



MUTATIONNELLES 09

*Focus on women engineers
and scientists in France*

Mutationnelles 09

Focus on women engineers and scientists in France (synthesis)

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This survey has been developed for the group France Télécom Orange with **exclusive data from the 20th annual survey on the CNISF** (National Council of Scientists and Engineers in France), analysis of Eurostat figures and group internal data.

This synthesis is downloadable on : <http://www.orange.com/mutationnelles09/>

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Foreword: And if it were true...

And if were true that soon, at the very time when the crisis is highlighting the importance of the new technologies to build new models of growth, when it is becoming vital to recruit more and recruit better in order to face this challenge, there will be a lack of resources... a shortfall, a breakdown...

As Britta Thomsen MEP, author of a report on the role of women in science,¹ points out: “Europe needs to recruit 700,000 more researchers in the coming years. That being so, can we really do without half our brains? If we do not take action to face up to global competition, we shall run into human resource problems.”

A decade ago, the European authorities were already warning governments and business leaders of the need to act and to mobilise women to “enrich European research”.² But how can we know what situation we are in without clear and precise figures? How can public and private decision-makers set targets and priorities without reliable references? How can one assess the impact of a policy without measuring tools?

The importance of access to simple and precise indicators is therefore increased. With Eurostat,³ Europe has already developed general tools for information on human resources in science and technology, especially as regards training and levels of employment. This data has enabled various Directorates General to develop reports, in particular the Directorate General for Research, with “She Figures”.⁴ But there is a continuing shortage of information on changes in company staffing, as underlined by the resolution adopted by the European Parliament in January 2008, which regrets the lack of “gender-differentiated statistics on the division of labour in the various occupational categories and the corresponding wage levels in industrial sectors”.⁵

The present report on women engineers and scientists in France has been compiled precisely to present a clearer picture of the actual situation. At the level of Europe, and indeed the OECD as a whole, this report is groundbreaking, since it is one of the first to provide detailed factual information on women engineers and scientists in industry.

Some simple indicators have therefore been developed and presented to give answers to some key questions:

¹ Source: "Women and Sciences", Research EU, April 2009.

² Source: Communication from the Commission of 17 February 1999

³ Eurostat: The statistical office of the European Communities.

⁴ “She Figures” is a report published every three years by the DG for Research, reviewing the position of women in Science and technology, as regards training and numbers working in the public sector.

⁵ Source: European Parliament resolution of 17 January 2008 on the role of women in industry (2007/2197(INI)).

- **Who are they?** How many women engineers are there in France? What are their main sociodemographic characteristics?
- **Where do they come from?** How do they access engineering schools? What specialisations do they predominantly choose?
- **What do they do?** What types of jobs do they do? How much responsibility do they exercise?
- **Which sectors do they work in?** How are they positioned on the labour market and in staff recruitments in 2008?
- **What are the springs of motivation and factors of attractiveness?**
- **What role do they have in the process of innovation?**
- **What are their levels of remuneration?**

One of the decisive impacts of the current crisis is that it urges us to envisage growth differently, thus revealing the renewed importance of interaction between the public and private spheres. The recent months have shown that the public and private sectors are linked by the need to develop together a new model of growth that guarantees respect for economic and social “values”. The approach implemented in this study is concerned to leverage this complementarity by drawing on private data sources, which increasingly complement existing public information. Several types of data are therefore integrated:

- Data from the **20th CNISF⁶ survey**. This survey, whose data have been further exploited for the present report, is to date the only one in Europe that makes it possible to conduct a detailed analysis by gender of the situation of engineers in industry. It is based on analysis of the responses provided in early 2009 by 8,235 women engineers (out of a total of 42,000 questionnaires completed by men and women engineers).
- Analysis of the **Eurostat databases**, which are more general in nature and make it possible to set the problem of women engineers in a wider context, that of women in science and research. Use of the Eurostat data also enables one to compare France with the European (EU-27) average.

This report seeks to provide a better understanding, backed by figures, of the issues surrounding the role of women in sciences and technology. It will achieve its goal if it helps to raise awareness and support decision-making so as mobilise men and women to participate equally in sustainable future developments.

⁶ Conseil National des Ingénieurs and Scientifiques de France (National Council of Engineers and Scientists in France)

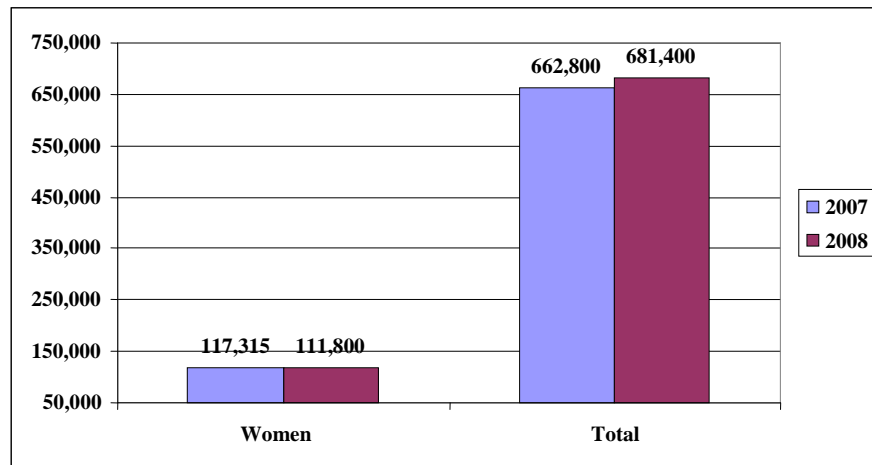
1 – Who are they?

Sociodemographic characteristics of women engineers in 2008

The proportion of certified women engineers is 17.4%

In 2008, out of an estimated total of 681,400 certified engineers in France, 118,800 were women. In one year the number of women engineers grew half as fast as the total number (1.2% as against 2.8%).

Change in numbers of certified engineers in France



This is not a specifically French problem. In many developed countries there has been stagnation and sometimes even a drop in the training of human resources.

In the USA, for example, the total number of students who completed engineering training (Master's level) fell by 8.8% between 2005 and 2007.⁷

The Eurostat data confirms this analysis, both Europe-wide and in France. While the overall number has grown, the number of women qualified as engineers has not increased⁸ since 2003 and as a proportion of all engineers lies in the range of 15% to 16% for the Europe of 27. In France, according to these estimates, the proportion of women was 15% in 2007.

⁷ Michael T. Gibbons, "Engineering by the numbers", American Society for Engineering Education

⁸ It should be noted that the reference population is different from that identified by the CNISF. Eurostat includes in its numbers graduates who have followed an EF5 course – "Engineering, manufacturing, construction".

Comparison France/EU 27 Proportion of women with engineering training

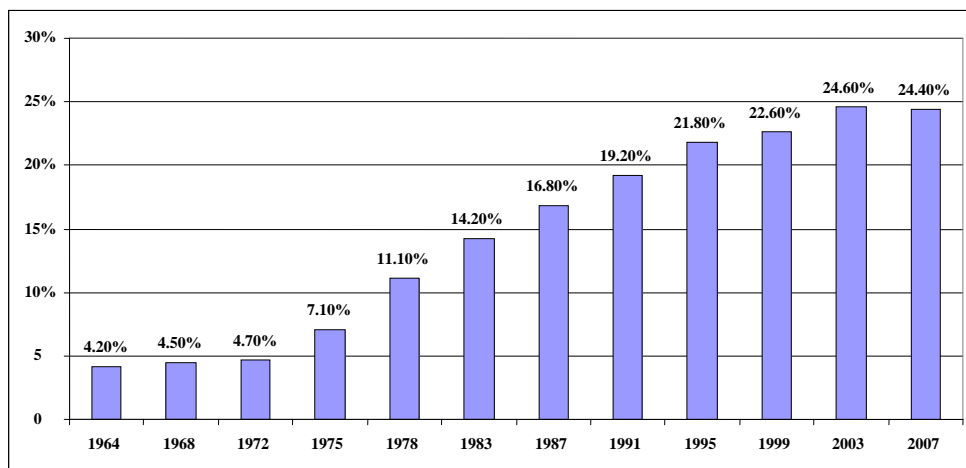
Year	2007A
<i>estimated numbers</i>	
<i>in 000s</i>	
EU-27	1,794
FR	200
<i>as % of total</i>	
% of women – EU-27	16%
% of women – FR	15%

Source Eurostat – Category HRSTE/age 25 to 64.

A cause for concern: the proportion of women trained in engineering schools has not increased in the last five years

It is remarkable that the proportion of women trained in engineering schools ceased to grow in 2003, with a negative impact on the relative proportion of women engineers. Having previously reached the region of 20 - 25%, then ceasing to grow five years ago, a slight fall in the proportion of women engineers is observed between 2007 and 2008.

Trend in the proportion of women graduating from engineering schools in France since 1964⁹



The trend is again consistent with that observed in other developed countries, both in the United States and in Europe. In the USA the proportion of women obtaining a Bachelor's degree (the prerequisite for a Master's) in engineering has fallen significantly, from 20.4% in 2003 to 18.1% in 2007.

The Eurostat data indicates a trend similar to that of the CNISF figures for France, with a one percentage point drop in the numbers graduating between 2005 and 2007.

By contrast, the trend is slightly positive at the level of the Europe of 27, which reflects the integration of countries in which the proportion of

⁹ Source: Catherine Marry and CEFI. For 1995 and 2003 the data relate only to initial training.

women with such training is significantly higher (e.g. Lithuania, Estonia). A trend similar to that observed in France is found in most developed countries (Germany, the UK, Spain, Italy).

Comparison France/EU 27
Trend in the proportion of women trained as engineers

Year	2004A	2005A	2006A	2007A
<i>estimated numbers</i>				
<i>in 000s</i>				
EU-27	1,479	1,694	1,750	1,794
FR	169	193	197	200
<i>as % of total</i>				
% of women – EU-27	15%	16%	16%	16%
% of women – FR	15%	16%	16%	15%

The majority of developed countries are confronted with a growing disaffection of the younger generations for scientific and technical occupations. Various surveys among adolescents in recent years have come to the conclusion on this.

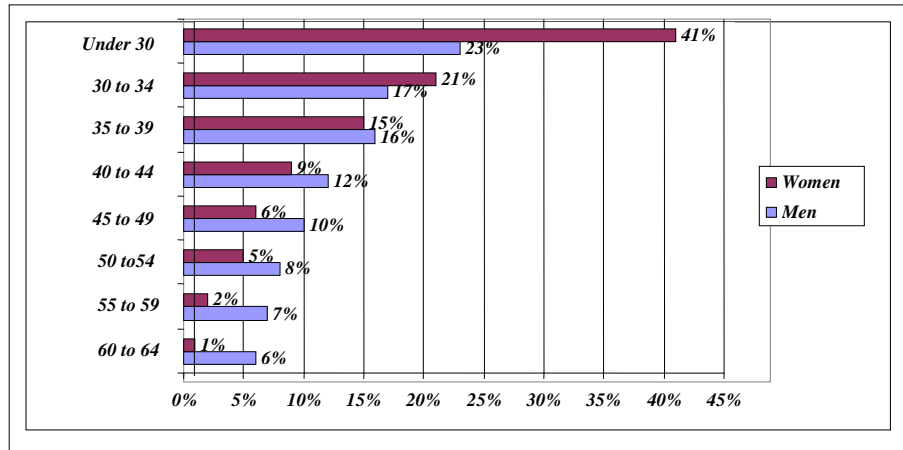
The general trend observed in the developed countries is more marked among young women than young men. This is confirmed by the European ROSE¹⁰ (Relevance Of Science Education) survey, which regularly analyses the interest and motivations of 15-year-olds towards scientific and technical occupations. In the majority of countries taking part in this survey, there is a gap of several points between boys and girls as regards interest and motivation towards scientific careers.

