“We just did it!” – Female employees in Swedish sigint during the Second World War

Fredrik Wallin
FRA
Box 301, 161 21 Bromma, Sweden
fredrik.wallin@fra.se

Abstract

When the Swedish sigint agency, FRA, was formed in 1942, the civilian personnel consisted of 67 percent women. This paper explores the roles and duties performed by women at the FRA during the wartime years and their working conditions.

1 Credits

This paper is based on documents in the FRA archives. Most of the material used is official documents, but parts consist of material collected by personnel at the FRA interested in preserving the history of the agency, including taped interviews with wartime employees. I want to mention in particular Bengt Beckman, author of the book ‘Codebreakers’[1] , and Sven Wäsström[2], who helped collect and preserve the “softer” parts of the history of the agency in the archives.

2 Introduction

The Swedish Defence Radio Establishment, Försvarets Radioanstalt, abbreviated FRA in Swedish, is the Swedish government agency for Signals intelligence. The FRA was created in 1942 from the parts of the Swedish Armed Forces High Command performing signals intelligence, mainly the Crypto Department.

Sweden had started modest preparations for signals intelligence already in the 1930s, by various exercises and training of suitable conscripts as cryptanalysts. In 1939 there were about a dozen people employed with these duties at the Crypto Department. They were all officers, and one woman, a secretary named Eva Löfvenmark who was the first civilian employee of the future FRA.[3]

Sweden was not an active participant in the Second World War, but the outbreak of war naturally led to a ramping up of intelligence activities. There was a very rapid growth of the organisation from about a dozen people in 1939 to almost 400 persons in 1942, when the FRA was created as a separate agency.

When the FRA was formed as a separate government agency on 1 July 1942, the agency had 287 civilian employees, of which 193 were women and 94 men[4], which gives a percentage of 67 percent women. In addition, there were 113 military personnel seconded to the FRA, so all in all the agency consisted of 400 persons at the time it was created. Why so many women? Many men were called up for military service, or were expected to be so, which led to an ambition to use women in those defence related duties where it was possible.

Another reason for the prevalence of women was that much of the work at the agency consisted of various kinds of entering data or typing up reports, or doing routine statistical or mathematical compilations[5]. Those were duties that were traditionally performed by women in the office workplaces of the 1930s.

[1] Bengt Beckman: “Codebreakers: Arne Beurling and the Swedish Crypto Program During World War II.”

[2] Sven Wäsström was a former head of the analysis section at FRA

[3] FRA. Löfvenmark.

[4] FRA. List of FRA personnel 1942.

[5] FRA. Descriptions of duties performed in certificates of employment for female personnel.

Fig. 1: Personnel outside an FRA site, c. 1942. The large proportion of women is apparent.

The large number of women in a Sigint agency was far from unique for Sweden. When one looks at the sigint organizations in other nations during the war, one can see that in Britain, the USA and Germany there was also a substantial number of women working in the sigint services, presumably for the same reasons.

3 Duties performed by women

Women at the FRA were mostly found in the lower paid grades with titles like office assistant, typist and similar[6]. Some middle positions at the agency had both men and women in the same grades, and the higher grades at the agency were dominated by men. This condition was of course very similar to the situation in the working life in general in those times.

The personnel at FRA were divided into working groups of varying size depending on the type of duties. Most often groups consisted of between three and ten people. It was common for employees to be moved between different groups, partly because of the changing demands for workers, but also as a conscious policy to try out employees in different kinds of work[7].

The most common type of work performed by women concerned various kinds of typing. This could be of reports, compilations or connected to codebreaking[8].

In some cases, women were trained by the agency to perform work normally typically performed by men. For example, in 1943 a number of women were trained to be telegraphists, a traditionally male occupation[9]. There was also a drive to use women as operators in interception of teleprinter traffic and automatic Morse.

Below are more detailed descriptions of some of the duties performed by women in the wartime FRA.

3.1 German Geheimschreiber traffic

In the spring of 1940, Germany asked Sweden to use telegraph lines through Sweden for traffic to occupied Norway. Permission was given by the Swedish authorities, but the traffic was intercepted. Expecting this, the Germans encrypted their traffic with the Siemens & Halske T52, the so called Geheimschreiber.

