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## **LIFE STORIES, SCIENCE JOBS AND GENDER**

**Gapp summary report of the in-depth interviews with opinion leaders**

**[BELGIUM, DENMARK, ITALY, THE NETHERLANDS, POLAND, PORTUGAL]**

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In order to draw a general picture of scientific and technological careers in a gender-oriented perspective, we have carried out in-depth interviews with some privileged witnesses working in the field of research and technological applications in Italy.

In the seven countries, the interviews were carried out in May-October 2007 and the sample included 22 men and 36 women. We had set the goal of learning and understanding their personal stories, their scientific, cultural and social background and the difficulties they had to face in their career. As the interviewees were chosen within a circle of privileged witnesses – in some cases they are real opinion leaders –, interviewing was also aimed at learning their vision on the future career opportunities for young people of both genders in their field of research or activity. Finally, our witnesses were required to suggest any possible action aimed at reducing the gender gap.

## **Obstacles in the life stories**

In most of the biographies the issue of gender does not turn up and is not a matter mentioned by itself. The interviewees perceive this discrepancy as natural, enrooted in cultural and sometimes biological differences. All of the interviewees – men as much as women – highlight some aspects in which their gender has always played an active role for their career. Not in all cases they are negative highlights: some advantages provided by gender are frequently mentioned. It is possible to identify some lead threads to describe the different levels of the issue.

On the top level, the deepest one as it involves the entire society: sexist prejudices emerge very soon and concern girls in particular. This is something that keeps them away from a basic scientific education and later, at university or in the first stages of their academic career, this is a major obstacle. Men recognize that their gender has had an influence on their career. Sexist prejudices also interfere in ordinary social interaction.

Yet prejudices are even more evident when responsibilities must be shared and distribution of power is concerned, because historically men are in control. A female researcher is first seen as a woman and then as a researcher. It is not always easy to steer clear of this mechanism and to focus the attention on the professional and research level.

Quite a typical and rooted sexist prejudice derives from the alleged belief that girls are not good at maths, which is obviously groundless. The amount of obstacles or the perception about it varies a lot within the group of interviewees. Obstacles were sometimes perceived as soon as secondary school but only by female interviewees: the choice of the amount of hours in maths and science at school is an important factor that is often influenced by the parents, by peers, or environment. Having parents who have studied or worked in exact sciences has, on the other hand, a positive influence on choosing to study exact sciences. Having supportive teachers can help too.

Another important issue in S&T careers is the competitiveness one. Competitiveness, when it is concrete and influences your everyday life, concerns especially your time management. Then, competitiveness needs training and education: this is not always tackled properly, with teaching not yielding the expected results.

In the end, in a researcher's everyday life, competition with one's colleagues plays an important role and if one is not used to compete, one risks being excluded and not being able to work at ease with the necessary instruments and resources.

On the second and probably more specific level of research, there are: movements and transfers as necessary professional procedures in the life of a researcher; the dynamics of young people recruitment and stabilisation; the distribution and allocation of resources – financial but also infrastructural ones.

Most of the interviewees started their professional careers in academia – though some of them are currently in politics or management. After finishing their first degrees in science or engineering, most of them went abroad in order to continue their studies and obtain their doctoral and, in some cases, post-doctoral degrees. Many of them stress those experiences abroad as one of the most important aspects of their professional careers. In fact, research requires freedom of movement and support when “hard” choices are to be made. In this regard, a family that follows and supports, or that hinders and holds back can make a difference. Males, in contrast to females, usually report stories of a supporting family.

Recruitment emerges as an issue from many interviews. It will suffice to quote one for all, as it clearly represents the conflict between willingness to work and sacrifice yourself (“hard work”) on the one hand, and not very clean personnel management on the other. Furthermore, recruitment is founded on a pre-selection in which women reveal all the prejudices, stereotypes and the self-exclusion mechanisms they interiorise. At the top levels, dynamics are driven by the power relations an organisation is inevitably involved in. Quite interestingly, the same percentages at the bottom level (30-70 percent) and at managerial level (10-90 percent) are to be found in private organisations.

