

Overarching Trends in Europe

TOPIC:

Is the Green Economy a Chance for women? Exploring the situation of Italian and German women in STEM

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General data on Women in STEM

Women in the labour market

In Order to be able to classify the situation of Women¹ in STEM (science, technology, engineering and mathematics) in particular, we shortly highlight the economic Situation in Germany and Italy. Both countries show a prevalent gender gap concerning employment rates and wages. In Italy the most recent data released by ISTAT for 2023 shows that in April 2023, the female employment rate was 52.3%, while the male employment rate was at 69.8%² In addition, Italy's gender pay gap is negative for both full-time and part-time workers: women earn an average of €8,000 less per year than men. In Germany there is a slightly higher general employment rate for both men and women (80% male, 73% female). At the same time the proportion of women working part-time is one of the highest in the world (13% male, 49% female)³. The gender pay gap is huge: women in general earn 18% less, among equally qualified persons still 7% less (2022)⁴.

Women in STEM

In both countries the data on the number of women graduates within the Stem subset is particularly critical: the presence of women drops drastically when only STEM graduates are considered.

In fact, in Italy, women represent 39% of the total number of STEM graduates⁵. These disciplines are usually the ones that offer the highest wage and most stable career paths, but also in this environment some gender disparities have been found: for example, among the working category of engineers, five years after their master's degree, men earn a net salary of 1,755 euro, while female colleagues stop at 1,487 euro. As for the newly employed, in the first half of 2022, 11,152 women engineers were hired, accounting for about 23.5% of the total number of engineers hired.⁶

Germany came last in terms of the proportion of women graduates in STEM subjects: 22% of bachelor's and equivalent degrees were completed by women, the lowest proportion in the EU (Numbers from

¹ In this text we assess the situation of Women. Other discriminated gender identities substituted under the term FLINTA (female, lesbian, intersex, non binary, agender) were not assessed due to lacking data basis. In general FLINTA persons can be assumed to be discriminated against as well, and it should be assessed more precisely by further research.

² ISTAT, BES Report, 98.

³ Destatis Statistisches Bundesamt. Gender equality dossier 2022.

⁴ Destatis Statistisches Bundesamt. GenderPay Gap 2023.

⁵ <https://www.corrierecomunicazioni.it/lavoro-carriere/competenze-stem-per-il-245-dei-laureati-litalia-sotto-la-media-ue/>

⁶ <https://www.cni.it/media-ing/news/240-2023/4306-l-ingegneria-italiana-e-sempre-piu-al-femminile-ma-sulle-retribuzioni-resta-il-divario-di-genere#:~:text=In%20Italia%20ci%20sono%20277.201,Ingegneria%20Industriale%20e%20dell'Informazione>

2020).⁷ Even after a successful STEM degree, women are significantly less likely to choose an actual STEM profession than men, which is explained by a lack of role models and career ideas⁸. Compared to their female counterparts, male engineering graduates are more likely to work as engineers or managers, while female engineers are more likely to work as office staff.⁹ In the end of 2022, women held a share of 16 percent of all employees in the STEM fields, with huge differences within the branches: Independent from degree, metalworking engineering occupations have the low and lowest female shares (4.5-11%). High female shares are found in the biology and chemistry professions (47%) and other scientific professions (73%) on the academic level, in mathematical and scientific occupations on the specialist level (30%) and the skilled workers level (89%).¹⁰

Expectations of young people

Gender inequality affects the expectations and perspectives of young Italian students entering the world of work. According to recent studies¹¹, more and more women are choosing scientific studies, but gender stereotypes still weigh heavily: scientific subjects continue to be perceived by girls as "unsuitable" for them, even though 54% of female students are curious about these subjects: some testimonies given by girls interviewed by Save The Children Italia serve as an example:

"It makes me feel useless when someone tells me that boys are better, like girls are useless." [Alice, focus group Palermo ZEN, 2020]¹²

The survey¹³ shows that only 59% of young Italians girls say they would achieve excellent results in the study of STEM when paired with a boy. The consequence of this misconception is that in Italy only 12.6% of female students choose a STEM-related educational path, only 6.4% work in ICT and 13.3% in engineering-related sectors.

