or ageist criteria in recruitment.

For most case study companies, the problem of women's under-representation in IT professions stems primarily from the fact that they are under-represented in the pool of graduates who first apply for jobs. Companies that are very eager to recruit more women report a marked shortage of female applicants for technical jobs. A few companies are experimenting with relaxing their recruitment criteria deliberately to create a larger potential pool of applicants containing more women. Most, however, treat this as an issue over which they feel they have no leverage.

2.2 Employee training, learning and development

All case study companies declare the importance of workplace-based training. Not all provide it, however. Training provision for IT professionals is widespread in IT services. In e-publishing, we found few examples of companies providing training opportunities.

Some professionals are seen to merit training more than others. Software engineers or developers tend to receive periodic formal training by their companies; content developers and editorial staff are not generally seen to need workplace training. This tends to reproduce gender inequalities, for women are clustered in occupations which are given lower priority for training.

The nature and extent of professional training offered by firms do not appear to be entirely related to firm size or wealth. Large multinationals generally have structured, programmatic training provision, but equally some small companies have been found to have systematic training programmes in place. However, in general, SMEs have fewer resources available to spend on training and employee development.

Differences in training provision across organisations also reflect the national context and the extent to which vocational training is embedded within the industrial culture. Other research has found that strong training regimes are present in the Nordic countries, in France and in Germany. Weak regimes are present in the southern European countries, and in Ireland and the UK.

Training and development are cut back during recessionary periods, in almost all organisations. The case studies for this project were undertaken during a period following the bursting of the dot.com bubble, when company profitability was reduced and there was a sharp contraction in the IT labour market in almost all countries. All case study organisations reported being affected by the recession in the IT industry, and most cut their training provision during this period. This may have serious implications for the ability of the industry to maintain skills and knowledge levels, to innovate and to recover from the recession in a sustainable way.

Training has been sacrificed in organisations where pressure of work does not allow time for employee development, either by the firm or by the employee her/himself.

Continuing training in the IT sector involves not only the enhancement of IT skills and knowledge, but also the development of managerial, organisational and interpersonal skills.

In a small number of organisations, access to training opportunities depends on being noticed by a line manager and singled out for development. This is potentially discriminatory and runs counter to good practice in equal opportunities.

Few organisations operate individual development plans to enable them to assess and meet employees' training and learning needs. In e-publishing, none do.

Continual learning is vital in IT professions in order to keep pace with technical developments. Knowledge and skills requirements evolve very rapidly and also become obsolete rapidly. A considerable amount of skills development is done individually by employees, through Internet news groups and help sites, conference attendance, magazines, and through day-to-day support from colleagues and peers.

Continuing training in the IT sector involves not only the enhancement of IT skills and knowledge, but also the development of managerial, organisational and interpersonal skills. These are generally incorporated into in-house professional training programmes, and reflect not only the requirement for a combination of skills when working with clients, but also career paths which (particularly in large organisations) often take IT professionals away from technical work and into managerial functions.

The growing tendency for employer-provided training to be replaced by individualised learning raises several issues of concern for women's professional development. It requires the employee to have and to make time outside work demands for learning new skills and techniques, which is sometimes particularly difficult for women. It also tends to get interrupted during career breaks or periods of leave (for example, maternity leave), so these can be detrimental to an employees' ability to keep their skills current.

2.3 Employment

Women's presence in the IT profession is declining over time. They are more strongly represented in e-publishing than in IT services

IT professionals in both IT services and e-publishing are typically male, young (in their mid twenties), and without domestic responsibilities. Where women are present, they too are likely to be young and without children.

Case study reports with time series data on employment by sex clearly show a decline in women's participation in professional areas of IT services over time. However, women remain strongly represented in e-publishing, though predominantly in editorial rather than in technical professions.

The 'skills shortage' which has traditionally affected the IT services sector has recently abated, due to the slump in IT and e-commerce activities following the dot.com crash of 2002. This has had an enormous impact on employment, with freelancers and contractors particularly hit by declining job opportunities. It is conceivable that this may also negatively affect efforts – by companies, by professional associations, and by public authorities - to attract women into IT professions, as organisations retrench and are under reduced pressure to widen the labour market from which they draw. Even though there are now signs that employment rates in IT professions are beginning to rise again, this is a longer-term issue which will only make itself felt in future years. It has important implications for equal opportunities initiatives and their reliance on the skills shortage issue as the motivating imperative upon companies to take action. These may need to be rethought or re-oriented around other issues.

Redundancy programmes have been widespread in recent years, particularly in e-publishing. It has been suggested by a senior informant in IT services that women may be more vulnerable to redundancy than

men of equivalent ability and status, though there is no data to confirm this hypothesis.

2.4 Employment status

Companies within the IT services sector generally take a conventional approach to working time, so that most IT employment is full-time permanent employment. Sub-contractors and freelancers are used in some organisations to meet variations in market demand, but this has been reduced with the recent decline in the market. In some IT services case studies, programming work is outsourced to outside the EU, in particular to Romania and to India.

Throughout the IT services case studies and the participating countries, part-time and other forms of ‘non-standard’ employment were exceptional. In e-publishing, employment contracts are more varied, possibly reflecting the diverse (usually shift-based) working arrangements within the publishing sector in general.

The few women who work part-time are construed by their employers as having less commitment to their work than their full-time counterparts.

The assumption in our conceptual framework that women take non-standard jobs in order to be able to balance work and domestic responsibilities is only partly supported by our empirical findings. In general terms, it remains the case. However, in IT services and e-publishing specifically, few employees of either sex work part-time. The small number of part-time contracts in IT services was indeed held by women, usually following maternity. In some cases, moreover, women who worked part-time were construed by their employers as having less commitment to their work and their organisations than their full-time counterparts, and as being uninterested in progression or promotion. However, we found that most employees in these two sectors are young, single and without children or elderly dependents, so do not face the same work-family reconciliation challenges as their older counterparts in other areas of the economy.

There is an “employment paradox” at work in IT services: despite a very conventional approach to working hours in most organisations, many employees are accorded autonomy over their working hours. They are not formally able to work flexibly, but in practice they can arrive at and leave work according to their own preferences. In practice, this results in IT professionals working extended hours and carrying out their own self-exploitation.

3. Organisational structures and practices

3.1 Work organisation

Organisations in both sectors have been affected by the recent dot.com crash. E-publishers have been strongly affected, and all have engaged in restructuring and redundancy programmes over the past two years.

Most IT services organisations are flat organisations with few hierarchical layers.

Most IT services organisations are flat organisations with few hierarchical layers. This is particularly true of smaller organisations. In organisation design and restructuring, there has since the late 1980s been a generalised move away from hierarchical organisations and a tendency to develop flatter structures with fewer layers of management. This organisational restructuring has been widely taken up in both the IT and E-publishing sectors. In IT services, and increasingly in e-publishing, market growth is now seen as residing not in standard products but in value-added services oriented towards the specific requirements of users and markets.

Women still experience glass ceilings which prevent them progressing beyond middle management levels

In the large companies where hierarchical arrangements are most likely to persist, there are more potential progression opportunities than in flat structures. However, women still experience glass ceilings which prevent them progressing beyond middle management levels, and remain excluded from higher decision-making structures.

In the IT services case studies, work is predominantly organised around project teams, led by a project team leader or manager. These teams can be temporary for the duration of the project, or semi-permanent. In E-publishing, work is generally organised around functional teams or groups concerned with a particular element of the production process, which generally operates according to more repetitive schedules than in IT services. It is important, however, to distinguish between teams of interdependent workers with complementary skills, and those in which members work independently of one another but in the same organisational entity. Our case study evidence does not show whether women are particularly undervalued within those teams.

We found some limited evidence to support the theory that women are assigned to less technical work in project teams. One IT services case study reported that women are directed towards project management even where they prefer doing technical work - possibly because it is assumed by employers that this sort of work is compatible with their assumed interpersonal and organisational skills. This issue might merit further and systematic investigation.

There is a paradox, among large multinationals in both the IT services sector and the e-publishing sector, of a rhetoric that flat organisations create a 'closeness to management' for all employees, in the context of global strategic decision-taking which means that management decisions are very far removed from individual employees. The centralisation of

management appears to be more pronounced during periods of recession or market downturn, with particular implications for organisational equality programmes.

Flat organisations make pleasant working environments on an interpersonal level but career ladders are short or non-existent.

From the point of female employees, there are both advantage and disadvantages associated with flat organisations. On the one hand, they are informal and flexible and therefore tend to make pleasant working environments on an interpersonal level. On the other hand, career ladders are short or non-existent, while employee and industrial relations are individualised and can be exploitative. The lack of formal structures and progression processes can make it difficult for women to gain advancement, particularly given their well-known difficulties in showcasing their own abilities and arguing for their promotion. Women seem more able to thrive in organisations where career paths are clear and extensive and where formal progression practices operate.

The recent crisis in the dot.com sector has led, particularly in e-publishing, to redundancies and budgetary cuts which have in turn created a marked intensification of work for those remaining employees. Several informants in e-publishing complain of the work pressures placed upon them as a result, and their consequent problems in finding time for training or self-development.

3.2 Skills

Technical qualifications, and specifically computer science degrees, are generally the main entry requirement for IT professionals in the IT services sector. For programming or development work in e-publishing, entry qualifications are lower-level than in IT services: degrees are not always required, but programming qualifications or experience usually are required.

Editorial jobs in the e-publishing sector are concerned with content production, journalism, or project management, for which technical skills are required to work on advanced applications (for example, desk-top publishing or image processing applications) rather than on programming.

Skills requirements for IT professionals are constantly changing, and there is a perpetual need for them to update their professional skills.

There is a progressive hybridisation of skills taking place in IT professions

Currently, there is a progressive hybridisation of skills taking place in IT professions in both sectors. Business and management skills are increasingly used alongside technical ones, and indeed, technical skills seem less important in comparison to business and management skills as IT professionals progress into more senior positions.

The assumption that women are not attracted by jobs that require technical skills is not borne out by the case studies. Many informants report that the use of technical, and particularly problem-solving, skills is

one of the most satisfying aspects of their work because they see it as creative. For some, creative work simply means being engrossed in coding and programming; for others, it means designing and developing a web site or service; for others still, it means developing an overview of a project through project management.

3.3 Employee Progression Policies and Practices

There is sometimes an assumption among employers that women are more comfortable in management than in technical roles

In IT services, there are considerable opportunities for progression, along two basic career trajectories. One is a technical career path, the other a managerial career path. It is most common for IT professionals to progress into management. There is sometimes an assumption among employers that women are more comfortable in management than in technical roles, particularly in project management. This may be an essentialist and mistaken assumption; some women informants in the case studies report a preference for retaining their technical activities, finding them more creative and providing concrete outcomes.

In e-publishing, there are very few progression opportunities, largely because of the truncated career structure in journalist and editorial areas. E-publishing professionals often find themselves stuck at the same level in their organisations for many years. Professionals may move horizontally between different specialist areas of publishing.

Large companies tend to have well-defined hierarchies and career paths, together with formal progression arrangements. In general, senior management positions are filled through these internal routes. Small companies are less likely to have these arrangements. Some case study organisations have specific programmes, such as 'fast track' schemes to groom employees with strong potential for managerial and executive positions. These often go together with specific policies for encouraging female potential specifically, and we have found these suites of policies to be effective means of improving women's progression and retention in IT professions. However, even in these organisations, women remain under-represented in executive jobs, so these initiatives have not solved the problem of inequality in progression.

One informal route into management or a senior position is through visibility to existing management. There are complaints that football and drinking clubs privilege men in this respect. The persistence of these informal men's networks supports the idea that companies still lack experience of developing women, and that management still lacks experience of working with women at all.

As suggested in our framework of explicative variables, role models of women in senior positions are rare, but we have found them to have an important motivating and empowering function for other women both within the profession and outside it. They exist primarily in organisations with formalised HR and equality or diversity policies, usually large companies.

Women are very strongly under-represented in management and executive roles

Our contention that women are over-represented in low-grade and/or insecure areas of work is strongly supported by our evidence from e-publishing, where there are complaints of low pay, low status, and poor progression prospects. In both sectors, women are very strongly under-represented in management and executive roles in the case studies. Few case studies have in place programmes designed to retain and promote women into senior positions.

There are striking examples of prejudice among male managers against employing and/or promoting women, usually on the basis of assumptions about their availability for and commitment to the work. We found little evidence of fear or ambivalence among male colleagues in relation to women's advancement.

3.4 Working time and work-life balance

In IT services there is a high expectation of availability by companies, and also by company clients.

In IT services, it is common for IT professionals to work long hours, or frequently to work overtime on a voluntary basis. There is a high expectation of availability by companies, and also by company clients. This particularly affects those in technical (e.g., programming) jobs, and those in senior management roles. It is a pattern that has been found across the countries participating in the study, and not simply in those countries which have a reputation for long hours working (such as the UK). Italy is the only country in this study in which working hours are settled by collective agreements at sector level.

In e-publishing, working hours are generally organised around full-time shifts, as in the conventional publishing sector. The pace of working is generally steadier and more constant than in traditional publishing, without the peaks and troughs in activity dictated by print deadlines, or by client demands.

Companies in both sectors emphasise availability and 'presenteeism'.

Companies in both sectors emphasise availability and 'presenteeism'. In many IT services organisations, career development appears to depend on working long hours and thereby demonstrating commitment to the work and the organisation. Where senior managers themselves work very long hours, they send implicit messages through their organisations that this kind of working is necessary for career advancement, which may discourage people who are unable to engage in these kinds of working arrangements.

Where it exists, part-time working is female-dominated in IT services, principally among women returning from maternity leave, but it can severely limit progression opportunities. Women and others with caring responsibilities find it difficult to work according to this kind of model, and are consequently indirectly discriminated against. We have one example of an Irish company demoting a woman after she transferred from full-time to part-time working, and another of an Italian company making the assumption that its female employees are unwilling to travel to clients' premises because of family demands – an assumption which

was flatly contradicted by the women in question. This indicates that women with caring responsibilities nevertheless make strenuous efforts to work effectively, and that it is employers who assume they cannot do so. We found no examples of women opting out of promotion opportunities.

IT jobs are typically full-time, with long hours and often locationally flexible

Our assumption that the conditions of IT work are therefore incompatible with domestic responsibilities is supported by the case study evidence. We found considerable evidence to support our contention that IT jobs are typically full-time, with long hours and often locationally flexible. Consequently, reconciliation between professional and private life is difficult for employees (of both sexes) in IT professions. However, in the case study organisations, informants were predominantly young, unmarried and without children or other caring responsibilities, so were largely unaffected by the reconciliation issue. It is unclear whether the industry attracts such workers because of the working conditions, or whether the working conditions have been developed by employers because they have a particular type of employee.

