Chapter 8
The Gendering of the Computing Field in Finland, France and the United Kingdom Between 1960 and 1990

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Abstract This chapter documents the role that women played in the computing field in three different European countries from the late 1960s into the early 1990s: Finland, a latecomer to the computer industry which was then deemed of national importance, France which boasted several computer manufacturing companies and where IT service companies played an important role in the early history of computing, and the United Kingdom, also involved in computer manufacturing, but where the public sector played a major role. We will see that despite national differences, similarities exist concerning the role women played in the computer industry and that the masculinisation of the profession can be attributed to similar causes. Initially, jobs were considered unskilled and marked out as women's work. When women acquired the necessary skills to play a more important role, various forms of discrimination slowly discouraged them from staying in computer science. The study of these three countries at the moment when computing was introduced into the public and private sectors and became a major tool for management and strategic decisions shows how software activities were socially constructed as masculine.

The history of computerscience in the United States clearly shows that women played active roles in its beginnings. They were largely responsible for operating the first American electronic calculators, and several of these women took part in major developments in computer software and computer languages.[1] Starting in the 1960s and during the two following decades, an ever-increasing number of women entered the new field of computer programming.[2] In Europe as well, computer program-

[1] Gürer, Denise. 1995. Pioneering women in computer science. *Communications of the ACM* 58(1): 45–54; Goyal, Amita. 1996. Women in computing: historical roles, the perpetual glass ceiling, and current opportunities. *IEEE Annals of the History of Computing* 18(3): 36–42.

[2] Ensmenger, Nathan L. 2012. *The computer boys take over: computers, programmers, and the politics of technical expertise*. Cambridge, MA: MIT Press; Abbate, Janet. 2012. *Recoding gender – women's changing participation in computing*. Cambridge, MA: MIT Press.

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ming jobs from the late 1960s into the early 1990s were largely held by women. In this chapter, we will document this trend by contrasting the situation in three different countries: Finland, a latecomer to the computer industry which was then deemed of national importance, France which boasted several computer manufacturing companies and where IT service companies played an important role in the early history of computing, and lastly the United Kingdom, also involved in computer manufacturing, but where the public sector played a major role. We will see that despite national differences, similarities exist concerning the role women played in the computer industry and that the masculinisation of the profession can be attributed to similar causes.

8.1 The Role of Women in the Institutionalisation of Computing in Finland

This section draws heavily on the work of Vehvilaïnen (1997, 1999),[3] who explored the culture and practices of computing in Finland by examining the archives of the Finnish Information Technology Society and the autobiographies of Finnish pioneers in computerscience. Women in Finland withdrew from the information technology field in the early 1990s as they did in most Western countries. However, for 20 years, from the 1960s to the 1980s, Finland presented a paradox: On the one hand, many women were involved in key activities of IT such as programming and analysis, but on the other hand, they were almost completely absent from the decision-making process which contributed to the institutionalisation of IT in Finland. In this section, we will first show how women were kept out of the spheres of decision-making despite Finland's reputation as a pioneer in female/male equality (in 1906, it was the first country in the world to introduce women's right to vote and equal access to public office). We will then track women's involvement in the field of information technology in Finland.

8.1.1 The Participants in the Development of IT in Finland

Compared with other Western countries, Finland is considered to be a latecomer to computing. The first Finnish computer, the ESKO, based on the German computer G1, was not built until the late 1950s. After World War II, the aim was

[3] Vehviläinen, Marja. 1997. Gender and expertise in retrospect: pioneers in computing in Finland. In *Women, work and computerisation: spinning a web from past to future,* ed. Anna Frances Grundy et al., 435–448. Proceedings of the 6th international IFIP conference. Berlin: Springer; Vehviläinen, Marja. 1999. Gender and computing in retrospect: the case of Finland. *IEEE Annals of the History of Computing* 21(2): 44–51.

twofold – reduce Finland's dependence on German technology and at the same time strengthen national culture. Nonetheless, the first computer in operation in Finland was an IBM650 bought by the Finnish Postal Bank in 1958, and the ESKO, already obsolete, was donated to the University of Helsinki. Despite this late start, there was a rapid increase in the number of computers, and 10 years later, more than 160 computers were in operation in Finland. Although initially dependent on foreign technical knowledge and expertise, Finland soon gained its technological independence. Three different institutions played a major role in this national and patriotic project.[4] Women however were almost totally absent in this early stage.

