

Work organisation and skills in ICT professions: the gender dimension

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Introduction

ICT professions constitute a privileged research area for understanding the relationships between ICT, skills and work organisation. Not only there is a close relationship between technology and skills. Moreover, ICT companies are often at the leading edge of organisational changes: flat hierarchies, project work, multi-skills teams, continuous skills update, flexible and extended working time patterns, customers' pressure, etc. High-tech companies are laboratories of organisational changes, which become widespread in other sectors which are characterised by "informational" activities.

Gender is a key issue in ICT professions. There is a huge gender gap in ICT professions (less than average 20% women across European countries), and the proportion of women is surprisingly declining for many years among ICT graduates. The issue of equal opportunities is a permanent challenge for women's careers in ICT.

Work organisation is one of the explicative hypotheses of the gender gap in ICT professions. Some specific organisational features of ICT jobs, such as unpredictable working rhythms, customer driven flexibility, continuous time pressure, are supposed to raise barriers to women's access and careers. Other hypotheses are related to unequal opportunities in education and training, gender bias in software design, male culture of computing.

This paper presents some results and recommendations from an European IST project, entitled "Widening Women's Work in Information and Communication Technology (WWW-ICT)" (1). They are complemented with results of a recent Belgian survey on professional trajectories in ICT: the M TIC project (2).

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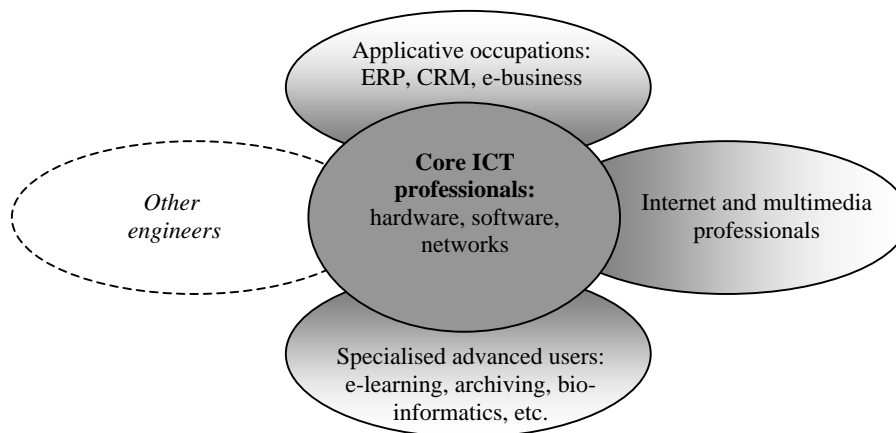
(1) Vendramin P., Valenduc G., Guffens C. (FTU), Ponzellini A., Lebano A. (FRPS), D'Ouville L., Collet I. (ANACT), Wagner I., Birbaumer A., Tollar M. (TUW), Webster J. (RCWE), *Widening Women's Work in Information and Communication Technology*, Final Report of the project WWW-ICT, (IST-2001-34520), European Commission, July 2004.

(2) Vendramin P., *Parcours professionnels dans les m tiers des TIC – R sultats de l'enqu te M TIC*, Rapport pour le Fonds social europ en et la R gion wallonne, Namur, 2004.

Methodological aspects

ICT professions are considered in a broad understanding: not only the classical computer professions (software, hardware and networks), but also the emerging professions in the area of internet services and multimedia products, specialised business applications (e-commerce platforms, ERP, CRM) and user-related software development (e-learning, bio-informatics, electronic archiving, etc.). Encompassing such a variety of professions allows for a better understanding of new economic activities closely linked to ICT, and to consider bridges and mobility between these groups of professions (figure 1).

Figure 1: Mapping the ICT professions



In the European WWW-ICT project, work organisation was mainly studied through case studies of enterprises, in two sectors: software services and e-publishing. Case studies of two enterprises of each sector were carried out in seven countries (28 case studies); among selected enterprises there are both small and big companies, in well-established or emerging activities. The issue of skills acquisition and development was also studied through a series of biographical interviews of women and men working in ICT professions (20 interviews per country, total 107 women and 33 men). The aim of the biographical interviews is to develop an understanding of a person's biography or trajectory. Crucial concepts are development tasks, individual coping strategies, detours and their implications, transitions and challenges, life themes.

In the Belgian MÉTIC project, a survey was conducted on 1100 ICT graduates, from a sample of universities, high schools and centres for ICT vocational training in the French-speaking part of the country. Among these persons having an ICT degree from higher education or vocational training, only 66% are still active today in an ICT professions; others have moved to other occupations or are job seekers. There are 16% women in the subgroup of "active ICT professionals", but 33% women among those who have moved to other occupations. The survey did not deal with work organisation as such, but provided relevant results on skills development and training paths of men and women.