Hot-desking and client-based working are common among IT professionals, and may be problematic for women or men with domestic responsibilities, where they involve long distance travelling or periods away from home. Home-based working is also common among IT professionals (with infrastructures often provided by companies), and employees report that it is very convenient, allowing them to work in family-friendly ways.

With some notable exceptions, explicit family friendly policies are unusual in the case study companies covered by this project. Some companies regard families as problems that distract employees from their work, and see families as the specific problem of individual female employees. One organisation sees the use of family-friendly policies as only necessary in tight labour markets when it has to attract and retain women; currently, it does not find a need for such policies. This confirms the view that recessionary conditions can damage programmes designed to increase women's participation in IT professions.

In both sectors, organisations rather use informal flexible working arrangements, in which they allow employees to organise their time autonomously and take time off where they need to, as long as their work gets done. In practice, this usually means more time spent at work by employees, rather than less.

3.5 Human resource management, labour relations and equal opportunities

Both the IT services and e-publishing sectors have emerged relatively recently. In many companies, human resource management and labour relations have little in common with longer-established industries. Most companies operate individualised employment contracts, pay and grading

systems, rather than collective agreements. In both sectors, union density is very low, and in IT services, the presence of US multinationals hostile to trade unionism, together with a young labour force unused to a culture of trade unionism, seem to have created this situation.

Formal organisational policies and practices have a major impact on women's participation in IT professions.

Individualised human resource management also includes a growing use of periodic appraisals and individual development plans for assessing pay, training needs and career development potential. These are particularly common in large companies. The theory that they have positive implications for women's career development is confirmed by the evidence, which shows that they formalise the criteria for progression and promotion, and move away from informal systems based on friendships, visibility or 'men's clubs'.

In general, our evidence confirms the view that *formal* organisational policies and practices have a major impact on women's participation in IT professions. Several case study organisations committed to the project of improving women's participation throughout their ranks also understand the need to implement consistent policies for recruitment, training, appraisal and development, as well as working time, and implement these policies as whole packages. This coherence of approach communicates clear and encouraging messages to female employees about their prospects and opportunities, and provides the infrastructural channels through which they move. Women were most likely to be found in senior positions in these organisations.

3.6 Organisational cultures

A culture of work which originates in the US is gaining ground in European IT services organisations. This principally involves long working hours, and competitive, individualised relationships between workers. In such a work culture, gender becomes invisible and the organisation appears to be 'gender-neutral', but it can be negative for those women who lack confidence in being their own advocates.

The evidence for the existence of a 'masculine culture of computing' work is patchy. It exists in some companies, and takes several forms. In some environments, it is reminiscent of the 'hobbyist' or 'hacker culture', and involves working long hours late into the night, constantly experimenting with technology, and treating IT problems as leisure pursuits, rather than only as work activities. In others, we found informal networks of men constituted around football, pubs or other leisure pursuits which were of more interest to men than to women, and tended to raise their visibility. The culture of masculinity also involves groups of young men decorating workplaces with pictures of nude women, sharing sexist jokes, and socialising together in all-male groups. We also found considerable evidence of persistent stereotyping of women by managers and executives, particularly in relation to their skills, their availability for work and their career commitment. However, such a culture is not always off-putting to women; some women are able to transcend it.

Many case study organisations are 'gender-blind'.

Many case study organisations claim to be 'gender-neutral' in their culture and practice. In fact, however, they are generally more likely to be 'gender-blind', in that they fail to notice and act on problems of gender inequality, treating gender as invisible.

On the other hand, several IT services companies have sought to create cultures which are strongly woman-friendly, by, for example, discouraging sexist language, images and behaviour, encouraging women's networks, recruiting and promoting women, valuing their skills, and insisting on equal treatment for women and men. This leads us to conclude that not all organisations in the IT sector are redolent with a masculine culture of work which excludes women; many are explicitly woman-friendly. It is unclear, however, whether they are more gender-balanced than their counterparts.

IT's competitive cultures, together with individualised HR structures and practices, are more decisive for gender inequality than the masculine culture of computing.

Editorial and journalist areas within e-publishing are more gender-balanced and in some cases, female-dominated. Consequently, women are not culturally marginalised in these areas, and generally report feeling comfortable with the workplace culture in their employing organisations. One case study is an e-publishing organisation with an explicitly feminist project, to which its female employees are strongly politically committed.

Our evidence therefore confirms the view that organisational cultures in the ICT sector are hostile to women, but it would seem from the case study evidence that it is competitive cultures, together with individualised HR structures and practices which are more decisive for gender inequality than is the masculine culture of computing.

3.7 Social, Cultural and Institutional Arrangements

The individualised employment relations culture of the 'new economy' is widespread across companies and countries.

There is little discernible variation between the employment relations within companies in countries with strong collective bargaining environments, and those in countries with more generally individualised arrangements. The individualised employment relations culture of the 'new economy' is widespread across companies and countries, and overrides national industrial relations arrangements in influencing local working conditions.

National training regimes have little bearing on the training available to IT professionals in firms, which seems more strongly connected to the size of company, its skills strategy and the resources it has available for developing this.

In countries with enduring 'male breadwinner-female domestic worker' models and relatively low rates of female labour market participation, there are examples of direct hostility to the employment of women in IT services organisations.

Women in countries with strong welfare support arrangements (for example, childcare provision) have no advantage over women in IT

professions in countries with weak support provision. Here, however, women's employment and prospects are strongly dependent upon the willingness of their employers to accommodate to their domestic situations. In these conditions, employer behaviour seems to be more critical than in countries where the state or other institutions provide support to workingwomen.

Gender stereotypes are widespread, though their precise content varies slightly in different national and organisational settings. These stereotypes provide a rationale for companies to prejudge women's fitness for technical work.

Lessons from practices improving women's place in ICT professions

For many years, various campaigns have been initiated to attract more women in ICT professions. Why is their success apparently so limited? Too often, they address only women, neglecting other agents of change. Their messages concerning job content and careers are too vague. And they often focus on only one of the causes of the gender gap in ICT professions: either education or working conditions or professional culture.

According to criteria explained in Chapter II, good practices aiming at improving women's place in ICT professions were collected in seven countries: Austria, Belgium, France, Germany, Italy, Switzerland and UK. The first section of this chapter describes the sample of collected good practices, while the second section analyses them. The final section gives some recommendations and arguments for the promotion of good practices in this area.

1. Characteristics of selected good practices

In their information collection, the research teams were keen to favour practices focussed on ICT, rather than to over-diversify by also counting practices geared towards “Women and Science” or “Equal opportunities” in general. However, some broader practices figure in our corpus due to their exemplarity or effectiveness in the ICT field.

The good practices that we gathered are briefly presented below under different angles of view: their field of application, their initiator, their target group and their tools and means. Detailed information on good practices can be found in the downloadable D8 report.

1.1 Fields of application

The practices identified cover three different moments in the relationship between women and ICT (some practices may apply in more than one field):

- 34 practices aimed at learning periods, including: school and higher education, adult training (job-seekers or professional training) and school or career guidance
- 31 practices aiming to change the professional world, for example, arrangement of working hours, management of staff aiming to break the glass ceiling or pay difference or networking inside or outside companies...
- 5 practices aimed at personal life, familiarisation with home computing, Internet use. This is somewhat removed from our concerns.

So if we only take the first two types of practices into account, we notice that the countries appear to distribute their priorities very differently. For example, Austria implements half of its practices in the field of education, while the UK targets half of its practices on the field of work. Meanwhile, Belgium and Germany show an equal distribution.

1.2 Type of initiator

Public authorities are the major initiator of good practices.

The top project initiators are public authorities, with 26 practices at local and regional level in almost all countries. At the earliest stage of the project, the impetus is often given by European programmes and funds.

Although employing organisations come second with 15 practices, this is due to the UK, where seven such practices were identified. It is also worth noting that this category covers practices from private organisations, two of which are actually training centres rather than companies likely to employ women.

Very few companies have set up policies encouraging better gender balance

In third place come groups of women, with 9 practices, operating as more or less formal non-profit organisations: some are women working in companies, others have created training centres for women, and others have set up help or information networks. Some apparently work voluntarily (at least in part), while others work for associations that pay them. Whatever the situation, this means of operation – in which there is likely to be a lack of formalisation or structure – often gives innovative results

We also count 9 practices from companies. However, as two of these companies are private schools, we should point out that only 7 companies providing employment in ICT seem to believe that encouraging greater gender balance would be profitable and depends on their own staff management. This is even more regrettable when we

consider that it is in this category that we find two very persuasive results, both in the UK. Not only do these two companies have surprisingly high rates of female presence (50% of senior executives are female at FI group, 75% of staff are women at Happy Software), but what is more, they are profitable and have become models in terms of personnel management.

1.3 Target groups

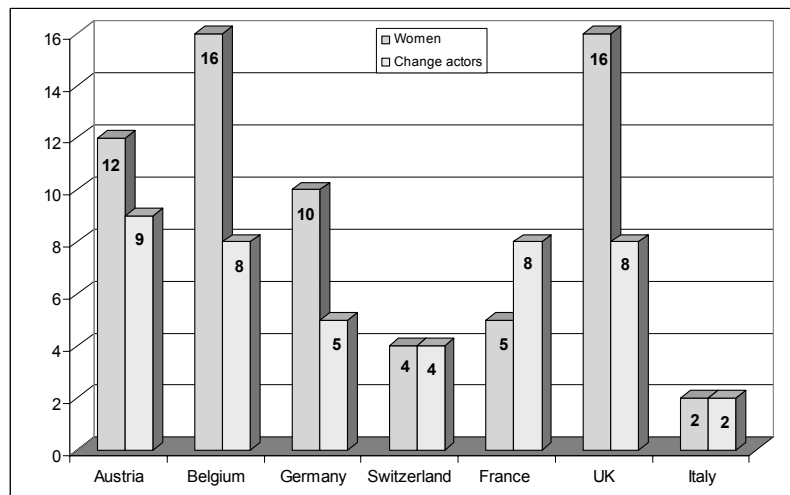
The main target group of good practices is girls and women.

Although the groups targeted by practices are very varied, we nonetheless note that the main efforts are geared towards women: teenagers, students and adults, in terms of training, awareness or, for adults, returning to work or support. This observation leads us to create two categories of target groups:

- Women: category which covers adults, young women and girls
- Potential actors of change: category covering employers (HR, employing organisation, etc.), school or professional guidance centres, schools (administration), teachers, family and the media. These audiences act in very different areas and for very different reasons. Nonetheless, they are all facilitators for bringing or keeping women in ICT.

Figure 7 shows the distribution by country leans mainly towards the category “Women” (except in France and Italy). Globally, out of the 105 responses relating to the target audience (still out of our 59 practices), 60% are geared towards women and 40% to potential actors of change.

Figure 7
Target groups, break-out by country



1.4 Tools and means

The means used are very varied. The most frequently used means include training for women and the provision of documents on women and ICT (online or in paper format).

However, there are differences from one country to another. For example, coaching is practiced extensively in Austria, but very little in other countries. Germany has a well developed tutoring system. The UK has greatly developed networking and is practically alone in focussing on working conditions and practice benchmarking. Belgium has involved the media in communication campaigns.

2. Analysis of good practices

This section aims to highlight the promising avenues, along with the omissions, bringing the previous analysis into the context of the research and our current knowledge of women and ICT.

It firstly presents and assess two types of approach we found to favour the entry of women into ICT professions. It secondly stresses three fields of actions, called “driving forces”, that we did not really encounter in the search for good practices: cross-disciplinary skills, networking and self-learning. Finally we insist on potential initiators of good practices to mobilise in a more efficient way.

2.1 Two approaches to foster women’s entry into ICT professions

Good practice can intend to remove obstacles encountered by women in ICT professions.

Removing obstacles

Initially, it is possible to act on the objective components of the profession, as we believe that women are turning away from IT because they are encountering solid obstacles in their path. We know that girls are more likely than boys to anticipate their professional life during school and career orientation, and that in particular, young girls choose industries that will enable them to live a life that meets their aspirations. The reasons may be varied: raising a family, of course, but also, travelling, or taking up challenges. Yet, the problem of reconciling their personal, family and working lives is ever present in the minds of many young women.

Given the clear obstacles that women meet during their studies and in the professional world, we can assume that a good practice is one that aims to correct, counterbalance or even remove these hindrances while strengthening the driving forces that are objectively favourable to women. This essentially covers:

- *Training* aimed at women, often in a single-gender environment, in order to enable them to access courses that they might not have dared to approach.

- *Coaching or tutoring*, which offers women advice or support to confront problems that they encounter in ICT (and discrimination in particular).
- *Networking*, as women are more isolated than men in the profession, not only because they are rare (women sometimes feel isolated because they do not have the same interests as their male colleagues), but above all because they have little time outside their working hours to build professional relationships.
- *Improvements in working conditions* in order to make family and professional life easier to reconcile (flexible working hours, part-time, possibility of working from home, crèche in the workplace or training centre).
- The desire to *smash the glass ceiling* and have a non-discriminatory personnel management policy, particularly in terms of salary and promotion.
- *Grants* to help young women in their studies, allowances for university research, projects, and organisations working to improve women's access to ICT.

Shifting representations

Secondly, some good practices chose to work on representations, to consider that if women are not embarking on studies leading to ICT jobs, or if they do not remain in these jobs once they are in, it is because:

- the image they have of computer scientists does not match the image they have of themselves;
- they are viewed by their colleagues and superiors via sexist stereotypes: they are assumed to be unsuited to the profession.

The consequence of this distortion is that when an obstacle – a real one this time – arises, it is felt to be insurmountable because it seems to reinforce such images and anchor them in reality.

Two examples can support this reasoning. The first one is the difficulty to reconcile work with family life because of long working hours, meetings at any time of day or night, travel, whereas other jobs such as nursing or cleaning, typically held by women, are hardly compatible with family life. The reason is that ICT professions are considered as male domains, and the slightest unforeseen issue simply confirms the idea that they are not compatible with family life and are unsuitable for women. The second example is the traditional suspicion of women's lack of technical competence. This attitude may end up destroying the somewhat fragile self-confidence that women have built up.

It is very hard to influence representations, as these are prejudices, stereotypes (which are well-rooted); we are working on something intangible, not reality, but an idea that people create.