62% of women engineers are aged under 35

After twenty years of continuous growth in the number of women training as engineers, despite the current downturn one finds that 62% of women engineers are now aged under 35 (as against 40% of the men). As a direct consequence, the proportion of women among engineers under 30 is much greater than the overall proportion. 27% of all engineers under 30 are women

¹⁰ An international study by Camilla Schreiner and Svein Sjøberg

Comparative age pyramids for men and women



Men and women engineers have similar social origins

There are few differences in the occupations of the parents of women engineers and engineers as a whole. In both cases, one finds that more than 50% have a father who is or was a senior executive or equivalent; among the women there are more working mothers.

Breakdown of women engineers by parents' occupation

Occupation	Mother	Father
Head of company, 'liberal profession' ¹¹	4.39	13.29
Engineer	1.49	16.35
Other executive or equivalent	10.85	23.52
Intermediate occupation (technician, supervisor, etc.)	9.7	10.82
Clerical	19.86	7.31
Manual	1.59	4.54
Self-employed	2.4	3.75
Farmer	2.17	4.57
Teacher	15.56	8.33
Other (housewife, retired, non-working, etc.)	31.99	7.52

Partners and children

72% of women engineers are married

72% of women engineers are married, a similar percentage to that for among male engineers overall. Whereas the women significantly more often live with a partner in the youngest age groups (reflecting a younger age of marriage), they more often live alone from age 45.

Proportion of engineers living with a partner, by sex and age group

	Women	Men
Beginners	48%	42%
Others under 30	66%	58%
30 to 44	81%	84%
45 to 64	71%	90%
Average	72%	80%

¹¹ Doctor, lawyer, etc. (translator).

74% of women engineers have a spouse who is an engineer and/or executive

94% of their spouses work (the very slight deficits in the youngest and oldest age groups may correspond to continuing student status for the youngest and retirement for the oldest, since it is known that the spouses of the majority of women engineers are older than their wives).

Men and women engineers are, as in society as a whole, in dissimilar situations. For women, there is considerable homogeneity, with 55% having a spouse who is himself a certified engineer (and 18% for the men). The spouses of the women - 94% of whom work – are much more often engineers or executives (74% as against 45%) than the spouses of male engineers.

Breakdown of engineers by spouse's occupation

For women engineers	
Head of company, 'liberal profession'	6.4%
Engineer	55.1%
Other executive or equivalent	19.2%
Intermediate occupation (technician, supervisor, etc.)	6.7%
Clerical	3.9%
Manual	1.5%
Self-employed	2.2%
Farmer	1.3%
Teacher	3.0%
Other (retired, non-working, etc.)	0.9%
For male engineers	
Head of company, 'liberal profession'	5.6%
Engineer	17.7%
Other executive or equivalent	27.3%
Intermediate occupation (technician, supervisor, etc.)	9.3%
Clerical	18.6%
Manual	0.3%
Self-employed	3.9%
Farmer	0.1%
Teacher	15.3%
Other (housewife, retired, non-working, etc.)	1.8%

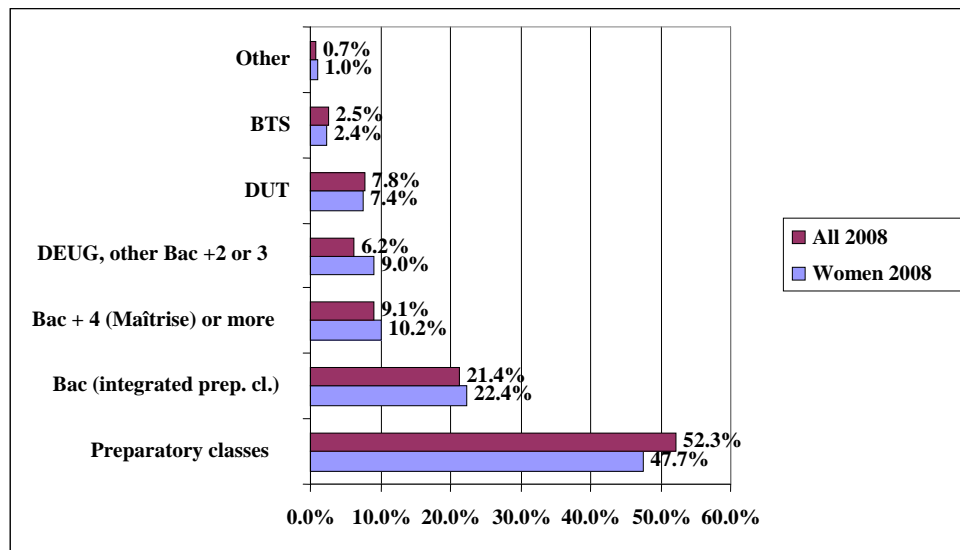
2 – What training did women engineers receive in their schools?

Qualifying as an engineer

Women engineers' routes into engineering schools are becoming more diversified

The routes which male and female students take to qualify as engineers are similar. In both cases, roughly half of the engineers have come through preparatory classes for the engineering schools; another 20% directly from secondary schools which prepared them for the baccalauréat and also offered classes for entry to engineering school.

Schooling before entry into engineering school
(comparison all engineers/women)



Classes Préparatoires aux Grandes Écoles (CPGE): The Grandes Écoles are the main channel for education in Engineering, Management and certain scientific fields such as life sciences. Entry into a "Grande École" is not achieved the same way as into other higher education institutions. They recruit students in a very selective manner at a national level. It involves passing through one of the 200 preparatory classes lasting at least two years after successfully passing the baccalauréat. The **BTS**, **DUT**, and **DEUST** are technology-oriented degrees, and the **DEUG** is awarded for general studies. The **BTS** courses are offered by "lycées" (upper secondary schools), while **DUT**, **DEUST**, and **DEUG** are awarded by universities. **BAC +4:** certificate of secondary education plus four years of University education

However, a slightly higher proportion of the young women enter engineering school after distinct initial training. Almost one in five had obtained a DEUG (two-year degree), or completed a four-year or longer course after the baccalauréat.

Field of specialisation is a strong element of differentiation between men and women engineers

Overall the proportions of women in each specialisation are similar to those observed in 2007. A comparison with some other developed

countries shows that women engineers' choices tend to be analogous from country to country.

In all specialisations the proportion of certified women engineers is below 50%.

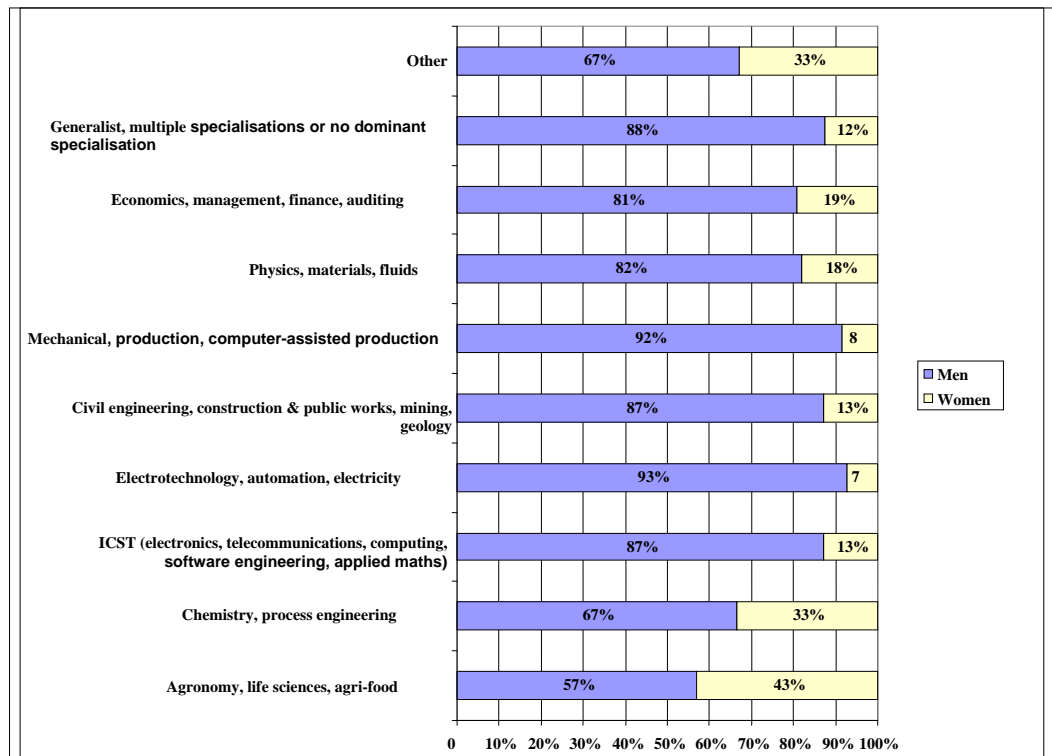
The proportion of women by engineering specialisation is always less than half, with important differences from one branch to another.

Numbers of certified men and women engineers by specialisation

In 2008	Men	Women	Total
Agronomy, life sciences, agri-food	39,100	29,660	68,760
Chemistry, process engineering	31,930	15,980	47,910
ICST (electronics, telecommunications, computing, software engineering, applied maths)	139,420	20,650	160,070
Electrotechnology, automation, electricity	50,300	3,880	54,180
Civil engineering, construction and public works, mining, geology	40,330	5,920	46,250
Mechanical, production, computer-assisted production	86,890	7,900	94,790
Physics, materials, fluids	34,540	7,600	42,140
Economics, management, finance, auditing	6,760	1,610	8,370
Generalist, multiple specialisations or no dominant specialisation	113,660	16,080	129,740
Other	19,770	9,520	29,190
Total	562,700	118,800	680,930

The agri-food sector and chemistry remain those in which the proportion of women is highest, at 43% and 33% respectively.

Proportion of men and women engineers by field of specialisation



Women engineers are more present in agronomy and chemistry

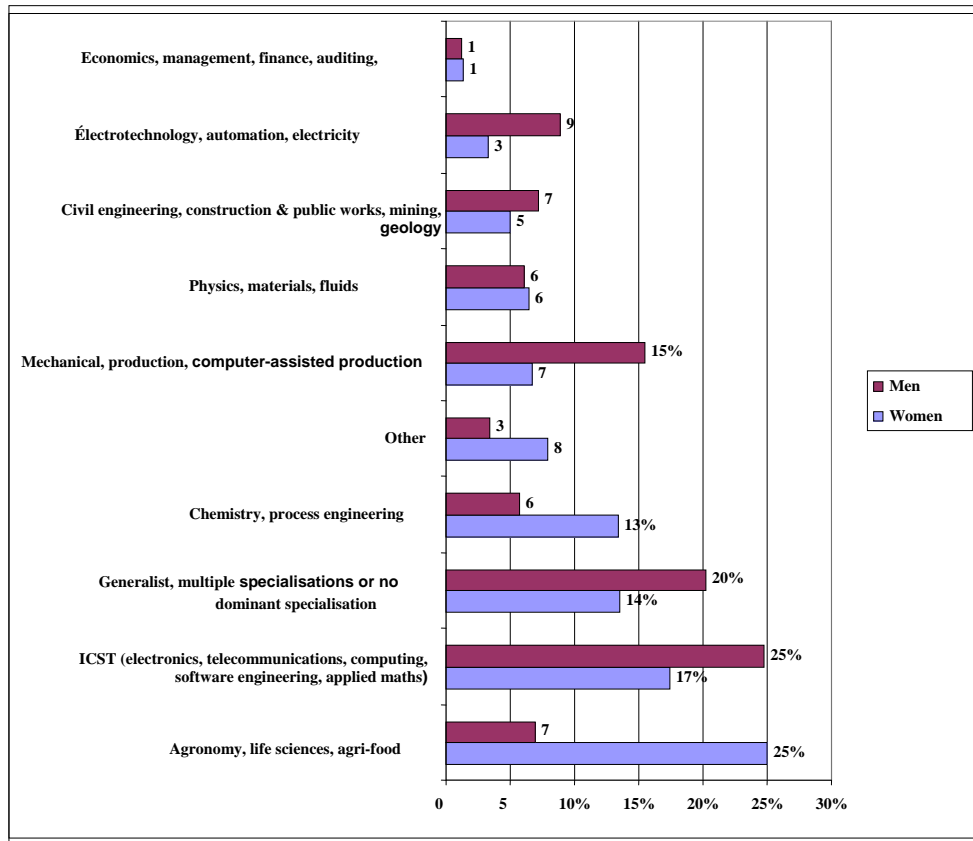
As in 2007, the two branches in which women are most present are agronomy and chemistry. In both cases a significant gap remains between the proportions of men and women moving into these fields:

