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Not a job for life? Women's progression, conversion, and dropout in ICT professions

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ABSTRACT

Why are there fewer and fewer women in ICT professions, while there are increasing numbers of women in other science and engineering professions? Why do young female students turn away from studies leading to ICT jobs, while young girls are just as engaged in Internet use as young boys? Why are women's careers in ICT jobs still characterised by the 'glass ceiling' (invisible obstacles to career progression) and the 'leaky pipeline' (dropout and reorientations)? These questions are not new. The problem is precisely that they are recurrent and aggravated.

After an introductory overview of research findings concerning the place of women in ICT professions, the second section of this paper will discuss some paradoxes about the position of women in these occupations. The third section will pinpoint some trends in the recent evolution of ICT professions, which have different implications for women and men in terms of their careers and professional development. The last section will consider the career mobility of women in these jobs, particularly the various forms of their entry and exit from the profession.

KEYWORDS

Gender; ICT professions; careers; gender gap; equality policies

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A BRIEF OVERVIEW OF RESEARCH FINDINGS

In the past ten years, a great deal of research has been devoted to gender disparities in ICT professions. Some of this research focuses on education and training, examining the gendered representation of computer science and technology and the ways in which this impacts on school guidance of students in secondary and higher education (Cohoon, 2009; Collet, 2006; Gras-Velazquez *et al.*, 2009; Kirkup, 2010). Other research findings focus on women's work and the labour market, examining gender inequalities or discrimination in working conditions, quality of employment, careers, work life balance (Castaño *et al.*, 2009; Ponzellini *et al.*, 2006; Valenduc *et al.*, 2004b; Webster J., 2003). Still another research stream develops a wider scope, covering digital exclusion and inclusion – the gendered digital divide– and analysing gender inequalities in ICT access and use (Castaño, 2008; Claeys & Spee, 2005; Sørensen, 2002). Finally, some gender studies underline the gendered features of concepts and methods in the area of computer and multimedia technology, as well as the gendered features of artefacts e.g software, interfaces, web design (Balka, 2000; Cohoon & Aspray, 2006; Collet, 2006; Merete, 2003).

Various international institutions have also published studies and reports on gender and ICT (European Commission, 2008; OECD, 2007). The European Commission also supports networks aiming at collecting and sharing good practices for the improvement of gender equality in ICT jobs (for instance: www.ictwomendirectory.eu).

The occupational group that is the focus of these research projects and reports is not homogeneous, and also not clearly defined. While some studies focus on high-skilled jobs in computer science and engineering, including mathematics or electronics, other studies encompass a wider spectrum of professional ICT skills (for instance the 'ICT practitioner skills' according to the e-skills programme of the European Commission). Still other studies aggregate 'traditional' ICT professions with new and emerging occupations in the areas of multimedia and online services. This is the reason why it is necessary to define more precisely what will be referred to as 'ICT professions' in this paper. According to previous research (Valenduc et al., 2004a) ICT professions include several occupational groups:

- The traditional core of 'informatics': occupations in design and engineering of IT systems, software, networks; in the development of software applications, programming and coding, functional analysis, quality monitoring, software parameterisation; in hardware and software maintenance, assistance to users and help-desk.
- The new and increasingly diversified web and multimedia occupations, which combine technical skills in computers, software and networks with communication skills and/or skills in arts or graphic design.

- The emerging jobs linked to specific application fields, for example medical informatics, scientific informatics, e-commerce platforms, enterprise resource planning systems (ERP), supply chain management systems (SCM), customer relationships management systems (CRM).

As the borders between ICT occupations and specialised user occupations become increasingly blurred, the presence of other professionals within ICT occupations has to be taken into account, notably:

- Non-ICT engineers may occupy an IT-job in their industrial sector, for example chemical, electrical, mechanical or construction engineers. Moreover, ICT professionals are nowadays in competition with business engineers specialising in the management of information systems, mainly in consulting activities.
- Some jobs of 'designers-users', such as librarians who develop and manage information systems, teaching specialists who develop e-learning systems and platforms, architects who design building modelling systems.