The Swedish armed forces crypto department started analysis of the code, and relatively quickly the code was broken in principle through work led by Professor Arne Beurling, one of the conscripts trained in the 1930s. However, even if the workings of the code is known, it is a very painstaking and slow process to decode a machine cipher by hand. After the daily key was broken, the practical decryption work was initially done by young women by hand. It took three weeks for seven “girls” to decrypt the traffic from one day. This was obviously too slow for the material to be of use as an intelligence source.

In cooperation with an engineer from the LM Ericson company, a machine was developed to decrypt the traffic. This decryption machine was called “App” at the time, an abbreviation of “Apparatus”. The apps were manufactured in great secrecy by the Swedish Cash Registry Company, a subsidiary of LM Ericsson[10].

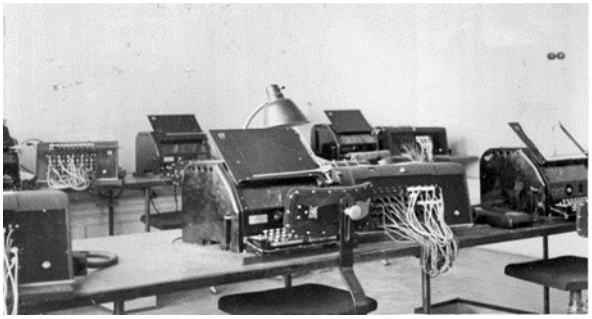

Fig. 2: Apps and teleprinters. Each station would be operated by a young woman typing in the encoded text.

[6] FRA. Lists of FRA personnel 1942 and 1945.
[7] FRA-order.
[8] FRA. Work description.
[9] FRA. List of FRA personnel 1945
[10] FRA. Receipt for the manufacture of equipment.

The machines were not fully automatic. The key had to be set, and then the encrypted text was entered on a teleprinter connected to the app. The codetext was entered on the keyboard of the teleprinter and the signals passed through the app, where they were decoded, and back to the teleprinter, where the plaintext was written out on a tape. This typing of the encrypted traffic was done by women, and it was not simple work restricted to just the typing. The app had to be continually monitored to make sure it did not go out of sync, in which case it produced only gibberish.

The whole workflow included interception and pasting teleprinter tapes with encoded text on papers, then breaking the daily key, done by male mathematicians[11]. Then typing it into the apps for decryption, pasting the resulting plaintext on papers, cleaning up the language and lastly typing out the end reports. In total 175 persons were employed with the process, the majority of them women. The work was continuous around the clock, and was in shifts. In total, more than 100.000 messages were decoded, printed out and delivered to recipients during the war.

3.2 Interception of voice radio traffic

Interception of voice radio was a relatively new field for Swedish sigint during WW2. Telegraphy was established since a long time, and Morse interception was a typically male area of work. In contrast, voice interception was seen as typical female work, to the extent that the job description “voice interceptress” was commonly used in writing. A document recommends the use of “female personnel with good language skills”.

In a study from 1943 outlining the organisation of a voice intercept detachment tasked with intercepting German Luftwaffe traffic, 20 female interceptresses were needed, working five shifts for around the clock coverage, with four being on duty at any given time. They were supervised by a male telegraphist. The men worked in four shifts, while the women worked in five shifts, it being assumed that women were less resistant to the rigors of shift work.

[11] FRA. Borelius.

3.3 Teleprinter and automatic morse interception

Interception of radio teleprinter traffic and automatic Morse traffic was another field that was developed during the war. Initially, the interception was performed by male conscript students. The output was enormous amounts of tapes, either with text or printed Morse code. These tapes had to be typed out, and this work was performed by women. To make the work efficient, a machine called a puller was used that propelled the tape across the top of a typewriter. The speed of the puller was regulated by a foot pedal. This was very monotonous work.

Fig. 3: Typist with rolls of tapes awaiting typing, c. 1942.

A problem with the interception was that once the conscript interceptors had been fully trained, there wasn’t much time left of their callup period, which led to a repeated needs to train new interception personnel. To alleviate this, trials were made with training female personnel as interceptors. Normally anything technical was performed by men, so this was a marked innovation for the time. The trials were a great success, and number of female operators were trained, completing an examination at the end of the course[12].