1. Agronomy, life sciences, agri-food: +18%
2. Chemistry, process engineering: +7%

On the other hand the sectors in which they are less present remain:

1. ICST (Information Communication Science and Technology) : -8%
(the gap tends to be closing this year in this specialisation)
2. Mechanical engineering: -8%
3. Generalist: -6%

Breakdown of engineers by specialisation
(comparison men/women in %)



There is a strong homogeneity in the specialisations chosen by women engineers in the developed countries

There is a clear pattern to the choices of training specialisation made by women in different developed countries. Women generally move more towards branches whose common point is a connection with social issues (life sciences, sciences of nature). The most notable feature of recent years

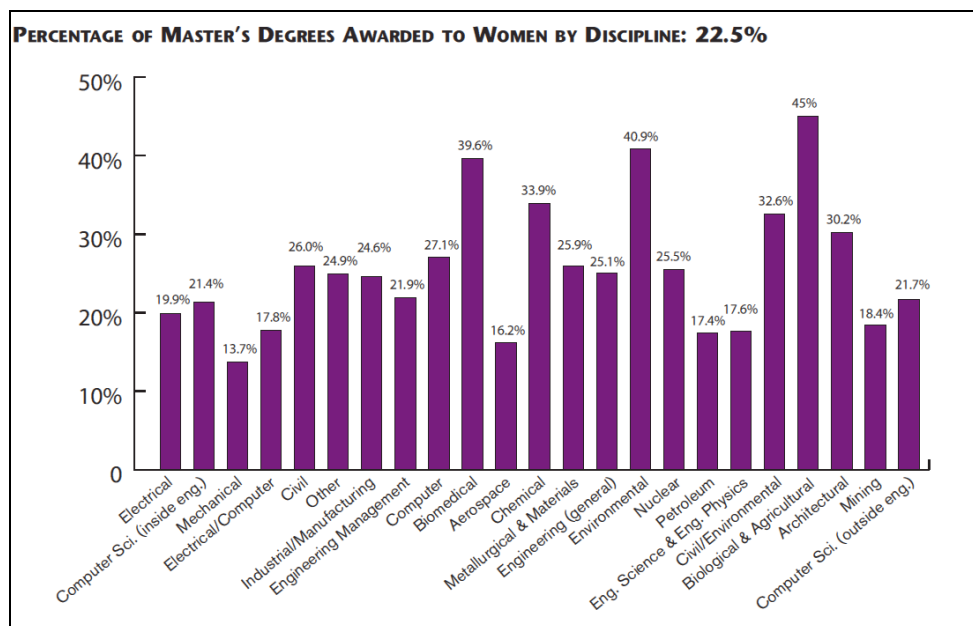
is the breakthrough of specialisations related to sustainable developments.¹² Analysis of the situation in the USA, often a precursor in terms of tendencies, is instructive in this regard. First, analysis of the women who obtained a Master's degree in engineering in 2006/2007 reveals that the sectors most often chosen by women are the same:

1. Agriculture, agri-food industries, biology: 45%
2. Chemistry, biomedicine: 33.9% and 39.6% respectively
3. Especially worthy of note are the specialisations related to the environment and sustainable development, where the proportion of women engineers is already close to 41%.

By contrast, the branches in which they are least present are:

1. mechanical engineering: 13.7%
2. followed by sectors where they make up less than 18% of the number, such as computing and physics

Percentage of Master's degrees awarded to women by discipline - 2007¹³



The disciplines chosen by women engineers aged under 30 strengthen their place in most specialisations, except ICST...

Comparison of the choices made by women engineers aged under 30 relative to all women engineers confirms the predominant position of agronomy and the agri-food industries and chemistry among the disciplines preferred by women. These two areas alone still account for 40% of the women engineers trained.

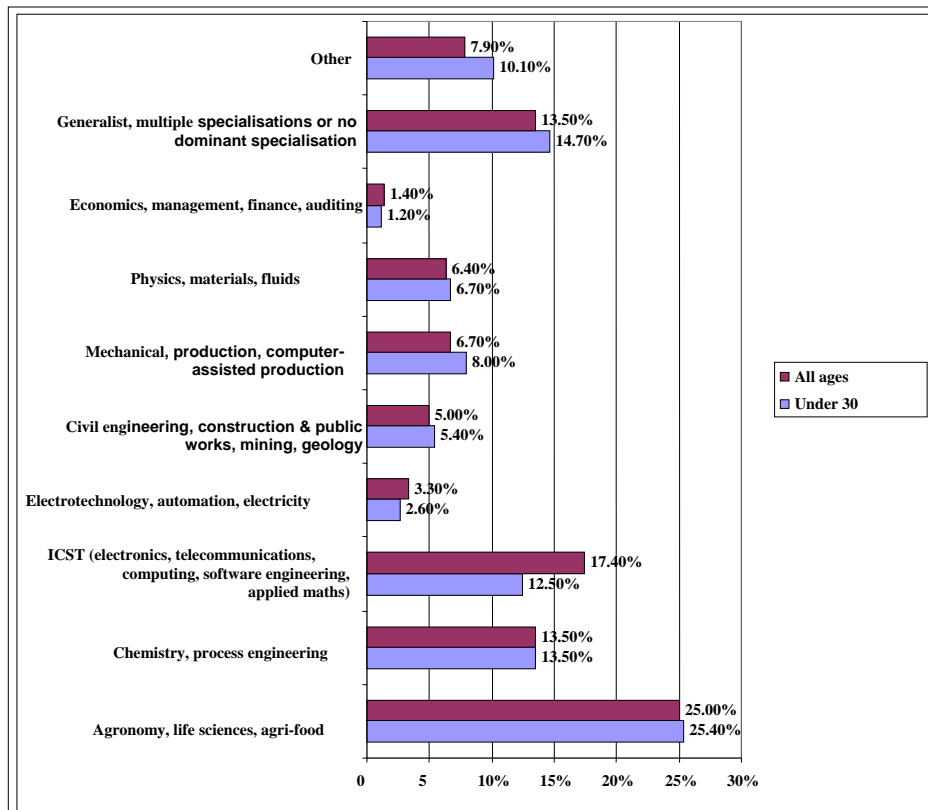
¹² See below – Detailed analysis of activities (What do they do? - § Quality, sustainable environment)

¹³ Source: Michael T. Gibbons, "Engineering by the numbers", op. cit.

There is also progress among the “generalists” (14.7% among the young, as against an average of 13.5%), in computer assisted production, and, more modestly, in civil engineering.

By contrast, the specialisation in which the decline in numbers is greatest is Information and Communication Sciences and Technologies, which attracts only 12.5% of the total number of young women, as against 17.4% on average.

Comparison of women under 30/all women engineers¹⁴



... a trend that is confirmed among the younger generations

A survey¹⁵ of 12,648 students in various engineering schools confirms that some of the traditional divisions observed over many years still persist, and that the proportion of women attracted by the ICST sector in the broad sense remains lower than that for men. By contrast, the breakthrough in the energy and environment sector is confirmed.

More specifically:

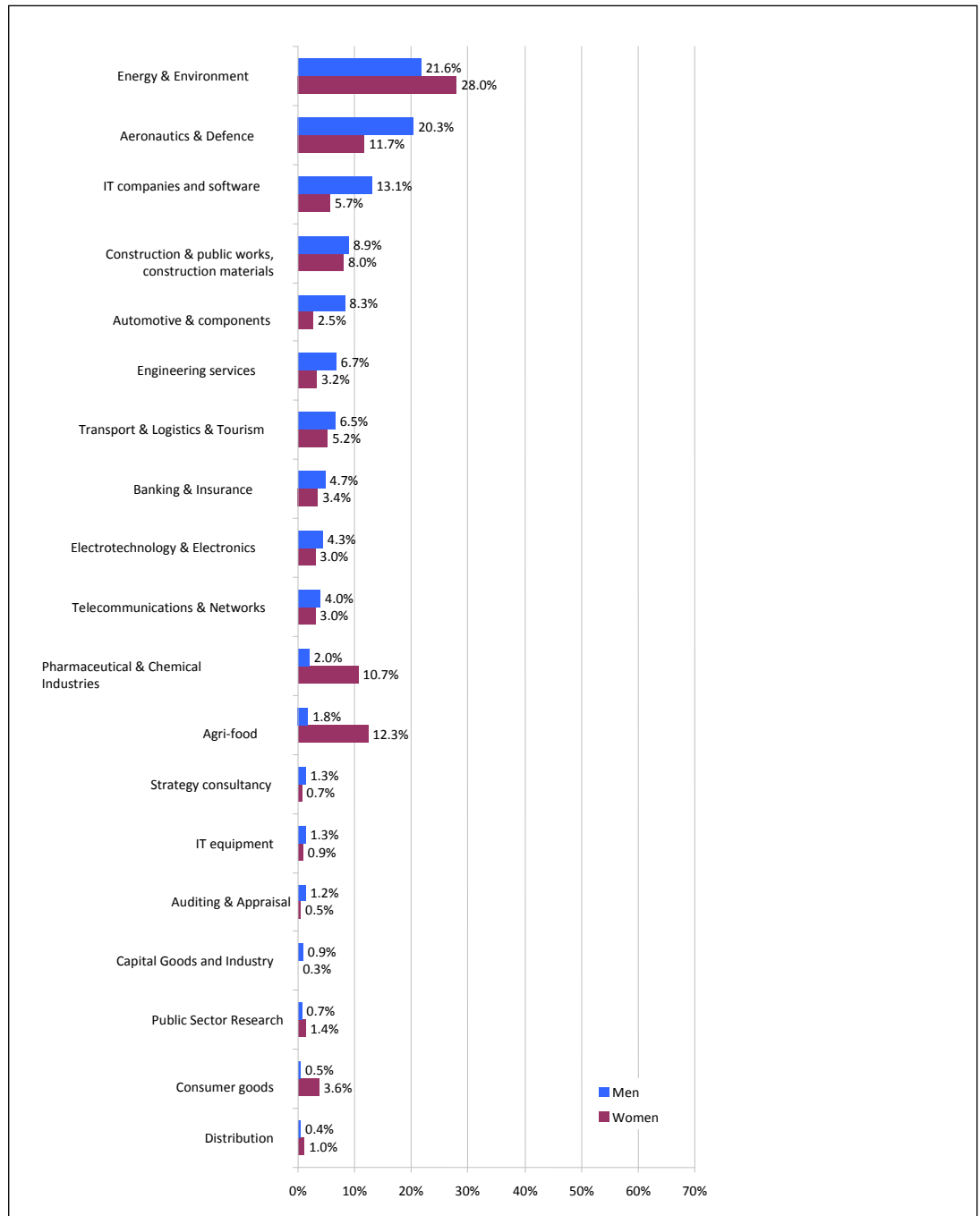
- for all the future engineers (male and female) questioned, the most attractive branches (expressed as % of responses) are:
 - o energy and environment: 22%
 - o aeronautics & defence: 18.3%

¹⁴ 100% of the women aged under 30: 37,725.

¹⁵ Source: “Baromètre étudiant”, Trendence, 2009.