Finally, the most relevant issues concern family and personal life. At this level there are: the role played by a married partner – often, the positive role played by wives; the education you get from your origin family; the obstacles at psychological level that a woman inflicts on herself. But in the personal sphere there are also the opportunities that a woman gets from being more visible in a group of young researchers.

Obviously, the role of a married partner is particularly relevant when there are also children to bring up: a small disadvantage of being a woman involves having children and care giving. There is a social pressure different on wives and husbands, male and female scientists, male and female workers. Often men's words reveal the sacrifice their wife had to make, by leaving her university career; but also the opportunities this sacrifice of hers has opened for themselves. In a framework of scientific competition based on high-level international standards (and not on local micro-dynamics), being a woman can also be a further opportunity, because it undoubtedly favours visibility. When the benchmark is given by one's ability and merit, on the same level, being visible is an advantage.

Some interviewees attach an important role to the educational choices received from one's origin family and, even before that, to the role models a family passes on. The family of origin, obviously after having provided an upbringing, guarantees also the maintenance of the children during their studies and, more and more frequently, even during the first phases of their inclusion into the work force and research. When living on your family becomes too heavy, then excellent brains get lost as they change path, forced to choose less risky and costly careers. This is a problem that invests all the young people, but probably its hits

women slightly more, as they have a biological time within which they need to be independent and to create their own new family.

For most of our interviewees the time of primary and secondary school is a distant past. All the undertaken choices and decisions dealing with educational careers and their causes are vaguely remembered. Preferences in natural sciences occur in different periods of life and are not recognised as dominant in the preliminary phase of educational career. This vocation appeared early (during childhood or adolescence) – in some cases resulting from contact with a role model or science popularization books, in others due to the excellence of certain teachers and the learning opportunities provided by certain secondary schools (e.g. learning through laboratory experiments). The enthusiasm felt during those first years of studying remained relatively constant.

Almost all of them stress the importance, for the emergence of a scientific vocation, of early contact with science and with practices that could raise the youngsters' curiosity about the world. Some also point to the importance of having positive role models and to the critical role of family, mainly in creating the conditions for a free and secure career choice.

## **Workplace conditions with regard to gender**

Within exact sciences, there are differences amongst the several disciplines when it comes to the number of female students or researchers. Anyway, women have entered the playing field. For instance, in Denmark, the gender distribution workplace is roughly fifty-fifty. This goes for every department but management, where it should be better to have more women: *"they have finally made it to the playing field that used to be occupied by men only"*.

Let's clear the way from a possible and banal misunderstanding: certainly for those who make science now there are not differences between men and women. A researcher may or may not be a good researcher, totally irrespective of their gender. We move in a scenario in which the possible "female qualities" may be useful to research. Among them, undoubtedly there is motivation. Perhaps for historical or cultural reasons, today women are positively pushed by a desire for an intellectual compensation.

Instead, a disadvantage is given by the children's care. Some of the interviewees see the management of maternity (not maternity in itself) as a task completely on the shoulders of women, very costly especially in terms of the pace of research. A career in research has some phases that must be rightly given regard, otherwise the result is waste of time, delays, postponements that therefore make female careers heavier than male ones.

Physics, engineering and computer sciences have very few female students (respectively 20%, 13% and < 10%) and this results logically in very few researchers or professors. One of the reasons mentioned by several interviewees is that those studies are perceived as too theoretical. There are more female students and researchers in biology and maths, but a reason for it is that they can easily become teachers afterwards.

Why do so few people (especially girls/women) choose the exact sciences and technology?

## 1. The image of (people in) the exact sciences and technology

The experts on gender issues stress precisely the same processes: on one hand, the youngsters' career choices still reproduce stereotypes (particularly concerning the engineering field), but on the other hand, some science fields have been benefiting from a deep feminisation process. They even mention that nowadays it might be more important to stress the deficit in S&T vocations among males, on account of the recent high school failure and school-leaving rates registered among boys, and also because girls are apparently being given more guidance than boys, by families and the school system, to succeed and to invest in their qualifications.