The first institution involved was the *Punched Card Association* (renamed the *Computer Association* in 1960). It published a journal aimed at disseminating knowledge of electronic machines. Membership was selective and members had to be considered experts (either those with considerable experience or those who had worked in top management positions). Only 3 % of the members were women, none held a leadership or editorial position, and working groups were all male. At the beginning of the 1970s, the Association modified its rules and encouraged computer professionals, which included many women, to become members. The participation of these women in discussions on professional practices has been widely documented in the Association's journal. Nevertheless, no articles were written by women in this journal until as late as the 1980s.

The Association of Data Processing (ADP), which also played a key role, was founded in 1961 by Otto Karttunen, a former World War II army officer. Its aim was to organise training in computerscience across Finland. It was run rather like a 'secret society'[5] – membership was limited to those who held leadership or management positions in computing. Until the end of the 1960s, no women had joined the 'club'. ADP members believed they had a mission to promote national progress, and its most influential members wrote to each other as 'my good brother'.[6] The *ADP* and the *Computer Association* were actively involved in setting up computer departments and services in both the public and private sector. Both groups also worked on defining the *ADP* training programmes and on developing the methods that organised work and practices in computing.

The third institution that influenced the development of computing in Finland was IBM. This company dominated the computer market in Finland in the 1950s and was also the unique source of computer training in Finland for several years (from the end of 1950s to the beginning of 1960s). IBM, like many other companies, was male dominated, and women long remained a minority despite government measures in favour of gender equality.

[4] Paju, Petri. 2008. National projects and international users: Finland and early European computerization. *IEEE Annals of the History of Computing* 1(4): 77–91.

[5] Vehviläinen 1999: 46.

[6] Vehviläinen 1999: 46.

8.1.2 The Place of Women in IT Professions in Finland

In Finland, the male-dominated founding bodies and the absence of critical debate among decision-makers resulted in the information technology (IT) world becoming a closed culture implicitly linked to men. Nevertheless, decision-makers increased the number of training programmes that were open to all, regardless of sex or social class, in order that Finland reached a level enabling it to be a player on the international scene. Women benefited greatly from this opportunity. Between 1960 and 1980, the percentage of female programmers rose from 7 % to over 30 % and the number of female analysts from 9 % to 30 %. However, the entry of women into computer professions must also be seen as part of a wider societal evolution. As early as the 1960s, female/male equality gave rise to much debate and led to measures being taken, notably in the field of education and childcare. Women entered the job market on a broad scale, and rapidly the number of women with high school diplomas had exceeded the number of men. By 1980, 30 % of all computer professionals were women.

Computer programmers were recruited on the basis of tests. Many women applied and were hired. Nevertheless in the 1960s, women's expertise was undervalued. They had little chance of promotion, and the experts continued to be men.[7] The situation evolved during the 1970s, when universities began to offer courses in computerscience. Soon 30 % of students in these courses were women, and these women went on to hold senior positions in companies and institutions. In many universities between 1980 and 1990, almost 50 % of those studying information technology were female. This figure began to decline from 1990 onwards. Moreover, technical universities continued to harbour a predominantly male culture, and few female students applied. In the 1980s, only 8–10 % of students in these schools were women and this figure decreased during the 1990s.

8.1.3 The Case of Finland: Concluding Remarks

To sum up, computerscience in Finland, introduced and developed in the 1950s, was considered to be of strategic and national interest. Only men and often old comrades-in-arms were involved in its promotion and development. Women were absent not only in the national decision-making spheres but also from associations and publications. On the other hand, as soon as they were given the opportunity, they chose to study information technology and to work in computer-related jobs. The case of Finland illustrates that the determining factor in branding the field of computing as masculine was not so much men and women's relationships to technology but rather the fact that a small group of socially dominant men occupied the terrain in terms of both decision-making and visibility. Furthermore, the increasing number of women

[7] Vehviläinen 1997: 441.