These methodological tools are used to understand the reasons and mechanisms that create and enhance gender gaps in ICT professions. A common purpose of both projects is to go beyond usual clichés on women and computers and to carry out a critical evaluation of explicative hypotheses related to work organisation, education and training, and professional culture.

Main results

Organisational patterns

Most software services organisations are flat organisations with few hierarchical layers. This is particularly true of smaller organisations. 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 software 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 software 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.

There is a paradox, among large multinationals in both the software services 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.

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, 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. Women seem more able to thrive in organisations where career paths are clear and extensive and where formal progression practices operate.

Organisation of working time and work life balance

It is common for ICT 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. 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. It is a pattern that has been found across the countries participating in the WWW-ICT study, and not simply in those countries which have a reputation for long hours working (such as the UK).

Case studies provide considerable evidence to support our contention that ICT 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 ICT professions. However, in the case studies, informants were predominantly young 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 these working conditions have been developed by employers because they have a particular type of employees.

With some notable exceptions, explicit family friendly policies are unusual in the case study companies. Some companies regard families as problems that distract employees from their work, and see families as the specific problem of individual female employees. The use of family-friendly policies is seen by some companies as only necessary in tight labour markets, when they have to attract and retain women. This confirms the view that recessionary conditions can damage programmes designed to increase women's participation in IT professions. In both studied 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.

Home teleworking is quite widespread in ICT professions (with infrastructures often provided by companies), but not in a structural way, rather as an opportunity for working time arrangements and for managing overwork. Teleworking is not really a substitute for office working, but rather an extension of working time, which looks less incompatible with family engagements than longer working hours at the office.

The MéTIC survey gives interesting results about working time arrangements of ICT professionals (table 1).

Table 1
Use of work organisation arrangements among salaried ICT professionals (Wallonie+Brussels)

	Very often or often	Sometimes	Rarely or never
Teleworking at home at least one day a week (as a substitution)	10%	11%	79%
Bringing work back at home in the evening or during the week end	19%	24%	57%
Working over-hours	53%	31%	16%
Working mainly at clients' premises	28%	10%	62%
Adapting work schedules to personal constraints (family, children, etc.)	27%	33%	40%

Source: Vendramin P. (2004), op.cit., p. 55 (MéTIC survey)

Women use more frequently than man home teleworking arrangements (14% against 9%), but bring less frequently work to do at home (16% against 20%), and work less over-hours than men (41% against 55%). The possibility of adapting work schedules to personal constraints mainly depends on the level of qualification: 30% among university graduates, but only 19% among low level graduates. The sectoral breakdown of these working time and organisational arrangements is also interesting (table 2).

Table 2
Very frequent or frequent use of organisational arrangements, according the sector of activity
(Wallonie+Brussels)

	Computer and software services, telecom	Manufacturing industry, trade, transport	Financial and business services (ICT services excepted)	Public administration, health, social services, other services
Teleworking at home at least one day a week (as a substitution)	12%	5%	5%	11%
Bringing work back at home in the evening or during the week end	16%	18%	18%	28%
Working over-hours	54%	54%	54%	48%
Working mainly at clients' premises	48%	11%	11%	10%
Adapting work schedules to personal constraints	28%	20%	28%	20%

Source: Vendramin P. (2004), *op.cit.*, p. 56 (MÉTIC survey)

Policies of human resource management (HRM)

Most companies operate individualised employment contracts, pay and grading systems, 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. 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.

Organisational cultures

In many studied organisations, the culture of work involves long working hours, and competitive, individualised relationships between workers. 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. 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. 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. On the other hand, several 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 ICT sector are redolent with a masculine culture of work, which excludes women. ICT competitive culture, together with individualised HRM structures and practices, are more decisive for gender inequality than the masculine culture of computing.

Skills

Technical qualifications, and specifically computer science degrees, are generally the main entry requirement for ICT professionals in software services. For programming or development work in e-publishing, entry qualifications are more diversified than in software 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, image processing or video intergration) rather than on programming.

Skills requirements for all ICT 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 ICT professions. 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 ICT professionals progress in their career.

The assumption that women are not attracted by jobs that require technical skills is refuted by the case studies. The use of technical, and particularly problem-solving, skills is one of the most satisfying aspects of women's work in ICT 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 web sites or services; for others still, it means developing an overview of a project through project management.

The types of professional insertion of women and men in ICT jobs and careers mobilise different sets of skills and competences. The MÉTIC survey shows that women must develop more skills in the areas of marketing, web design, multimedia design, teaching and help-desk, as well as in the business domain of their company. Skills in the areas of operating systems and security, hardware and network design are more required from men. Core software skills (programming, software development, project management) are equally expected from men and women. Moreover, "relational skills" (communication, team work, team management, pedagogical aptitudes) get increasing importance for both men and women, but still more for women (table 3).