Modifying representations will act on the image that women have of ICT professions, on the image that employers have of women, and on self-confidence.

The practices aiming to modify representations will work on the image that women have of the ICT professions, the image that employers have of women and the profession, and on self-confidence.

Assessment of these two approaches

Although these two approaches may seem contradictory, they are in fact quite complementary. If the representations of employers and women do not change, women will not be attracted to these jobs and employers will not come looking for them. If we are satisfied with simply changing representations, women will quickly be confronted with obstacles that will reactivate them again.

Among the range of practices we have identified, we observe that the two approaches are often carried out in tandem and that generally, both aspects are well represented.

2.2 Driving forces to be harnessed

The importance of cross-disciplinary skills and applied ICT

The scope of ICT professions is hard to sketch out, just as it can be tricky to distinguish professionals from savvy users. In this study, we consider professions in which knowledge of ICT predominates over knowledge of the field of business. In this context, two categories may be considered:

- ICT as a means: professions for which ICT are essential to business. Employees in this branch, in addition to their professional skills, must acquire and maintain a palette of increasingly advanced computer skills.
- ICT as an end in itself: the professions in the hard core of computer science, accessible only after an education focussed specifically on computer science.

In between there is a grey area where both categories meet and mingle. ICT specialists must often have a good knowledge of the field of business in which they work. As well as having computer skills, they will also specialise in an activity that uses ICT resources and will, depending on the direction that their studies or career have taken them, become specialists in banking ICT, or computer vision. In this area, they will come across jobs equivalent to their own, financial specialists or electronics experts, which will have taken a different path leading from business skills to computer skills.

Of the practices identified, some very clearly target the hard core, featuring computer courses for women, tutoring for female ICT students, or a proactive policy for hiring female computer scientists, for instance.

Conversely, as regards the grey area around this hard core, messages are scrambled: some practices, for example, may address both types of

professions, whether ICT is a mean or an end: in particular, practices which target girls (girls' day, ICT workshop for teenagers, etc.). However, it is highly likely that these practices will be perceived either as an encouragement to take up ICT as a profession, or as a workshop focussing on computer use, rather than as a possibility of interfacing between ICT and a business activity.

These days, it is a real challenge to make this perspective visible and to promote it among women. Currently, when computer proficiency becomes a necessity in a job (or in a branch of a job), it clearly tends to become male-oriented, even if the job was more female-oriented at the outset. We should stress that the issue here is technical proficiency, and not use; the secretarial profession has not suddenly become male-oriented with the arrival of office computing.

Furthermore, there are more and more degree courses emerging in which ICT is a tool to serve another discipline: ICT for social sciences, biotechnology, publishing, etc. Although computers rarely fascinate girls per se, computers when used for another discipline (such as maths, biology, art, etc.) may become attractive. Girls tend to be put off by the image of the hacker who spends his entire life in front of a computer screen, and imagine that computer scientists do nothing but programme.

While fighting the false "lonely hacker" image of the profession, it is important to stress the need for cross-disciplinary skills, and applied computing.

As we fight this false image of the profession, it is important to stress the need for cross-disciplinary skills, and applied computing.

This is a key avenue to explore. According to Catherine Marry (2004), girls seek diversity above all. They are not put off by selective industries and are not afraid to be isolated among boys. However, they will not be attracted by overly specialised courses. Quite involuntarily, cross-disciplinary courses can be considered as women-friendly: For them to become truly so, girls must be made aware of their existence, and must feel welcomed.

We did not find any practices that make explicit reference to this aspect of ICT. However, we could imagine work placements, communications campaigns, competitions, etc., that do not deal with the vague notion of ICT as a whole, but which stress the idea of applied IT and are not geared towards future computer scientists, but to people having already chosen a career path, within which the benefits of ICT can be shown.

Building a relational network for women

In order to learn how to encourage women to choose ICT careers, we can look at the reasons that have encouraged women to change career direction (Collet, Ingarao, 2003). For these women, at a given moment, there is a trigger that turns ICT from something unthinkable to something desirable. The two major arguments in this situation are:

- The ease with which work can be found in these professions (conversion is almost always due to unemployment).

It is more common for men than for women to build more or less formal networks outside working hours. Yet, these contacts are crucial for one's career.

- A friend or family member has given them the idea or desire to convert.

In the survey quoted as a reference, the authors note that the arguments for men are very similar to those for women, but men are simply more likely than women to have contacts in the ICT world. One of the reasons relates to the fact that it is common for men to build more or less formal networks outside working hours. Women, even if they are ready to join in mixed or female meetings, often have less time to devote to maintaining a professional network. And as extra-professional networks are often built by gender group, they often know fewer computer scientists.

This is where programmes based on tutoring and coaching, or presenting positive identification models, come into their own. The idea is to weave a network of contacts that might be of used by women, enabling them to be less isolated by building a reliable relational support structure that they may consult.

Preparing for self-learning

One of the specific features of the ICT sector is its constant, rapid evolution, which requires employees to make regular efforts to continue their training. Companies are aware of the importance of up-to-date knowledge, they generally offer training to their employees. However, they also expect people to make this effort themselves.

Self-learning is necessary, but neither organised nor recognised anyway.

Generally speaking, self-learning has a very particular status in companies: it is both obligatory, in order to keep up to date, but not recognised: it is supposed to be done naturally, it is not organised, and skills acquired are not validated any way. This self-learning is also invisible within our corpus of practices. There are no provisions upstream in order:

- To raise women's awareness of these techniques,
- To get them used to training themselves, asking peers for help,
- To institutionalise the transfer of knowledge so that everybody finds it natural to exchange information,
- To validate skills acquired in this way, so that women (like men) can acquire some real benefit from it, that they would not necessarily dare to highlight if such skills remained informal,
- To make these practices visible and define them, in order to avoid long hours of work at home.

2.3 Initiators to mobilise

Private sector

In the corpus of UK practices, two particularly remarkable practices merit our attention: those of FI Group and Happy Computer. As we mentioned above, these are two successful examples, which indicate that

when a company wants to have a positive discrimination policy, it manages to find competent women at every level (50% of managers are women) and remain in excellent financial health and that when a company applies women-friendly measures, it has no problem recruiting women: Happy computer is not necessarily seeking to employ women, but simply to limit staff turnover, and 75% of its staff are women. Yet, it appears that out of all these practices,

- Fewer than 2 practices in 10 are initiated by companies
- Only 13% of employers are targeted by these practices
- Companies are rarely the core target group of practices.

Burdening women with the majority of the effort entails that the gender gap is essentially due to their reluctance to enter the profession, and yet there are few practices that are really working hard to create a place for them.

Social partners

Social partners could tackle the glass ceiling, sexist behaviour in technical professions, or male/female salary gaps in the ICT world.

Social partners could tackle the glass ceiling, sexist behaviour in technical professions, or male/female salary gaps in the ICT world.

Evidence from our case studies and biographies confirm this situation. Sector-wide collective agreements usually exist and in large companies, one also finds collective bargaining at company level. While basic employment conditions are collectively bargained, career advancement is mainly based on individual performance and wage and benefits are currently negotiated at individual level. Although big firms have more structured internal systems regulating career advancement, mobility and training, in most of our case studies, only few rules as regards pay and reward systems are reported and the individual negotiation mostly depends on manager's good will. While this situation seems to be preferred by a number of employees who chose to manage themselves their problems and concerns, without any intermediary, women in this situation appear to be disadvantaged. Although they often do not acknowledge to be discriminated, they often refer to be less successful in such negotiation than men are (and the reason is probably because they underestimate themselves).

However, even when in a large company with a trade-union tradition, such questions are rarely addressed, if at all. Although we might have expected to see practices initiated by social partners to tackle the glass ceiling or sexist behaviour in technical professions, or male/female salary gaps in the ICT world, we encountered nothing of the sort.

2.4 Improving equal opportunities within a systemic approach

The variables that explain the gender gap in ICT work systemically. One of these spheres would not, on its own, suffice to explain the gap: it is the interacting whole that is at the origin of the current situation. By

consequence, when tackling this gender gap, it is pointless to try and address only one sphere. Why try and convince employers to hire women if few women are actually opting to study IT? How can we persuade girls that there are interesting careers in ICT if they are to quickly hit the glass ceiling and realise that their salaries are significantly lower than those of their male counterparts? In both cases, the effects of good practices would be fleeting, and limited.

Each sphere of the gender gap must be targeted if the monster is to be killed. When an employer decides to increase the number of women on the staff, then there must be well-trained, self-assured women on the labour market. If such women are to exist, then they must feel sure that there is a place for them in this profession, via the media, and educational and career guidance. And if this fragile balance is to last, then people surrounding these women (colleagues, managers, and partners) must consider them to have a legitimate place.

The gender gap can only be reduced if a series of actions enable to approach equality, step by step.

Although in the previous section we indicated various fields of application that have been underexploited, this does not mean that other practices are without worth. Indeed, the gender gap can only be reduced if we align a series of actions, which will enable us, step by step, to approach equality. Equal opportunities between men and women in ICT will work as an emerging phenomenon, based on an effective, balanced system of good practices, working together on multiple causes, to achieve a common goal.

This is why efforts as they stand in many countries must be pursued: they must be strengthened in the less targeted fields of application, and above all, practices must be evaluated in order to ensure that all spheres are effectively targeted. In this context, the development of the situation in Belgium should be closely studied, as this would seem to be the country in which practices are best distributed and interconnected. Also, the size of the country in question means that the critical mass of the target group affected by the range of practices is reached more quickly.

2.5 Towards strategic evaluation

A report of the European Foundation for the Improvement of Living and Working Conditions (Olgianti & Shapiro, 2002) presents a useful model to assess the impact of corporate equality strategies on gender equality in the workplace

It differentiates practices following their content (focused, scattered or transversal), their process (one shot, building blocks or continuous) and their outcomes that can be limited, leopard spots or across the boards. By identifying which level of equality activity exists within an organisation, it is possible to track its overall direction as regards equality. This analyse is widely developed in the D8 report.

This model demonstrates how different approaches to developing gender equality in the workplace, across each of the dimensions analysed, have a cumulative effect, producing different equality outcomes at different levels.

3. Recommendations and arguments

As the SIGIS project has pointed out for their topic, it is difficult to find evidence of good “inclusion” practices. Many workplaces are denying the requirement for gender inclusion/supportive practices but at the same time have “diversity practices”. It seems that gender inclusion practices are subject to economic cycles – in recession, they are of no interest to ICT firms; in times of economic growth, pressure on retention and recruitment stimulates their interest.

The “good practices” appear to be rather biased towards changing/adapting women to fit within existing systems

Our analysis of good practices bridging gaps in gender and skills in the labour market for ICT-related professions meets one of their conclusions: the practices they have included appear to be rather biased towards changing/adapting women to fit within existing systems rather than looking to understanding different workplace systems and cultures and to see where these systems include good inclusion strategies as one part of a broader good practice culture.

Here, we present some recommendations and put forward arguments for women and potential actors of change, enabling them to be win over to policies aiming at reducing the gender gap.

3.1 Recommendations for good practices

- To develop actions to raise awareness of equal opportunities, so that potential change actors and women better perceive and understand the gender gap and its results. A good practice implemented by people who do not fully believe in the utility of equal opportunities policies is doomed to failure.
- To publicise the importance of cross-disciplinary training by stressing the need for IT proficiency in business domains. Stress the diversity of professions affected by ICT by emphasising the applied computing aspect rather than the pure ICT aspect alone.
- To pursue initiatives that act both on the hindrances and driving forces encountered in ICT studies and professions, and those acting on women's and employers' cultural representations.
- To set objectives that contribute to the quality of working life within ICT professions, so as to make these conform more closely to both male and female employees' aspirations, and the overall performance of companies. Raise awareness and equip social partners so they become change actors within the company.

- To develop systems of recognition for the professional training carried out informally (transfer of knowledge among peers and self-learning), by organising formal validation system for skills acquired in this way, through additional professional exams codified by a panel of professionals, for example; raise women's awareness of this means of skill acquisition.
- To ensure that each practice is properly evaluated (not just a satisfaction survey or estimated report of results)
- More generally, to link up these recommendations within equal opportunities programmes enabling practices to be managed and coordinated – the only way to achieve mainstreaming and lasting change both in terms of images and daily life.

3.2 Arguments to be put forward

At this stage in our study of good practices, we suggest solutions and arguments to convince the various target groups – women and potential change actors – to take part in these actions.

Arguments for women

Over-emphasising a message such as “girls are just as capable” is likely to reduce girls’ self-confidence and reactivate scorn and mistrust from boys.

It can be noted that around ten years ago, representations of men and women changed. We no longer have to persuade girls that they are capable of doing the same jobs as men, even though 95% of them continue to see ICT as a man’s job. Although their older counterparts still doubt their abilities, partly due to their more traditional education and the weariness caused by obstacles in their professional lives, young girls generally believe that woman are as capable as men of succeeding in the ICT world. They believe that the fight for equal opportunities is behind them, at least at school, and that if they are not attracted to ICT professions, it is because they are not interested in them, not because they are incapable.

Over-emphasising a message such as “girls are just as capable” is likely to reduce girls’ self-confidence and reactivate scorn and mistrust from boys and to put them off programmes that seem to want to “bring girls up to the same level as boy”. However, in some countries, which are developing greater awareness of equal opportunities, encouraging messages could be directed at girls without ill effect.

Chapter III shows that women’s testimonials already feature many relevant arguments, which can be relayed, for example, by future campaigns:

- ICT offers jobs in a respectable area and status.
- ICT is challenging work, offering the opportunity for learning and perfection, and for being creative.
- ICT is fascinating, satisfying the urge to solve riddles and generally the curiosity to get to the bottom of things.

- Being able to work with customers, translating their needs into software or a web site – this may even include a care-taking aspect.
- ICT is an open world, with a wide horizon.

Why to close the gender gap? Firstly because it is fair, and secondly because it is in the interest of companies to do so.

Arguments for potential actors of change

Speaking to companies, the argument to put forward in favour of closing the gender gap is the company's interest, for many different reasons. Acting in favour of a better gender balance would increase the visibility and public image of the company, possible media coverage which will strengthen its reputation. It could help to achieve recognition on a national, European or even worldwide scale, as a leading company in the use of progressive management practices and corporate social responsibility. It would also increase job applications and standards of candidates (this argument also holds true for schools) and reduce staff turnover. Last but not least, it could increase the feeling of pride and satisfaction among employees

Another argument strategy would be to rely on a concept that is generally well received within large companies: diversity. A company policy in favour of diversity has the advantage of not focussing directly and exclusively on equality between men and women. However, the danger with this type of argument is that women are reconsidered as a specific group rather than one half of all different population categories. Diversity aims for an organisation to reflect the populations existing in society, and therefore, the markets in which it develops.