in university IT courses, in contrast to the almost total absence of women in similar courses in technical institutions, makes it clear that it is not the discipline that is at issue here (IT courses being similar in both types of institutions) but rather a difference of culture. Technical universities retained practices that discouraged women from entering the field. To illustrate the role of gender in limiting access to certain areas, Vehvilaïnen reported in reference to Otto Karttunen: 'In Karttunen's world, there were three kinds of women: (1) those related to machines within the routines of scientific management, (2) the attractive secretaries and (3) one token woman who was able to make men laugh during the lunch break'.[8]

8.2 The Role of Women in the Development of Computing in France

France lagged behind Finland and other European countries in granting political equality to women; women's right to vote and to hold public office was not won until after World War II. However, women were admitted to study sciences at university as early as the second half of the nineteenth century. Nevertheless, the more renowned and highly respected French engineering schools continued to maintain a male-only policy well into the twentieth century.[9] In 1917, the loss of a great number of young men during World War I convinced leaders of the need to allow women to access engineering jobs. Thus, four engineering schools opened their doors to women. In 1925, a female engineer, Marie-Louise Paris, frustrated that only few women were being admitted into these schools, set up an engineering school exclusively for women, the *Ecole PolytechniqueFéminine* (EPF). However, women would have to wait until 1972 for all engineering schools to be co-educational, notably the highly prestigious *Ecole Polytechnique*. A second institutional mechanism contributed to prevent women from accessing positions of power in computing: the 'engineering corps'.[10] Since the eighteenth century, the French State has recruited engineers on a very selective basis. These engineers become government employees and are organised into 'engineering corps' according to their area of expertise – mining, civil engineering, telecommunications engineering, etc. The majority of these engineers are former students of the *Ecole Polytechnique*. They then follow additional courses at the other engineering schools (Mines, Ponts et Chaussées, Télécom, etc.). During the period 1960–1990, this 'engineering corps', notably the graduates from the *Ecole Polytechnique*, played an important role in industrial development in France,[11] acting as key decision-makers in government

[8] Vehviläinen 1999: 48.

[9] Marry, Catherine. 2004. *Les femmes ingénieurs: une révolution respectueuse*. Paris: Belin.

[10] Canepa, Daniel, Jean-Martin Folz, and Florian Blazy. 2009. Mission d'étude sur l'avenir des corps d'ingénieurs de l'Etat. http://www.ladocumentationfrancaise.fr/rapports-publics/094000145/. Accessed 3 Mar 2015.

[11] Canepa et al. 2009.

bodies and state-owned companies (in the fields of electricity, nuclear energy, telecommunications, armaments, aeronautics, transport, etc.). In addition, the *Ecole Polytechnique* alumni represented an influential network in French politics and economics.[12] This was notably true in the development of computing in France.

8.2.1 The Major Players in the Development of Computing in France

The French State played a major role in the early development of computerscience and computer industry in France. In 1954, SEA (Société d'Electronique et d'Automatisme) secured a military contract, thus allowing France to join the 'club' of manufacturers of large computers. The French State continued to intervene throughout the turbulent history of computing, both politically and economically, in particular in the creation and mergers of computer manufacturing firms – CII (Compagnie Internationale pour l'Informatique), Bull, Unidata, CII-Honeywell-Bull, R2E, SEMS, etc.[13] A government programme, the 'Plan Calcul', was launched in 1966 with the aim of developing a national computer manufacturing industry. In addition to the construction of large computers, the world's first microcomputer (Micral) was developed in France in 1972 thanks to a government contract. The State continued to support the development and commercial distribution of minicomputers. As a result, the total number of computers in use increased considerably. While in 1962 there were only 600 computers installed in France, by 1970 there were 1300. Other major players in the computerisation of both companies and public sector bodies were the IT service companies. Their mission was to provide qualified personnel and turnkey solutions. They flourished between 1958 and 1973 and were more numerous in France than elsewhere.[14] Several were set up as subsidiaries of banks or major industrial firms (Crédit Lyonnais, Société Générale, Crédit du Nord, France Telecom, Schlumberger, Péchiney and Alcatel). Thousands of companies specialised in programming were formed between 1965 and 1969, but more than half had folded 10 years later.[15] However, the majority of the firms which were to play a decisive role in IT services at an international level (Sema, SESA, SOPRA, CGI, STERIA, Sligos) were started by engineering graduates of *Ecole Polytechnique*.[16]

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[12] Kosciusko-Morizet, Jacques-Antoine. 1973. *La 'Mafia' polytechnicienne*. Paris: Seuil.