- construction & public works and construction materials: 12.2%
- IT companies and software: 10.4%

Attractiveness of sectors by sex¹⁶



- The proportion of women attracted by ICST is lower than that for men:
 - Only half as many women as men are attracted by IT companies and software (5.7% as against 13.1%)

¹⁶ Source: "Baromètre étudiants Trendence 2009".

- The gap is less pronounced in Telecommunications and Networks which have an overall attractiveness of under 5% in both cases (3% for women, 4% for men)
- The attractiveness of branches related to the environment and sustainable development is significantly underlined. Energy and Environment and Construction & public works and construction materials attract three out of every ten students. The attractiveness of construction and public works, which attracts men and women in equal proportions (an untypical characteristic in the light of the overall trend in the sectors), may confirm that the link with the themes of sustainable development and the environment (new housing, energy savings) is well established.

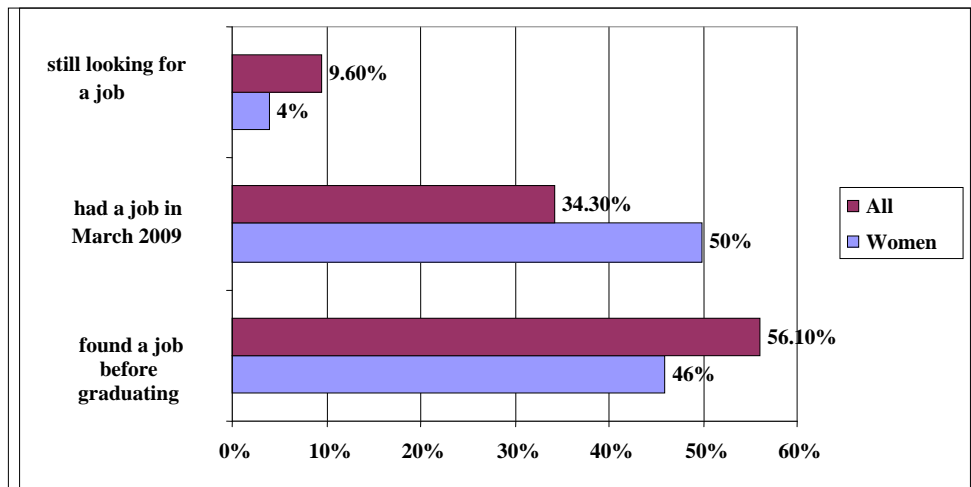
3 – What do they do?

Being a women engineer is an asset on the French labour market

Women engineers find their first job more quickly than engineers overall

96% of women who have trained as engineers rapidly find employment. Only 4% were still seeking employment at the time of the survey; the figure for engineers overall is 9.6%.

Comparison of speed of finding first job for women and for all engineers



The percentage of women engineers who have found their first job after 18 months is even better, at close to 99%. More precisely, the durations of job-hunting were as follows:

- Less than 3 months 33%
- Less than 6 months 70%
- Less than a year 95%
- Less than 18 months 98.6%

32% of the women engineers who graduated between 2000 and 2008 found their first job in the company in which they did their internship or apprenticeship.

Women's employability is enhanced by possession of a qualifying diploma. This conclusion is also confirmed by the Eurostat 2007 data on human resources working in Science and Technology.¹⁷ In 2007, Eurostat counted approximately 78 million employees with executives or technician status in Europe (EU-27), 9.7 million of them in France. Out of this total, the proportion of women with a high level of qualification was 50% in France (compared to 46.6% for engineers overall).

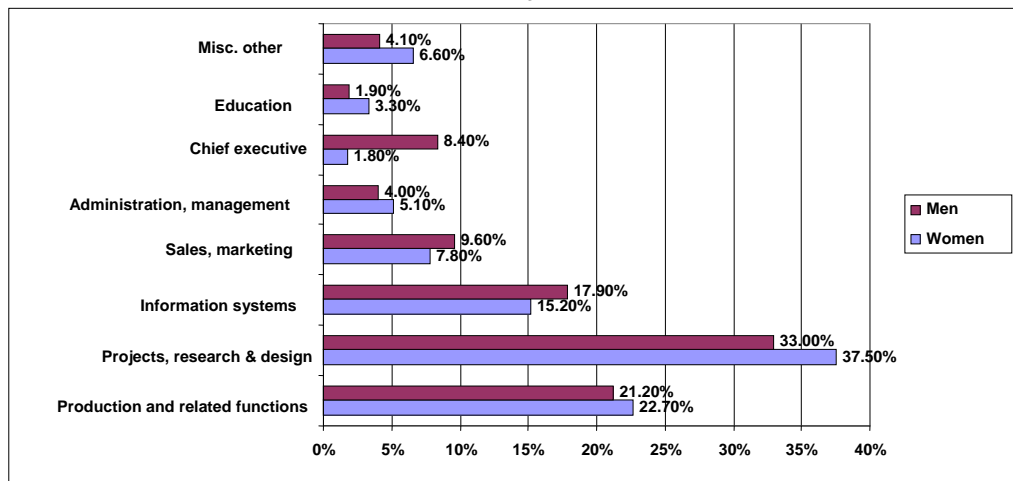
¹⁷ Scope of comparison: HRSTC (HR in Science and Technology Core group – aged 25 to 64, all NACE sectors), HRST (HR en Science and Technology, aged 24 to 64, all NACE sectors). Analysis by Global Contact.

Men and women perform similar functions, but new trends emerge in 2008

Overall, the activities carried out remain similar

The tasks that women engineers carry out are stable. The weight of the Projects, research & design function is increasingly preponderant, occupying more than 35% of women engineers. These are followed by production activities and related functions, which occupy more than 20% of them. Next come information systems, which lie in the 15-20% range; all other activities each occupy fewer than 10% of women engineers.

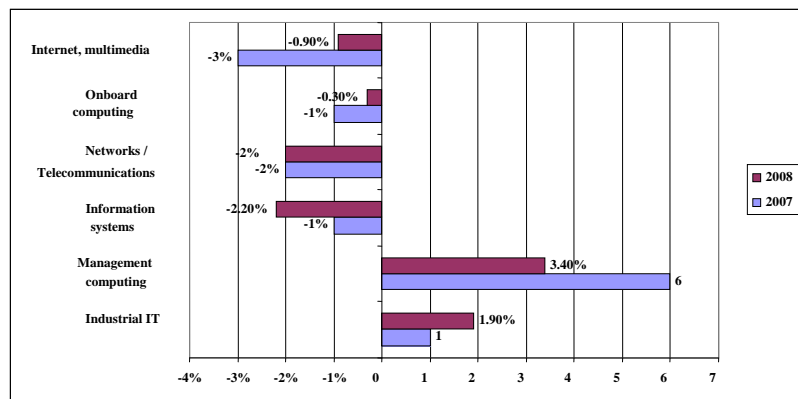
Comparison of proportions of men and women engineers by type of activity



Women engineers and the NTIC

In 2008 the differences observed in 2007 tended to narrow in most of the activities analysed. More specifically, there was a significant decline in the gap between women and engineers overall in the Internet and Multimedia area, where it narrowed from -3.0% to -0.9%, and in Management IT, where the gap closed from 6% to 3.4%.

Comparison of the gap between women engineers and all engineers 2007/2008



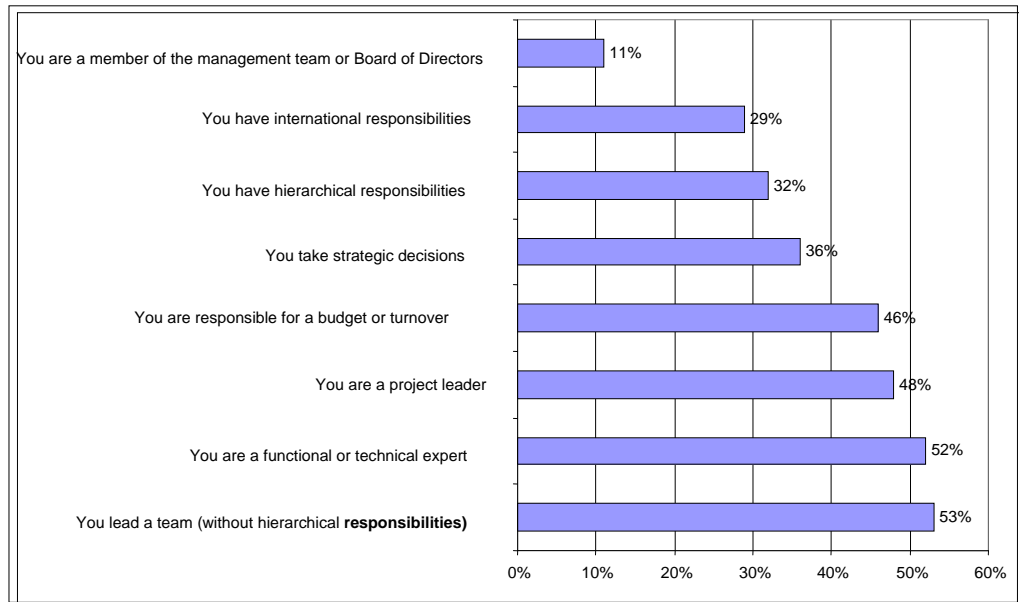
On-board computing and networks/telecommunications are the two other activities in which there is a slight progression or stabilisation of the distribution of men and women. The two activities for which the gap persists and slightly widens are industrial IT and information systems.

What are the responsibilities and careers of women engineers?

Technical expertise and team leadership are the two main competences exercised by women engineers

More than 50% of women engineers lead a team, and are recognised within the enterprise for their expertise. Of the 32% of women who exercise hierarchical responsibilities, 18% run a small team, 12% a service or department and 2% are at chief executive level. These percentages are consistent with the disparities observed in France, as reflected by the data in Global Gender Gap 2008¹⁸. According to that analysis, France comes 53rd among 160 countries as regards the economic participation and opportunities for women¹⁹. In Europe, the DG Employment ranks France in the bottom third of EU countries, the group in which the representation of women in Boards of directors is under 10%.

Proportion of women engineers by type of responsibility



Indeed, the gap between women engineers and engineers overall is more marked (i.e. greater than 10%) for four types of responsibilities:

- exercise of hierarchical responsibility: 13%
- strategic decision-making: 12%

¹⁸ Global Gender Gap: annual indicator published by the World Business Council, Davos.

¹⁹ Source: "L'accès and la représentation des femmes dans les organes de gouvernance des entreprises", IFA, EPWN, ORSE, September 2009.

