Gender Equality in STEM: Exploring Self-Efficacy Through Gender Awareness

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Abstract: The aim of this article is to explore how and if, gender awareness affects self-efficacy among women scientists in Science, Technology, Engineering and Mathematics (STEM). Women scientists in STEM, due to their underrepresentation, embody a critical point for the whole research system. This is broadly considered as the result of cultural embedded unconscious bias that affects female professional career paths and strongly interacts with the role identity and self-efficacy. This is true also among research organisations, which indirectly reproduce the traditional job role division considering women closer to family-care responsibilities and men more suitable in performing at high-level positions. Traditional culture, seen as male-centred, defines particular ways of doing science as well as particular ways of doing gender. Gender awareness is considered as one of the powerful instrument to overcome traditional unconscious bias and stereotypes and to get away with the discriminatory attitudes and abuse of power. A qualitative case study carried out on female researchers in STEM working at the Italian National Research Council provides findings about the relation between gender awareness and self-efficacy. In this paper some evidences from the CNR case study are provided as well as a conceptual attempt classification of gender-based discrimination.

Keywords: gender equality, gender-based discrimination, self-efficacy, STEM field

Introduction

Within social sciences, gender equality is supposed to be one of the most controversial topics. As gender related factors are embedded in the dominant male-centred culture (Bourdieu, 1998), they are strictly associated to the development of the personal identity. Several studies sustain the hypothesis that unconscious bias considering women closer to the theoretical thought and to the family-care responsibilities are settled in our culture (Pajares, 2005; Butler, 2001; Faulkner, 2000). For these reasons, women are supposed to be not suitable in fulfilling high scientific positions whereas men, contemplated as more talented for the rational and scientific thought, are more appropriate in performing at higher managerial roles (Castilla & Benard, 2010).

In line with the sociological constructivist paradigm, gender is perceived as a category that reproduces itself and its social values helped by language, which is linked to the power (Foucault, 1978) and, since gender roles focused on the construction of personality (Butler, 2011), it differs from men to women. In our traditional culture, male identity and men power do not need to state themselves because they are contemplated as dominant and more powerful than the female identity (Bourdieu, 1998). The relations between women and men are considered conflictual, dialectic and producing a duality where the strongest personality and the weakest, appear (Bourdieu, 1998). The dialectic duality shapes people personal identity and shows itself as the result of a multiplicity of socializing factors such as: family, education, friendship, job-role division (Butler, 2011). Each socializing factors affects with different level of strength people identity hindering or facilitating the construction of the personal identity (Di Tullio, 2018) and this *represents the structural and structured process.* Gender identity and self-regulatory practices, affect every aspect of life and constitute the Leif-motive of the life's choices; this is particularly true concerning personal inclination in choosing professional career paths. In the research contest, doing science and doing gender are strictly connected and very conflictual (Faulkner, 2000) and research system should never be considered as gender neutral because it contributes to the reproduction of the traditional job-role division, traditionally embedded in preferring men in powerful positions (Acker, 1992). Considering gender in more structural terms (Bourdieu) and approaching it by performative-discursive method (Butler and Foucault) represents two ways of looking into gender that co-exist within a theoretical framework highlighting two-fold aspects. One is the structured process originated from society as a result of the historical factors (Bourdieu); the other declares itself from the continue interaction between people and society (Butler).

From eighties until nowadays, the core of the debate has been based on the relation on how cultural bias affects the lack of women in science as a result of the feminine figure who is not capable of performing high scientific position. This question leads to the debate between epistemology of science and philosophy of science focusing on how cultural bias involves scientific productivity damaging the entire scientific compartment and how relevant consequences for the epistemology of the science have happened (Barad, 2007; Haraway, 1991; Harding, 1986). For these reasons, in the last decades, sociologists preferred a more relativist approach embracing the standpoints theories, embedded in the Marxist thought, enhancing the relativist assumption of points of view (Harding & Intikka, 1983; Hartsock, 1981; Hekman, 1997). Whereas, following Tanesini classification (2015) accordingly, the feminism empiricism (Harding, 1986), based on the mainstream notion of positivism, and the postmodernism mainly based in favouring the interpretation of the social reality, considering more fixed ways in looking into reality are less considered within a gender framework interpretation of the reality.