The new and ever-growing sector of the Green Economy seems to be a turning point for the new generations of women interested in pursuing a career in the engineering sector: in fact, in Italy, Isfol - Institute for the Development of Professional Training of Workers- reveals with its own study that 57.8% of women employed in "ecological" jobs hold medium-high roles in the company hierarchy, while the percentage for men stops at 35.3%. The presence of women is beginning to become more visible within companies active in the green economy¹⁴. Other studies, on the other hand, contradict this trend. The

⁷ https://www.destatis.de/DE/Presse/Pressemitteilungen/2023/01/PD23_N004_213.html

⁸ <https://www.iab-forum.de/should-i-stay-or-should-i-go-frauen-arbeiten-nach-einem-mint-studium-seltener-in-einem-mint-beruf-als-maenner/>

⁹ MINT Frühjahrsreport 2023

¹⁰ Anger, Christina / Betz, Julia / Plünnecke, Axel, 2023, MINT-Bildung stärken, Potenziale von Frauen, Älteren und Zuwandernden heben, Gutachten für BDA, MINT Zukunft schaffen und Gesamtmetall, Köln <https://www.iwkoeln.de/studien/christina-anger-julia-betz-axel-pluennecke-mint-bildung-staerken-potenziale-von-frauen-aelteren-und-zuwandernden-heben.html>

¹¹ Save The Children: "Science is not just a man's job"

¹² <https://s3.savethechildren.it/public/files/uploads/pubblicazioni/barriere-sociali-e-di-genere-alla-formazione-e-all'educazione-stem.pdf>

¹³ <https://www.assolombarda.it/centro-studi/I2019interesse-delle-giovani-donne-europee-verso-le-materie-stem-una-sfida-da-non-perdere>

¹⁴ <https://www.corrierecomunicazioni.it/lavoro-carriere/competenze-stem-per-il-245-dei-laureati-italia-sotto-la-media-ue/>

study conducted by the International Labour Organization¹⁵ highlights a significant challenge: despite the ecological transition generating new opportunities, gender inequalities persist and the risk of marginalisation of women even in green jobs is significant. As far as green jobs go, it can be easier to access them for men from non-green sectors such as fossil fuels due to the similarity of tasks, which therefore requires less investment in training.

Similar problems are reported for German girls, when it comes to self-perception and respective career choice. Although girls and boys have the same academic performance in STEM subjects and 8th grade girls even have significantly higher computer and information-related skills than boys, they are significantly less confident in their competence.¹⁶ It is also particularly problematic that not just the girls themselves are less confident, but this perception is shared by their parents and teachers. This ambivalence between competence and perception is also reflected by a number of 70% of girls being very interested in STEM fields and at the same time over 40% seeing major hurdles for themselves in entering such a field.¹⁷ As a consequence the choices in vocational education follow the same pattern as in the STEM studies: while the most popular vocational jobs for men are STEM occupations, the most popular vocational jobs for women are not STEM related occupations.¹⁸

Also, it seems that there are different motivational factors for girls and boys in their choice: an average 15 % more income for graduates in mathematics, computer science, natural sciences or mechanical engineering than for people who have studied other subjects is a factor that matters more for boys than for girls. For girls the compatibility of their career and family planning seems a more prevalent factor.¹⁹

Trend: Role of Women in the Green Economy

As far as Italy's labour market is concerned, studies²⁰ show that about 73% of all female graduates in engineering disciplines are employed. The figure reaches peaks of 77% in Northern Italy, while it is lower in the South: 62%. Unfortunately, the data confirm the persistence of the gender gap, both in terms of employment levels and pay. One year after graduating in engineering, only 10.6% of men are unemployed, while the percentage rises to 16.3% for women; the same goes for pay levels.

As far as the Green Economy is concerned, the United Nations Commission on the Status of Women encourages the employment of women in the green economy sector, with the aim of achieving a clear improvement in women's employment through sustainable development²¹. This element must be compared with the trend of the sector in Italy: Isfol reveals with its own study that 57.8% of women employed in "ecological" jobs hold medium-high roles, while men stop at 35.3%. The presence of women

¹⁵ https://www.ilo.org/wcmsp5/groups/public/---ed_emp/documents/publication/wcms_732214.pdf

¹⁶ <https://www.iwd.de/artikel/frauenmangel-in-digitalisierungsberufen-581520/>

¹⁷ <https://www.mdr.de/wissen/mathematik-informatik-technik-mint-studiengaenge-frauen-100.html>

¹⁸ Destatis Statistisches Bundesamt. Top Ten Ausbildungsberufe Männer 2021/ Destatis Statistisches Bundesamt. Top Ten Ausbildungsberufe Frauen 2021.