Society, culture, globalisation take the gender issue to the level of the imagery. In the common imagery, the representation of a researcher is very much a male one.

When a female interviewee wanted to study in Delft, many people asked her: "*Why do you want to go to Delft with all of those nerds? That can't be fun*".

And when doctors, researchers and scientists are portrayed in TV series, for example, men are always the positive characters, the protagonists and the heroes. There is a force of inertia in the imagery that drags the professional and social images of the past few decades up to today.

## 2. The different characteristics of girls and boys

When questioned about the factors that could explain the girls' and boys' (different) options, everyone rejects explanations based on any supposedly "natural" male and female missions, different abilities for each S&T area, or an association between gender and various ways of reasoning. On the contrary, they tend to stress that gender-differentiated vocational choices are the result of cultural factors that have been incorporated into the youngsters' education since the first years and end up profoundly determining their life projects.

It is a matter of reproduction of the gender stereotypes connected with various occupations – in particular, the association between engineering and masculinity or between life sciences and a woman's sense of caring. Holding managerial posts is also connected with different type of personality, which is rare among women. Girls are expected to study something not too theoretical or to work in a caring profession. Or during their scientific career, women are expected to work less after giving birth. The result is that they often have to work more, or more efficiently, to prove they can still handle the job. One interviewee said: "*I had to prove that my brain wasn't damaged by giving birth!*". In conclusion, these problems obviously are all intertwined: there are cultural issues, limitations imposed by a family, the pace of life, mobility.

Another biological obstacle results in an emotional approach to the world in case of women and a distance in case of men. According to the interviewees it does not come from cultural differences or stereotypes, but from a different performance of a feminine body in the first place. As it may be seen, emotions do not forbid women to work in science, but they make their attitude towards knowledge more pragmatic, especially if it is connected with people.

The case with technical predispositions is different, where cultural obstacles play major role. There is a dominant conviction that an engineer is male. Women are convicted that they do really well in technical

sciences. In these areas they perceive inequality caused by stereotypes on the image and role of an engineer in society. But on the other hand, the women performing managerial duties have not noted discrimination practices.

The interviewees perceive the problem of underrepresentation of women in technology in the educational system, which not only does not encourage girls to take interests in these areas, but also preserves existing stereotypes.

### **3. Girls and women working in a man's world**

The differences occur when thinking of the scope of discrimination practices in particular work relationships. As for science itself there are not any of such problems – these relations are not connected with gender. In science, according to the interviewees what counts is what is done, not by whom.

Opinions tend to be slightly more divergent when it comes to discussing the effective conditions for woman to progress in their S&T careers. There are rather few women in top positions, a fact that could be explained by the limited number of women who have acceded to these professions in the past. The current gender distribution in top positions just reflects the former recruitment base and has nothing to do with any other organisational processes. In that case, a change can be expected soon; and, in fact, it has already happened in some institutions where woman form the majority, even at the top of the hierarchy.

Another damaging element is provided by the necessity of mobility. Mobility is in contrast with family management, because it basically is a sort of sedentary community. This issue is closely related to the one of the persistently creeping male chauvinism. Between a wife and a husband, the trend is to follow, to favour the husband's career. Male chauvinism is historically interwoven with power.

### **4. Combination of work and care giving**

Working in S&T is hard for women also in combining family and research. You can't really work part-time in science. Motherhood is one case which does not allow women to fully engage in a scientific work. In such a case longer brakes are unavoidable, which are not advisable in natural sciences. Another case is connected with institutional relationships, which discriminate women in applying for managerial posts. It is worth mentioning that all the interviewees have children and perceive their personal experience as natural.

Pregnancy in itself makes you fall out of pace with the world of science, which is a very competitive world. Therefore the woman who retires for a year to care about her family is a researcher that has a one-year delay.

Another aspect often mentioned relates to the work and family balance, a concern that tends to be more challenging for women, given the traditional inequality in the sharing of family responsibilities between men and women. Therefore, they may often face additional problems because they end up competing with younger – and thus apparently more promising – men with similar curricula. It could be the case, for instance, in academic careers, which are dependent on post-graduate degrees and scientific papers that require extra time to prepare.