[13] Griset, Pascal (ed.). 1999. *Aux origines de l'informatique française: entre Plan Calcul et UNIDATA, 1963–1975*. Paris: Editions Rive Droite, Institut d'Histoire de l'Industrie.

[14] Lacombe, Frank, and Philippe Rosé. 2011. *Entreprises de services et économie numérique: une radiographie des SSII*. Paris: CIGREF éditeur.

[15] Lacombe and Rosé 2011: 31.

[16] Bret, Christian. 2005. L'histoire des 40 premières années des SSII en France à travers leurs hommes et leurs activités. *Entreprises et Histoire* 3: 9–14.

8.2.2 *The Women Involved in the Growth of IT in France*

Between 1960 and 1975, women were almost entirely absent from decision-making and entrepreneurial spheres with regard to the development of computing. Firstly, they were late in gaining access to the various 'engineering corps', notably those which dominated the history of IT as shown with the case of the *Ecole Polytechnique*, and it was not until the 1980s that a few female engineers were admitted to the influential 'corps des mines' or 'corps des télécommunications'. Despite this, women were interested and active in computerscience. We can see this by examining three different areas: computer design, computer science studies and IT professions.

In computer design, in the second half of the 1950s, two female engineers, Alice Recoque (ESPCI, Ecole Supérieure de Physique et de Chimie Industrielles, graduate engineer) and Françoise Becquet (EPF, Ecole Polytechnique Féminine, graduate engineer), designed a small conversational machine, the CAB 500, a forerunner of the personal computer and SEA's biggest commercial success. Following the merger of SEA with the newly formed company CII in 1966, Alice Recoque was put in charge of the design of CII's Mitra range of minicomputers, notably the Mitra 15 at the end of the 1960s. The latter was also very successful both technically and commercially.[17] These minicomputers were not within the scope of the 'Plan Calcul', which may explain why a woman was placed in charge of research in what was then termed 'small computers'. Despite her achievements,[18] Alice Recoque never reached a position of responsibility either in the public or private sector.

Concerning higher education, women in France as in Finland were attracted to computerscience studies. In 1972, women represented less than 5 % of students in engineering schools, but the highest percentage of women (9 %) were in engineering schools specialising in computer science.[19] Ten years later, in 1983, the percentage of female engineering students in schools specialising in computer science peaked at over 20 %. Then numbers began to fall, with a sharp decrease at the end of the 1980s, despite the fact that the overall number of women entering engineering schools continued to increase during this period. The case of the INSA engineering school in Rennes is noteworthy. For three consecutive years, male/female parity was more or less achieved (percentage of women in 1978, 47 %; 1980, 55 %; 1981, 50 %).[20] In a study carried out on ten engineering schools in France, Isabelle Collet showed that in the 1970s, the number of female computer science graduates was relatively high in comparison to the number of male graduates, given the higher percentage of male students in engineering schools overall. However, she pointed

[17] Mounier-Kuhn, Pierre-Emmanuel. 1990. Genèse de l'informatique en France 1945–1965. *Culture Technique* 21: 21–35.

[18] Recoque, A. 2007. Miria a validé l'ordinateur personnel avant qu'IBM ne le découvre. *Code source, hebdomadaire des 40 ans de l'INRIA* 1: 6.

[19] Marry 2004: 109.

[20] Collet, Isabelle. 2005. *La masculinisation des études d'informatique. Savoir, pouvoir et genre*. Thèse de doctorat en Sciences de l'Education, Université Paris X.

out that at the end of the 1980s, the figures for female graduates in computer science remained stable, whereas the number of male graduates soared. In 1979, male/female parity was reached, with approximately 100 students overall, whereas in 1989 there were about 120 female students and 400 male students.[21]