From one occupational group to another, the proportion of women is highly variable. The lowest proportion is found in the traditional core occupations, while a higher proportion is found among multimedia and web occupations.
This paper draws on three research projects carried out at Fondation Travail-Université (Namur, Belgium) during the past seven years:

- The European WWW-ICT project (Widening Women's Work in Information and Communication Technology), already cited, directly concerned the place of women in ICT professions (Valenduc *et al.*, 2004a).
- The European project WORKS (Work Organisation and Restructuring in the Knowledge Society) included several case studies in the sector of software services and IT consulting (Valenduc *et al.*, 2008), and case studies of occupations and careers in knowledge-intensive jobs, among them ICT jobs (Valenduc *et al.*, 2009).
- The MéTIC project, in the French-speaking part of Belgium, included a survey on occupational trajectories in ICT professions (Vendramin, 2004).

In an attempt to synthesise the different approaches to gender imbalances in ICT professions, the European project WWW-ICT (Widening Women's Work in Information and Communication Technology) has identified four categories of hypotheses that are proposed in current research on gender inequalities in ICT (Valenduc et al., 2004a):

- Imbalances in education and training: there are few women in these occupations because they are not oriented towards study options leading to these occupations. The main reason is that the image of ICT is not made attractive to women, from early infancy to adolescence.
- Unfavourable working conditions for women: ICT jobs are reputed to require long working hours, permanent availability, and flexibility, which are not easily compatible with the family constraints and the gender division of roles in care and society.
- Career patterns and rules that are favourable to men: professional progression relies on game rules that are defined by men and for men. Career breaks or temporary working time reduction patterns, such as time credit, are not welcome in these jobs.

The glass ceiling is placed at the level above project management: while the proportion of female project leaders is high, there are few women in upper hierarchical levels.
- Cultural factors enhancing the masculine image of ICT: the stereotypes associated with the ICT culture are a mix of the dominating culture of programming and gaming, and the technical pioneering culture, often caricatured in the media as 'nerdy'. These values and behavioural models are considered more appealing to men than to women.

These hypotheses are rather specific to ICT and they are partly distinct from general hypotheses related to gender in the whole set of scientific and technical occupations (Alalauf et al., 2004). This demarcation mainly concerns issues linked to working conditions and cultural factors.

According to the findings of WWW-ICT, if considered in isolation none of the hypotheses listed above explains the gender gap in training and occupational trajectories of women and men in ICT. Moreover, the hypotheses should not be thought of as 'universal', and should be contextualised with reference to specific national or socio-economic conditions. The gender gap has differing degrees of importance and evolution across Europe, with regards to both education and training and the labour market. The WWW-ICT findings offer some surprising insights on women in ICT professions (Vendramin, 2005).

First, women working in ICT professions do not report any specific problem with technology itself. They describe the ICT universe as creative, stimulating, fascinating and source of satisfaction. Their professional orientation was not strongly influenced by their family environment. Particularly, and contrary to some other results mentioned in the literature (Hapnes et al., 2000), fathers interested in mathematics or engineering do not play a determining role. Among 107 biographical interviews of women in six countries, only a few of them had a father with a technological occupation.

Secondly, although case studies provide evidence of demanding working conditions, particularly concerning working hours, women do not consider working conditions as the main factor that explains the limited presence of women in the profession. Women often accept such working conditions, in exchange for considerable autonomy in the management of their own working time. The WWW-ICT researchers have met few cases of women who were either unsatisfied with their current ICT job or who had left their ICT job for this reason.

Finally, there is no unique path leading women to ICT professions, contrary to men's paths, which are strongly determined by their initial training curriculum (Vendramin, 2004). Among women working in ICT, there are science and engineering graduates, as well as graduates who have studied economics, humanities, journalism, and arts. Moreover, in all countries, many women entered the ICT professions from other occupations in the same organisation, after re-training, or resulting from a reconversion process (retraining, reorientation) in the labour market.

These results suggest that a better understanding of gender disparities in ICT professions needs a renewed approach, in terms of occupational trajectories or, better, in terms of 'life cycle'. As the life cycle concept integrates both elements from the occupational trajectory and the personal life course, this approach allows for a better integration of

research results concerning education and training, recruitment, working conditions, careers and occupational mobility.

THREE PARADOXES

The current situation of women in ICT professions can be characterised by three paradoxes. First, despite numerous awareness campaigns, women's situation in ICT professions has not improved, neither in Belgium nor in most other European countries. Secondly, there are proportionally more women in ICT jobs than in higher ICT education; thus many women working in ICT come from other educational backgrounds. Thirdly, in cross-national comparisons, there is no correlation between the gender gap in women's' employment rate in general and the gender gap in ICT professions.