- responsibility for a budget or turnover: 11%
- international responsibilities: 11%

Differences between types of responsibilities entrusted to women engineers and to engineers overall

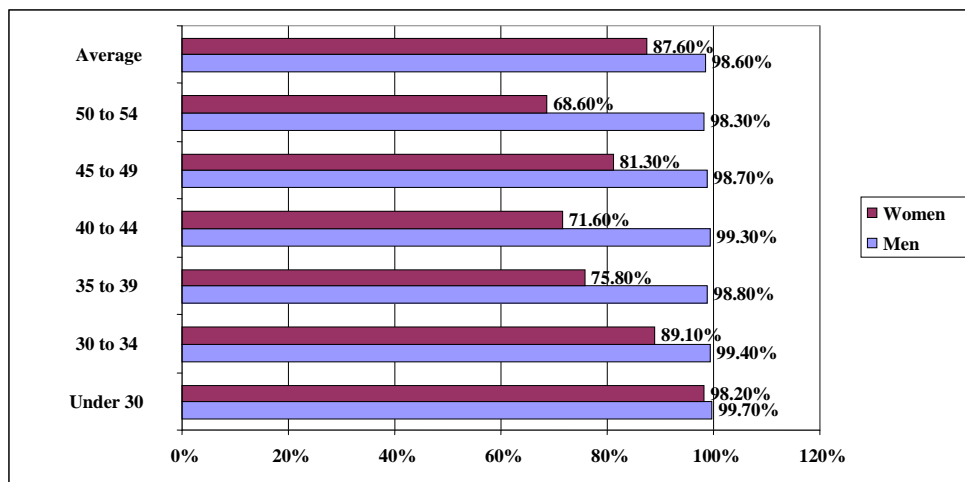


The organisation of professional life

Women tend to opt for part-time work from the age of 30 - 35

Analysis of the proportions of women and men working more than 90% of full time confirms that the proportion of women often declines for family reasons from the age of 30 - 35

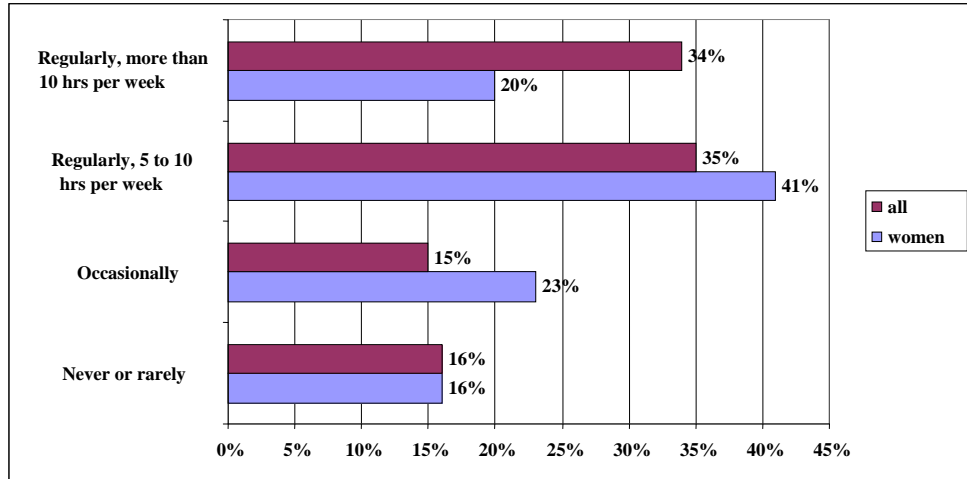
Proportion working more than 90% of full time by age and sex



Overtime

As is the case for executives in France, more than eight out of ten engineers (of both sexes) work overtime. The proportion of women who never work overtime is identical to that for men: 16%.

Breakdown of engineers by amount and frequency of overtime



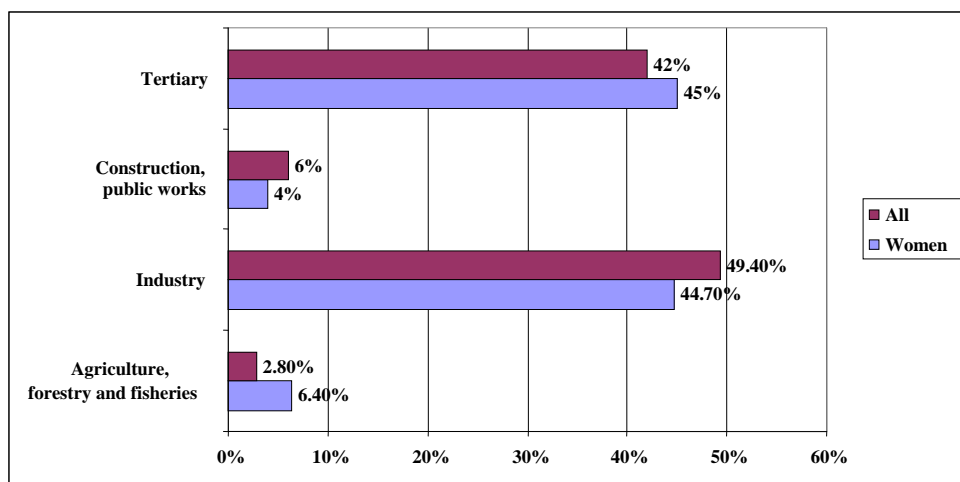
4 – Who do women engineers work for?

Characteristics of the organisations that employ women engineers in France

Almost half of all women engineers work in the tertiary sector

The breakdown of women engineers is similar to that observed for engineers overall, and remains identical from 2007 to 2008, with almost half of them employed in the tertiary sector, and around 45% in industry. Agriculture employs more than 6% of all women engineers, twice the figure for engineers overall, which is just under 3%.

**Comparison of breakdown of engineers
by sector in 2008**



Women scientists and engineers are more present in the service sector²⁰

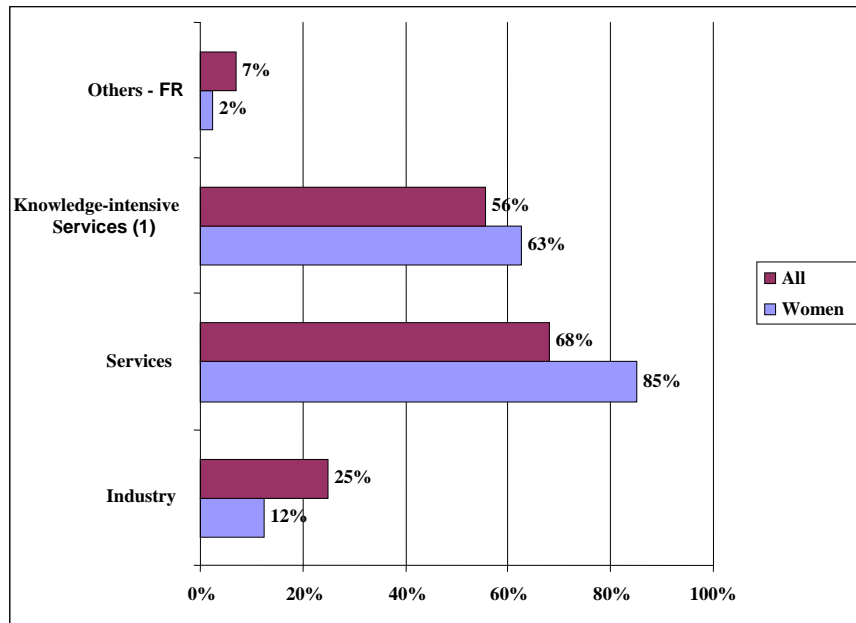
According to Eurostat, Europe (EU 27) has a total of approximately 10.7 million scientists and engineers, of whom 3.3 million are women. The corresponding figures for France are estimated at 1.3 million and 370,000.

In terms of all scientists and engineers, analysis by gender brings to light the following elements in France:

- Since 2004 the proportion of women in industry has been under 20% and it has recently declined (from 17% to 12% between 2004 and 2007). Women are only half as present as men in this sector.
- A higher proportion of women in the services sector, with a steady increase in the last four years (81% to 85%).

²⁰ Source: Eurostat - HRST stocks at national and regional level by sector of activity and gender, updated 23/8/2009; analysis by Global Contact.

Comparison of breakdown of scientists and engineers by broad sector 2007²¹



(1) Total of knowledge-intensive services sectors – NACE Rev 1.1 - codes 61, 62, 64 to 67, 70 to 74, 80, 85 and 92 (including in particular Computing, Telecommunications)

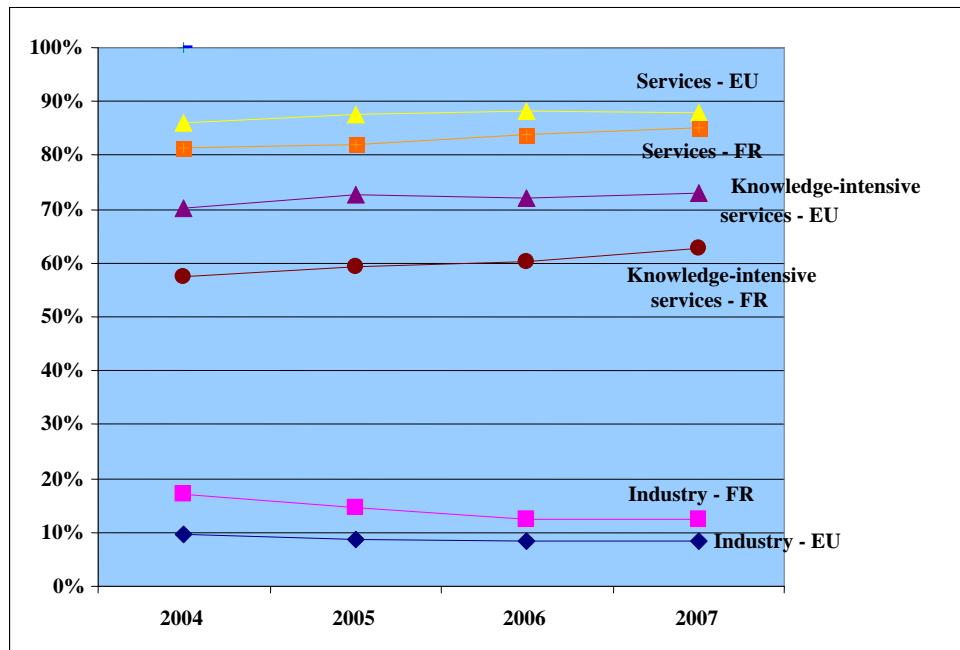
The proportion of women scientists and engineers in knowledge-intensive services is lower in France than in Europe overall

France differs from Europe overall in having a higher proportion of women scientists and engineers in industry.

The gap between the proportions of women scientists and engineers in the service sectors in Europe (EU-27) and France is tending to close. However, it remains constant in knowledge-intensive services (which include, in particular, telecommunications, computing, and IT and software engineering companies).

²¹ Source Eurostat, HRST stocks at national and regional level by sector of activity, analysis by Global Contact.

Trends in proportions of scientists and engineers Europe (EU 27) and France²²



Main sectors of activity

2008 recruitments do not modify the distribution by sector

The distribution of women engineers by sector also remains identical to that of 2007; as last year, it is similar to that observed for engineers overall.

	Women	All
Agriculture, forestry and fisheries	6.4%	2.8%
Energy	6.4%	7.1%
Minerals, metallurgy, foundries, metal work	2.0%	2.2%
Production of construction materials, ceramics, glass	0.6%	0.9%
Chemical industry	3.9%	3.1%
Parachemical industry	0.7%	0.4%
Pharmaceutical industry	2.9%	1.5%
Manufacture of mechanical equipment, machinery, arms	1.7%	4.2%
Electrical equipment, electronics, computing	4.9%	8.4%
Automotive, transport equipment	5.8%	8.9%
Aerospace	3.9%	5.2%
Agri-food industries	7.1%	3.2%
Textiles, clothing, footwear	0.5%	0.4%
Paper, cardboard, rubber, plastics	1.0%	1.5%
Other industry	3.3%	2.5%
Industry	44.7%	49.4%
Construction, public works	4%	6%
Large-scale distribution	1%	1%
Retail, repairs, hotel & catering	1%	1%
Transport (road, rail, air, etc.)	2%	2%
Telecommunications	3%	4%
IT companies, software publishers	8%	11%
Engineering services	7%	8%
Sewerage, water, waste management, etc.	2%	1%
Insurance, banking, real estate, holding companies	4%	4%
Civil service, central, local & hospitals	10%	6%
International bodies	0%	0%
Other tertiary	6%	5%
Tertiary	45%	42%
Corresponding numbers	93,500	528,900

²² Source Eurostats – idem supra.

... nor the distribution by type of organisation and its location

Most women engineers work in the private sector.

Breakdown by type of organisation

	Women	All
Individual companies or self-employed	4.1%	3.7%
Private sector	76.0%	82.5%
State companies (EDF, SNCF, etc.), public-private, EPICs	8.4%	7.6%
Central govt., local authorities, public hospitals	6.8%	3.9%
Other, associations, NGOs, international bodies	4.7%	2.2%

The Paris region remains the leading employment area.