Women, in the 21<sup>st</sup> century, are still the linchpin to a family's life (*"men are not yet able to manage the private side of their life"*). Women seem to explicitly attach to family a greater importance.

Still on this topic, it is interesting to note that in the companies with which we have contact, due to the competitiveness of the market in which they are working and the need to provide their personnel with high quality working conditions (whether male or female), there is considerable concern about the creation of fair mechanisms to promote flexible working hours or work at home.

Indeed, not all the protection measures have positive consequences. "Prolonged maternity leaves" may end up driving women away from research and are a deterrent to employers. Action should be therefore taken to remove these side effects from those measures. For example, forcing their implementation on men as much as on women.

## 5. Social context

One of our interviewees – with political responsibilities in the S&T field – also adds that there is a general leadership crisis currently affecting the whole of Europe and both sexes. This might be due to a lack of interest among highly qualified people in assuming leading positions in public science organisations.

Among other factors, they emphasize the fact that, being a minority in many S&T organisations, women tend to be rather loosely integrated into sociability networks, so that they end up in a weak position within lobby groups. Besides isolating woman from science information interchange channels, this may make access to top positions even more difficult.

In this context, even in formal calls for applications, evaluation criteria always involve some subjective components, which make them more susceptible not only to the (unintentional) favouring of those candidates that have some kind of connection with the evaluator, but also to the unconscious influence of gender stereotypes (for instance, to the idea that careers are more important for men or that leadership is more difficult for women).

A small group of our interviewees considers that the introduction of certain positive discrimination measures in favour of women could possibly have a positive effect for some time, as a way of speeding up the ongoing process of change. This policy, however, is far from the point of having the support of most people: nowadays, girls find in the reasons for studying and working in S&T.

## Possible action to bridge the gender gap

People expect the gender differences within science and technology to gradually decrease, especially as concerns the total proportion of women working in the field and interested in it. This optimism results mainly from the fact that the number of women interested in these careers has already been increasing in recent decades; girls often perform better at school than boys; many women are increasingly focused on their working life; and equality in the gender distribution of family responsibilities is also rising.

Nevertheless, some people also admit that there are a number of significant obstacles to be faced in this change process, especially regarding the conditions for women to progress in these (as in other) careers – indeed, it is precisely in this latter domain that recent changes are even less evident. These difficulties involve, among other things: the persistence of certain gender stereotypes within the society and, in particular, within work organisations, which are not changing easily or rapidly; the increase in competitiveness in these sectors, which may make progress even harder for those who have to deal with

heavy family responsibilities; or a rise in the social pressure on women with regard to motherhood, on account of the crisis in the birth-rate and the growing difficulties in finding family support services.

Given this frame, what can be done to get more girls in the exact sciences and technology?

## **1. Elementary and secondary education**

The interest for science should be aroused in primary school by giving an elementary course of science or using illustration kits. At that age there are as a matter of fact already strong stereotypes about scientists that are enhanced by several media.

A few interviewees also suggested that there should be more attention for languages in scientific training.

Perhaps, we should begin early teaching science and technology, even for two- or three-year-olds.

Generally, everyone points to the school system as one of the most – if not the most – important spaces for the promotion of S&T vocations among the young. In this context, it is argued that the schools: reinforce experimental learning and create ever more activities focused on increasing the young people's curiosity and critical capacities with regard to the world around them; improve the opportunities for the students to have contact with the new challenges of science and the applications of scientific knowledge to daily life; and implement new measures to combat failure at school and disseminate the idea that the understanding of some subjects is not as difficult as many students think, i.e. it is not a matter for the better ones alone. In almost all cases people highlight the importance of directing this kind of measure to the whole student body without exception, and especially for the younger ones who are now starting their schooling process.

Students should first be allowed to become enthusiastic for the subject before they are 'bothered' with other things.