A Worsening Situation

Awareness of the gender gap in ICT professions is not new and it is partly linked to cyclic recurrence of shortages in this specific labour market. For instance, during the boom of the 'new economy' or 'net-economy' at the very end of the nineties, the need to attract more women was clearly expressed by the IT industry. Women in IT were considered as an untapped potential for industry. Diversity organisations, which were already active in the promotion of gender equality in ICT, took the opportunity to promote their aims to a wider audience. In Belgium for example, the platform ADA – Women and computing carried out a remarkable programme of awareness building and networking among women, from 2000 to 2007. Awareness campaigns were also implemented in other countries and by the European Commission itself, with the involvement of large IT sector employers (European Commission, 2006). National and international platforms were set up, among which was the European Centre for Women and Technology, which benefits from support from the European Commission and some important players in the IT industry.

A longer time ago, in the eighties, computing was presented as a technical discipline particularly open to women. In French universities and engineering schools for example, the proportion of female students in informatics was about 35 to 40% at the beginning of the '80s, against less than 10% in 2005 (Collet, 2006). Times have radically changed. During the past ten years, women's employment in ICT professions increased more slowly than men's employment, in such a way that the gap widened (Table 1). This table shows that, among employed women, the proportion of those who have an ICT occupation did not really increase from 2001 to 2006, whereas, with the exception of Sweden, the proportion of men increased significantly.

As shown in Table 2, the gender gap is wider among young professionals (under 40 years) than among older professionals (over 40 years). This can be interpreted as a long-term consequence of the widening of the gender gap in education and training.

Table 1 – Percentage of population in employment who is working in ICT occupations, by sex

Employment in occupational categories ISCO 213 (ICT specialists) and ISCO 312 (ICT technicians), as % of employed women and men in all occupations

	2001		2006		Difference in percentage points	
	Women	Men	Women	Men	Women	Men
EU25	0.7	2.3	0.7	2.6	0.0	0.3
Belgium	0.5	2.6	0.6	2.8	0.1	0.2
Germany	0.7	2.5	0.8	2.9	0.0	0.2
Denmark	0.9	3.2	1.1	3.8	0.2	0.6
Spain	0.6	1.4	0.6	2.0	0.0	0.6
France	0.7	2.8	0.7	2.7	0.0	-0.1
Hungary	0.6	1.6	0.5	2.4	-0.1	0.8
Italy	0.6	1.4	0.6	1.9	0.0	0.5
Sweden	1.4	5.2	1.5	4.9	0.1	-0.3
UK	1.0	3.5	0.8	3.3	-0.2	-0.2

Source: EUROSTAT, Statistics in focus, n119, 2007.
Data from the European Labour Force Survey, 2001 and 2006.

Table 2 – Percentage of population in employment who is working in ICT occupations, by sex and age group

Employment in occupational categories ISCO 213 (ICT specialists) and ISCO 312 (ICT technicians), as % of employed women and men in all occupations

	<40 years		>40 years		Gender gap in percentage points	
	Women	Men	Women	Men	<40y	>40y
EU25	0.8	3.5	0.5	1.8	2.7	1.3
Germany	0.8	3.6	0.6	2.3	2.8	1.7
Spain	0.8	2.8	0.4	1.0	2.0	0.6
France	1.0	3.5	0.5	1.8	2.5	1.3
Italy	0.9	2.7	0.3	1.2	1.8	0.9
Sweden	1.7	6.4	1.3	3.8	4.7	2.5
UK	0.9	4.4	0.6	2.4	3.5	1.8

Source: EUROSTAT, Statistics in focus, n119, 2007.
Data from the European Labour Force Survey, 2001 and 2006.

In Belgium, in the sector of IT services and consulting (NACE-72 code in the European classification of industries), the number of women employed (all kind of occupations) increased by 25% from 2000 to 2009, while the number of men employed increased by 34%. In occupational statistics, the proportion of women among ICT specialists (all

sectors of industry end services) dropped from 18% in 1997 to 16% in 2006 (ISCO-213 code in the International Standard Classification of Occupations).