	Men	Women
Operating systems and security	71%	45%
Programming and computer languages	63%	61%
Integration of applications	58%	51%
Software development	55%	50%
Network design and management	49%	32%
Hardware	49%	27%
Design and management of web sites	33%	43%
Graphics, layout, multimedia editing and publishing	17%	38%
Business domain of the enterprise	67%	75%
English	84%	76%
Flemish (Dutch)	35%	37%
Other foreign languages	12%	12%
Capacity to manage commercial relationships	28%	31%
Marketing	11%	22%
Capacity to work in team	89%	91%
Capacity to communicate	86%	93%
Didactical skills	56%	77%
Capacity to lead a team	50%	50%

Source: Vendramin P. (2004), op.cit., p. 48 (MÉTIC survey)

The learning and training process

All case study companies declare the importance of workplace-based training. Not all provide it, however. 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.

Training and development are cut back during recessionary periods, in almost all organisations. The WWW-ICT case studies 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 ICT labour market in almost all countries. All case study organisations reported being affected by the recession in the ICT 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.

Continual learning is vital in ICT 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 ICT professionals away from technical work and into managerial functions.

Table 4
Opinions of active ICT professionals on various aspects related to training (Wallonie+Brussels)

	Agreement	No opinion	Disagreement
The practice of on-line learning becomes more and more important in ICT professions	57%	30%	13%
It is important to learn about Linux and open source software	53%	27%	20%
Private certifications are very important in a curriculum vitae	45%	37%	18%
Your current job corresponds to your degrees and training	73%	9%	18%
Employers give time enough to self-training of their employees	44%	13%	43%

Source: Vendramin P. (2004), op.cit., p. 25 (MÉTIC survey)

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.

Careers and re-orientations

Another evidence from the MÉTIC survey is that women have experienced more changes in their career than men: professional conversion, change of work status, change of employer. One third of women enter ICT professions after another professional experience or through re-orientation and re-training processes. Once they are in ICT professions, they are less likely to move from an enterprise to another. Nevertheless, one fourth of them does not intend to develop their whole career in ICT professions.

The individualisation of the wage relation is systematically unfavourable to women: the MÉTIC survey reveals that women are disadvantaged as regards all “extra-wage” forms of indirect remuneration, such as personal computer, cellular phone and home internet connexion paid by the employer, performance bonus, company car, etc. This confirms that informal HRM and career patterns are more disadvantageous to women than the formal ones.

Conclusions and policy recommendations

Some classical assumptions, linked to the roles of education, work organisation, and professional culture in the gender gap, are not confirmed by the WWW-ICT project. Women do not seem to have such a problem with technology and the computer culture. The classical hypothesis of the role of the family in social reproduction of career orientation is not confirmed. Although the working conditions in ICT jobs may be quite hard for women, it is neither the main reason why they do not enter these professions, nor why they would like to leave them, provided they get sufficient autonomy in the organisation of their working time. The capacity of women to reconciling work and family life, which is the hugest for young mothers, highly depends on the span of this autonomy. Working time does not appear as the main problem of work organisation, but just as a problem among others, linked to professional recognition and progression, and to individualisation of labour relations and skills development.

As regards the links between ICT, skills and work organisation, some specific conclusions may be highlighted:

- ICT professions are knowing a wide diversification. Hybrid profiles are growing in the “emerging” professions and even in the core software professions, but these profiles are not yet stabilised.
- Both WWW-ICT case studies and the MÉTIC survey stress the importance of both solid ICT technical skills, including project management, and non-ICT skills (languages, communication, business domains). Both men and women are concerned, but still more women. However, examples of occupational segregation were found in several companies.
- Although continuous skills update is required at all professional levels, companies do not offer enough formal training possibilities to their employees. Work-based learning and self-training are necessary to keep pace with technological developments. Pressure to informal self-training may disadvantage women, for time reasons.

- Flat organisations, project teams, project work (deadlines instead of schedules), networking experiences present both opportunities and threats for women. Policies of HRM are essential to assess whether the balance is positive or not.

In the area of skills and work organisation, some policy recommendations emerge from our empirical studies:

- Creating a better understanding of ICT professions: a better image of the variety of ICT professions is favourable to a wider access of women.
- Emphasising re-orientation practices: many women enter ICT professions through re-orientation, which allows them hybrid skills and good job prospects.
- Developing role models for women in a wide range of ICT professions, and encouraging mentoring practices.
- Organising more formal schemes of continuing training and skills update, including specific schemes for particular women's situations (after maternity leaves, or when re-entering after a career break). But also promoting informal women's networks for skills upgrade and professional development.
- Improving the work / family balance through targeted measures: better training of project managers to time management, family friendly initiatives in companies, women-friendly time scheduling.

Our research emphasises the key role of organisational variables in mediating the relationship between ICT and skills change. Moreover, the gender dimension is revelatory of the relevance of organisational variables.