In conclusion, teachers in secondary school are not bringing over the passion for science enough. They should be more involved with the scientific world (e.g. universities). They should also be more trained in bringing the passion over and being aware of social influences on girl's study choices. Someone suggests that teachers already have a heavy workload without doing the study choice accompaniment.

## **2. Higher education and teacher training**

On the other hand, most people also stress the decisive role that the scientific community, the research/higher education institutions, and private companies can play in improving people's interest and trust in S&T. Special mention is made of the importance of providing the public, especially the young people, with the opportunity to have direct contact with those who are really working in S&T and their daily working activities.

These initiatives involve the reinforcement of a policy of openness on the part of the science institutions towards society, and a growing sensitivity to their social responsibilities: these activities – that have hitherto essentially been carried out on the basis of the personal enthusiasm of individual agents – should count on progressively more support from experts on communication and public relations issues.

In this context, the respondents also often mention the importance of museums and science centres in the popularisation and promotion of a closer and perhaps more fun-oriented and motivating connection between science (and its experts) and its public(s). The role of these institutions is highly valued by most people, even if some of them also alert us to the fact that science exhibitions, despite their informal character, should avoid communication strategies excessively based on “show and entertainment”, which could end up having perverse. These dangers are, in fact, also mentioned in connection with the experiment-based learning of science in schools.

### **3. Image and role models**

This emphasis on the school system does not mean that other spaces, agents and publics are not also indicated as important. Many of our interviewees also bring up the mass media (particularly television) as a decisive instrument for popularising S&T and reinforcing the trust of the public(s) in it. More specifically, through the media young people can encounter role models and create an “emotional connection” with the science world.

The media are also pointed out as a precious instrument in the changing of gender stereotypes. These tasks could be carried out not only within the spaces for popularizing science but also in many other programmes, in particular entertainment programmes with vast audiences.

Pupils often have a wrong image about ‘the scientist’ as being a nerd or some old professor in a white laboratory coat so actions need to be undertaken about the image of scientist: show more female scientists on television in soaps, let real scientists talk about what they do, show role models, do good PR, etc.

A deeper analysis focuses on the role models and the imagery that many interviewees frequently express. More positive role models are needed, both quantitatively and qualitatively – they should be “less high” role models, to be closer to the everyday female researcher with her problems and her achievements, with her weak and strong points, and all the limitations of a normal life.

This point falls within the more general discussion on how to communicate positive experiences. And within the obligation the scientific community has to inform all citizens, young people in particular. It is about what is now called the “third mission” of university. Aside from research and higher education, information, communication, dialogue and the debate with the rest of society.

Another element that should be exploited is the exceptionality of the job of a researcher. The fact that it is an elitist job should be more stressed.

A good argument for recruiting young people is that an education in the exact sciences is a good starting point for something else. Many of the top functions are filled by people from the exact sciences: people don’t know it.

### **4. Contacts between education and business**

In conclusion, a suggestion regards the creation of occasions, contexts for young women to express themselves, talk and listen to one another and debate. Without any male presence. In fact, in activities including both women and men, the latter fatally monopolise the debate, as both genders are influenced – positively and negatively – by the stereotypes that depict science as a male business.

And finally, initiatives and promotional events addressed to girls only may help to highlight more effectively that some typically female qualities do exist and are functional to research and should be exploited by girls as the strong points in their career. Avoiding to fall into the trap of adopting a male mentality and to turn their existence into a male-like one.

## **5. Continuous attention for the gender gap at universities and research institutes**

Before dealing with the future prospects, it is worthwhile to take a look at the past to contextualise the gender gap issue in scientific-technological careers in the framework of the employment dynamics of the 20<sup>th</sup> century. It was a century of changes and improvements, also (or even especially?) in the condition of women.

This does not mean that “modern times” are not hard times; young people and their families should have clear in mind that investments – in resources, commitment, time, studies – are needed to achieve longer-term results. And suitable means, especially cultural and mental ones, should be adopted to tackle short-term and casual work.