Still in Belgium, according to the data of the Council of French-speaking Rectors (CREF: www.cref.be/statistiques.htm), the number and proportion of female students in higher education (universities and high schools) in ICT disciplines is decreasing. Between the academic years 2004-2005 and 2007-2008, the proportion of female students dropped in all ICT sections of higher education, with the exception of engineering.

The case of Bachelors' degrees in Multimedia is symptomatic of this broader issue. Currently they represent the most populated section among ICT-graduates. It is a new section, combining skills in technology and communication, where more women should be expected than in programming or hardware sections, according to the gendered representation of the distribution of hard and soft skills. It is so: according to CREF data in French-speaking Belgium, women are nowadays 21% among the students of this section but they have been 24% four years ago. More generally, the decrease in female students in ICT disciplines goes against a wider trend in increased participation of women in other science and technology disciplines.

Diversity of Training Trajectories of Women

The second paradox is that the proportion of women working in ICT professions, either in the IT industry or in user industries, is significantly higher than the proportion of female graduates studying curricula leading to those professions. In Belgium, women comprise 16% of ICT specialists (ISCO 213 in the classification of professions), whereas women comprise less than 8% of the students studying ICT disciplines in higher education. The gap is similar in countries such as France, Spain and the UK (Valenduc et al., 2004a).

This finding suggests that many women who are now working in ICT occupations completed their initial education in other fields, eventually followed by additional ICT training. In Belgium, this hypothesis is confirmed by various data on women's participation in ICT disciplines in lifelong vocational training and in social promotion education (evening schools). For example, in 2007-2008, the proportion of women among ICT graduates in evening schools was 25% in French-speaking Belgium, according to CREF data.

Consequently, many women working as ICT professionals have a double skills profile: one from their initial graduation and another one from their additional training. Male professionals have more frequently an initial background in ICT, even if they also followed additional ICT training (Valenduc et al., 2004b).

ICT, Women and the Labour Market

There is no evidence that the gender gap in ICT occupations could be explained by gender disparities in access to the labour market. As indicated in Table 3, cross-national comparisons reveal contrasting pictures. Among the countries where there is a lower gender gap in employment rates of men and women, there are countries with both a higher and a medium gender gap in ICT professions. Similarly, where women's participation in the labour market is lower (high gender gap in employment rates), the gender gap in ICT professions is lower.

Table 3 – Gender gaps [1] in general employment rates versus in ICT professions: Cross-country comparisons.

		Gender gap in ICT professions		
		High	*Medium*	*Low*
Gender gap in national employment rates	*High*			Spain, Italy, Ireland
	Medium	Netherlands	Austria, Belgium, Germany	France, Portugal
	Low	Sweden	Denmark, Finland	

Source: WWW-ICT (Valenduc et al., 2004a, p.22), updated with data from EUROSTAT, Statistics in focus, n119, 2007, and European Commission, Employment in Europe 2010, statistical annex 1999-2009.

So, those data do not establish any clear correlation between general gender inequalities in participation in the labour market and specific gender inequalities in ICT occupations. The high/high and low/low cells of Table 3 are empty. Explanations must be found elsewhere.
In order to explain such paradoxes, the third section of this paper will explore how new trends in ICT professions can reinforce or reduce gender disparities.

NEW TRENDS IN ICT PROFESSIONS

A New International Division of Labour

Current trends in the evolution of ICT professions are strongly influenced by changes in the international division of labour in the sector of ICT services (software industry, IT engineering and consulting). These changes concern the geographical, technical and social division of labour, at all stages of the 'value chain' as schematised in Figure 1.