¹⁹ <https://www.mdr.de/wissen/mathematik-informatik-technik-mint-studiengaenge-frauen-100.html>

²⁰ <https://www.cni.it/media-ing/news/240-2023/4306-l-ingegneria-italiana-e-sempre-piu-al-femminile-ma-sulle-retribuzioni-resta-il-divario-di-genere#:~:text=In%20Italia%20ci%20sono%20277.201,Ingegneria%20Industriale%20e%20dell'Informazione>

²¹ <https://economiecircolare.com/green-job-donne-una-questione-di-genere/>

is beginning to become more visible within companies active in the green economy, perhaps also because women are more sensitive to these issues²².

For Germany it has become visible, that even having chosen a STEM study, women start working in STEM jobs less often than men or get lost for STEM jobs later in their career.²³ Often the STEM jobs have a traditional male "atmosphere" and seem not to bring the needed flexibility in career planning, which is for women sometimes hard to combine with family planning. Another reason might be job descriptions, only mirroring the jobs' technical aspects, pushing women away – although the jobs often bear unexpected aspects such as a need for communicative skills.²⁴

CASE STUDY: Women in STEM – Green Economy as a catalyst for transformation?

An Italian study from Save The Children²⁵ shows that girls and boys are aware of "gender equality rights" to a certain level: they recognise that girls and boys have equal skills in STEM subjects and that everyone should have the same opportunities and be treated equally:

"It makes me feel useless when someone tells me that boys are better, like girls are useless." [Alice, focus group Palermo ZEN, 2020]

"... I disagree, girls can do well in math too." [Martina, focus group, Rome Torre Maura, 2020]

Another study of Save the Children regarding gender disparities in education, reports these testimonies:

"I chose this one, she's an astronaut. I'm interested in planets and celestial bodies because in 5th grade we did some work on them. I know who she is, it's Samanta Cristoforetti, she was the first woman in space. Is this her?" [Bambina 2, Focus Group Torino, 2020] "I chose the builder because I like to build things." [Girl 3, Focus Group Prato, 2020].

To further investigate on this topic and the consequences this kind of stereotypes have on professional career pathways, Alfa Liguria and LIFE e.V. conducted small qualitative research, through semi-structured interviews.

The scope of the research revolves around understanding the position held by women engineers in the green economy and whether there is a general perception the work environment to be less subject to gender disparity compared to other engineering sectors. The interviews highlighted how many women perceive large gender differences when carrying out their work in engineering.

The Italian participants were employees working in a company that deals - among other topics - with sustainable solutions in Liguria. The analysis of the data has led to the recognition of various indicators for which there is a strong gender gap, especially when speaking about hiring. For example, M. (woman of 45 years, engineer) states:

²² <https://www.assodonna.it/it/lavoro/green-economy-professionisti-emergenti-spazi-donne.html>

²³ <https://www.mdr.de/wissen/mathematik-informatik-technik-mint-studiengaenge-frauen-100.html>

²⁴ <https://www.iab-forum.de/should-i-stay-or-should-i-go-frauen-arbeiten-nach-einem-mint-studium-seltener-in-einem-mint-beruf-als-maenner/>

²⁵ <https://s3.savethechildren.it/public/files/uploads/pubblicazioni/barriere-sociali-e-di-genere-alla-formazione-e-alleducazione-stem.pdf>

"I had just graduated, and I went to do an interview for a large company that dealt with energy in Milan. It was me together with a boy with whom I had done my thesis. I had graduated with a higher grade, I had higher qualifications, I had gotten better marks in the written test but then they called my partner... I asked myself a few questions."

Once again:

"It happened to me, when I was younger, that during interviews they asked me about my personal situation. Now it would be a big scandal, years have passed... They didn't ask me directly –do you want to have children - but something veiled, through which they could have the information."

For what concerns technical skills and the perception of women in the sector, it is noted that, in some cases, women are considered unsuitable for certain tasks or for STEM subjects. Women are considered, by their male colleagues, not able of fully understanding STEM subjects, as well as not suitable for jobs that require scientific and mathematical technical skills. Due to the culture that has been established in society for centuries, it is thought that the role of women is to carry out jobs related to teaching, care and home. Even if this is not openly said, this is found in the working dynamics.