This activity was expanded, and in 1943 it was described as consisting of 20 female assistants with a male engineer as head of department. As in the example with voice interception, the women were organised in five shifts of four women each. A perhaps even more radical innovation was that one of the four women in each shift was shift manager; in other words, the

[12] FRA. PM on the use of women in automatic morse.

women were expected to be able to lead themselves, with no male involvement A problem with the interception was that once the conscript interceptors had been fully trained, there wasn't much time left of their callup period, which led to a repeated needs to train new interception personnel. To alleviate this, trials were made with training female personnel as interceptors. Normally anything technical was performed by men, so this was a marked innovation for the time. The trials were a great success, and number of female operators were trained, completing an examination at the end of the course .

This activity was expanded, and in 1943 it was described as consisting of 20 female assistants with a male engineer as head of department. As in the example with voice interception, the women were organised in five shifts of four women each. A perhaps even more radical innovation was that one of the four women in each shift was shift manager; in other words, the women were expected to be able to lead themselves, with no male involvement.

3.4 Codebreaking assistant

Code breaking was performed in a number of different areas. Diplomatic and military codes were broken to a smaller or greater extent from a number of countries. The actual mathematical analysis in breaking the code was in almost all cases done by men, usually with an academic degree. However, as we have seen in the case with the Geheimschreiber, even if the workings of the code is figured out, the daily decryption of encoded messages is very labour intensive. Most of the routine decryption work was done by female codebreaking assistants. The work often involved writing up the encrypted text on large sheets of paper mounted on artist's worktables. This led to one of the rooms where this work was performed being called "the gallery".

Fig. 4: The "Gallery".

One area where it was popular to work was the French code department, led by the Franco-Swedish cryptologist Yves Gyldén. He had many French mannerisms, and when a new code was broken he served champagne to the entire group, with glasses being specially acquired for the purpose[13].

A not so well known field of decryption was weather reporting. During the war, the belligerent nations encrypted their weather observations, to prevent the enemy from using the information. This led to problems with accurate weather forecasting in Sweden, which hampered the activities of the Swedish Air Force.

To alleviate this, the FRA started a cooperative project with the Swedish Meteorological Bureau to decrypt and use foreign weather observations[14]. German and Soviet weather observations were regularly broken and read, but the encryption of British weather observations proved too difficult to crack. The bulk of the routine work was done by female codebreaking assistants, supervised by male mathematicians. The activity took place at the offices of the Swedish Meteorological Bureau.

Fig. 5: Female codebreaking assistants at the FRA office at the Swedish Meteorological Bureau in 1945.

4 Background and education

Most of the women hired by the FRA during the war years were very young. A majority were in their early 20s, and some were as young as 16 years. In 1945 the average age for female employees of the FRA was 24 years[15]. For men it was 30 years. As a comparison, the average age for employees at the FRA today is 47 for women and 46 for men.

[13] FRA. Löfvenmark.
[14] FRA. PM H 153/44.
[15] FRA. List of FRA personnel 1945.

Most of the women employed by the FRA were unmarried, and indeed one reason for the low ages of the female employees is that at that time women worked until they married, and after that they normally quit working life.

The skills wanted in female applicants were mainly typing and language skills. The main languages sought were German, English, French and Russian. Knowledge of Russian was relatively uncommon in Sweden, so applicants with knowledge in Russian were highly sought after. German was the most common second language in Sweden in the 1940s, with English and French also being fairly common.

The majority of women working at FRA had some kind of secondary school education. In 1945 about 10% of both men and women in Sweden completed an examination from secondary school. Thus, the women working at FRA had a considerably higher level of education than both women and men in general. The proportion of employees with a secondary school degree was actually higher among women than among men at the FRA at that time. Many of the men, being telegraphists, had only primary school and some kind of military or civilian telegraphist training[16].

If we look at university level education, 12 women at FRA in 1942 had some level of degree from university, compared to 21 men. An interesting observation is that the proportion of women among all employees with university education at FRA was more than 30%, while in general only 20% of university students in Sweden at the time were women[17].

So, in general, the women working at FRA were much better educated than women in general at the time, and indeed better educated than the general male population.

5 How women were recruited

As mentioned, the FRA was formed out of the sections at the Armed Forces High Command that were employed with signals intelligence and codebreaking, and took over the existing personnel that were employed there. Under the High Command there was policy to recruit daughters and other relatives of officers or existing personnel to female sigint positions, as it was considered an advantage from a security standpoint[18]. As an aside, this led to rather large proportion of female employees having names from the nobility, as it was not uncommon for higher officers to be of noble families.