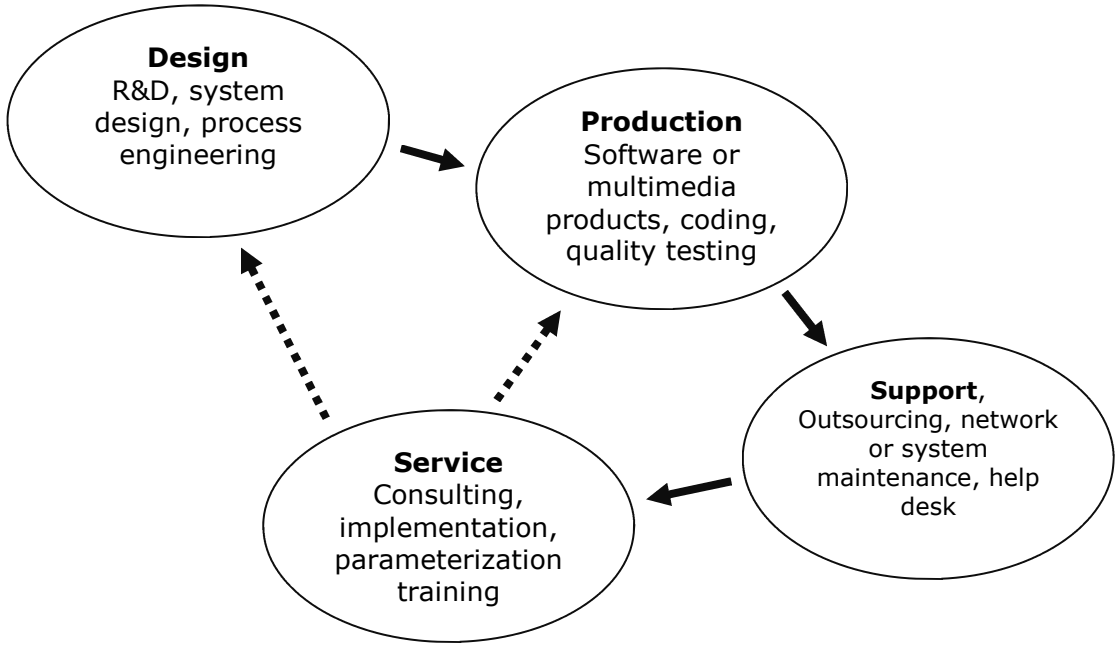
According to the WORKS results (Valenduc et al., 2008; Flecker et al., 2008), this new division of labour, linked to value chain restructuring in ICT services, has differentiated effects on women and men working in ICT occupations.

The technical division of labour is characterised by a growing importance of knowledge codification and process codification, which leads to standardisation of tasks, notably in programming and coding, functional analysis and software quality testing. Standardisation fosters local or worldwide outsourcing. Codification has a counterpart: tasks of project management, marketing, communication, and customer relationships have a growing role.

The geographical division of labour relies on 'offshoring' of codified and standardised tasks, as well as some services that can be easily delocalised with the support of new network technologies: help desk, outsourcing of IT systems management (*infogérance* in French), coding, remote maintenance, exploitation of shared computer resources (grid computing). The geographical division of labour also concerns R&D. Large European ICT laboratories have expanded their operations in India, South-East Asia or California, in

order to build partnerships and to develop activities of 'technology watching'. Within Europe, both R&D policies and company strategies are bringing research and the market closer, leading to hybrid laboratories, which operate at the interface between science and industry.

Figure 1: Value chain of ICT services



The social division of labour is characterised by changes in the respective status of occupations, depending on their orientation towards technology, management, communication or commercial relationships. All segments of the value chain are affected by these changes. While services tend to come closer to the clients, software production and technical support are widely externalised and internationalised.

Women's and men's jobs are affected differently by these distinct patterns of externalisation and globalisation. Offshore outsourcing mainly affects jobs where levels of employment of men are higher, such as programming, remote maintenance and exploitation of shared computer resources. New forms of technical division of labour reinforce gender segregation between roles attributed to women and men in technical, commercial, relational or managerial tasks. Local outsourcing is very frequent in web and multimedia activities, where women are more numerous, and in small companies.

These structural changes in ICT services entail several transformations in occupational profiles. From all changes outlined by the WORKS case studies (Valenduc et al., 2008), three specific trends will be highlighted here, precisely because they have differentiated effects on women and men: the broadening of the skills portfolio, diversification of career patterns, and evolution of occupational cultures.

Broadening of the Skills Portfolio

The broadening of the skills portfolio, beyond core professional skills, is nowadays a common trend in all ICT occupations (Ramioul & De Vroom, 2009). In the new international division of labour, emerging skills in Europe concern research, security, human/machine interfaces, software quality, team management, project management, training and assistance to users. Management skills, non-technical skills (soft skills), as well as some leading-edge technological skills, are of growing importance. According to the WORKS results, the most significant changes concern the following areas of competences (Valenduc et al., 2008, p87):

- Methodological skills, notably in the areas of functional analysis, software development, software quality control.
- Project management skills, including technical skills (project planning and functional specifications), economic skills (budget control), and human skills (team management). Offshore outsourcing reinforces the importance of project management in Europe.
- Customer communication skills, including the capacity to understand clients' needs or problems, to dialogue all along the project, to translate complex requirements into technical language and to quickly become familiar with clients' business or client company culture. Linguistic skills, mainly in multilingual countries, are also important communication skills.
- Social interaction skills, such as assertiveness, team working ability, autonomy in tasks execution and integration into the particular business cultures of companies or institutions.