Many women we interviewed complained about how their opinion is often not taken into consideration or how a good idea is considered by men colleagues only a good intuition and not the result of their logic and professional competence:

"...both for the fact that I was young but essentially because I was a woman I wasn't taken into consideration in the activity, for example on construction sites I've always been stigmatised, if I did something good I did it because I was female, if I had an intuition, I had it because I was female, not because I used my brain. Or I was accurate because I was female, not because I used my brain. Now in the company where I work, I feel it much less also because there are many more women." (S. woman of 38 years, engineer)

Gender gaps are exacerbated when female engineers become mothers. In fact, in this work field, the status of mother seems to surpass that of professional woman:

"The female situation gets much worse after a woman becomes a mother, because going to a construction site while pregnant or with your child at home is seen as inexcusable and is not tolerated: in certain sectors, becoming a mother is like losing all competence."

These dynamics appear to be changing within the green economy sector. In the company analysed by Alfa, there are no salary or hiring differences:

"In my company I am a project manager and honestly there are women who have higher salaries than men, given the same level of employment. There is no gender difference, also because the director of our section is a woman." (M. woman of 45 years, engineer)

"If we talk about education, there is a male prevalence and therefore there are also more men in the green economy. Green economy is not an exception... then it is true that there are growing numbers of women. When I went to university it's true, there were many more men, but many more women completed their studies, many more men were lost in education. In other fields, for example in mechanical engineering there are many more men, compared to other fields such as civil [engineering]." (M. woman of 45 years, engineer).

It is interesting to observe how the interviewed men do not notice gender gap in the engineering field in general, and in the green economy. R. 26 years old man, tells us:

"I don't think there is an obvious distinction between men and women. I have never seen situations in which a person was more right for being a man and less for women, I have not noticed this. In a previous experience I saw a situation in a non-green company, most of the operators were men, but there were also some women who carried out the same tasks as men".

The German Interview partners were three female engineers in their late thirties working in public service companies (C., 37 years; I., 39 years) or as freelance engineer (N., 39 years).²⁶

When asked about their motivation for studying STEM all of them bring up humanistic, social or ecological relevance as striking arguments for their choice. This is reflected by reports showing, that when STEM jobs and studies are connected to topics such as environment, medicine/health or creativity, the share of women increases.²⁷

"I think at some point I realised that my strengths lie in the natural sciences and technology and then I tried to find something meaningful there" (I., 39 years, studied environmental engineering)

The factor of getting practical added to that for N. and C.

"I think I was influenced by growing up on a farm, very close to and dependent on the environment, seeing that if we are sensible, then it works out well [...] In the end, after an ecologically oriented volunteer service, I thought I would like to do something sustainable and meaningful - I didn't see my skills in the social field, but practical things suited me, I wanted to do something technical and ecological" (N., 39 years, studied environmental engineering)

"I spent a year in Uganda after school, I was totally influenced by another fellow volunteer who was super sure, that she wanted to study mechanical engineering. There I had lots of contact with development workers which made me think about conditions and development cooperation: what is good, what works, what levers people have depending on their education. After the year in Uganda, I was sure that I wanted to become an engineer. I'm more interested in the political side, but I can't bear not to get into the implementation: I actually want to do something, I want to be able to become concrete through my education." (C., 37 years, studied mechanical engineering)

One person explicitly mentioned the expected better gender balance as a further motivational factor to take on an engineering studies in combination with environment.

"I tried to find something meaningful there, which is perhaps not quite as male-dominated as other engineering sciences" (I., 39 years, engineer)

Concerning gender equality in their work lives, the interviewed reported about partially or very open and progressive working surroundings such as a good and appreciative communication, as well as an almost 50/50 share of male/female personnel, and a general openness to women as engineers, one of them also reporting on a women's representative in the company. But all the three of them also made broad experiences with gender imbalances: Differences in salaries, in the share of female (executive) personnel, a lack of acknowledgment of expertise by old (white) men, sexist behaviour and sexualised remarks – all

²⁶ They are working as engineers in the role of Project Manager Climate Protection and Energy Supply Concepts (C., 37 years) and as an immission control officer for waste treatment plants (I., 39 years) in public service companies. The third one is a specialist planner for rainwater utilisation and stormwater drainage and planner and constructor of PKA in two private engineering collectives (N., 39 years)

²⁷ <https://www.iab-forum.de/ingenieur-und-naturwissenschaften-in-manchen-mint-faechern-dominieren-frauen/>

these were experienced or observed by the interviewed, though there seem to be big differences depending on the area and field of work.