Obviously, the 20<sup>th</sup> century was also the century of science, the century in which research became collective, leaving behind the ivory towers, the academia and all those single contexts in which a scientist did suffice by (more or less) himself. Big science was born and the relation with society has become a daily one. Present trends suggest that this enlargement process will not stop and in the next decades it will further transform the dynamics within the scientific community, including also employment and the female work force in particular.

This will inevitably lead to a readjustment between genders, in research as much as in management. Apparently this is a readjustment the scientific community is ready for, as demonstrated in the previous chapters, whereas society as a whole has still to realise and accept it.

The critical point seems to be society that, according to our witnesses, has changed only slightly or has not evolved at all and therefore finds it difficult to be compatible with the novelties the new science will need. There are many possible risks: society may remain a step behind, young people may not have scientific professions in their vision, policy-makers and politicians may not plan and implement the services needed for a mobile community such as the one of researchers.

All of this may result in a huge waste of resources. The female gender would be wasted if kept away from research; and also those people who do not accept the frustration of selections not always based on merit would be wasted. These two groups are widely overlapping. This is a long-term and deeply rooted phenomenon that requires long-term solutions. In particular, action should be strongly implemented in the education field.

A much controversial solution envisages the establishment of “female quotas”, i.e. a minimum guarantee threshold for the number of women to be employed. Obviously, this is an instrument that can be used only in association with the meritocracy principle, which cannot be disregarded in the selection of people who carry out research. Rather, one should wonder whether meritocracy is actually the principle adopted or is only a smoke screen that frequently hides other choices.

Hence, the first action to be taken is to guarantee that merit is the criterion to select those who are to carry out research. It may not be a question of establishing female quotas, rather of sweeping away male quotas, in order to clear positions that are occupied only for power reasons.

## **6. Programmes geared towards women who have recently earned their degrees**

Finally, as regards, more particularly, the creation of better conditions for women to progress in their careers, the interviewees who were more aware of this issue pointed out the importance of making the evaluation systems less ambiguous and more transparent; changing the organisational culture of many institutions, promoting greater awareness of gender problems and unconscious prejudice-based practices; equipping institutions with new mechanisms that allow them to deal better with the diversity of current careers paths in these fields (e.g. the reintegration of staff who have temporarily interrupted their careers for family reasons or for work experience abroad or in other companies/sectors); and developing further studies on this matter and disseminating their results in order to promote a greater debate on gender and science issues.

## **7. Child care**

Child care is poorly organised. The expectations are not connected with revolutionary changes, because they come from the observation of evolving reality. This evolution is actually succeeding very fast. Civilizational changes give more and more opportunities for equality most of all through perfecting technologies lessening most of the women's duties. Such cultural changes enable changes of the roles in a marriage.

The expectations for the change of quantity and role of women are first of all connected with civilizational changes. Much hope is connected with the growth of economic condition, population and more expenses for science. As for practical solutions, they deal with the reforms in educational systems, however not in structure but in substance. There was also an agreement on policy based changes, which should target at equalisation of the proportion of gender in science. The idea of parity was especially criticised. In all the interviews there could be seen revealing consciousness of a cultural change effecting in two ways. Positive one is about the increasing equality of women, differentiation and exchange of social roles. The negative one centred on the decrease of interest in difficult sciences by young people, not only girls.

## The Gapp project

Starting from the evidence that in the European Union gender differences still exist in science and technologies, Gapp is a project intended to investigate differences between girls' and boys' in their perception of science careers and to propose a range of innovative and concrete participatory activities involving scientists, engineers and professionals from the public and private S&T sectors.

Gapp wants to explore how the perceptions of science professions affect interest, motivation and subject choice at school, at the university and consequently in their career in order to implement an effective social dialogue and identify main issues and expectations from research community, teachers, students, parents and other social actors.

Gapp uses innovative participatory methods, among which in-depth interviews that will lead to practical activities to overcome gender differences.

In this report, Gapp presents the results obtained in the interviews with opinion leaders in Belgium, Denmark, Italy, the Netherlands, Poland and Portugal. The complete analysis of the results is exposed in the survey "*Why do women hold only 7 percent of the lead positions in science?*". Both the report and the survey are based on the six national reports.

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