Nevertheless, the majority of ICT professionals (women or men) who were interviewed in the various partner countries of the WORKS project do not spontaneously establish any causal relationship between globalisation in the value chain and the evolution of their skills portfolio. They often consider that such an evolution is due to the internal dynamics of their profession. They do worry, however, about growing tensions between, on the one hand, creativity and innovation, and on the other hand, direct market pressure and acceleration of the pace of activities and tasks, wondering if those tensions are sustainable in the long term.

The division between technical and relational tasks is deeply marked by gender stereotypes: technology for men, communication for women. In software services and web services, there are numerous women project managers, but few programmers. Although relational skills are more often attributed to women than to men, they are insufficiently valued by company managers and they are not recognised in wage levels.

As many women entered ICT professions from another background completed by additional training, their double skills profile (technical and non-technical) gives them a comparative advantage. Therefore the broadening of the skills portfolio is generally favourable to women, but they might be confined into gender roles that are defined by men.

Diversification of Career Patterns

Value chain restructuring, and particularly the changing strategic importance of design stage, upwards in the value chain, and customer service, downwards in the value chain, influence career patterns of women and men in ICT occupations.

The theoretical debate on ICT careers is shaped by the opposition between organisational careers, which are supposed to belong to the Fordist model or the bureaucratic tradition, and boundaryless or nomadic careers, which are supposed to prefigure new work forms (Cadin et al., 2003; Guerrero, 2001). This opposition is widespread in the literature about 'knowledge workers' (Bouchez, 2004; Huws, 2007), but it has to be tempered by the fact that career models are much more diversified (Valenduc et al., 2009):

- Organisational careers, i.e. careers in which progression models are a priori defined by the company or institution, are getting rid of their bureaucratic image. The pyramidal hierarchic model is increasingly replaced by functional models, in which there are various progression paths.
- Besides hierarchical organisational careers, there are nowadays more and more technical organisational careers, in which progression relies on increasing levels of expertise, recognised by peers, inside or outside the organisation, for example in national or international technical committees or expert panels.
- Multi-organisational careers are developing. They are characterised by mobility of workers from one enterprise to others, not as a career purpose, but as a means to find the best organisation that suits their wishes or expectations in relation to job content and career opportunities.
- Boundaryless or nomadic careers, i.e. careers that are voluntarily built up by the individual on the basis of own competences and experience, without any attachment to an organisation, are limited to specific professions, notably in the multimedia (Krings, 2007; Tremblay, 2003) or to specific metropolitan zones, such as London, Paris or Milan.
- New careers patterns are emerging since the turbulences of the ICT sector after the bursting of the 'Internet bubble' at the beginning of this century. These can be characterised as fragmented careers, and they are made of a succession of constrained choices, due to redundancies, closing down or delocalisation of companies, or chronic instability. They look like nomadic careers, but they are not because they are reactive instead of proactive, constrained instead of voluntary, and not driven by an individual strategy.

For women, the diversification of career patterns has contrasting effects (Bender et al., 2001; Valcourt & Tolbert, 2003).

In hierarchical careers, the persistence of the 'glass ceiling' often prevents women from going further than intermediate hierarchical levels, such as project manager. In the ICT sector, career progression systems are often opaque, and then unfavourable to women. In some cases, women are blocked at the same level during their whole professional life: there is a 'sticky floor' in addition to the glass ceiling. Technical organisational careers are generally blocked by men, who benefit from co-option by male peers, notably within expert committees and technical committees of professional associations. In multi-organisational careers, women are not less mobile than men, in opposition to common

stereotypes, but their mobility choices have different motivations, which combine professional purposes and quality of life purposes, more frequently than men.

Nomadic careers are controversially appraised from a gender point of view. The appraisal depends on the balance between advantages and disadvantages of individual career management and individual risk taking. This balance may evolve with age, personal situation, and the labour market context.