Some of the women came from the Women's Voluntary Defence Organization[19], others came as a result of a course in cryptography for female students organized by the Armed Forces High Command at the University of Uppsala in 1938.

These sources of personnel were not sufficient with the rapid expansion during the early years of the war, and the agency also resorted to advertisements. At that time, advertisements for jobs were divided into male and female in the newspapers. Accordingly, the FRA had adverts for female typists. As both the existence and the activities of the agency were secret in those days, the advertisements did not give the name of the eventual employer. Instead there was just an anonymous signature like "Personnel manager" or "Work for typists". This might seem strange today, but in fact this was a rather common practice in Swedish newspaper ads of the 1940s.

Lastly, the FRA also cooperated with the Public Employment Service, who recommended suitable female work applicants to the agency [20].

Applicants to the FRA were not taken to the offices of the agency for interviews. Instead, offices were borrowed at other places, for example at one of the larger Swedish insurance companies of the time, Skandia-Freja. Applicants were interviewed and tested at these offices, and only when they had been accepted were they told who their real employer would be [21].

Tests for female employees in almost all cases included a typing test. In many cases that was all, but in 1942, the agency developed a number of "Psychotechnical tests", in practice IQ tests with a strong tendency towards aspects of codebreaking [22]. These were used for applicants, but also to find suitable talents in codebreaking

[16] Ibid.
[17] Swedish Higher Education Agency.
[18] FRA. Krybo order June 5 1941.
[19] FRA. Certificate of employment Nr 140/1943 and FRA. Krybo-order June 23 1941.
[20] FRA. Personnel file Bojan Frykholm.
[21] FRA. Interview with Maj-Britt Skoglund.
[22] FRA. Psychotechnical tests.

among the already employed personnel [23]. As a result, some already employed women who scored well were given courses in cryptanalysis.

6 Working conditions and health issues

Apart from pay grades, there were also in the 1940s several different subgroups of government employment, with the main difference being job security, pensions and sickness benefits. A majority of the personnel at FRA were employed as "extras", which meant a minimum of benefits and not much job security.

In 1936 a common pay grade scale was introduced for both men and women in Swedish government service. In practice, women tended to cluster in the lower pay grades. However, the pay was fixed for each grade, so if a man and a woman had the same position, they were paid exactly the same.

Working hours were 40 hours per week if working shift and 42 hours a week if working regular office hours. However, from June to September, work hours per week were reduced to 34.5 hours per week, at that time called "summertime". This reduced the average hours per week over the year to something close to modern hours worked. Overtime work appears to have been common.

Women working shifts had a working time of 35 hours per week, this being explained in a period document as "shift work has proven to have an adverse effect on the psyche, with female personnel being less resistant than men to the pressures of working shifts".

Some duties entailed working until 22.00 in the evening, then sleeping at the workplace and starting again at 06.00 the next morning. In those cases, 25% of the sleeping time was counted as time worked.

The new site for FRA at Lovön was completed in 1943. As there was need for some personnel to sleep at the workplace, there were barracks arrangements for both male and female personnel. Human nature being what it is, there were strict rules against male personnel being in sleeping areas reserved for women and vice versa.

[23] FRA-order, March 27 1942.

Being absent due to illness was common, with around 10% of the total personnel being ill at any one time not being uncommon [24]. Women had four times as many days absent from illness as men, counted per employee.

The high level of absenteeism among the female employees was noted by management, and several investigations were conducted in the causes. It was concluded that the number of workdays lost from sick leave were considerably more in the lower pay grades, while women in higher positions had only slightly more illness days than men in the same grade.

The phenomenon of high female rates of absenteeism was by no means unique to the FRA. A government study from 1953 came to the conclusion that if men and women with the same work duties were compared, sick leave for the women were invariably much higher[25]. The numbers for the women were highly influenced by the fact that married women were far more likely to be absent than unmarried women. The report concluded that this had to do with "responsibility for home and care for the children".

As a comparison, sick leave today at the FRA is much lower than in the 1940s, both for men and women, but still slightly higher for women than for men [26].