By focusing on diversity, the following arguments can be developed:

- *Companies are more competitive:* comparative international studies show a correlation between a high level of female activity and a high economic growth rate in the country. Moreover, the two selected good practices (Happy computer and FI Group) support this idea.
- *Companies are more dynamic and pleasant to work in:* firstly, many gender-balance studies show that employees prefer to work in a mixed gender environment. Secondly, women, by entering very male-oriented working groups contribute other values, such as the reconciliation of private and professional life. They help to make people understand that efficiency is not related to how long you spend at work and that “female” qualities are just as essential for the company as “male” qualities.
- *Companies are more in tune with their market:* companies that wish to develop or retain their competitive advantage in a globalised marketplace have every need to structure themselves to suit the profile of their customer base. According to Business for social responsibility, women in the USA apparently initiate 70% of purchase decisions. It is worthwhile for companies to adopt a broader vision and to reflect the characteristics of their consumers – and this holds

true for ICT professions as well as others: for example, women will soon comprise 50% of all Internet users in Europe.

Because diversity is founded on the idea of performance, it has been seen to form an approach that is more easily accepted by all, men and women alike. Nonetheless, the measures taken to boost diversity may lead to the gender variable being forgotten, and neutralising its scope by bringing it down to the level of a categorical variable.

However, we can suppose that diversity, currently considered as a cutting-edge method in human resource terms, is a framework for implementing equal opportunities between men and women, by favouring a dynamic of belonging to general equality principles in the company. By using the diversity argument as a “Trojan horse”, which is probably more effective at present than the gender-equality argument, it is likely that companies may be persuaded to set up a mainstreaming policy.

Conclusions

The question raised at the beginning of the project was “Why is the ICT sector not open to women?” Now it can be reformulated into “What are the main characteristics of ICT which can be relevant for women’s employment and quality of working life? And what conditions can make ICT jobs more attractive for women?” The conclusions give interesting – and sometimes unexpected – answers drawn from our research efforts.

1. From hypotheses to findings: some surprises

General assumptions and current responses mentioned in the conceptual framework and state of the art (Chapter II and D1) raise a major question: why is the ICT sector not open to women? We suggested that it might be for several reasons, mainly linked to education (under-representation of women in technical courses), cultural aspects (computer culture as a masculine culture, the importance of an early familiarisation with computer, etc.), family responsibilities (ICT jobs require a high commitment that makes it difficult to reconcile work with family life), organisational sphere (few role models of women in senior positions, high segregation between “men’s jobs” and “women’s jobs”).

Some generic assumptions on women and technology are refuted by the project findings.

But in fact, from the project empirical evidence, it emerges that such generic assumptions are strongly criticised, and even refuted, by the project findings.

- *Women do not seem to have such a problem of relation to technology.* Taking into account the fact that we report on women already in the field, technology results very attractive for most of our female informants, who speak of ICT as a creative, challenging, fascinating and satisfying world, despite in our sample an early familiarisation with computer is not so common. The existence of a “culture of masculinity” in computing, which according to some authors is responsible for women difficulties in a ICT environment (Cockburn 1988, Wejcman 1991, Hapnes and Sorensen 1995), and also the division between a

female “working with” and a male “working on” way of approaching technology and computers (Cockburn 1988), do not result confirmed by the experiences of our informants.

- *The classical hypothesis of the role of the family in social reproduction of career orientation* (particularly the role of fathers interested in engineering or mathematics) *is not confirmed*, since in most of the cases, family background is not such a determinant in women’s choice: as for biographical interviews, only a few informants have a technical family background (in most of these cases is the father who is in a technical profession). This is coherent with the fact that we found only few cases where the attachment to computer began at an early age.
- Although from both case studies analysis and biographical interviews the working conditions in ICT result quite hard (especially long hours working), as many authors already underlined (Hayes 1989, Grint and Gill 1995, Webster 1996, Smith 1997, Vendramin and Valenduc 2002, Gill 2002, Kunda 2002). Nevertheless, this does not appear to be the most explicative variable of the low female participation in this sector: women generally seem to accept them, at least women already in these jobs. Actually, only few cases are reported of women quitting their jobs and not so many of women being unsatisfied about their work. Women might accept longer hours in change of self-management of working time (Gerwitz and Lindsey, 2000). Meanwhile, this point requires a further analysis, since it comes out to be still a controversial matter.

Therefore, according to this empirical evidence, WWW-ICT initial question might be reformulated in: “What are the main characteristics of ICT which can be relevant for women employment and quality of working life? And what conditions can make ICT jobs more attractive for women?”

We can summarise here some interesting – and even unexpected – answers we could draw from our research efforts. They are:

ICT professions are more diversified than they are supposed to be, as well as entry routes in ICT careers.

- *From inside, ICT professions look more varied and articulated than they were supposed to be.* The scarce “readability” of the real content of these occupations might be one of the reasons of the scant orientation of girls to these jobs. In particular, despite most ICT jobs require technical, math and science based skills – which may discourage women without specific technical degrees – other non-technical skills may be important as well. Especially in their more recent developments (e-publishing, multimedia), ICT professions consist of a number of different contents, from technical ones through economic, marketing and management matters, to arts, communication and linguistic subjects.
- By consequence, *there is not a privileged education and route to ICT professions.* Scientific and technical degrees coexist with degrees and diplomas in arts, journalism, economics and human sciences. Moreover a number of our informants’ careers has been undertaken

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by women coming from different jobs in the company or from different fields of work: a work-based route into ICT is quite common especially among senior professionals – who entered the sector when formal ICT curricula were not enough articulated – but many examples of “by chance” contacts with ICT are reported as well.

- The research, both case studies on work organisation and biographical interviews, confirms that ICT careers are little formalised (especially in small companies) and that institutionalised continuing training inside the companies is quite rare (except for a few large companies, particularly multinational ones). By consequence, one of the most relevant feature of ICT labour market is the fact that *professional development is mainly up to the individual*. In order to enhance their knowledge and build up their career, people benefit from coaching, team-working, professional community networks and through mobility to other companies (ICT careers as “boundary-less” careers). “Employability” rather than employment, skill recognition and certification are important goals for ICT professionals. In such a labour market, women appear to be disadvantaged by the lack of steady role models of successful women (except for a few experiences of women mentors and female professional networks), by the scarcity of time to invest in self-training and by the heavier constraints to mobility.
- Working by project is quite widespread. It often implies strict deadlines and long-hours working during some periods (including working at night and/or at home during week-end, being continuously on call, etc.) and also working at the client’s often means more stressful rhythms. These hard conditions are balanced by the autonomy for workers in self-managing time (even if generally the hours worked are always more than the standard ones). *The capability of women professionals to reconciling work and family life strictly depends on the span of this autonomy*. On the other hand, we cannot exclude that women in ICT jobs might be involved – as men are - in this kind of self-exploitation resulting from the “seductive and emotional kind of work”. This aspect has been pinpointed by Kunda (2002) and confirmed by Lehndorff and Mermet (2001) who speak about “IT long hours often self-imposed by employees”.
- *Work in ICT is highly deregulated*. Low union density and few collective agreements in the sector enables individualised negotiation of wages and careers (EIRO 2001), which is a major source of differentiation and sometimes inequality among workers. Outside a steady framework of Industrial Relations, HR practices are much addressed to enhance productivity through competitiveness than through motivation and participation of workers (Webster 1996). Moreover, precarious free-lance work is increasing in the sector, especially in small multimedia and e-publishing companies (Bechmann 2001).

In such a highly deregulated working environment, individual resources and capabilities are extremely important.

Two different methodologies for the empirical research were used – biographical interviews and company case studies – that provided us with

a wide evidence on the education, the working conditions, the labour relations and the career paths of men and women working in ICT. Moreover, the integration of the two methodologies enabled us to highlight the specific gender issues characterising the condition of women working in this sector, their peculiar education models, their relationship with technology, their diversity at workplace, especially as far as family responsibilities are concerned.

2. Education and training

2.1 Backgrounds and the influence of family

Family as a whole appears to be very important – both in a concrete and a symbolic way – for most of our interviewees. In the majority of cases, families gave a great emotional and moral support (sometimes also an economic one): the fact that parents encouraged their daughter to make their own decision and respected their choice of study and career was mentioned as the most important support. While in some cases parents played a more incisive role having strong expectations over their children's career and success orientation, only in few cases (in Belgium) informants had to fight against the expectations of their family to enter a more traditional career.

Sometimes it was the father's scientific or technical background or interest, which strengthened informants' affinity to technical things and/or encouraged them to go into science and technology studies. In these cases, the father (sometimes also an older brother) was an important role model, who gave them the reassurance they could manage a technical job too. Some fathers had attractive jobs, and not necessarily in scientific fields, such as architect, industrial designer or entrepreneur. They transmitted to their daughters a more general positive attitude towards career.

Family background is not such a determinant in women's choice.

There are also several cases (notably in Austria and Italy, not in Belgium) in which the mother had a strong influence on the daughter's personal development and career choice. These mothers are described as role models – strong, admirable, and supporting, expecting their daughter to be strong and independent – either if they had successful careers and were running their own business or if they were only housewives. This resonates with research stressing the importance of the mother as a role model and source of encouragement for girls (Huang et al. 1999, Hapnes and Rasmussen 2000).

However, family background is not such a determinant in women's choice: as for biographical interviews, only 20 informants (on 140) have a technical family background, 14 have the father in a technical profession; 3 cases only the mother in ICT field, 6 cases both. Therefore, from a general point of view the classical hypothesis concerning social reproduction of career orientation – parents influencing children through

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their own professional choices – is only very partly confirmed. Many of our informants have parents coming from very diverse study and career backgrounds.

2.2 The entry into ICT: relation to technology, inclinations, school curricula, and other determinants

The assumption that women are not attracted by jobs that require technical skills is not confirmed by case studies and narratives. Many informants report that the use of technical and particularly problem-solving skills is one of the most satisfying aspects of their work, and that they see many tasks as creative: design and developing a web site or service, developing a project and even being involved in coding and programming. A good relationship with technology seems to be important as well for choosing an ICT career.

Early contacts with computer do not appear as a prerequisite.

Early contact with computer applied just to a part of the informants and seems not to be a determinant in choosing ICT as a career. Some of the younger women had computers at home, provided by their father, their older brother, in a few cases their mother, or they bought one from their pocket money. Anyway, most of our informants came late to ICT.

As for the scientific inclination, some, but not all, of our informants excelled in math and/or sciences. The interest in these fields is one of the major entry routes to computing. The second one is through an application area: for many of our informants ICT is attractive because it requires analytical and problem solving skills (and they experience this as a source of creativity). Therefore, the assumption that assimilation of informatics with technology, mathematics and physics is a reason for the reluctance of girls to approach computers – which was also questioned by Nelson and Cooper (1997) – does not result from research evidence.

Many routes lead to ICT professions: degrees in informatics, but also in subjects not directly linked to ICT, work-based routes, and careers by chance.

According to our empirical material, another reason for choosing computer science curricula and an ICT career emerging was the aim to get a secure and well paid job, catching the employment opportunities offered by a new-open labour market: computer science like a ticket to economic opportunity. According to some authors (Margolis 2000), this holds true in particular for women with an ethnic background and women living in economically deprived regions. In our results, it particularly fits in the case of some informants from Southern Italy.

In conclusion, as it comes out from empirical data, entry routes in ICT professions can be diverse, both for women and men. Different routes have been found:

- The most common educational curricula include *degrees* (or also technical high school diplomas) *in the area of informatics*: computer science, information sciences, software engineering and information systems. Also maths, physics and other scientific degrees are a frequent entry route to computing (although interest in electronic

engineering, as in the example of a woman fascinated by robotics, is rare);

- *Degrees and diplomas in subjects not directly linked to ICT* are present too, such as in economics, biology, tourism, marketing etc. Among these diverse curricula, most common are journalism and graphic arts, which mainly applied to people working in e-publishing and multimedia activities who entered an ICT career after discovering Internet. They usually acquired ICT skills by self-learning.
- Another part of our informants followed *work-based routes* into ICT. Especially the older informants have no formal education in ICT. They come often from clerical jobs (like secretaries and accountants) – where significant technological change occurred – but also from teaching. They learnt how to use a computer rather late, availing themselves of a variety of resources to acquire the necessary skills: from formal school-based training to learning on the job and complementary special training courses.
- Eventually, a few informants went into ICT career *by chance*, after having eliminated other choices, having had an internship or a temporary job that brought them into contact with ICT, having attended a course or having met a good job opportunity, such as joining her brother's activity. This is more frequent in case of the web professions, where the entry is less difficult.

2.3 Is education the reason for women's under-representation in ICT careers?

The hypothesis that the modes of socialisation of girls discourage them from technology is not conformed by empirical results.

The “skill shortage” that traditionally affects the ICT sector has recently slowed down, due to the slump in ICT and e-commerce activities following the dot.com crash of 2002. This affected employment very much, especially the more vulnerable workers (contractors, free-lancers, older workers and probably women). As for ICT sector, case study reports show a decline in women participation in professional areas too. Nevertheless, there are now signs that employment rate in the sector is rising again and some companies declare an increasing in the applications of women for IT jobs (not in UK where, according to some HR managers of ICT companies, they are still under-represented in the pool of graduates who first apply for jobs). As for e-publishing, even if in recent years many companies got into redundancy programmes, women remain strongly represented, although predominantly in editorial rather than in technical jobs.

One of the categories of explanatory factors of the gender gap in ICT professions includes the educational model. The hypothesis of a socialisation of girls that discourages interest in technical issues, which is confirmed by statistics on graduated in high tech curricula, actually can't be supported by evidences emerging from biographical interviews and case studies, even if our sample includes only women taking up an ICT career.

2.4 Skill profiles

The purpose of WWW-ICT is to go beyond the classical ICT core professions characterising the specialists in networks, software and service and system and to include new professions linked with multimedia and Internet services: digital graphic design, e-publishing, e-business and e-commerce, ERP.

ICT professions are knowing a wide diversification. Hybrid profiles are growing in areas surrounding traditional computer-related jobs.