Fragmented careers are frequent among women, who are more exposed than men to careers breaks, notably for maternity and care for young children. The societal context makes it more difficult for them to fine-tune the optimal equilibrium between work and private or family life, and this optimum evolves along the life cycle. Here, the unequal breakdown of feminine and masculine roles in society in general, and particularly within families, is unfavourable to women's careers in occupations that are often demanding as regards availability and unpredictability.

Evolution of Occupational Culture

ICT professions are characterised by a specific occupational culture, which can be outlined through the analysis of the work practices (Vendramin, 2007). This occupational culture is often caricatured, for instance in the media and the fiction, and fosters stereotypical representations that give a negative or unattractive picture of ICT occupations (Collet, 2006). Such caricatured pictures are at odds with the reality of work in ICT occupations.

ICT professionals often develop a strong personal involvement in their work, and an inclination to lifelong learning. They identify with a profession or a specialised field, rather than a company or institution. The value good quality of human relationships at work, but in small groups, linked to projects or specialisations. They develop online communities of practices and other tools for online communication and sharing. They look for an expressive dimension of work in their job, through self-accomplishment or integration in networks – far from the stereotype of the asocial, fanatic and nerdy computer professional. Nevertheless, they feel some threats to the creative nature of their job, because of codification of knowledge and increasing market pressure. Value chain restructuring confronts ICT professionals with other occupational cultures, coming from the commercial sphere or from the new media, and this can raise cultural tensions (Valenduc et al., 2009; Valgaeren, 2007).

While the expressive dimension of work is something common to both women and men, other aspects of the occupational culture raises several problems for women. The pressure of companies for self-training outside working hours is unfavourable to women, who have much less free time than men. The 'male breadwinner model', which is still widespread in ICT occupations and ICT companies, relegates the need of women to build up their own career to a second importance.

The corporate culture of the ICT sector is 'gender-blind', (Tremblay, 2003) in that it does not recognise the differentiated situations of women and men. The message directed to women is: 'make like a man' (Krings, 2007). While the occupational culture fosters flexibility as a general principle of work organisation, corporate cultures are less open to concrete flexible working time arrangements, aimed at answering specific women's needs

or at managing the day-to-day constraints of conciliation between work and family care, which are still mainly taken on by women. As such, women are more likely than men to have to reject certain career-related choices because of their family/caring commitments. This 'gender-blindness' of the corporate culture has been present for a long time in computing occupations, as in other engineering occupations. Now it is contaminating new occupations, for example in multimedia and user-oriented service provision, in which the corporate culture could have been expected to be less traditional. In the ICT sector, corporate cultures are often an unstable mix of innovative and conservative behaviours. It is so about gender.

In conclusion, the evolution of skills portfolios, career patterns and occupational cultures has a contrasted balance from the gender point of view. While some trends are likely to be more favourable to women, other trends reinforce the existing gender-biases or gender blindness.

Entry and exit of women in ICT occupations

The diversity of entry paths of women in ICT occupations has already been emphasised. Three kinds of entry paths can be distinguished:

- Direct paths. Such entry paths rely on studying ICT disciplines in higher education. As already seen, all over Europe the proportion of women is decreasing in these disciplines. The decreasing proportion of women in 'core' ICT disciplines is not compensated for by the new web-orientated disciplines.
- Indirect paths. Such entry paths are characterised by non-ICT degrees in higher education, followed by additional training (6 to 12 months) either in higher education or in the vocational training system (ICT competence centres and other similar institutions), eventually leading to vendors' certificates (Microsoft, Cisco, Oracle, SAP or many others). This kind of indirect entry path is common in web or multimedia occupations, as well in application-oriented occupations (Enterprise Resource Planning systems, Customer Relationships Management systems, Supply Chain Management systems, biomedical informatics, etc.). Even if the additional training is much shorter than the initial background, women who follow this entry route have a 'double graduation', which may open broader career prospects. Double graduation of women is, however, rarely recognised in the wage classifications.
- Postponed entry paths. These paths occur at a more advanced stage of the professional life course, following either a period of unemployment, or a career break, or a voluntary occupational conversion. Institutional settings for continued vocational training, which are very different from one country to another, play an essential part here. ICT occupations look very attractive for many women who are in situations of re-insertion in the labour market, paradoxically much more attractive than for young female students. It may be that, at this moment of the life course, the motivation for job content and working environment is more important than career prospects.