Accidents and mishaps occurred from time to time. In the 1940s as today, government employees having an accident while on their way to work could report that as a workplace accident.

Accidents befalling women at the FRA during this time included[27]:

- Falling in a stair while leading a bicycle on the way to work.
- Fainting during work in the kitchen and knocking the chin on an open cupboard door and the head in the floor.
- Slipping on a newly polished floor and hurting the knee so that "swelling

[24] FRA-order.
[25] SOU 1953:18.
[26] FRA annual accounts 2019.
[27] FRA, Reports of accidents at the workplace.

appeared and absolute stillness had to be maintained”

- On one occasion the bus to the FRA collided with a truck and a woman working in the kitchen was hurt so badly that her leg had to be amputated.

7 Retention issues

During the first years of the Second World War, Swedish sigint underwent a very rapid expansion, from a dozen persons to around 400, but quick expansion has its drawbacks. All were not content at their new place of work. We have already discussed the relatively high levels of sickness absence. Another issue probably related to the quick expansion was rapid turnover of personnel. During 1943 over 50 percent of the women working at FRA quit their jobs and had to be replaced. Among the men, the corresponding ratio was 33 percent[28]. This was of course a far from an ideal situation for a secret organization and studies were made to find the causes of the problem.

Among the women, one obvious cause was marriage. The women working at FRA were mostly in their early twenties, and thus very much of marriageable age. As mentioned before, at the time it was common for women who married to quit working, if not immediately, at least when children arrived. In 1943 21 women working at the agency got married[29]. Compared to the total of 98 women ending their employment at the FRA, that is only a fifth, but it still accounts for a large part of the difference between women and men leaving the agency.

Other causes found were that the work, while perceived as adequately paid, was considered repetitive and boring. Prospects for advancement were not good, and as the activities at the agency were expected to be cut down after the war, many employment contracts were of the less permanent type with lower levels of benefits for the employee. Many were not happy to work shifts.

These problems were not unique for the FRA. In 1944, a government enquiry was initiated to find solutions to the problem of high turnover of female personnel among government employees.

Fig. 6: Women working in the archive at the main FRA site in 1943.

Recommendations from the study included better conditions of employment with more job security, and clearer regulation of the possibilities of promotion[30].

Another cause for the great turnover in 1943 and 1944 was that the agency moved to the new site at Lovön outside Stockholm. The previous offices were to a large extent more centrally located in Stockholm. Lovön was felt to be very far away in those days.

This was alleviated by instituting chartered buses that ran from convenient spots in the centre of Stockholm directly to the agency at Lovön[31]. However, these buses were often full, and many had standing room only. A system of reserved seats was instituted, were personnel senior in age had their own seats. Interestingly, women became seniors at the age of 30, while men had to wait until they turned 40 for the coveted reserved seat[32].

All in all, these measures seem to have reined in the rapid turnover of personnel. In the post-war year 1953, turnover of personnel was down to 10%. As a comparison, today the turnover at FRA is 9.3% for women and 7.4% for men[33]. It should also be mentioned that a substantial part of the women hired during the war liked their work at the FRA, and continued their employment until they retired.

[28] Numbers compiled from FRA-order.
[29] Ibid.
[30] SOU 1946:66.
[31] FRA. Missive to the government re buses.
[32] FRA Tjänstemeddelande June 14 1944.
[33] FRA annual accounts 2019.

8 Women as managers

During the time in question the FRA was organizationally divided into three departments or bureaus, the Signals bureau, the Analysis Bureau and the administrative bureau. The departments in turn consisted of sections, and each section contained a number of working groups. As mentioned, a working group normally consisted of three to ten persons working on a clearly defined subject or target, for example Soviet Baltic Navy ciphers or German Air Force voice traffic. The total number of groups varied, but were usually around 30 to 40.

There were women serving as managers of working groups, but there are no records of women managing sections or departments. In total, the records mention at least nine female managers of working groups at various times [34]. Groups with a female manager could contain male employees or conscripts.

There appears to have been no bias against female managers at the working group level, though it must be admitted that is doubtful if such sentiments at the time would have been recorded for posterity in the archival material. It seems that group managers were selected on ability and previous education level, which is confirmed by the fact that most of the female group managers were among the women with highest education levels.