Location of employers

	Women	Ensemble
Paris Region	44.0%	44.9%
Champagne	1.0%	1.0%
Picardie	1.7%	1.5%
Haute-Normandie	2.0%	1.9%
Centre	2.3%	2.1%
Basse-Normandie	1.2%	1.2%
Bourgogne	1.2%	1.2%
Nord	3.0%	3.2%
Lorraine	1.6%	1.7%
Alsace	2.0%	2.3%
Franche-Comté	0.9%	1.5%
Pays de Loire	3.7%	3.5%
Bretagne	2.9%	3.2%
Poitou Charente	1.1%	1.1%
Aquitaine	3.0%	2.8%
Midi-Pyrénées	6.0%	6.0%
Limousin	0.4%	0.5%
Rhône-Alpes	12.0%	11.8%
Auvergne	1.4%	1.3%
Languedoc	2.4%	1.8%
Provence-Alpes-Côte d'Azur - Corse	6.2%	5.5%

Labour market: key tendencies of 2008 recruitments

External recruitments of certified engineers (all sectors, all activities combined)

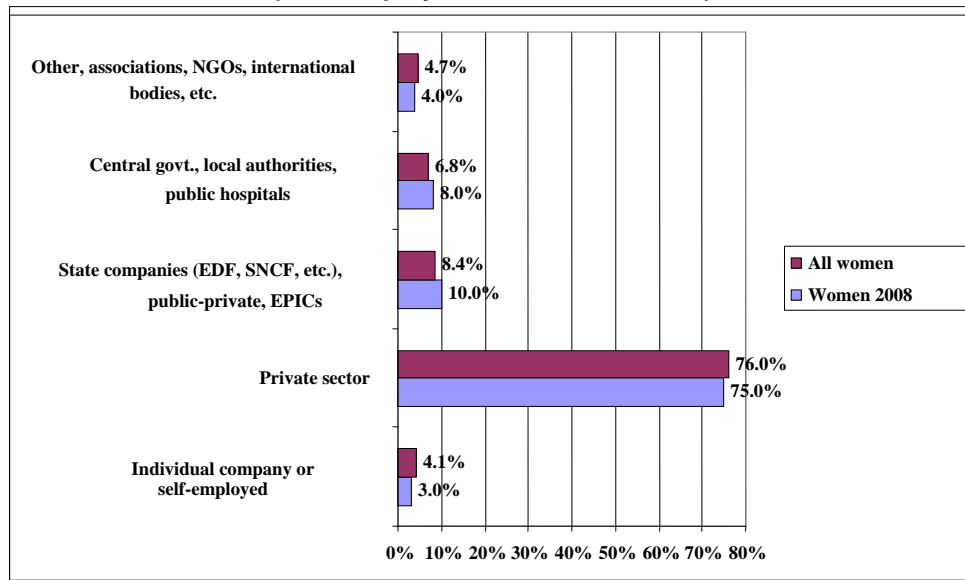
The total level of jobs created grew, but the proportion of women recruited fell from 30% in 2007 to 21% in 2008.

In 2008	71,700 ²³ (executives and non executives)
Executives	60,500
Of which women	12,900 (executives)
As %	21%

2008 recruitments by type of employer

The proportion of women by type of employer increased in the public and/or para public sector, but declined slightly in the private sector.

**Comparison of breakdown of women by type of employer
(total employed/2008 recruitments)**

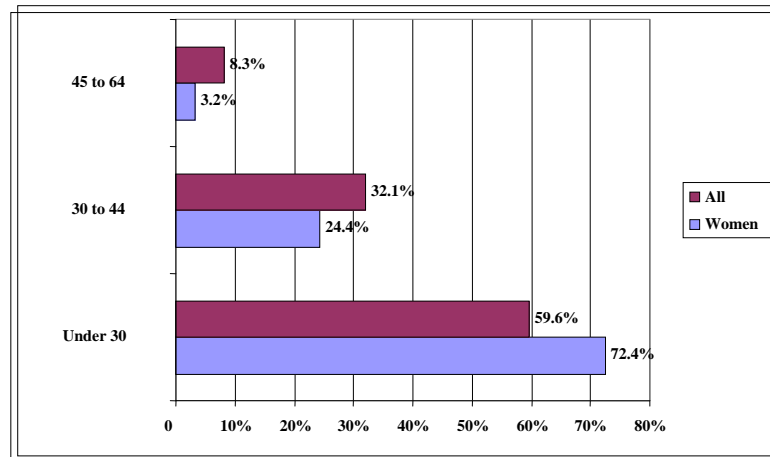


By age groups

Two thirds of the women recruited are under 30; for engineers overall the figure is 59.6%. As in the previous year, the proportions of women recruited in the older age groups are lower than the average for recruitments in each age group.

²³ Total including executives and non-executives.

**Comparison of recruitments per age group
(women/all engineers)**



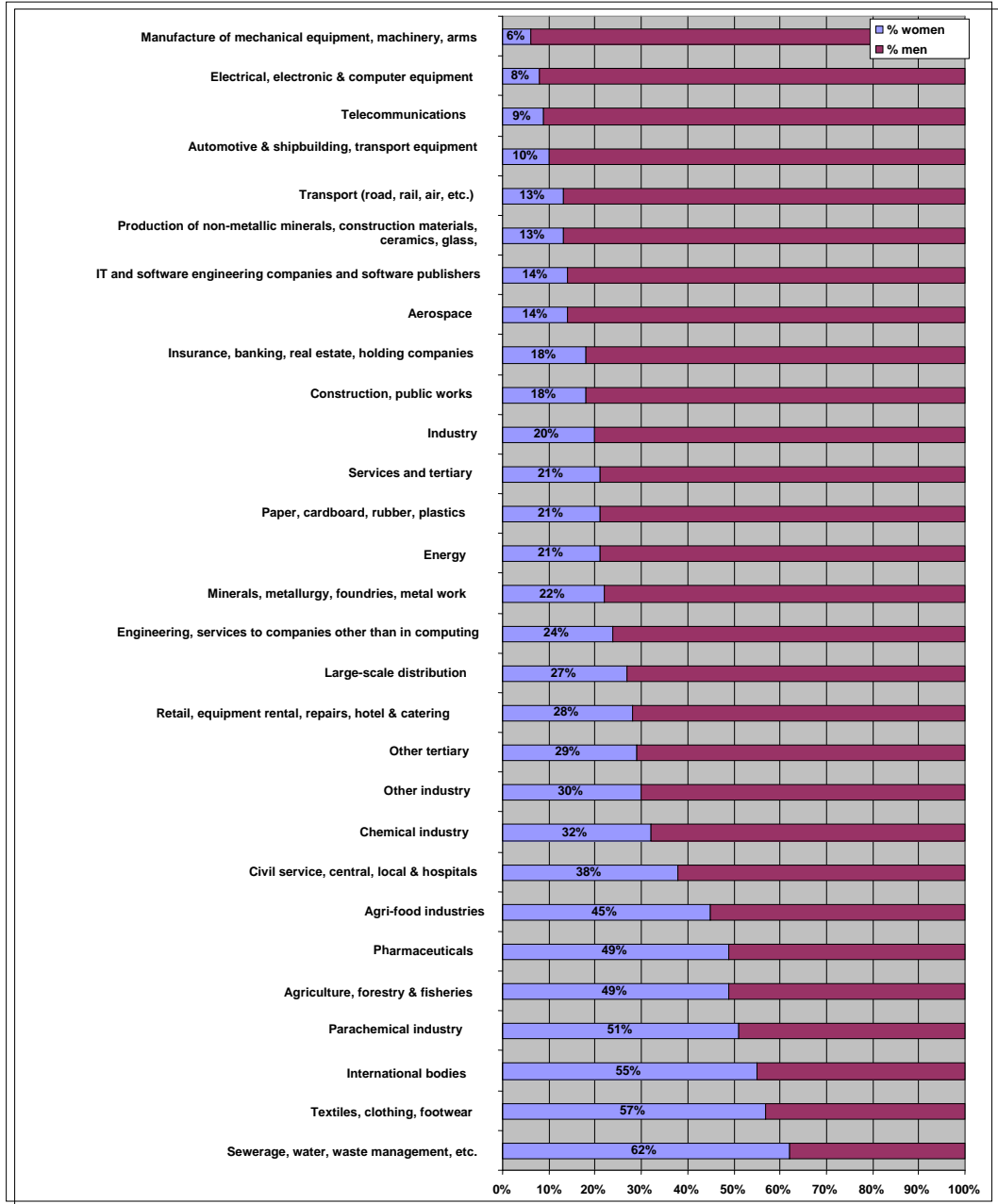
Recruitments by sector of activity

Except in three sectors - environment, textiles and the parachechemical industry – the number of women recruited is lower than that for men.

	Men	Women
IT and software engineering companies and software publishers	8565	1417
Engineering services to companies other than in computing	4851	1541
Energy	4136	1108
Automotive & shipbuilding, transport equipment	3497	382
Construction, public works	2951	634
Electrical, electronic & computer equipment	2873	251
Aerospace	2533	398
Manufacture of mechanical equipment, machinery, arms	2610	163
Other tertiary	1807	731
Civil service, central, local & hospitals	1392	845
Insurance, banking, real estate, holding companies	1793	400
Other industrial	1374	585
Telecommunications	1661	171
Agri-food industries	912	761
Chemical industry	1051	483
Pharmaceuticals	744	727
Minerals, metallurgy, foundries, metal work	1120	319
Agriculture, forestry and fisheries	599	577
Transport (road, rail, air, etc.)	1016	156
Sewerage, water, waste management, etc.	288	467
Large-scale distribution	358	135
Production of non-metallic minerals, construction materials, ceramics, glass	416	61
Paper, cardboard, rubber, plastics	368	96
Retail, equipment rental, repairs, hotel & catering	318	124
Parachechemical industry	99	103
Textiles, clothing, footwear	78	104
International bodies	9	14

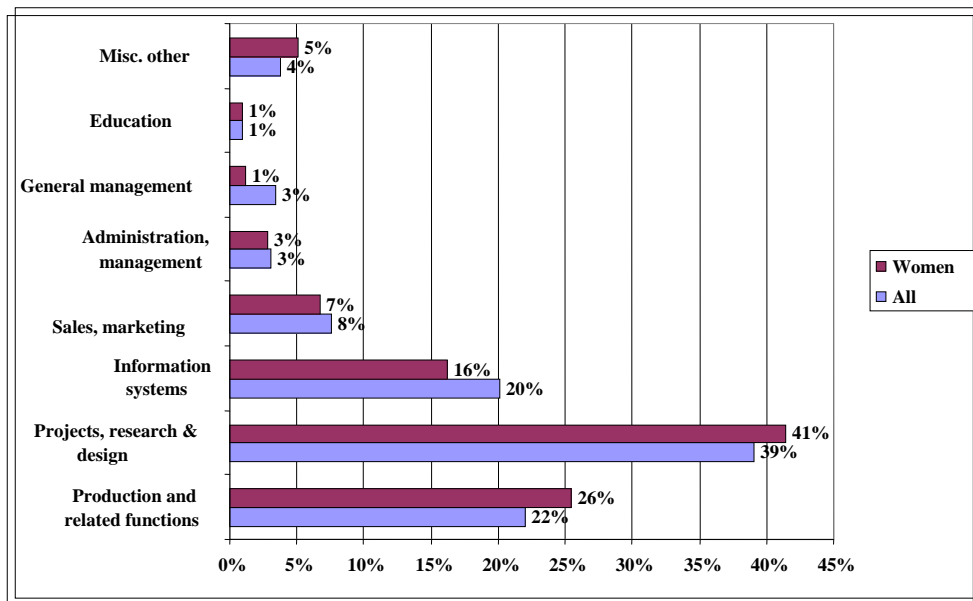
The proportion of women recruited by sector in 2008 confirms the breakthrough of the environment sector and the persistence of the differences already observed.

Proportion of men and women recruited by sector



Recruitments by type of activity

As last year, the relative proportion of women recruited is greater in R&D and production activities.



5 – What are women engineers' criteria of satisfaction and motivation?