After empirical research, definition of jobs and functions appears still difficult, due to an evolving situation in traditional ICT professions and to the emergence of new Internet and multimedia related occupations. In ICT services, and increasingly in e-publishing, market growth is now seen as residing not in standard products but in value-added services oriented towards the specific requirements of users and markets. Professions have changed in consequence and have known a wide diversification. Hybrid profiles, made of a mix of ICT-related skills and other competencies, have grown in areas surrounding traditional computer-related jobs. Therefore, especially in Internet and multimedia, job profiles are still little stabilised.

Moreover, in the comparison of the seven countries we faced some difficulties due to the mismatch between formal and actual definitions of the competencies. In addition, for both ICT and e-publishing jobs, there is not always a strong link between the job titles and the required skills, which can vary from one organisations to another. So we tried to draw a picture of tasks and skills, which are most recurrent and characterizing ICT jobs.

The empirical work shows the importance of both solid technical skills, including project management, and non-technical ones.

Our empirically grounded categories of jobs (summarised in Chapter III, page 57) tend to confirm the job profiles defined by Career-Space. It shows the importance of both solid technical skills, including project management, and non-technical ones. It is confirmed, especially according to case studies evidence, that more “behavioural skills” (Career Space 2001) or “personal qualities” (Valenduc, Vendramin 2000) such as problem solving, communication and relation skills are relevant in order to fulfil the ICT sector needs. The resulting picture is quite far from the “nerdy-ness” and masculine stereotypes sometimes associated with the ICT occupations (especially development work), according with results from both biographical interviews and cases studies informants, who mostly reported of a great satisfaction in doing their work.

2.5 Training and lifelong learning

Companies often do not offer enough formal professional training to employees.

Even if continuous learning is vital in ICT professions as knowledge and skills requirements evolve so rapidly, evidence from research shows that companies often do not offer enough formal professional training to employees. Few organisations operate individual development plans to enable them to assess and meet employees’ training and learning needs (in e-publishing, none do). Our results are coherent with other researches that found that most of the countries involved in our research project –

i.e. southern European countries (like Italy and Portugal), Ireland and the UK – are characterised by having weak training regimes (on counterpart, in Belgium, continuous training offer is wide and can lead to a qualification equivalent to higher non-university education).

Since the research was undertaken during a period following the bursting of the dot.com bubble, when company profitability was reduced, most case study organisations reported cutting their training provision during this period (as it is evident also from biographical interviews). However, as for the companies included in our case studies, the training opportunities offered by firms do not appear to be completely related to firm size or wealth. Not always large multinationals and big software companies have structured, programmatic training provision for their whole workforce, while some small companies resulted to have systematic training programmes in place – even if many narratives witness that small work organisations do not offer any formal internal training and mainly relies upon self-learning and peer-group support.

Employers and employees give a high importance to work-based learning in order to keep pace with technical developments.

When existing, continuing training in the ICT sector involves not only the enhancement of technical and content skills and knowledge, but also the development of managerial, organisational and interpersonal skills. These are generally incorporated into in-house professional training programmes, and reflect not only the requirement for a combination of skills when working with clients, but also career paths which (particularly in large organisations) sometimes take professionals away from technical work and into managerial functions.

As for on-the-job training, considerable importance is placed by employers and employees on work-based learning in order to keep pace with technical developments. Both companies and workers have benefit from ensuring that this is fully available and utilised: organisations maintain their in-house expertise-base and their competitive advantage, while employees maintain their employability.

Teams and informal networks are the training ground: workers learn from their coach, from older colleagues, from different specialists in the team, from the clients. People benefit from many specialised web-sites in their field, conference attendance, magazines as well. Since the web is the place where strong professional communities are created and continuously structured, it is as well an important way to transfer new skills. These forms of learning are an integral part and a highly appreciated characteristic of a supportive work culture.

Moreover, further chance to enlarge knowledge and skills, probably the best professional development opportunity, often comes from internal and external mobility. Moving from one job to another and from one firm to another is considered a very typical pattern of ICT career: the “boundary-less career”. But it may be a difficult matter for women.

Particularly in some countries (notably in United Kingdom), there is a move towards private certification within the IT sector, for example,

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through supplier-based training and examinations. This raises questions of how competence recognition is to be handled across the sector where differing curricula are in operation and different competences, or competence labels, are created.

When in-company continuing training is not provided, employees ask for public training. ICT public training supply – at low cost or free – is not homogeneously diffused in all the countries, depending on the overall strength of national training programmes. Even in case of paid courses, skill updating has to be managed by the individual employee, mainly in his/her free time. This may be a problem for women with family responsibilities. Women report also on mixed experiences with e-learning, some are rather critical (notably in Belgium).

3. Women's working conditions

3.1 Work organisation

In organisation design and restructuring, there has been, since the late 1980s, a generalised move away from hierarchical organisations and a tendency to develop flatter structures with fewer layers of management. This organisational change has been widely taken up in both the ICT and e-publishing sectors, particularly in small companies, even if we could also find different, more traditional forms of organisation.

Companies emphasize the need for self-management and responsibility. Traditional hierarchy-based system of control is replaced by self-control and by-peers control (Barley 1996), referred both to the quality of the product and the meeting of deadlines. Particularly as for the second point, in ICT sector, the capacity of managers to estimate and plan the work is a crucial aspect of their function of control and coordination, which may have a relevant impact on working hours and on the quality of working life of employees.

Female ICT professionals perceive both advantages and disadvantages associated with flat organisations.

From the point of female employees, there are both advantages and disadvantages associated with flat organisations. On the one hand, they are informal and flexible and therefore tend to make pleasant working environments on an interpersonal level. On the other hand, career ladders are short or non-existent (Osterman 1996). The lack of formal structures and progression processes can make it difficult for women to gain advancement, particularly given their well-known difficulties in showcasing their own abilities and arguing for their promotion. Moreover, managers are visible and close. Personal relationship with them becomes a key aspect of work and this may positively influence the quality of working life but also, as a few cases show, a negative personal relationship can lead to the decision to leave a job. However, in general, also in ICT sector women still experience glass ceilings, which prevent them progressing beyond middle-management levels.

As it emerges from case studies and narratives, ICT work is predominantly organised around project teams, led by a project team leader or manager. Whereas in web design this reflects the need for a variety of skills – graphic design, programming, content production, video and sound, etc. – software development work is based on a well-defined division of labour, sometimes combined with a high polyvalence of workers. Depending on system architecture, different sets of functionalities are distributed to different modules, with defined interfaces, and different teams being responsible for the development of those modules. In large projects, tasks such as software testing and system integration (re-composition) are carried out by specialists. Despite of this division of labour, developers need awareness of the overall project design and arch of work to be able to do their work.

Being part of a team requires to cooperate and align the work with others, distributing tasks, discussing coding practices, changing design and creating and managing different versions of a system. This also implies helping each other when it comes to special problems requiring a particular skill. Being a member of a good team is an important experience and also a value for the informants. They not only enjoy the personal side of working with friendly and supporting colleagues but also appreciate the support they get in a good team for creating a high quality product and for developing their own skills. Our case study evidence does not show whether women are particularly undervalued within these teams. On the contrary, team may be the occasion for expressing and enhancing some personal qualities (Valenduc and Vendramin 2000) – often considered typically “female” capabilities – as negotiation, communication and coordination abilities.

Project working is another ICT-specific pattern of work organisation. It is based on fixed deadlines instead of traditional schedules.

Project working is another ICT-specific pattern of organisation of work. It is based on fixed deadlines instead of traditional schedules. This results in a peculiar organisation of time, made of hard working periods alternating to more relaxed ones (Boulin 2001). Close to deadline, project working often implies long hours, even night working and week-end working, while during looser periods frequently people can self-manage their hours. According to the case studies and narratives, workers seem to appreciate the opportunity to organise their work themselves, although the span of workers’ individual autonomy appears different in different contexts. Even women are generally satisfied from this way of working.

Especially in computer servicing, customer occupies the core place. So often working hours are tailored on their needs and travelling to the client is quite frequent. The strong customer-orientation is one of the reasons of the high pressure on work that characterises these occupations. Employees, commercial staff, managers, all feel tight to the customer. Customer is the key value. This presents a double consequence: on the one hand, orienting self-control of employees in a profitable direction, because the ability of a firm to satisfy its customers is a competitive advantage; and, on the other hand, transferring to the customers a part of the control that was formerly fulfilled by the

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hierarchy. At-customer working sometimes also implies body-rental of workers, particularly consultants (IT company “sells” the day-time of its consultants to the customer), so workers end up by being considered as “goods”, they must be “100% billable”. Obviously, this very demanding way of managing human resources may be problematic for consultants having family responsibility.

Networking experiences (coordinated teams working by means of internet/intranet) are widespread either among workers belonging to the same organisation or throughout different companies. They are diffused in Internet and multimedia activities and in “older” ICT professions as well. By means of this way of working strong professional cultures take place (even stronger than corporate culture), which most significant values of are innovation, cooperation, problem solving and result orientation. These cultures are grounded on professional communities, creating and continuously developing through the World Wide Web. Due to these young, highly educated and rather democratic professional communities, women are likely to be less discriminated. Moreover, they often benefit from the marked coaching attitude of senior managers, aimed at enhancing the team spirit and at empowering the team members. Anyway, not always they can fully benefit from the chance of professional development, which generally depends on a strong closeness to the community (Coleman 1988) and on the availability to frequently change job, company and work experience.

3.2 Working-time and reconciling work and family life

ICT jobs are typically full-time, with long hours and often locationally flexible. Furthermore, permanent changes and speed are also attributes of this specific work environment, which enhance the work related stress for many informants, both men and women.

Long hours and availability during evenings and weekends are problematic for working mothers.

People working in ICT have often to cope with high workloads and long hours. Actually, it is common for professionals to work overtime on a voluntary basis. This is particularly true of those in technical (e.g. programming) jobs, and those in senior management roles. It is a pattern that has been found across the countries participating in the study, although only in some cases informants work long hours (50-60 hours) regularly (notably in UK). Moreover, overtime is in general not paid to professionals. In Belgium and in UK a large part of the informants found long working hours a definite draw-back of jobs in ICT, while in the other countries few informants complain about long working hours and stressful working conditions.

For the female informants it is not uncommon to work at home during evenings or weekends, e.g. when the children are in bed, either reading emails and continuing an unfinished job or working on a training programme. Long hours, including availability during evenings and weekends, are a problem for working mothers (in particular for those without a supporting partner) and few companies and/or colleagues

generously adapt to the need to reduce or regularise working hours when children are young.

Mobile working, client-based working and even hot-desking are common among ICT professionals and are particularly problematic for women and men with domestic responsibilities, where they involve long distance travelling or periods away from home.

In many ICT services organisations, career development appears to depend on working long hours and thereby demonstrating commitment to the work and the organisation. The typical male habit to “presenteeism” is rather widespread. For these reasons, one can say that one of the major features of the working culture of the ICT sector is the “total availability” (Laufer 2000). A strong interiorisation of company goals, as far as both the quality of the product/service and the observance of the deadline are concerned, is sometimes likely to produce even a company “total control on work and life” (Kunda 1992). This kind of model appears to be rather discriminating against women with family responsibilities. Perhaps it is not accident that in some case study organisations, informants were predominantly young, unmarried and without children.

Evidence from biographies and case studies also shows that, in many cases, the strong interest and passion for ICT work makes women challenge these tough working conditions and strive to the top. Actually, although workers with family responsibilities in general suffer from long hours and others hard working conditions, they sometimes benefit from the possibility to better balance work and family-life. The being more autonomous in managing his/her own work often permits to concentrate the hours and to take some hours/days off when they need to, usually to dedicate to children and other personal needs: as a matter of fact, 64% of the biographies informants referred to enjoy a high level of discretion and about 41% of the female informants in ICT service companies (often considered as the most unfriendly sector for women and their family responsibility) have one or more children. This evidence confirms the hypothesis that women might accept longer hours in change of self-management of working time (Gerwitz and Lindsey, 2000). Anyway, self-management of hours usually means more time spent working by employees, rather than less.

With some notable exceptions, formal family-friendly policies are unusual in the case study companies.

Actually, with some notable exceptions, formal family friendly policies are unusual in the case study companies covered by this project nor were reported during biographical interviews. In one large multinational ICT services provider, however, flexible working is offered in the context of a more general programme of encouraging women into and through the organisation.

In summary, in ICT sector there is a tacit, unspoken agreement to balance long hours versus the flexibility to arrange them. Moreover, working time arrangements are in general rather flexible, hence

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individualised. In some cases (Belgium), anyway, the only way to reconciling work and family life is a reduction of hours (with a consequent reduction of pay): this is mainly a female solution that consists of small reduction of contractual working time, from full time to 4/5 time.

3.3 Organisational and national cultures

As for organisational cultures, case studies and biographies give examples of supportive work cultures and exclusionary ones as well.

As for organisational cultures, evidence from research shows there are cases of supportive work cultures and exclusionary ones as well. No clear pattern emerges, with work cultures being organisation-specific, location-specific, and even team-specific.

For example, the evidence for the existence of a “masculine culture” of computing (Cockburn 1985, Wejcman 1991, Hapnes and Sorensen 1995) is patchy. It exists in some companies and takes the form of working long hours late in the night, constantly experimenting with technology, etc. – sometimes also sharing sexist games and socialising in all-male groups. However such culture is not so generally widespread and, whereas exists, women are generally able to transcend it.

Other unsupportive and exclusionary workplace cultures exist which makes it difficult the personal situation and the career of women with children, particularly calling into question their career commitment. However, the most widespread culture we could find is in organisations that apparently do not share any discriminatory culture and claim to be “gender-neutral”, but which are generally more likely to be “gender-blind”, treating women and their problems as invisible.

On the other hand, we found also several companies – especially large companies in IT sector – which have sought to create woman friendly culture, discouraging sexist language, encouraging women’s networks and insisting on equal treatment for women and men. Moreover, in the more female-dominated e-publishing companies, women are not marginalised and generally report feeling comfortable with workplace culture.

As for national cultures, we could not find any discernible variation in labour relations between countries with a strong tradition of industrial relations and those with weaker industrial relations and collective bargaining. The individualised culture of the “new economy” seems to be widespread across companies and countries.

Similarly, national welfare models (notably, childcare provisions) and training regimes do not have particular influence on specific conditions of women and ICT professionals, which mostly depend on employer resources and behaviour. Anyway, in countries with enduring “male-breadwinner and female-domestic worker” models and low rate of female labour market participation – like Italy – there are examples of more explicit hostility against women employment.

4. Labour market and labour relations

4.1 Labour market, career progression, mobility, segregation

In ICT sector, company internal labour markets are quite open and competitive, as high turn-over and little in-company training demonstrate. Therefore, working conditions – especially wage and career mobility – have mainly market regulation rather than organisational or collective bargaining regulation.