9 Examples of women working at the wartime FRA and their careers

5.1 Marina Löfström

Marina Löfström was born in 1906 and was daughter of the Finnish general Ernst Löfström, of Finland-Swedish descent. At the time of her birth, Finland was part of Czarist Russia, and General Löfström served in the Czarist army. His wife was from the Russian nobility and Marina was born in Saint Petersburg, where the family lived until the Russian revolution, after which they moved to Finland.

Marina knew a number of languages: Russian, Swedish, Finnish, French, German, English and Italian. She gave Russian as her mother tongue, and knowledge in the other languages as very good. She had an education in business correspondence in Helsinki[35].

When the Winter War broke out in 1939, Marina, her sister and mother rapidly fled to Sweden (the general had died in 1937). We do not know the background to this, but it is fair to guess that the family, having lived through the Russian revolution, feared a communist takeover of Finland.

Marina and her sister were more or less immediately hired by the crypto department of the Swedish Armed forces high command. This is remarkable, as there were strict rules for employees against socializing with foreigners, and here we see two foreign citizens going straight into the most secret part of the Swedish defence efforts. We can only assume that General Löfström had good connections with his Swedish colleagues, and that the sisters excellent command of Russian was of great interest to the agency.

Marina, who was described as the more gifted of the sisters, initially worked with Soviet ciphers. In July 1941 she was head of a working group at the Rabo site[36]. From June 1943 she was head of group 53g, working with Soviet Naval encrypted telegrams[37]. From November 1944 she became head of group 55f, which worked on Soviet diplomatic ciphers. The group consisted of three male employees and one conscript. In May 1945, Marina is listed as “independent cryptanalyst”, where she is the sole woman [38].

Marina and her sister worked at the FRA until their retirement. Colleagues described the sisters as always having something Russian about their dress and style. Even after many years in Sweden, they still spoke Swedish with a slight Russian accent.

5.2 Bojan Frykholm

Bojan Frykholm was born in 1920. Her education was “realexamen”, which was the lower grade of Swedish secondary education at the time. She had several shorter office employments around 1940, among them at Åhlen & Holm, a Swedish department store chain today

[34] FRA-order.

[35] FRA. Personnel file for Marina Löfström.
[36] FRA. Rabo-order July 22 1941.
[37] FRA-order.
[38] FRA. List of FRA personnel 1945.

known as Åhlens. In January 1942, she was laid off from work as a typist at the Government Industrial Commission. She was referred to the FRA by the employment office, applied for a post in February and was hired as a typist. She initially worked with typing out German Geheimschreiber traffic. The fact that she did not pass her school exam in German was apparently not a problem [39].

From January 1943 she worked at group 53f, decoding Russian Naval telegrams [40]. In 1945 she is listed as codebreaking assistant. She apparently had a natural talent at solving ciphers. Her colleagues say that she had an incredible ability to solve complex transposition ciphers, and reputedly could solve double transposition ciphers by just taking a glance at the codetext [41]. Later in the 1960s she worked on encoded traffic relating to the Biafran war.

Bojan Frykholm is an example of a woman that started at the FRA more or less by accident, but once there her natural talents were recognized, and she was given the opportunity to develop them. She continued to work at the FRA until her retirement, and finished her career as a respected specialist in her field.

5.3 Eva Löfvenmark

Eva Löfvenmark was trained as a typist at the Bar Lock institute in Stockholm, a well-known school for secretaries in Stockholm at the time. She finished the course in 1937[42], and by the Bar Lock employment service she was referred to the Armed forces High command, who were looking for a secretary. She was hired, and ended up at the crypto department. At the time, it consisted of her and five officers. She was initially employed with typing up various reports and examples used in cryptologic training exercises. She took part in preparations for a number of exercises, and typed out results and conclusions. The employees were encouraged to bring any relatives or acquaintances who were interested in cryptology.

Early in the war, she worked in the group decoding French telegrams. She could well remember champagne being served on the successful breaking of a new French code. Later she worked on Soviet Naval ciphers and typing and pasting German Geheimschreiber traffic. In 1945 she worked on decoding weather observations at the Government Meteorological Office. This description of working in several different groups is fairly typical, and a good example of how employees were shifted around between various tasks.