As the EU Directorate General for Research points out, “the most competitive companies are the ones which can attract, motivate, and retain the best talents”.²⁴ In this context the tools enabling to measure satisfaction levels and attractiveness factors are useful.

Level of job satisfaction

The proportion of women engineers who expressed no major dissatisfaction with their job was 45% in 2008 – very similar to previous years.

Surveys consistently show a significantly higher level of job satisfaction among engineers who have managerial responsibilities. The same is true for women engineers.

The main sources of job satisfaction for women engineers are related to the quality of the content of the work

For 80% of women engineers the three most important reasons for satisfaction are:

- the content of the work and the interest of the projects,
- the autonomy they are granted,
- the variety of tasks to be performed.

The only factor external to the content of their work that they also mention as a source of satisfaction is the quality of interpersonal relations. On the first three factors, women vary little from engineers as a whole, whose stated satisfaction levels are identical for the same criteria.

Comparison of the proportion of engineers who declare themselves satisfied with their job in terms of various criteria

	Women 2008	All 2008
The content of the work and the interest of the projects	86%	86%
The autonomy you are granted	80%	80%
The variety of tasks to be performed	80%	77%
Interpersonal relations	68%	67%
Job security	62%	56%
Opportunities to develop your skills	62%	61%
Recognition of your work by other engineers	60%	60%

²⁴ Source: « Women in Science and Technology: creating sustainable careers”, DG for Research, 2009.

Meaning and value of your work	59%	58%
Personal fulfilment	59%	59%
Recognition de your work by the hierarchy	58%	57%
Life/work balance	56%	50%
Exercising responsibilities	53%	62%
Degree of creativity in your work	52%	58%
Opportunities for career development	49%	52%
Leading a team and managing projects	49%	51%
Your salary and other benefits	46%	50%
Your suggestions are taken into account	45%	46%
Training offered by employer	42%	34%
Relevance of employer's strategy	38%	46%
Management style	35%	39%
Work abroad	30%	40%
Workload	29%	26%
Quality of general organisation within company	29%	32%
Clarity of employer's strategy	28%	36%
Quality of employer's communication	27%	30%
Recognition of your work outside the company (conferences, seminars, teaching activities, etc.)	27%	28%
Stress level	26%	24%

Between 2007 and 2008, women engineers' satisfaction level is fairly stable for all criteria, but with some fluctuations on a few aspects. These trends are consistent with the general pattern observed for all engineers. They concern:

- increased satisfaction regarding job security and workload;
- less satisfaction regarding opportunities for career development and work abroad.

Life/work balance

The level of satisfaction as regards the balance between private life and professional life is of the same order for men and women, with a 6% positive difference for the proportion of women satisfied. The higher proportion of women under 35 and without children in the total numbers may have an impact on this finding.

Comparison of responses on life/work balance

	Satisfied	Dissatisfied	Indifferent
Women	56%	31%	14%
Men	50%	30%	20%

Do you make a clear break between your professional life and your private life?²⁵

	Women	Overall
No, that is unrealistic	8%	9%
No, and that is not a problem	10%	12%
You try to, but it doesn't happen as much as you would like	40%	39%
Yes, and that is essential for you	42%	40%

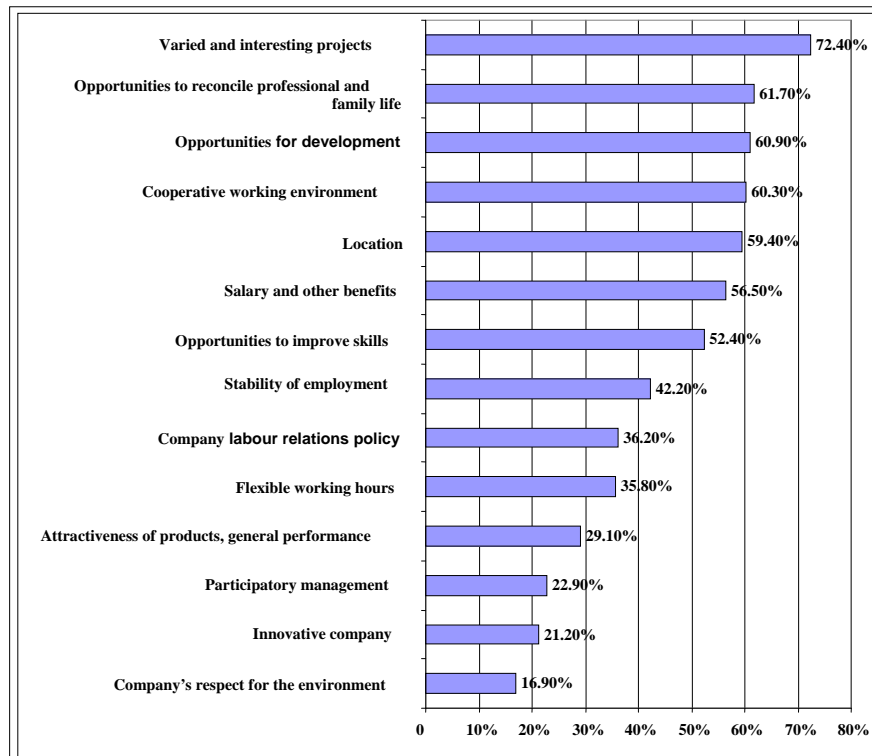
What are the factors of company attractiveness for women engineers?²⁶

Interesting work and flexible organisation are the two main factors of attractiveness in a company for women engineers.

For more than of 60% of women engineers the main criteria of attractiveness are:

- the interest of the job (variety and interest of projects, opportunities for development)
- work life balance: the possibility of maintaining a balance between private life and professional life, and location
- the context: a cooperative working environment.

Company attractiveness factors for women engineers



²⁵ Question asked in the 2008 survey.

²⁶ 58.3% of the women who responded to the questionnaire answered these questions. Total of answers collected: 4,655.

6 – How much did women engineers earn in 2008?

General data on 2008 salaries

The population studied

Certified engineers aged under 65, employed at executive level in metropolitan France.

The beginners are graduates from initial training (former apprentices and students) having qualified in 2006, 2007 or 2008, now in their first job and aged under 30.

Salaries are defined as gross annual salaries inclusive of various bonuses and allowances, for full-time work for a full year. The types of employee contract taken into account are: open-ended contracts, fixed-term contracts, civil service tenure, and casual contracts. Salaries under 16,000 € and over 300,000€ are excluded.

The notion of average salary is used in this study, yet one high salary can “offset” half a dozen low ones, hence it supplies a less accurate picture of reality than that of median salary. The median, which is the figure at which 50% of the population earn more and 50% earn less, gives much more precise image of the breakdown.

Where the number of responses available to calculate a figure was under 20, this is indicated by the abbreviation “n.s.” (“not significant”) in place of a value.

In France in 2008, for male certified engineers with executive rank, the median salary was 55,000 € and mean salary 64,550 €. For women engineers, the median was 42,871 € and the mean 48,915 €.

Breakdown of salaries

Definition of quantiles

Quantile	Definition
1st decile	10% of engineers earned less than
1st quartile	25% of engineers earned less than
Median	50% of engineers earned less than
3rd quartile	50% of engineers earned more than
9th decile	25% of engineers earned more than
	10% of engineers earned more than

Breakdown of salaries in 2008 by sex (all ages)

	Men
9th decile	105,785 €
3rd quartile	75,500 €
Median	55,000 €
1st quartile	41,391 €

1st decile		34,606 €
Mean		64,550 €
	Women	
9th decile		75,120 €
3rd quartile		56,219 €
Median		42,871 €
1st quartile		35,000 €
1st decile		30,000 €
Mean		48,915 €
	All	
95%		125,000€
90%		101,000€
75% Q3		72,651€
50% Median		52,000€
25% Q1		40,000€
10%		33,464€
5%		30,456€

The distribution of women's salaries is overall lower: whereas 90% of the men earned more than 34,600 euros, only 75% of the women did so. At the other end, 10% of the women earned more than 75,120 €, as against almost 25% of the men. However, when comparing the salaries of men and women engineers, one must always bear in mind that 30 years ago, women were a rarity in this occupation. Because salary is related to years of experience, some of the difference is simply due to the age of the women. The table below shows, however, that the differences are not solely attributable to age.

Median salaries by age group and sex in 2008

	All	Men	Women
Beginners	33,440 €	33,780 €	32,706 €
Others			
under 30	38,000 €	38,466 €	36,000 €
30 to 34	47,008 €	48,000 €	44,308 €
35 to 39	56,000 €	57,000 €	50,000 €
40 to 44	66,000 €	67,500 €	57,115 €
45 to 49	73,125 €	75,000 €	62,000 €
50 to 54	80,560 €	82,353 €	70,716 €
55 to 59	86,414 €	87,500 €	67,868 €
60 to 64	89,110 €	90,000 €	n.s.
All	52,000 €	55,000 €	42,870 €

In the "Baromètre des étudiants 2009" survey of engineering students, the expectations of annual salary lay precisely between the median salaries of the beginners and those of other engineers under 30.

Level of salary expected by engineering students²⁷

Salary expectations	Future Engineers	Men	Women
Mean annual salary expected	35,760.70 €	35,782.10 €	34,231.40 €

²⁷ Source: "Baromètre des étudiants", Trendence, 2009.

Percentage gaps between men's and women's salaries by age (medians, in 2008)

Beginners	3.3%
Others under 30	6.9%
30 to 34	8.3%
35 to 39	14.0%
40 to 44	18.2%
45 to 49	21.0%
50 to 54	16.5%
55 to 59	28.9%
All	28.3%

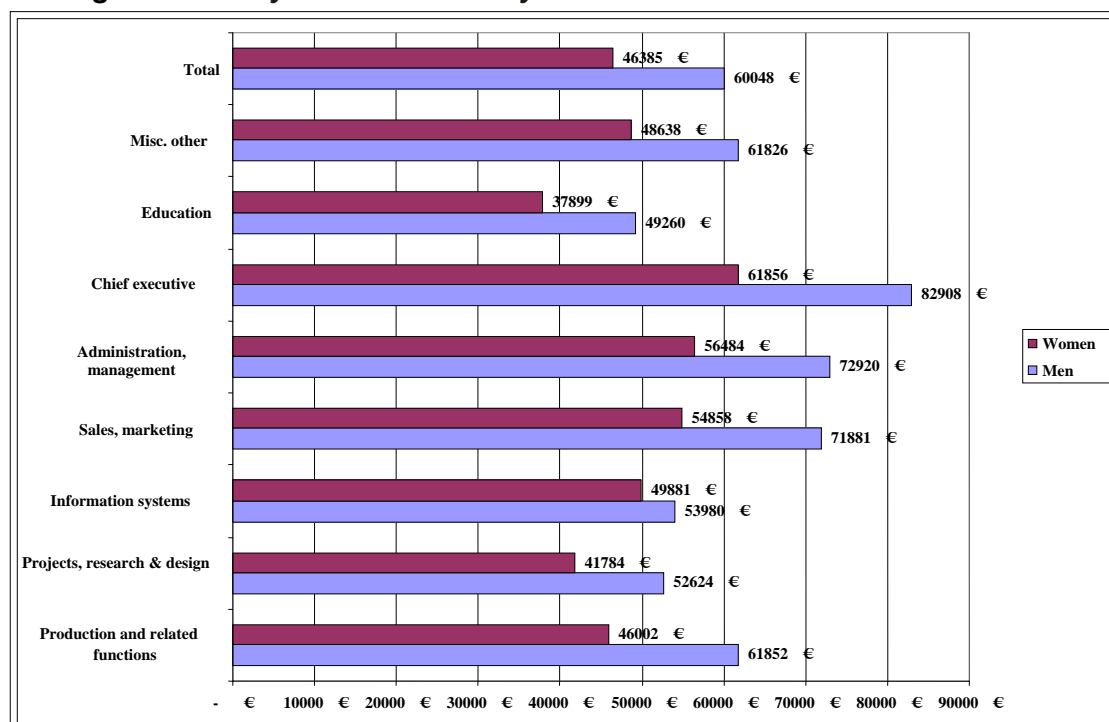
While the progression of salaries with age and therefore experience is observed for both sexes, at equal ages the men's salaries are systematically higher than those of the women. The gap is 3.3% in starting salary and reaches 21% between ages 45 and 49, when the fact that women are less often in managerial positions takes on its full force. After age 50, the small numbers of women in the sample (and in the reality) produce more chaotic differences.