The lack of clear career paths can make it difficult for women to gain advancement, particularly given their well-known difficulties in showcasing their own abilities and/or arguing for promotion.

As seen before, in IT companies career ladders are short or non-existent (Osterman 1996) while the individualisation of labour relations can produce competitiveness and exploitation. The lack of clear career paths can make it difficult for women to gain advancement, particularly given their well-known difficulties in showcasing their own abilities and/or arguing for promotion. As for e-publishing, progression opportunities are few as well. Moreover, especially in these professions we found complaints of low pay, low status and poor progression prospects. However, in these jobs horizontal mobility – between different specialist areas of publishing – is more common. In general, in ICT professions women in high positions are still rare: the lack of motivating role models may be a further difficulty for young women.

High inter-company mobility is a specific feature of an open labour market. ICT workers frequently change their jobs, in order to better develop their knowledge capital or even only to increase their wage. Up to now, the external mobility has been very intense also due to the skills shortage in the sector that made it easy to find a better paid job in another company. However, in recent years, the sector market crisis has produced a reduction of this mobility.

Although women are usually seen to be disadvantaged in competitive labour markets, according to some of our case studies and interviews, at least some of them appear to be competitive enough “to cross the borders of gender order” and have successful careers. We also found a few women in leading positions or entrepreneurs of their own company. However, biographies show that the external mobility of women is less intense than the male one. Due to their family responsibility, women cannot catch all the chances offered by the labour market (especially when the request is to move to another town/region).

As for skills, there is an evidence of different forms of occupational segregation.

As for skills, there is an evidence of different forms of “occupational segregation”. Among computer service activities, gendered lines are present between development (female) and network-related tasks (male). Moreover, in some cases women are not included in project acquisition activities, e.g. in cooperation projects with industry, assuming customer prejudices against women. Among e-publishing professions (design of web sites, digital graphics, e-commerce, web journalist, multimedia editors), women result better represented in content-related (editorial) jobs than in more technical areas (system architecture, hardware

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configuration, and databases integration). Anyway, the assumption among employers that women are more comfortable in management than in technical roles has not been totally confirmed by the research: we found women having a preference for retaining their technical activities, finding them more creative and providing concrete outcomes.

4.2 Employment status

From biographies, it emerges that a few informants are or have been self-employed, building their own software house, web-agency or training academy (and some consider this as an option). The main motivations of these women are to shape their own work environment and to be their own boss. Sometimes they work – or are helped – by their husband or father. In some cases, women went freelance in order to be able to spend more time with their children.

Several of our interviewees work as freelancers. For those with a background in art, journalism or graphic design it is almost a “natural” solution. For a few of them, going freelance offered the opportunity to have more flexibility and time for children and family.

However, companies within the ICT sector generally take a conventional approach to employment status and workers often have permanent full time contracts, while in Internet and multimedia the contingent work (free-lance and temporary work) is more widespread. Moreover, relevant differences have been observed as far as diverse national institutional contexts are concerned. In some countries (for example, UK and Belgium) sub-contractors and free-lancers are only used to meet variations in market demand, in some others (for example, Italy) free-lance workers have a specific quasi-subordinated status and they are very frequent especially in new multimedia jobs but also in high levels of ICT consultancy. A few experiences of self-employment and running their own company have been found among the informants, both men and women.

Even in salaried jobs, ICT professions are getting more and more similar to independent work rather than to subordinated work, being mainly evaluated by achieved results than by working hours.

Part-time work is less widespread than elsewhere, due to the specific organisation of work that is mainly based on project work and at-client work. Project work is based on objectives to be achieved rather than on time measurement; therefore part-time working arrangements appear quite rigid to be accepted by companies. When existing, it is female and temporary, often related to the period after maternity. Some women who negotiated part-time arrangements told us it had evident consequences on their salary and career but not so much effect on their overall workload.

In conclusion, the evidence from research is that even in salaried jobs, ICT professions are getting more and more similar to independent work rather than to subordinated work, being mainly evaluated by achieved results than by working hours (i.e. company reward systems are mainly based on performance-related pay and overtime pay often is not

provided). On the other hand, in these jobs workers give a huge importance to personal development through work: the need to realize an interesting job, in which learning goes on and even the passion for the job is nearly always pinpointed by both men and women while employment security and formal grade seem secondary (Rullani 2002).

In general, we may say that in ICT jobs the implicit contract between employer and employee (or free lance worker) has now changed: while the old contract was based on job security and reward as a counterpart of corporate loyalty, in the new one autonomy, team working and empowerment are offered by employers as a counterpart of higher responsibility and flexibility (ILO 2002).

4.3 Labour relations and Human Resources Management

In general, few collective bargaining is present in European ICT sector. Although different countries are marked by different systems of industrial relations, some issues are common. In none of the countries the whole ICT sector is covered by a single sectoral collective agreement. Moreover, the three main segments of ICT sector have very different industrial relations patterns. Hardware/manufacturing and telecommunications have long and more or less stable industrial relations systems, while software and services companies – including dot.com firms and all the so-called new-economy area – are a world apart. Trade unions still have a long way to go, particularly in these latter companies and in small medium sized ones (Eiro 2001).

Evidence from our case studies and biographies confirm this situation of labour relations. Trade unions are not always reported to be present and/or recognised. In both IT and multimedia sectors, union density is very low, also due to young and high educated labour force (which usually has a scarcer inclination to union membership). In computer services sector, the presence of US multinationals hostile to trade unionism is a further discouraging factor for unionisation.

There is little interest in organised social relations, both from men and women.

Moreover, both for men and women, there is no interest in organised social relations. All adopt self-organisation and personal relation with hierarchy; trade unions are seen as inadequate to these professions and not useful. Individualisation of working and work relation is a common trend well accepted by ICT professionals.

Sector-wide collective agreements usually exist and in large companies collective bargaining at company level too. While basic employment conditions are collectively bargained, career advancement is mainly based on individual performance and wage and benefits are currently negotiated at individual level. Although big firms have more structured internal systems regulating career advancement, mobility and training, in most of our case study organisations only few rules as regards pay and reward systems are reported and the individual negotiation mostly depends on manager's good will. While this situation seems to be preferred by a

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number of employees who chose to manage themselves their problems and concerns, without any intermediary, women in this situation appear to be disadvantaged. Although they often do not acknowledge to be discriminated, they often refer to be less successful in such negotiation than men are – and the reason is probably because they underestimate themselves.

Employment standards in ICT professions are currently defined in opposition to the civil servant model and the bureaucratic model.

Employment standards in ICT professions are currently defined in opposition to the civil servant model and the bureaucratic model. There is a widespread opposition against all what is too formalised, too rigid and pre-established. As far as human resources management (HRM) is concerned, we must consider that both the ICT services and e-publishing sectors have emerged relatively recently. In many companies, human resource management and labour relations issues – promotion, training, mobility, etc. – have little in common with longer established industries. A considerable number of companies operate individualised employment contracts rather than collective agreements. Individualised human resource management also includes a growing use of periodic appraisals and individual development plans for assessing pay, training needs and career development potential. These are particularly common in large companies and seem to have positive implications for women's career development, as they formalise the criteria for progression and promotion, and move away from informal systems based on friendships, visibility or "men's clubs". Specific policies for encouraging female potential have been found in a few large companies. However, even in these organisations, women remain underrepresented in executive jobs, so these initiatives seem have not solved the problem of inequality in progression.

Despite a general discourse that denies differences, empirical observations show that most of the female informants have been confronted to differences in attitudes and treatments between men and women.

As far as specific gender issues are concerned, we did not meet any employer explicitly declaring to prefer men to women. On the opposite, it seems that some skills, more frequent among women, are appreciated, which especially suit new occupations related to multimedia and Internet. Yet, a collective gender-blindness (Korvajarvi 2003) seems to exist over possible difficulties that women can encounter in these jobs, especially as far as they have family responsibilities: HR managers and even labour representatives seem not to consider that women are not confronted to difficulties to which men are not. Anyway, despite a general discourse that denies these differences, empirical observations show that most of our female informants have been confronted to differences in attitudes and treatments between men and women: while a few organisations persist in using manifest sexist criteria in recruitment, most are not free from prejudices against promoting women, usually on the basis about their availability for and commitment to the work. Moreover, very few equality programmes have been introduced (mainly in UK companies) but none diversity management policy.

4.4 Social and gender relations

Relationship among colleagues in ICT sector are characterised by a mix of cooperation and competition. Although competition is mainly seen as a male attitude, a few of the female informants admit that in this kind of environment, being competitive is sometimes necessary. A good relationship with the team manager is very important, since both one's career advancement and the possibility to have flexible time for family depend on his/her decision.

In ICT, professional communities are quite a significant resource for professional workers. Women with children may be partly excluded.

In ICT, professional communities are quite a significant resource for professional workers, especially "virtual" communities for those working on web networks. The professional community is a very useful means to learn, to share new skills, and to "sell" oneself on the labour market. Women with children may be partly excluded, since they have not enough time and/or continuity to participate.

As for gender relationships, among the informants there are women who enjoy working in (almost) male environments and who feel that they even benefit from their visibility. There is another group who feels uncomfortable in (almost) male environment. Furthermore, there is a difference between older women, who often experienced a lot of hostility and younger ones whose technical background, competence and familiarity with male environment help them adapting and being accepted. There are cases of "sexist and racist humour" to which the informants react in different ways (sometimes also addressing them openly).

Among few women (notably in Austria and in Italy), we could find a high awareness of gender issues. In some cases, these women engage in activities supporting women in the field, such as training courses.

5. Women's trajectories

5.1 Career progression in ICT

Progression and career follow simple rules: availability, mobility, and long working hours. Adding the gender aspects, women who have a family encounter more difficulties than men.

From a general point of view, we could say that progression and career in ICT follow simple rules: availability, mobility, and long working hours. Before adding the gender aspects, women who have a family encounter more difficulties than men.

Moreover, professional horizon is often at short term. This is linked both to the concern of self-accomplishment at work and, in recent years, to economic instability of firms. People who do not exclude a radical change of activity were often met. Both for men and women, jobs changes are mainly determined by the wish to continue to develop competences and to learn new things. However, women with children are less mobile than those who have no child.

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After the “broken ladders” strategy (Osterman 1996) experienced in recent years by many ICT companies, hierarchical levels are now very few and, by consequence, workers benefit from few promotion possibilities (often, women are not among the lucky fews). Formal career paths are also rare, so everybody has to find his/her way, and the employers do not take any long-term commitment. Professional progression happens through changes of firm. As a result, people have to maintain their employability and to self-manage their career. The expressions “nomadic career” or “boundary-less career” refers to these new professional trajectories.

5.2 Trajectories and life stories

As the women entered ICT through a wide variety of routes, occupy a diversity of jobs and live in different personal situation and work environments, it is rather impossible to define clear-cut trajectories. To better comprehend women stories and to define some explicative patterns of their trajectories, in examining biographies we considered some variables: educational and family background, age, caring responsibilities, tasks, relation to technology, size of companies, work experience, personal life. Our analysis took into account not only professional steps but also the full women’s life contexts, which provides us a better insight of opportunities, choices, life themes, strategies and constraints of women histories. Eight different patterns were recognised; they are summed up in chapter III (page 66).

5.3 Male trajectories

According to our empirical information referring to 33 men’s biographies, male and female biographies in computing and ICT do not differ radically. However, the men seem more mobile and at the same time less passionate and ambitious than our female informants. The women we interviewed have more articulated lives and other important interests beyond computing.

Among the defined patterns, the one recurrent male trajectory is *building one’s own work environment*. In most cases this resonates with being on their own and primarily accomplishing themselves, either if they want to take care (of his family, his staff) and to lead a whole life, combining the world of academia, business, and family life, or to develop and sell their own product.

Other interesting features of men’s biographies are: the different role often played by fathers (admired, mythical images); the obviously different role played by partners (available, taking care of children, sometimes also giving professional advice); sometimes the different way to approach to technology (extension of their hobby, tinkering instead of analysing); the grater inter-company mobility (changing companies is more taken for granted).

6. Final remarks

We could not answer to all the questions that the statistic evidence of the employment gender gap in ICT jobs is asking to experts and researchers. This was primarily because the objective of our research was the experience of women already being in these professions, so missing the point of view of women who were discouraged in entering them and made an alternative choice.

However, we are now able to describe some features of women job life in this sector: motivation, strategies, opportunities and constraints. Unexpectedly, from both biographies and case studies, they often appear to be passionate of their work, comfortable with technology and, in general, to feel rather at ease in this world which has always been considered affected of a “masculine culture”.

ICT companies are good examples of post-fordist organisations, characterised by both positive and negative aspects.

We have analysed their workplace and we found that ICT companies are a good example of post-fordist organisations, characterised by both positive and negative aspects. Among the positive, and sometimes even woman-friendly, aspects there are: flattened structures and lean organisation, working by project when it allows a larger employees' autonomy in working hours, teams enabling cooperation and friendship among colleagues, a strong relation with professional communities, a professional development to be mainly acquired through learning-by-doing. Among the negative ones there are long hours, severe deadlines, stressful rhythms and even self-exploitation, which make it harder, especially for women, to balance work and family life (even if several women were found who succeeded in overcoming these difficulties). Other problematic features of the employment in the information society have been pointed out: increasing individualisation in bargaining of the working conditions, rising of job precariousness and overall deregulation of labour relations.

In ICT organisations there are also problems to which women are familiar in almost any workplace.

In ICT organisations we also found problems which women are familiar to in almost any workplace. Women jobs are rather concentrated in some areas (as for computer service sector, the software development and as for e-publishing professions, the content-based skills), although it looks more like a personal choice than an imposed destiny. The glass ceiling is operating in ICT companies as well, where only a few women are in executive positions, although some of them have reached the middle management positions. Stereotypes against women still exist in company organisational and HR cultures, while the cultures of professional teams are often more open and egalitarian.

At present, we cannot answer definitively if these professions will improve the working life of women (i.e. introducing new ways of work organisation, enhancing the self-management of working hours, etc.) and will enable them to better develop their capabilities and qualities (i.e. through learning-by-doing opportunities, exchanges among colleagues and female networking experiences).

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However, on the basis of the results of WWW-ICT project, the contribution of all the social actors seems to be precious for realising such an encouraging perspective. Companies, trade unions and public institutions should cooperate in implementing a new regulation of work based on the structuring of new, important rights for women and men of the information society. Each one of them has clearly emerged from the research: time and resource for training, peers' exchanges and networking opportunities (in order to develop the knowledge), recognition and certification of acquired skills (in order to improve employability), a larger workers' participation in the workplace, a better quality of working life (in order to reconcile work and families).