Eva Löfvenmark describes her time at the wartime FRA as a "wonderful time". In an interview in 1976, she said "This fantastic feeling of taking part, of doing something useful. We didn't care that we had to work overtime, we didn't think about that. When something needed to be done, we just did it!"[43]

10 Women at the FRA, then and now

When the FRA was created, 67% of the employees were women. Since then the proportion of women in the agency has declined steadily. Already in 1945, the proportion of women was 52%[44], and in 1949 it was down to 33%. Today the FRA has 25% female employees.

What is behind this decline? Doubtless there are several factors. During the war years, there was a tendency to use women in headquarters and staff duties in the military to free up men for frontline duty. After the war, when defence was no longer a self-evident duty for everyone, there was a reversal to more traditional roles.

Signals intelligence is a highly technical activity, today as in the 1940s. However, the part played by technology has increased more and more since the 1940s, and focused on the use of computers. Computer technology tends to be a male area, and the increased use of computers has contributed to an increase in the proportion of men at the FRA.

The technology of the 1940s demanded much manual work in the form of typing, routine decryption, compilations, statistics and other supporting jobs, that were at that time typically performed by women. The increased use of computers has automated many of these jobs and made them redundant.

[39] FRA. Personnel file, Bojan Frykholm.
[40] FRA-order.
[41] Wik.
[42] FRA. Personnel file Eva Löfvenmark.
[43] FRA. Löfenmark
[44] FRA. List of FRA personnel 1945

Fig. 7: Female typists at an FRA site during the war.

If we look at differences in pay, in the 1940s women were predominantly found in the lower pay grades at the FRA, even though there were exceptions. However, pay was fixed in the pay grade, and if a man and a woman had the same job, they had the same salary.

Today, wages are individually set depending on performance at work. However, when men and women are performing the same duties, men typically have higher salaries. Differences in salary between women and men remain, but the mechanisms are different.

References

Borelius, Carl Gösta c 1980, *CGB*. Memories of a mathematician who worked with the Gehemschreiber traffic. FRA archives.

FRA. *FRA-order*, FRA weekly administrative regulations 1942 - 1943. FRA archives, vol BII:1.

FRA. *Rabo-order*, weekly administrative regulations for the Rabo site, 1940-1943. FRA archives, vol B III:1.

FRA. *Krybo-order*, weekly administrative regulations for the Krybo site, 1940-1943. FRA archives vol B III:1.

FRA. *Tjänstemeddelanden* 1944-1945 (replaces FRA-order as weekly administrative regulations from 1944). FRA archives, vol BII:2.

FRA. *List of FRA personnel 1942*. Attachment to, FRA-order July 27 1942, FRA archives, vol BII:1.

FRA. *List of FRA personnel 1945.* FRA archives

FRA. 1992. *FRA 50 year anniversary memorial publication.* Interview with Maj-Britt Skoglund. FRA archives.

FRA. *PM H 153/44 Interception and decryption of foreign weather telegrams.* FRA archives.

FRA: *Receipt for the manufacture of equipment by the Swedish Cash Register Company 1943*. FRA archives.

FRA. 1942. *Psychotechnical tests I-IV*. FRA archives.

FRA. *Certificates of employment.* Outgoing correspondence 1942-1945, FRA archives.

FRA. *PM on the use of women as automatic Morse operators 1943*. FRA archives.

FRA. *Work description for personnel at FRA sites on Lidingö, 1942*. FRA archives.

FRA. *Missive to the government requesting financing of buses to FRA site, Nr 72/43*. FRA archives.

FRA. *Personnel file Marina Löfström*. FRA archives.

FRA. *Personnel file Eva Löfvenmark*, FRA archives.

FRA. *Personnel file Bojan Frykholm*, FRA archives.

FRA. *FRA annual accounts 2019*.

FRA. *Reports of accidents at the workplace.* FRA archives.

Högskoleverket (Swedish Higher Education Agency): *Study of higher education and research 1945-2005*, Högskoleverket, ISSN 1400-948X

Löfvenmark, Eva. 1976. Taped interview made by Bengt Beckman. FRA archives

Swedish government. *SOU 1946:66. Study of working conditions for government employees.* Official reports of the Swedish government.

Swedish government. *SOU 1953:18. Study of equal pay for women and men in government service.* Official reports of the Swedish government.

Wik, Anders. Former head of FRA crypto department, interviewed by the author.