2008 salaries by some major criteria***Average salaries by year of starting employment as an engineer***

Year	All	Men	Women
1975	89,040€	89,361€	79,159€
1976	85,046€	84,585€	88,722€
1977	88,855€	91,546€	76,465€
1978	82,708€	84,379€	49,407€
1979	91,954€	94,943€	64,376€
1980	76,120€	76,748€	69,939€
1981	86,056€	88,896€	66,000€
1982	81,696€	82,230€	74,611€
1983	76,859€	77,944€	65,037€
1984	82,283€	82,487€	80,333€
1985	80,485€	82,557€	60,097€
1986	76,565€	77,142€	71,902€
1987	75,489€	76,666€	67,561€
1988	75,272€	77,487€	63,336€
1989	75,027€	77,169€	61,265€
1990	71,373€	73,531€	57,470€
1991	70,131€	71,266€	63,349€
1992	67,719€	69,449€	55,006€
1993	67,189€	68,071€	59,824€
1994	63,692€	64,921€	57,574€
1995	62,638€	64,445€	54,296€
1996	59,742€	61,100€	52,299€
1997	56,703€	58,200€	49,187€
1998	55,480€	56,775€	47,269€
1999	51,935€	52,466€	49,032€
2000	51,135€	52,596€	43,869€
2001	46,804€	47,654€	43,427€
2002	44,870€	45,989€	40,350€
2003	42,597€	43,753€	37,545€
2004	40,868€	41,437€	38,784€
2005	39,042€	39,927€	36,238€
2006	36,310€	36,977€	34,244€

2007	34,492€	35,344€	32,057€
2008	32,007€	32,560€	30,388€

Average salaries by dominant activity



Median salaries by detailed types of activity

Type of activity	Median salary
Production, operation, process, site	42 500
Maintenance, servicing	45 000
Organisation, production management, monitoring, scheduling	43 000
Purchasing	49 990
Supplies	42 188
Logistics	45 000
Quality, hygiene, safety, environment, sustainable development	41 000
Other production	41 625
Fundamental research	30 687
Design	42 498
Research and development	42 800
Engineering, technical studies, testing	38 428
Consultancy, non-technical studies, journalist	39 724
Other studies	45 000
Production and Operation	50 594
Development and integration	44 912
Technical support and assistance to users	44 657
Information systems consultancy, project management	48 000
Management, administration	62 500
Other computing	47 330
Sales, after-sales, pre-sales	57 704
Business manager, contract manager	44 688

Technical/sales	47 270
Marketing, product communication	48 000
Other sales	61 000
Finance, management	62 602
Auditing	44 669
Legal, patents	55 000
Corporate communication	47 600
Human resources and training	52 235
Other administrative	40 153
Chief executive	67 200
Higher education (and research)	40 000
Other education	27 059
Instructor	64 706
Misc. other	40 134

Average salaries by sector of activity and gender

	Men	Women
Agriculture	50,904 €	36,858 €
Energy	70,104 €	49,651 €
Minerals, metallurgy, etc.	62,611 €	50,176 €
Materials	78,402 €	45,434 €
Chemical industry	73,941 €	47,204 €
Parachemical industry	76,110 €	41,174 €
Pharmaceutical industry	69,128 €	43,643 €
Machine prodn.	61,118 €	50,757 €
Electrical, electronic.	64,750 €	60,580 €
Transport equipment	62,978 €	51,920 €
Aerospace	59,719 €	52,652 €
Agri-food	71,748 €	46,106 €
Textiles	57,265 €	43,652 €
Paper, plastics.	74,614 €	45,637 €
Other industry	52,984 €	42,885 €
Construction & public works	56,482 €	41,678 €
Large-scale distribution	64,987 €	47,177 €
Retail, hospitality	59,290 €	43,763 €
Transport	67,373 €	52,847 €
Telecommunications	64,895 €	59,776 €
Computing services & software	48,486 €	43,611 €
Engineering services	46,605 €	38,912 €
Sewerage, water, waste management, etc.	60,178 €	38,752 €
Insurance, banking, etc.	74,141 €	60,837 €
Government departments	52,283 €	40,013 €
Other tertiary	57,264 €	45,373 €
Total	60,048 €	46,385 €

Median annual salaries by hierarchical responsibility (size of staff)

Women	< 30 year old	30 to 34	35 to 39	40 to 44	45 to 49	50 to 64	TOTAL
= to 1	33 856 €	42 127 €	48 366 €	54 129 €	56 145 €	60 669 €	42 131 €
< to 5	35 022 €	43 666 €	49 441 €	52 277 €	58 418 €	ns	46 111 €
5 à 10	37 849 €	47 178 €	53 121 €	61 877 €	ns	ns	54 849 €
11 à 50	37 388 €	50 989 €	60 169 €	76 457 €	80 000 €	94 442 €	65 395 €
51 à 250	ns	ns	ns	ns	ns	ns	73 569 €
>250	ns	ns	ns	ns	ns	ns	ns
Total	34 296 €	43 601 €	50 871 €	59 291 €	63 393 €	71 447 €	46 385 €

Men	< 30 year old	30 to 34	35 to 39	40 to 44	45 to 49	50 to 64	TOTAL
= to 1	36 901 €	47 048 €	54 073 €	60 415 €	61 257 €	67 341 €	50 296 €
< to 5	39 691 €	48 912 €	53 740 €	62 841 €	65 318 €	73 716 €	55 750 €
5 à 10	39 240 €	50 802 €	60 721 €	68 781 €	71 081 €	81 636 €	63 487 €
11 à 50	41 498 €	56 861 €	63 841 €	76 942 €	78 278 €	90 561 €	71 879 €
51 à 250	45 793 €	57 102 €	78 364 €	88 385 €	101 953 €	99 734 €	88 607 €
>250			95 467 €	122 058 €	123 539 €	139 720 €	127 440 €
Total	37 678 €	49 279 €	58 939 €	70 538 €	74 135 €	81 942 €	60 048 €

Additions to salary**Bonuses and benefits in 2008**

	Men	Women	All
Incentive scheme	47%	42%	46%
Profit-sharing	39%	36%	39%
Stock options	4%	2%	4%
Free allotment of shares	7%	5%	7%
Allotment of discounted shares	7%	6%	7%
Funded pension plan	13%	9%	12%
Employer's contribution to company savings scheme	31%	27%	30%
Health insurance	37%	35%	36%
Personal use of company car	18%	9%	17%
Accommodation	2%	1%	2%
Portable computer	48%	39%	47%
Blackberry, iPhone or equivalent	21%	10%	19%
13th month of salary (or more)	36%	39%	37%
Exceptional bonus	25%	24%	25%
Time savings account	24%	22%	24%
Other	6%	6%	6%

“The truth never dreams”²⁸

Conclusion:

Can we envisage another form of growth? Is it possible to develop a durable - or, as Joseph E. Stiglitz calls it, “sustainable”- growth? At a time when “uncertainty has become the oppressive factor in human history”,²⁹ no one knows. But the economic crisis that we are going through strengthens the view that we must change our paradigm. In this search for a new model of growth in which economic performance and social progress can coexist, the Stiglitz report confirms the importance of putting in place the right tools to measure natural capital, physical, human and social capital.³⁰

The present report seeks to respond to this new demand by complementing the first data assembled on an international scale (Eurostat, OECD) through analysis of various studies, surveys and reports so as to give a better understanding of the role and place of women engineers and scientists in France today.

The picture that emerges is at the very least a mixed one. Just where one might have thought that the proportion of women in these future-oriented occupations would be rising, in most sectors one finds the opposite. All in all, the concerns expressed by the European Commission are justified. The risk of shortage is real; and in some sectors is already no longer a risk but a reality!

Some improvements are becoming apparent, but they are still limited: the employability of newly qualified women engineers is higher than the average for engineers and the added-value of women in industry is better recognised. They are valued for their technical expertise, their team-management skills and their contributions to innovation. But the persistence of certain gaps (the level of responsibility they are allowed, the differences in salaries) reduces the attractiveness of these sectors.

The need for urgent action is all the greater. In particular, the general problem of the attractiveness of the engineering professions and the science sector in general depends on action that calls for increased cooperation between the private and public sectors. This is all the more important because solving these problems will ease the transition towards a growth that is being chosen.

²⁸ Source: « Fin du monde ou sortie de crise », Cercle des Économistes, March 2009.

²⁹ Source: *La Prospérité du vice*, Daniel Cohen, 2009.

³⁰ Source: *Report by the Commission on the Measurement of Economic Performance and Social Progress*, Joseph E. Stiglitz, Amartya Sen, Jean-Paul Fitoussi, 2009.

Notes on methodology

1/ CNSIF³¹ survey

The conduct of the survey

This survey, like the three previous ones, was conducted over the Internet. The 116 alumni associations that agreed to participate emailed the members whose addresses they had, to invite them to complete the questionnaire on the Web. The website was open from 1 March to 4 April 2009.

Structure of the sample

42,103 responses were collected from engineers aged under 65; 8,235 of the respondents were women. The responses were weighted for age to represent the 681,400 certified engineers under 65, regardless of school. Female respondents were better represented among the respondents than in the total population of engineers. They were also younger than in reality.

Remarks on the presentation of findings

Rounding of percentages in the tables

Percentages were often rounded, since an excess of precision was not meaningful; totals may therefore not add up to exactly 100%.

Populations of reference

Estimations are sometimes given of certain percentages in different populations, for example, for all engineers, for the whole active population in France. The reader should therefore not be surprised to see different percentages for each sub-population.

The number of engineers in a population of reference may also differ from that expected because not all respondents answered the particular question on which the analysis is based. For example, for the breakdown by specialisation, the total is 680,920 rather than 681,400.

Definition of beginners

Beginners are defined as follows:

Having graduated in 2007, 2008 and in some cases 2009

Qualified with initial training, with student or apprentice status

Aged under 30

Having had only one employer

Having executive status

The term “engineers” refers to engineers of both sexes unless specified as “woman engineers”.

2/ Eurostat Database

Source:

Eurostat, analysis of national data on the working population (European Union Labour Force Survey – EU LFS). The most recent data relates to 2007. There was a change in methodology in 2006. The data presented in this study was derived from extractions made in August 2009.

The principles laid down for EU LFS on the sample sizes required for representative results have been applied.

³¹ Conseil National des Ingénieurs et Scientifiques de France - National Council of French Engineers and Scientists

3/ Trendence Survey: “Baromètre Étudiants”, engineers edition

Trendence is a leader in employer branding market research and HR marketing. Trendence conducts the largest employment and careers survey in France among future graduates: Le Baromètre Étudiants. This provides a deep understanding of the market and advice of exceptional quality, and supplies employers with the tools they need measure the performance of their employer brand by country, by sector of activity, by institution, level of education, etc.

- Number of questionnaires completed – Edition ingénieurs*: 12;648 (74.3% by men, 25.7% by women)

- Study carried out between October 2008 and the end of January 2009.

- Students of 88 schools took part.

- Methodology: - On-line questionnaire protected by password transmitted to students by a representative of their school.

- Students questioned: see above. 12,648 is the number of valid questionnaires used for the survey, submitted by engineering school students who had completed at least four semesters of their course. Only complete questions were accepted.

- The responses were weighted -a mathematical adjustment to obtain the real weight of the data reflecting the real student population.

This survey has been conducted in France each year since 2007.

Trendence started in Germany ten years ago and carries out national and international employer branding market research.