Lastly, many women clearly chose to work in the field of computerscience. A study conducted in 1969[22] showed that 30 % of EPF (Ecole Polytechnique Féminine) graduates worked in computing. For other engineering schools, the trend was less pronounced. However, the author noted that 17 % of all female engineering graduate students aged 30 and under chose to work in computing. At the beginning of the 1980s, a government report on the range and variety of jobs held by women noted that the computer science field was evidently not marked by gender stereotypes as were the fields traditionally dominated by men. The authors of the report were optimistic: 'We may therefore hope that the advent of new technologies and the ensuing changes in work organization will allow women, if they are able to seize the opportunity, to find their place in the new technical fields'.[23] In the 1980s, many IT service firms trained graduates, and recruitment was very open. In 1982, 35 % of computer scientists were women. However, by the end of the 1980s, the trend began to revert: In 2002, women represented 20 % of the computer science workforce,[24] and by 2011, the IT engineering profession figured among the 20 professions which contributed most to job segregation.[25] Concerning entrepreneurship, few women set up IT service firms. For example, in 1974, Marie-Therese Bertini developed a structured programming method that encountered some success. Nevertheless, MBT, the company she set up in 1985, never reached international scope although it is still operating. Despite her expertise, she was not invited to participate in the 'Merise' project, i.e. the development of a national information system development methodology.

8.2.3 The Case of France: Concluding Remarks

Women had little access to certain positions – decision-makers or key players – during the early period where there was a rapid development of IT. This was due to their late entry into the institutions that played a major role in this development. As regards to setting up a business, women encountered more obstacles than men for two major reasons. First, they did not belong to the alumni network of the 'grandes

[21] Collet 2005: 31.

[22] De Peslouan, Geneviève. 1974. *Qui sont les femmes ingénieurs en France?* Paris: PUF.

[23] Appert, Monique, Anne-Marie Grozelier, and Cécile Baron. 1983. Diversification de l'emploi féminin: insertion professionnelle des femmes formées dans des métiers traditionnellement masculins. *Dossier de recherche du CEE* 8, AFPA-CEE éditeur, quoted by Collet 2005: 55, our translation.

[24] DARES. 2004. Vingt ans de métiers: L'évolution des emplois de 1982 à 2002. *Premières Synthèses* 43: 2.

[25] DARES 2013. La répartition des hommes et des femmes par métiers. Une baisse de la ségrégation depuis 30 ans. *Dares Analyse* 79: 1–13.

ecoles', a major advantage in France in terms of securing partners and clients. Second, until 1965 according to French law, married women were not entirely independent legally. They required their husbands' permission to open a bank account, to manage family property and their own personal property and even to hold a job. Nevertheless, early on, female engineers were interested in the new and exciting area of computers and computing. To women at that time, the field appeared very open, as Françoise Becquet who started working for the manufacturer SEA in the late 1950s explained: 'It didn't matter if you were a man or a woman, a French national or a foreigner as long as you worked diligently and did the job well'.[26]

At the beginning of the 1980s, more and more women moved into the area of software. Nonetheless, a detailed study[27] clearly showed that women were the first, voluntarily or not, to leave the field as soon as the sector was hit by a crisis. IT once again became a male activity in the early 1990s. 'It is certain that IT jobs and careers are open to women. Neither their knowledge, interest or competence in the field can be questioned. Women are present in IT. However, it will be difficult for them to say they are computer engineers. Often they have the impression of being guests in the profession and of being welcome for their subsidiary 'feminine' qualities', concluded a study of female scientists, some of whom had spent their entire career in IT service companies (Collet and Ingarao 2002: 79, our translation).[28]

8.3 Women and IT in the Public Sector in the United Kingdom

In the United Kingdom, as early as the nineteenth century, the struggle for equal rights for women gave rise to diverse social movements. At the turn of the twentieth century, most British universities were open to women, although the most prestigious universities were the last male-only strongholds: Oxford (1920) and Cambridge (1948). In 1928, women obtained the right to vote. 1954 saw the introduction of a policy of equal salaries for men and women in the civil service. Between the years 1955 and 1985, the public sector occupied an ever-increasing position in the country's economy[29] with the welfare state and the wave of nationalisations (banks, industry, transport, etc.). Along with Germany and the United States, the United Kingdom was a pioneer in the computer industry (e.g. Colossus Mark 1 in

[26] Becquet, Françoise. 2010. *Exposition « Courbevoie, berceau de l'informatique française », Souvenirs de Françoise Becquet*. http://sea.museeinformatique.fr/Souvenirs-de-Francoise-BECQUET_a2.html?com. Accessed 3 Mar 2015, our translation.

[27] Stevens, Hélène. 2007. The professional fate of woman engineers in the computer sciences: unexpected reversals. *Sociologie du travail* 49: 443–463.