When it comes to salaries, C. reports some more male connected features to positively influence the salary's height:

"There is a need to negotiate salaries [...] Male people make target agreements and then get "Bonuses" depending on the contracts they make – for that you need a certain appetite for the challenge, the competition, the thrill, the self-confidence in your own success." (C., 37 years, engineer)

The fact of not being taken seriously is mentioned by all the three of them, being combined with the possible effect of a relatively low age by N.:

"When it comes to real implementation [on the construction site], experience also shows that it was definitely more difficult to be taken seriously; things were questioned in a way that it became clear, that it went beyond a constructive approach; that [my work] was not considered to be of such high quality, probably also depending on age." (N., 39 years, engineer)

And even when taken seriously it seems to be connected to being exposed and exoticised:

"And then also that, when people realise that I can do what I do after all, that you're also treated as a bit of a ... er ... something special." (I., 39 years, engineer)

But is being an engineer in the green economy better than in other engineering sectors? Generally, all the three interviewees were – more or less – optimistic, expecting working in the former fossil world to be 'even worse'.

"I could imagine that it's even worse elsewhere." (I., 39 years, engineer)

C. also brings it together with a more decentralized, differentiated working world in the green economy:

"If I look at the professions compared to the jobs in the energy/engineering office, then I would think formally in such a fossilised world it was even more male-dominated, there were fewer professions, less diversity; the way I see it now with service providers, customers, contracted companies - I suddenly see a lot more women, I would say it has a positive influence. Jobs are diverse, due to the decentralisation of energy generation, due to transformation processes, that are being pushed forward, many new fields of activity are emerging." (C., 37 years, engineer)

All of them agree – with different emphasis and on different level – to the question, that it might bring new and better chances to women.

"Yes, I could imagine that men are more open to the idea that women can do this than in other areas.

And there's a bit more awareness that you're not allowed to say everything!" (I., 39 years, engineer)

Conclusion: what can recommend for future female engineering?

Gender differences in engineering

In conclusion, what the research highlights is a gender difference in the engineering work sector resulting from several indicators:

gender gap in hiring women engineers;

the lack of consideration of women's ideas and skills in the STEM sector;

the role of professional which is not considered compatible with that of a mother.

Certainly, the green economy sector sees gender equality, both because there are more young people who work there who have fewer gender stereotypes, and because, as in the case analysed, it sees women hold medium-high positions.

Also, we can take the hint that the motivational factor of valuable, humanistic work can be taken into account for example when marketing studies and courses, making them attractive to young women.

Advice for future generations

Among the advice given by the interviewees was that of intervening on gender gap at an early age, starting from elementary school:

make girls, and not just boys, passionate about mathematics and science, without expecting that they cannot succeed as well as men.

invest in positive role models to show to girls: talk about the women scientists, mathematicians, physicists and engineers who have made important discoveries for our society.

provide greater gender education in schools, making both boys and girls passionate about STEM subjects from an early age.

"Children's minds, when they are so young, are easily influenced. Then adults send messages like that mathematics and science are not suitable for you as a girl. Another thing that can be done is to give positive examples, that is, not just to talk about the beautiful princess, but also about the beautiful scientist." (M. woman of 45 years, engineer).

Other advice concerns in particular young people – boys and girls - who are entering the world of work. First, the interviewees solidly all gave the same advice: to aim high and to be ambitious, because in the engineering sector only people with these characteristics get ahead:

"Be ambitious and understand that the activity you are carrying out has positive implications for society. You must be motivated by your professional ethics and morals. If you have finished as an engineer, you have the skills, the skills can always be acquired. Demonstrate that you want and don't settle." (R. 26 years old man, engineer)

Still women are confronted with a masculine world and must be ready to reveal their real abilities against male resistance again and again – to emphasize this one interviewed persons put it that way:

"In one of the last Missy Magazines²⁸ [feminist magazine] there was an interview with a female civil engineer, saying "every woman in the engineering profession is a kind of ambassador". Just being a woman in the engineering profession is a feminist action!" (I., 39 years, engineer)

To see it that way might be intimidating – but being an ambassador can also empower, can make the double effort of women visible and show the relevant dimension of women entering STEM for future society.

²⁸ <https://missy-magazine.de/blog/2023/11/13/work-work-work-bauingenieurin/>