Recommendations

Research findings refute some usual hypotheses on women and ICT professions. Traditional constraints to women's work (labour market segmentation, glass ceiling) are still present in these professions, while some typical factors of an open labour market (scarce institutionalisation, competitive culture, inter-company mobility) and some typical forms of work organisation in the knowledge economy (project working, flexibility, long hours) are also relevant for employment conditions of women.

As explained in the preceding chapter, empirical evidence tells us that there is not a lack of familiar role models; there are not such problems of relation to technology (women have quite a good relation, indeed); working conditions – although they are often hard – are not the main cause of the gender gap (since women tend to accept them).

In order to get some concluding points which could orient policy recommendations, we have reformulated our initial question into: what are the conditions that can make the ICT more attractive for women? According to this, we articulate a list of topics resulting from what does exist in the ICT sector, at least as far as our research evidence shows. The recommendations consist of two parts. The first section steps from results to recommendations. The second section formulates recommendations according to European policy areas. It ends with a synoptic view of the main recommendations.

1. From results to recommendations

In this part, we go through the main outcomes of the research and highlight a set of recommendations linked with them. When it is possible, we also present some of the good practices we found as examples of concrete and effective actions. For full reference to these good practices, please consult the downloadable report D6, to which descriptions of all selected good practices are annexed.

1.1 Creating a better understanding of ICT professions

There is no sufficient and shared information on the actual content of ICT professions.

The first outcome of our empirical research is that there is no sufficient and shared information on the actual content of ICT professions. As it comes out from the empirical evidence, ICT professions, especially in their more recent developments (e-publishing, multimedia), consist of different contents: from technical strongly math and science-based contents (engineering, physics, chemical, biology), through economic, marketing and management matters, to arts, communication and linguistic subjects.

As a consequence, speaking of one “privileged” road and curriculum to ICT occupations induces in most of the cases rather a distortion. Having a strong inclination to math and technical science is not a condition *sine qua non* for entering ICT field, although it is often the major entrance route. According to the project findings, it is essential to encourage the circulation of information on diverse career opportunities and diverse skills and job content of ICT professions. Vocational advisors, counsellors, head hunters and human resources managers, but also parents, teachers and students are likely to be the main agents of these kind of initiatives.

- Informing women on the *variety of the content of the ICT professions* and not only by awareness campaigns and programmes addressing girls, but also by real experiences, such as summer school and stages at companies. (See for example “Cybersonda”; the Belgian good practice addressing girls from 13 to 16 to make them discover the different facets of computing world and the “Yolante” programme in Germany, organised by Siemens, which assigned young students, who are oriented to scientific university, to different business division to make them better understand the world of work; “Daughter’s at work day” in UK; the German “Girl’s day”).
- At a systemic level, national educational institutions in charge of the Process of Bologna (which aim is “to continue developing a system of easily readable and comparable degrees, based on undergraduate and postgraduate studies”), should have precise information on the job contents in ICT professions, in order to *better design school and university curricula*. School and university should make clear, grounded and *cross-disciplined curricula*, on account of the great diversity of entry routes into computing and including also the foreseen skills. (For example the initiative of a high school in the north of Belgium, supported by the national ICT employers’ federation, “Information administration Bachelor”) Finally, teachers and advisors should be trained on the contents of the ICT professions (as in case of the Belgian Electronic@ project; and the SEFIA project in France).
- Workshops addressing human resources managers and unionists could contribute to the reformulation of the *entry criteria in ICT professions* (including also other routes into ICT skills and not just

RECOMMENDATIONS

formal ICT education), both at a *managerial recruiting practices* level, and at the level of collective agreements on entry rules.

- Defining European and national independent *systems of recognition of the skills acquired by workers during their career paths*, that takes into account the variety of ICT competencies, in order to improve and clarify information about the real content of occupations, better define career paths and make inter-company mobility easier.

1.2 Career re-orientation practices

Quite a number of careers in ICT are undertaken after re-orientation.

One of the unexpected results, emerging especially from biographical interviews, is that quite a number of careers in ICT are undertaken “by chance”, i.e. due to random or unpredicted events. There are cases of women: i) coming from different fields of work into an ICT job (often just thanks to informal ICT training); ii) having different kind of degrees and curricula, also not technical ones, when they entered ICT occupations; iii) entering ICT jobs attracted by the opportunity to learn new things.

Computing and other skills linked to ICT have sometimes come out to be a good solution to overcome crisis and break in professional life. We even found in some cases that having picked up ICT is useful for reinsertion after unemployment and maternity breaks. As a consequence:

- Vocational advisors, counselling institution should contribute to women’s awareness of possible connection between their degrees/profiles and ICT jobs.
- Improving initiative aimed at re-orienting, re-inserting and re-training, by means of ICT “*generalist*” *degrees and graduations* (arts, human sciences, journalism) to make them more suited to new economy. *Retraining opportunity* might be especially realised by improving the secretariat profiles to maintenance and support ICT skills; the artistic and journalistic profiles changed into web profiles. See for example the Belgian good practice “Interface 3”; the Italian project “intellectual unemployment” aiming at training tutors on-line, web masters and content manager profiles; Austrian “WebAcademy”.
- Social partners (unionists, employers associations, companies) and institutions should promote *retraining courses*, or *tutorship for women after unemployment or maternity*, in order to support re-insertion career in ICT jobs without high technical requirement. (Examples of two interesting practices in Austria: the first organised by Microsoft, Siemens and Manpower, called “EDP-Academy for women”, the second is the “Thelm@ project” offering courses in ICT and telecommunication addressing women in a region of high unemployment rates).

1.3 Continuing training

Although ICT professions need permanent skills update, formal and institutionalised continuing training inside companies is an exception rather than a rule.

The research confirms that one of the main feature of ICT sector and profession is the need for continuing training due to the rapid changes in scientific and technological matters. Notwithstanding this constitutive feature, formal and institutionalised continuing training inside the companies is an exception more than a rule (companies tend not to invest on training also on account of the high turnover of the personnel). In most of the cases, updating his/her own skills is completely up to the individual. Moreover, providing ICT training courses addressing women results an attractive career perspective for some of the informants.

As for self-training opportunities, according to our data, we must underline the importance of the *team* and of informal network (either inside the company or on web) as a major place for self-training, exchanging competencies and experiences and enhancing ICT skills. On the opposite, from our empirical evidences, e-learning does not seem to be such a widespread practice.

- *Free and low cost courses or subsidising private offer with bonus* for self-education (by which public institutions may encourage workers investment in “human capital”) result very important (see for examples the Austrian example “The Web academy” initiative).
- Encouraging and recruiting *women ICT professional as trainers* in ICT courses designed for women. In particular, there are examples showing that female teachers could be an interesting resource in order to strengthen the role model. (See for example the German “Network of female IT trainers”, that organised courses to train female ICT professionals as trainers and built up a network between women IT professional acting as trainers).
- Specific training in new ICT skills should be addressed to women in the so-called “*blocked - skill jobs*” (ICT jobs and situations in which nothing new can be learnt on the job).
- *Continuing training for women after maternity leave and when they come back to work* should be improved. In this case, even e-learning may be a useful tool, but only if provided with a strong social component. (See “Web Wise Women” programme and the company’s initiatives “Happy computer” in UK).
- *Networks among professionals* in different ICT occupations should be diffused for its being a key source for continuous learning. We found one interesting good practice aimed at promoting and consolidating the networking between women working in ICT professions and women in sciences and training (the network “web women” in Austria; the ADA project in Belgium).

1.4 Reconciling work and family life.

Working conditions are critical and controversial factors. The pattern and rhythm of work in ICT is dictated by project deadlines (sometimes aggressive ones) and emphasis is on completion of work rather than on hours; unpredictability of hours is quite common, also due to lack of efficient project management. Both part-time and teleworking did not emerge as frequent shapes of the work organisation.

If working conditions do not make ICT jobs repulsive for women, difficult working conditions partly explain the low presence of women in ICT professions.

The research does not confirm, in general, the hypothesis that working conditions (hours, geographical mobility; work and life balance) of ICT professions made them “very little attractive for women”, although we have cases in Belgium and UK where high workloads and long working hours (50-60 hours per week) are likely to discourage women from choosing or staying in the ICT field. Moreover, if the majority of the informants seem to want to exchange long hours with flexible hours (or working at home), we cannot exclude that difficult conditions are some of the reasons for the low presence of women in the ICT. As a matter of fact, long hours, including availability during evenings and weekends, appear a problem for working mothers (in particular for those without a supporting partner).

As it comes out, the problem of difficult working conditions is worsened by the lack of social regulation: in the ICT sector; there is often no collective bargaining but just individualised arrangements.

- *Project management* (and scheduling competencies) in companies should be improved by training, not only addressing people in charge for organisation of tasks and deadlines, but also addressing employees (self-managing of time). This kind of initiatives would support quality of work, enhancing the predictability of hours.
- Companies’ human resource managers should adopt *family friendly practices* (including the improvement of part-time arrangements), in order to enable work-life balance: it would represent a key tool for retention, too. (See successful company policies in Belgium, IBM policy on equal opportunity, that matches actions for attracting and promoting women in the company, with retention practices based on family friendly human resources management and redesign of work organisation to adapt to work-life balance, for men and women; see also the Italian project “Flexibility in working time and working organisation”, addressing women back to work from their maternal leave and the company’s initiatives “Happy computer” in UK).
- Social partners should try to find new forms of *performance evaluation to integrate those based on “clocking in and out”*, in order to trespass the rigid and tayloristic quantitative time control of work, so to let more autonomy to people in self-managing their work.

1.5 New HRM tools in recruitment, retention and mentoring.

In many ICT companies, human resource management and labour relation issues have little in common with longer-established industries.

Few practices directly dedicated to women emerged from the research, except for a few recruiting and mentoring experiences, which have a key role in promoting women participation in ICT labour market and in reducing occupational and hierarchical segregation. As far as human resources management is concerned, we must consider that both the ICT services and e-publishing sectors have emerged relatively recently. In many companies, human resource management and labour relation issues – promotion, training, mobility, etc. – have little in common with longer-established industries.

Moreover, a considerable number of companies operate individualised employment contracts rather than collective agreements.

- As we have seen before, in order to improve *company recruitment practices addressing women*, public institutions should invest in awareness campaign showing the variety of contents of ICT professions (see IBM, Belgium)
- As we have seen before, *family friendly practices help retention* and should be improved. (See the national government initiative in UK, DTI work-life balance challenge fund, to assist IT company in developing family-friendly practices in order to recruit, retain and develop women; the company's initiatives "Happy computer", UK).
- Human resources managers should make young women in contact with successful women inside the company, which is quite important to create *role models* and to show them concrete professional perspective in ICT professions. (See for example "Opportunity Now" initiative by employing organisations in UK).
- *Mentoring practices* should be encouraged, both inside the companies and between companies and universities, for their being an effective tool to develop competencies and to support career path in ICT, therefore Public institutions should assure economical support to these initiatives. For examples, a good practice undertaken in Austria consists of mentoring ships of several months for young computer scientists in industry giving female students impressions of what kind of research and practices is needed and maybe opening them opportunities for further co-operation between science and industry (see the "Fit project", Austria).

1.6 Women networking

Empirical evidence resulting from the biographical interviews shows the importance of networking among women as a source for training, information exchange, general development of an ICT culture and in order to build ICT professional's role model for women.

- *Networks among women* should be promoted by women's associations as a way for exchanging knowledge and experiences

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among women joining ICT field at different level (teachers, professionals, amateurs). (See for example the “Donna Informatica” initiative in Switzerland, a network involving both women in ICT professions and all those women who are interested in ICT, and the “WITEC” project in UK, promoting women participation in ICT field by creating networking opportunities for women in science, engineering and technology).

1.7 New labour market/ welfare policies

The ICT sector presents a lack of institutionalisation of employment, with important consequences for all employees, but even more for participation and inclusion of women.

Research findings show that in comparison with more traditional sectors, the ICT sector presents a lack of institutionalisation of employment – low union density and a tendency of individual bargaining of wages and careers – that has important consequences for all employees but even more for participation and inclusion of women. Free-lance work is present and the related precariousness as well, especially in the e-publishing and multimedia field. Inter-company mobility is another main feature of the ICT labour market: it results in opportunities for professional development and economical growth, but women (especially with family responsibilities) hardly take advantage from it.

- Trade unions and companies should bargain “*framework*” agreements on *wage, working hours flexibility and career paths*, as a basis for individual bargaining.
- Public institutions and social partners should ensure *a sustainable flexibility to ICT free-lance workers* by job security measures enabling them to face mobility, unemployment, inter-contract periods and training leaves and especially for women, by paid maternal leaves and other protections measures.

1.8 Research and technology development

It is important that the European programmes focusing on socio-economic research continue supporting the analysis of the impact of ICT technology and activities on the labour market and on working conditions, in order to promote equal opportunities and positive prospects for women and men. According to our findings, further investigation should especially contribute to the enhancement of knowledge and debate on the impact on labour in ICT of different organisational contexts and of different forms of national institutional frameworks of regulation. These research questions are “policy” relevant, since they cross at the same time research and public debate and can strengthen the links between scientific community and European Commission.

- *New forms of work organisation*, notably different forms of teamwork, project working, networking, working at client and so on - need more investigation, not only in a gender perspective, but also in a more

general sense. In particular, consequences of project work on working conditions have to be better clarified.

- *The role and the future of Industrial Relations* in ICT sector and, in particular, the increasing individualisation of employment relations need to be more investigated, in order to produce more focused suggestions for trade-union policies.

A better understanding of the intra-European diversity in the employment regulation will be precious in order to clarify *the role of national institutional frameworks and work cultures in influencing concrete workplace conditions in ICT*. In particular, a deeper insight in this sector labour market may verify whether the prevailing determinants of employment conditions in ICT are: general factors relating with the market of ICT services, the single-company strategy or the different national labour market and welfare regimes.