[28] Collet, Isabelle, and Maud Ingarao. 2002. *La place des femmes dans les SSII*. Rapport au Ministère des affaires sociales, du travail et de la solidarité- Service des droits des femmes et de l'égalité professionnelle.

[29] Clark, Tom, and Andrew Dilnot. 2002. *Long-term trends in British taxation and spending*. The Institute for Fiscal Studies, Briefing Note 25. London.

1944, EDSAC and Manchester Mark in 1949, Elliott 152 in 1950, LEO 1 in 1951, Ferranti Mark 1 in 1951, DEUCE in 1955, Pegasus in 1956). Computers were widely used to support growth in the public sector. Contrary to what one might think, women did not receive equal treatment with men in this new area of activity. The 'meritocracy' ideal was to suffer as work in the field of computing required higher qualifications and was better paid. The obstacles notwithstanding, many women worked as operators and programmers. However, faced with discrimination, certain pioneering women decided to set up their own IT businesses.

8.3.1 Female Computer Scientists in the Civil Service and the Nationalised Industries

This section draws heavily on the work of Marie Hicks, which focused on gender in the history of computerisation in British government from 1950 (2010, 2011).[30] Before 1960, operating calculators required trained staff for command entry, fine-tuning of cables and replacing faulty tubes. These jobs were called 'machine positions' in the civil service job classification system and were almost exclusively held by women. In 1954, it was decided that these positions would not be covered by the equal salaries legislation. Furthermore, the few existing male operators were shifted to higher paid jobs with better prospects of promotion. Electronic computers began to be installed in civil service and government departments at the end of the 1950s. This required the staff to acquire new technical capabilities but also management skills as the number of computer-related projects increased.

Women, who had been hired to write code for the calculators, progressed to programming computers. By 1963, 70 % of programmers were women. Nevertheless, it was considered inappropriate for women to hold management positions, especially as the ever-increasing need for programmers meant attracting more men into the profession. Moreover, it was customary for young women to give up working when they married. Initially, programmers were recruited internally from middle management within the civil service which was heavily male dominated (90 % men). Senior women programmers, although required to train the new young male recruits, had no prospects of promotion. This wave of recruitments was relatively unsuccessful, partly because the aptitude tests were ill adapted and did not guarantee that recruits would be competent programmers. Yet despite the preference for recruiting men, women for a variety of reasons did not abandon the programming field. In the first place, women increasingly chose to continue working after marriage, and secondly, there was a growing need for programmers. Also following the 1965 economic crisis, wages in the civil service were frozen, notably those of the IT

[30] Hicks, Marie. 2010. Only the clothes changed: women operators in British computing and advertising, 1950–1970. *IEEE Annals of the History of Computing* 32(4): 5–17, Hicks, Marie. 2011. Meritocracy and feminization in conflict: computerization in the British government. In *Gender codes: why women are leaving computing*, ed. T.J. Misa, 157–192. Hoboken: Wiley.

staff which made the jobs less attractive. Young men did not rush to join a sector of activity which was predominantly female and thus with low prospects. In the end, the government decided to recruit externally, targeting those under 25. No qualifications were required and no reference was made to gender in the job advertisements. Many women applied and were hired to be operators and programmers, and the principle of equal pay was better respected. Nevertheless, female programmers and operators gradually left the profession due to discrimination encountered in their career path. For example, at the end of the 1960s, the high salaries women earned were considered an anomaly and they were refused promotion, while their male colleagues were promoted. Women became increasingly rare in computer departments.[31]

In her research on women in computing, Janet Abbate (2012: 117–119)[32] pointed out the difficulty, in both Great Britain and the United States, for a qualified female IT engineer to come back to a salaried job after maternity leave. She describes the case of two female British computer engineers who had been working for computer manufacturing companies – Bobby Hersom at Elliott Brothers and Mary Berners-Lee (the mother of Tim Berners-Lee) at Ferranti – and who regretted having to quit their jobs after the birth of their first child. They then had to be content with working freelance.

But discrimination also led two British women, both of whom held degrees in mathematics and were enthusiastic about the fledgling computer industry, to set up their own software companies.