These findings however rely on qualitative research methods (case studies, biographical interviews), such as in the WWW-ICT and WORKS projects. There are very few quantitative data on entry or re-entry routes in ICT occupations. In Belgium, for example, the MéTIC survey indicates that 33% of women working in ICT occupations arrived there through indirect or postponed paths, against 17% of men (Vendramin, 2004).

Dropout of women from ICT occupations is another concern. This phenomenon is named the 'leaky pipeline' by some authors, and this career dropout is raising some concern among managers of ICT companies and the European Commission, who envisage the development of specific retention policies for women in ICT (European Commission, 2006). As expressed by several women interviewed in the WORKS case studies, ICT is not a 'job for life'. Women's careers are perceived as a steeple chase, and not all runners sustain the severe competition. Taking advantage of their frequent 'double-skilled' background, many women prefer, at a moment of their life course, to develop a career outside ICT occupations rather than inside.

There is also a lack of data concerning the leaky pipeline. Some authors mention discrepancies between girls' motivation for ICT in secondary schools, which is not low, and girls' orientation towards ICT in higher education (Collet, 2006). In Belgium, the MéTIC survey indicated that 26% of women working in ICT occupations did not think that they would develop their whole career in this area, against 13% of men. Moreover, among ICT graduates who had left ICT occupations, 33% were women, although women represented 16% of those graduates who remained in ICT occupations (Vendramin, 2004). The main obstacles perceived by women are the opacity of career progression rules, the glass ceiling, the lack of recognition by male peers and by management, and gender inequalities in remunerations.

CONCLUSIONS

The first section of this paper provided an overview of hypotheses and research findings concerning the place of women in ICT professions. It concluded that no single category of hypotheses – either imbalances in education, or unfavourable working conditions for women, or favourable career rules for men, or the masculine image of ICT – can provide satisfactory explanations of the gender gap. In addition, as highlighted in the second section, the gender gap is characterised by some paradoxical features. In the third section, some new trends in the evolution of ICT occupations are discussed from the point of view of their differentiated effects on women and men. The broadening of the skills portfolio and the diversification of career patterns are structuring trends for the future of women's jobs in ICT. The specific features of entry and exit paths of women in ICT occupations (section 4) reinforce the relevance of the issue of occupational trajectories of women.

Understanding gender inequalities in ICT professions is still a research work in progress. Too univocal explanatory hypotheses are insufficient. Conversely, the repeated statement that the problem is complex and multidimensional does not help in terms of looking for efficient solutions. The lack of success in the reduction of gender inequalities is not only due to difficulties in understanding the social process leading to inequalities. It is also due to the difficulties in the design and implementation of targeted awareness campaigns and policy measures, beyond never-ending collection of 'good practices', of which the European Commission is particularly fond.

In this context, the development of a life cycle approach is really relevant. A life cycle approach allows for following women's trajectories from early school education, its family environment and the social context, until developments of professional career and life

course. Such an approach has several advantages. First, it identifies the main factors shaping women's engagement in ICT, at different moments of their life, and how they can have cumulative effects or particular synergies. Second, the life cycle approach can highlight the key transition moments in women's lives, as well as the moments when enthusiasm or disappointment, adhesion or withdraw may appear. The purpose is to explain why women's careers are influenced not only by education and business, but also by gender relations in the domestic sphere. Finally, the life cycle approach recognises the importance of choices and decisions made by women themselves, and the way they cope with changing situations in their personal and professional environment.

The life cycle concept not only opens improved analytical perspectives, but also better opportunities for the design of policy interventions, targeting specific domains or specific moments in the life course.

The problem of gender disparities in ICT professions is still far from being solved. One of the reasons why it receives more attention than gender disparities in other occupational groups is that ICT professionals influence work organisation and the organisation of economy and society. Occupational inequalities in ICT are also inequalities in power relations in society.

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[1] In this figure, the gender gap in national employment rates is calculated as the difference, in percentage points, between employment rates of men and women. The gender gap in ICT professions is calculated as the difference, in percentage points, between the proportion of men and women working in ICT occupations within the employed population. The gender gap is considered as "high" when higher than the average of the twelve concerned countries, "low" when lower, and "medium" when close to the average. Data are retrieved from the European Labour Force Survey.

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