2. Recommendations by policy areas

2.1 Education and vocational training

EC policies and programmes

There has been growing concern at EU level about the under-representation of women in scientific careers, which is seen as an obstacle for the full realisation of European objectives of social inclusion and of development of Europe as the world's most competitive and dynamic knowledge-based economy. In 1999, the European Commission adopted a Communication setting out an action plan to promote gender equality in science: *Women in Science-Mobilising women to enrich European Research*. This plan originated a report on women and science in EU from the European Technology Assessment Network (ETAN); the creation of a focus group on women and science (the Helsinki Group), made by civil servant and gender experts from the 15 member states. According with the report on *Women in Industrial Research*, the objectives for 2010 are:

- Increasing the expenditure on R&D from 1.9% in 2000 to 3% in 2010, in line with the recommendation of the European Council at Barcelona summit of 2003. This will mean increasing the number of researchers, a proportion of them female.
- Changing work culture and organisation to improve inclusion and release creativity.
- Promoting diversity and gender balance through work-life balance policies, creating transparent structures and processes, opening promotion and reducing patronage and nepotism.
- Using “visioning” to implement gender mainstreaming: companies should examine their internal customs and practices that disadvantage or exclude women.

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- Developing sex-disaggregated statistics, equality indicators and gender impact assessment as management tools.

Recommendations

- Informing women on the variety of the content of the ICT professions and not only by *awareness campaigns* and programmes addressing girls, but also by *real experiences*, such as summer school and stages at companies.
- At a systemic level, national educational institutions in charge of the Process of Bologna should have precise information on the job contents in ICT professions, in order *to better design school and university curricula*. School and university should make clear, grounded and *cross-disciplined curricula*, on account of the great diversity of entry routes into computing and including also the foreseen skills.
- Workshops addressing human resources managers and unionists could contribute to the reformulation of the entry criteria in ICT professions (including also other routes into ICT skills and not just formal ICT education), both at a *managerial recruiting practices* level, and at the level of *collective agreements on entry rules*.
- Defining European and national independent *systems of recognition of the skills acquired by workers during their career paths*, that takes into account the variety of ICT competencies, in order to improve and clarify information about the real content of occupations, better define career paths and make inter-company mobility easier.

2.2 Continuing training and e-skills

EC policies and programmes

In recent years the European Commission has been stressing the importance of ICT skills in order to guarantee the Lisbon Council 2000 target of “making Europe the world’s most competitive and dynamic knowledge-based economy and to enhance social cohesion. Referring to these objectives, the gap still existing e-skills still is a serious barrier and in dealing with it, we have to consider both its quantitative (the number of e-skilled people) and qualitative side. As for the second point, e-skills are a mix of technical, commercial, interpersonal skills aiming to match service and products addressing customer needs.

If the Lisbon summit can be seen as the starting point, there are successive steps which have been done in order to define, measure, and forecast e-skills. We can draw a path whose main steps are:

- Setting up of the ICT skills monitoring group, made of representatives of the Member State, the Commission, the CEDEFOP, the OECD and the industry consortium Career-space. First report on ICT skills in Europe issued in September 2001, final report and benchmark report in October 2002.

- Organisation of the e-skills summit in Copenhagen (October 2002), heavily supported by the ICT industry (Cisco, IBM, Microsoft, Nokia and HP), and policy declaration at the end of the summit, claiming for a closer and stronger involvement of industrial players in the European policy for the improvement of e-business and ICT skills.
- Policy decision (EC) and implementation of the e-skills forum. The e-skills forum is not anymore made of (mainly) representatives of public authorities in the Member States, as was the ICT skills monitoring group. It is more open to industry and training institutions.

One of the main problems in dealing with e-skills is to reach a shared definition and categorisation of skills (and a certification) in order to assess corresponding professional profiles. There are different actors involved and contributing at different levels in this matter such as the ComTIA e- skills certification consortium, the Computing technology Industry Association, established at worldwide level; Career Space is a consortium of major ICT companies; CEPIS, which is the Council of European Professional Informatics Societies.

Recommendations

- Vocational advisors, counselling institution should contribute to women's awareness of possible connection between their degrees/profiles and ICT jobs.
- Improving initiative aimed at re-orienting, re-inserting and re-training, by means of *ICT "generalist" degrees and graduations* (arts, human sciences, journalism) to make them more suited to new economy. *Retraining opportunity* might be especially realised by improving the secretariat profiles to maintenance and support ICT skills; the artistic and journalistic profiles changed into web profiles.
- Social partners (unionists, employers associations, companies) and institutions should promote *retraining courses*, or *tutorship* for women after unemployment or maternity, in order to support re-insertion career in ICT jobs without high technical requirement.
- Free and low cost courses or subsidising private offer with bonus for self-education (by which public institutions may encourage the workers investment in "human capital") result interesting initiatives.
- Encouraging and recruiting *women ICT professional as trainers* in ICT courses designed for women. In particular, there are examples showing that female teachers could be an interesting resource in order to strengthen the role model.
- Specific training in new ICT skills should be addressed to women in the so-called "blocked - skill jobs" (ICT jobs and situations in which nothing new can be learnt on the job).

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- Continuing training for women after maternity leave and when they come back to work should be improved. Even e-learning may be a useful tool, but only if provided with a strong social component.
- Networks among professionals in different ICT occupations should be diffused as a key source of continuous learning.

2.3 Women's employment: labour market and welfare policies

EC policies and programmes

WWW-ICT project is concerned with nature and conditions of work in ICT professions and with identifying the way for improving women's participation within them. The project settles in the framework of the European initiatives addressing employment and equal opportunities.

- The European Commission' Paper on Growth, Competitiveness and Employment, published in 1993, which outlines the development of measures necessary to improve the innovative and competitive qualities of European's organisations and identifies changes to European organisations ranging from the development and implementation of new technologies to the creation of jobs.
- The European Employment Strategy (EES) launched in 1997 and aimed to develop among the Member States a co-ordinated strategy for employment based on common method, and to develop a common framework for action.

Concerning the connection between WWW-ICT and EES, the project directly recalls the four pillars: Employability, Entrepreneurship, Adaptability and Equal Opportunity.

In particular the project addresses pillars I, II and IV of the European Employment Strategy in dealing with individual skills development to overcome exclusion from the labour market; encouraging the modernisation of work organisation within companies and supporting the upgrading of skills to cope with new, flexible working arrangements.

The European Commission has strongly highlighted the emergency of concerns about difficulties that women have in balancing work and life commitments. The equal opportunities issues and the connected measures; aiming at reconciling family and professional life and reducing gender gap and job segregation, appear in the fourth pillar of the European Employment Strategy. Therefore they are directly addressed by some funding programmes such as European Social Fund and Equal, and are as well underlined in the corporate social responsibility issue. In particular, the ESF has changed its focus from being a training programme to becoming a policy-driven instrument, supporting the strategic goals of the EES. As for the Equal programme, it is funded by ESF and is part of the European Union's strategy for more and better jobs and for ensuring that everybody can enter them.

Recommendations

- Public institutions and social partners should ensure *a sustainable flexibility to ICT free-lance workers* by job security measures enabling them to face mobility, unemployment, inter-contract periods and training leaves and especially for women, by paid maternal leaves and other protections measures.
- Trade unions and companies should bargain “*framework*” *agreements on wage, working hours flexibility and career paths*, as a basis for individual bargaining.
- *Networks among women* should be promoted by women’s associations as a way for exchanging knowledge and experiences among women joining ICT field at different level (teachers, professionals, amateurs).

2.4 Corporate social responsibility

EC policies and programmes

The European strategy basic message (Gothenburg Summit in June 2001) is that long-term economic growth, social cohesion and environmental protection, must go hand in hand. This has numerous implications for companies relations with their employees. “Socially responsible human resource management involves a commitment to aspects such as lifelong learning, health and safety, a better balance between work, family and leisure, greater workforce diversity, gender-blind pay and career prospects, profit-sharing and share ownership schemes. These practices can have a direct impact on profits through increased productivity, lower staff turnover, greater amenability to change, more innovation, and better, more reliable output. Indeed, a major thread throughout the paper is that companies often have an interest in going beyond minimum legal prescriptions in their relations with their stakeholders. Peer respect and a good name as employer and firm are highly marketable assets”.

Recommendations

- *Project management* (and scheduling competencies) in companies should be improved by training, not only addressing people in charge for organisation of tasks and deadlines, but also addressing employees (self-managing of time). This kind of initiatives would support quality of work, enhancing the predictability of hours.
- Companies H. R. managers should adopt *family friendly practices* (including the improvement of part-time arrangements), in order to enable work-life balance: it would represent a key tool for retention.
- As we have seen before, in order to improve *company recruitment practices addressing women*, public institutions should invest in awareness campaign showing the variety of contents of ICT professions
- Human resources managers should make young women in contact with successful women inside the company, which is quite important to create *role models* and to show them concrete professional perspective in ICT professions.

RECOMMENDATIONS

- *Mentoring* practices should be encouraged, both inside the companies and between companies and universities, for their being an effective tool to develop competencies and to support career path in ICT, therefore public institutions should assured an economical support to these initiatives.

2.5 Industrial relations

EC policies and programmes

As for industrial relations, since 1992, the international trade union of employees, technicians and executives (ex-FIET, now UNI since 2000) runs various working groups of ICT workers and union officers involved in the ICT sector. The ICT forum is the oldest working group, having started in 1992 and continuing now (last meeting on 30-31 October 2003 in Prague). For some years, there is a specific department within UNI, named IBITS (Industry, Business and Information Technology Services).

The European Industrial Relations Observatory published in 2001 a comprehensive study entitled *Industrial relations in the ICT sector*, which covers the European and national aspects (EIRO, 2001). The study highlights that industrial relations are very different in the three main segments of the ICT sector:

- In hardware and manufacturing, industrial relations are still characterised by the adherence to the metalworking industry and its traditions of negotiated sectoral agreements giving a framework for company agreements. However, agreements reached in ICT manufacturing are very often weaker than in the metal industry in general.
- In telecommunication services, the “historical operators” (former public monopolies) have also a strong tradition of negotiated agreements, guaranteed by public authorities. Newcomers in telecommunication services escape from this tradition of regulated labour relations and fall into the same category as software and services.
- In software and services, the companies are either not covered by bargaining structure at all, or they have only few recent “experimental” collective agreements, or they are indirectly covered at a basic level by unspecific collective agreements (“by default”), or they belong to other sector’s agreements (for example: commerce, business and financial services). Trade union recognition and application of the labour legislation on workers council is even not guaranteed

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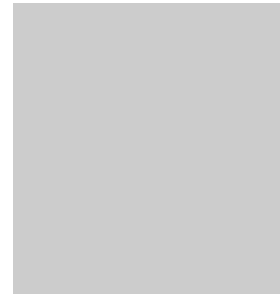
- Trade unions should be better aware on the importance to be present in this sector and *adapt their representation model to these new jobs*, in order to raise union density and improve their capability to collective bargaining in ICT sector.
- Social partners should try to find new forms of *performance evaluation to integrate those based on “clocking in and out”*, in order to trespass the rigid and tayloristic quantitative time control of the work, so to let more autonomy to people in self-managing their work.

3. Synoptic view

Results	Recommendation	Agents of change	Examples of selected good practices
Creating a better understanding of ICT professions	Awareness campaigns	Vocational advisors, counsellors, head hunters and human resources managers, but also parents, teachers and students	<i>CyberSonda</i> , Belgium; <i>Yolante and Girl's day</i> , Germany; <i>Daughter's at work day</i> in UK.
	Cross-disciplined curricula; training addressing teachers and advisors	National educational institutions in charge of the Process of Bologna, school and university	<i>Information administration Bachelor and Electronic@ project</i> , Belgium; <i>SEFIA project</i> , France.
	Managerial recruiting practices; collective agreements on entry rules	Companies' Human Resources Managers, Trade Unionists	
	Systems of recognition of the skills acquired by workers during their career paths	European and national institutions	
Career re-orientation practices	Awareness of the connections between degrees and ICT jobs	Vocational advisors, counselling institutions	
	Re-training opportunity for “generalist” degree and graduations unsuitable to new economy	Social partners and institutions	<i>Interface 3</i> , Belgium; <i>Intellectual unemployment</i> , Italy; <i>Web Academy</i> , Austria.
	Retraining courses, or tutorship for women after unemployment or maternity	Social partners and institutions	<i>EDP-Academy for women and Telm@ project</i> , Austria.
Continuing training	Free and low cost courses; subsidising private offer with bonus to employees for self-education	Public institutions	<i>Web Academy</i> , Austria
	Women ICT professional as trainers	Counsellors and teachers, women's associations	<i>Network of female IT trainers</i> , Germany.

R E C O M M E N D A T I O N S

	Training for women after maternity	Social partners and public institutions	"Web wise women programme" and "Happy computer", UK.
	Networks among professionals in ICT	Public institutions, women's associations	The network "web women", Austria; "ADA" project, Belgium.
	Blocked - skill jobs	Social partners and public institutions	
Reconciling work and family life	Project management	Companies' HRM	
	Family friendly practices	Companies and trade unions	<i>IBM in Belgium; Flexibility in working time and working organisation, Italy; The FI Group and Happy computer, UK</i>
	New forms of performance evaluation, not simply based on working hours	Social partners	
New HRM tools in recruitment, retention and mentoring	Recruitment practices addressing women	Companies' HRM	<i>IBM Belgium</i>
	Family friendly practices for retention	Companies' HRM, National governments	<i>DTI work-life balance challenge fund; The FI Group and Happy computer, UK.</i>
	Role models	Companies' HRM	<i>Opportunity now, UK</i>
	Mentoring	Companies' HRM and Universities, with public institutions support	<i>Fit project, Austria</i>
Women's networks	Networks among women	Women's associations, with public institutions support	<i>Donna Informatica initiative in Switzerland; WITEC project, UK; WebAcademy Austria.</i>
New labour market/ welfare policies	Framework agreement on working hours flexibility	Trade unions and companies	
	Sustainable flexibility to ICT free-lance	Public institutions and social partners	
Research and Technology Development	More investigation on new forms of work organisation, on future of Industrial Relations in ICT, on the role of national institutional settings	DG Information Society, IST programmes officers, national and local research institutions	



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On-line bibliography

An extended bibliography is available on line:

either through <http://www.ftu-namur.org/www-ict>
or directly on <http://www.media.tuwien.ac.at/wwwict>.

Three main publication types are considered: books, articles (including chapters in books) and websites, which can be searched by a retrieval tool. For all kinds of references, an abstract of 3-5 lines is provided.

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SIGIS – Strategies for Inclusion of Gender in the Information Society (IST)

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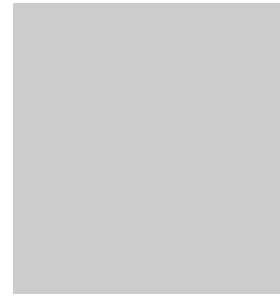


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