8.3.2 Two Pioneering Women in the Software and IT Service Industry

Dina St Johnston, née Vaughan, began her career in 1947 working in a research institute while continuing to follow evening classes at Croydon Polytechnic.[33] She passed the entrance exams to two major universities (Bedford and Royal Holloway), but 90 % of the places were reserved for World War II veterans, and the remaining 10 % were allotted to men. She finally enrolled in London University and obtained a degree in mathematics. However, the company she was working for refused her a promotion (which was systematically granted to men under similar circumstances). She therefore changed jobs and went to work for Elliott Brothers, a computer manufacturing company. There, she learned computer programming and soon proved to be brilliant. She married a colleague at Elliott Brothers and in 1959 left the firm to

[31] Hicks 2011: 161.

[32] Abbate 2012.

[33] Lavington, Simon. 2009. An appreciation of Dina St Johnston 1930–2007 founder of the UK's first software house. *The Computer Journal* 52(3): 378–387; Porter, Collin. 2008. Dina St Johnston 1930–2007 Obituary. *The Institution of Railway Signal Engineers IRSE*. Proceedings 2007/2008: 17.

set up her own company. She founded the first private sector IT service company in the United Kingdom (Vaughan Systems and Programming). It specialised in software for industrial control and automation systems (warehouse automation, flight reservation systems, railway signalling systems). The company even built small dedicated computers such as the *Vaughan 4M* which introduced an automatic system for locating trains. Dina Vaughan continued programming until 1996 when she sold her company to retire.

Three years after Dina St Johnston, Stephanie Shirley also set up her own company. She had joined the research department of the London Postal Services in 1951.[34] She took evening classes and obtained an honours degree in mathematics in 1956. She discovered computerscience and became enthusiastic. She worked on several important computer-related projects for the post office. Although she was eligible for promotion, having received a degree in mathematics, she was not promoted. The members of the promotion panel refused to consider appointing a woman to that higher grade. She left the postal services in 1959 and went to work for a software development company that was a subsidiary of two computer manufacturing companies, GEC computers and ICT. She led a team carrying out tests on a new computer. She was very well paid; however, the 'glass ceiling' once again reappeared. When she made suggestions to the project steering committee, she was asked not to intervene in the project management meetings on non-technical subjects and to keep to her role as technician. She thus understood that she would never be able to move up the ladder in the company, and she decided to become her own boss.[35] She was also hoping to have children and wanted to continue on working afterwards. In 1962, at the age of 29, she set up a software development company (*Freelance Programmers*) using the name Steve Shirley.[36] She adopted this name so that potential clients would not know she was a woman until the first face-to-face meeting. She recruited women who wanted to work part-time in order to look after their children. All the analysts and programmers were women who worked freelance from home. The company soon became a British success story: In 1965, there were 65 employees, almost exclusively female until the 1975 Sex Discrimination Act required the company to hire more male employees. By 1986, 16 % of employees were men.

In an interview, Stephanie Shirley quotes one of her female employees who had difficulty persuading the Inland Revenue Service that she had earned her money honestly working at home and looking after two children[37]! By 2009, the company, then known as *F International*, boasted 1000 employees in three different countries (the United Kingdom, Denmark and the Netherlands), with sales of $10 million and an annual growth rate of 30 %. The name of the company was subsequently changed

[34] Abbate 2012: 125–143.

[35] Abbate 2012: 126.

[36] Abbate 2012: 138.

[37] Shirley, Steve, and Eliza G.C. Collins. 1986. A company without offices. *Harvard Business Review* 64: 127–136.

to *Xansa* and was bought by the French IT service company Steria in 2007. Stephanie Shirley was honoured with the title of 'Dame' in 2000 for her contribution to the British computersoftware industry.

8.3.3 The Case of the United Kingdom: Concluding Remarks

After World War II, the United Kingdom invested in computers to compensate for its decline as a world power. The public sector adopted IT early on. The civil service equality policies notwithstanding, computer coding was initially considered as women's work, badly paid and with no prospects for promotion. These jobs were then voluntarily redefined as male because it became imperative to reposition computing as a male field to meet the challenges of computerisation. On the other hand, stereotypes concerning women's technical incompetence were unknown. Later, in the years 1960–1980, other factors contributed to preventing women from establishing themselves in computer science. The first factor was low pay, as male/female work categories were maintained circumventing the 1954 law on equal pay. Finally, when higher salaries were offered because of the need to recruit more staff in computer departments, women employees were soon considered to be overpaid, and their career advancement was blocked, but this was not true for male employees. The second factor was the question of careers. Despite a 1969 government campaign to encourage young women to join the workforce, women were not really supposed to have a career, in particular if they had children. Employers were not encouraged to train or promote women and most believed women would leave employment early on. The last and perhaps most important factor was that, by not allowing female computer scientists, regardless of their abilities, to hold management positions, most of these women remained in subordinate positions. Nevertheless, women showed a real interest and enthusiasm for the computer industry. This is clearly illustrated by the successful pioneer female start-ups in IT services which expanded employing only women but also paid decent wages.

8.4 Differences and Common Traits

Historical studies on women in IT in Europe are as yet rare or incomplete, and it is virtually impossible to establish a strict comparison of the situations of Finland, France and the United Kingdom. It is interesting nonetheless to examine the three countries during the period between 1960 and 1990 despite the fact that the data for each country focused on different aspects of the situation. In the first place, in all three cases, there was a strategic commitment to invest in the manufacturing of computers and the State played a role in this. On the other hand, the countries differed in terms of female/male equality. Finland had a pioneering role, the United

Kingdom was well known for women's movements and equal rights, while in France, women only gained access to certain educational institutions and economic independence in 1960.

Despite these differences, common traits can be identified concerning women in computing professions. First, we see that women took advantage of any opportunity that arose to enter the field: In Finland, young women applied in great numbers to study the new field of computerscience; in France, computer engineering became the most popular job choice among young female engineering graduates; in the United Kingdom, great numbers of young, unqualified women took up programming jobs in the civil service. We then see that the stereotype of women's presumed technical incompetence, which later became so pervasive, rarely came into play until the late 1980s. At the outset, technical incompetence was not identified with women in this relatively new field. One possible explanation is that the countries considered as pioneers in the field of computing, notably the United States and the United Kingdom, employed women to operate and code the early computers. This implies that women in these countries were familiar with and worked in proximity with computers. Nevertheless, it must be noted that as early as the 1950s, advertisers used images of women to convey the simplicity of using computers and thus to promote sales. Such advertising campaigns may have given rise to the idea that women working in the field of computer science were less skilled.[38] Moreover, we observe that in the early days of computer technology, certain structural barriers kept women out of the decision-making spheres and out of the highly visible positions in the field – for example, the all-male composition of the founding bodies of Finnish computing, i.e. the army, IBM, etc., and the gendered practices such as the old boys' club mentality; in France, women being prevented from accessing both the 'engineering corps' and entrepreneurship; and in the United Kingdom, the barriers to women's career advancement both in the public sector and in the computer construction industry. The study of these three countries at a moment when computing was introduced into the public and private sectors and became a major tool for management and strategic decisions shows how software activities were socially constructed as masculine. Lastly, we note a turning point at the end of the 1980s. Although the number of women studying computer science or working in computing continued to increase, the trend was beginning to reverse: The percentage of women declined slowly as large numbers of men hastened to join a promising sector that provided well-paid employment. And when the computer manufacturing industry entered a crisis, women's withdrawal from the field continued, as they were nowhere firmly established in decision-making spheres or positions of power and responsibility. This appears to have particularly affected female computer scientists in France. Many of them chose to move into non-technical professions. And in the United Kingdom, the civil service recruitment and career advancement policies favoured men, thereby pushing women out of computing in the public sector.

[38] Hicks 2010.

The over-representation of men in computerscience in the 1990s has also been documented in the United States[39] and elsewhere in Europe, notably in Germany.[40] Starting in the mid-1980s and increasingly throughout the following decade, technological innovations and social practices around computers raised new and additional issues. The diffusion of home computers contributed to creating new gendered spheres and practices in households.[41] The hacker phenomenon, recognised as an emerging culture,[42] and the communities which emerged from the free software movement led by Richard Stallman in the United States in 1985 followed by Linus Torvalds in Finland in 1991 contributed to a widespread representation of computing as a male activity.[43] As computers and computing moved beyond the professional sphere, computer technology emerged as a masculine culture.[44] Nevertheless, our study shows that women had already begun to leave computing before the advent of microcomputers and network technology. Thus, women in IT should be studied within the broader context of the long-term evolution of computing technology, industry and communities.

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