From a more psychological perspective, Bandura (1977) first drew attention to the relationship between self-regulatory practices and self-esteem introducing the concept of self-efficacy, the perception that we develop in order to be aware about our skills or capabilities to accomplish achievements and challenges. Through this concept, he developed the Social cognitive theory of human functioning (Bandura, 1977; 1986) and tried to identify a theoretical framework setting the social and the human factors contributing to the construction of the personal identity. Bandura sustained that self-efficacy is ruled by social and human factors and it is determinant in people ordinary and extraordinary life's choices. It is based on four main sources of information: master experiences, vicarious experiences or modelling, verbal persuasion and emotional arousal. And the hypothesis is that the more the sources are depending from each other, the more there will be great modifications if one of the four sources changes. People with strong self-efficacy are more confident in achieving goals, overcoming obstacles and following own expectations.

Several studies tested Bandura's theory and shown that boys tend to have higher self-efficacy and outcome expectations, particularly for math and science than do girls (Pajares, 2005; Sadler et al., 2012). Hackett and Betz (1981) first used the self-efficacy concept to explain women reluctance in avoiding math and sciences career through a career development context. A huge study conducted in Maryland in 2007 (USA) tested self-efficacy framework on 1208 students from 42 American colleges. The study showed that the perception of self-efficacy is also predictive of the choice of the discipline at the universities and girls with weak self-efficacy were

not likely choosing STEM disciplines. Results from a study conducted by D. Falco et al., (2017) showed how a career group intervention that incorporates the four sources of self-efficacy is effective at improving career decision self-efficacy in STEM. This has been attributed to a lack of self-confidence in STEM subjects, lack of support and lack of social encouragement to achieve STEM goals.

These studies showed that student's self-efficacy beliefs influence their academic performance in several ways and, often, they engage tasks about which they are confident and avoid those in which they are not (Pajares, 2002).

To investigate self-efficacy factors can allow foreseeing people behaviours and can predict the choice concerning the disciplines of study or which kind of career people want to embrace. Accordingly, with these theories, self-efficacy beliefs could be considered as powerful predictors of motivational and academic practices. A study conducted by Zimmerman investigating students' confidence in self-regulated learning strategies, discovered that this "self-efficacy for self-regulated learning" contributes both to students' motivational beliefs and to their academic success (Zimmerman, 1989; 1994; Zimmerman & Bandura, 1994; Zimmerman & Martinez-Pons, 1990). From this point, the identity is the result of the continuous connection and interaction between the "self" and the "other" in the social environment (Ybema et al., 2009; Watson, 2009; Webb, 2006; Jenkins, 2004).

This is only one possible explanation on why women are still so few in science and cultural prejudices represent only the tip of the iceberg pushing women to always doubt about their personal accomplishments and about personal skills and capabilities and, for these reasons in avoiding scientific career path considered male-friendlier. This affect the entire scientific production's system and the lack of gender dynamics contributes to reproduce vertical and horizontal segregation. Out of concern in this paper is to support the literature on gender equality in STEM and the impact of the self-efficacy among women scientists and their identities.

Methodology: the Italian case study

European Commission latest data show that in Europe in the last 8 years, an increase of the 4% in the number of women on the total number of researchers has been registered. Besides that, female researchers in the universities and in laboratories are still the 33% (EC, 2016) and, even if women represent the 47% in doctoral scientific paths, only 1/3 of them choose to study Science, Technology, Engineering and Mathematics (STEM) disciplines. This phenomenon is known as horizontal segregation and it highlights consistent gender gap through disciplines. It is evident especially

in engineering and in information technologies where, at tertiary level of education, only the 25% of engineers and only the 19% of informatics are women (OECD, 2017). The situation is even worse concerning the career progression where females, on the total of researchers, represent the 33% at the third level academic staff (ISCED C), the 24% at the second level (ISCED B) and the 13% at the first level (ISCED A), (European Commission, 2016). This highlights the leaky pipeline phenomenon, which shows that as an increasing number of females does not lead a proportional increasing number of women in the high levels of research.

The Italian situation shows similar data and it is interesting CNR context which, since it embraces 2/3 of the totality of research personnel, it is considered representative of the Italian research scenario (ANVUR; 2016), even if the research personnel is different from academic and industrial research staff. The evidence carried out from a secondary statistical data analysis, conducted on administrative data, highlight that researchers working at CNR, even if they are almost well-distributed across gender (45% women; 55% men), they are not equally represented in STEM fields; especially in physics and engineering where the score is 1 out of 3 and 1 out of 2.

Figure 1. Total % of research personnel at CNR*. Data discriminated for gender and departments
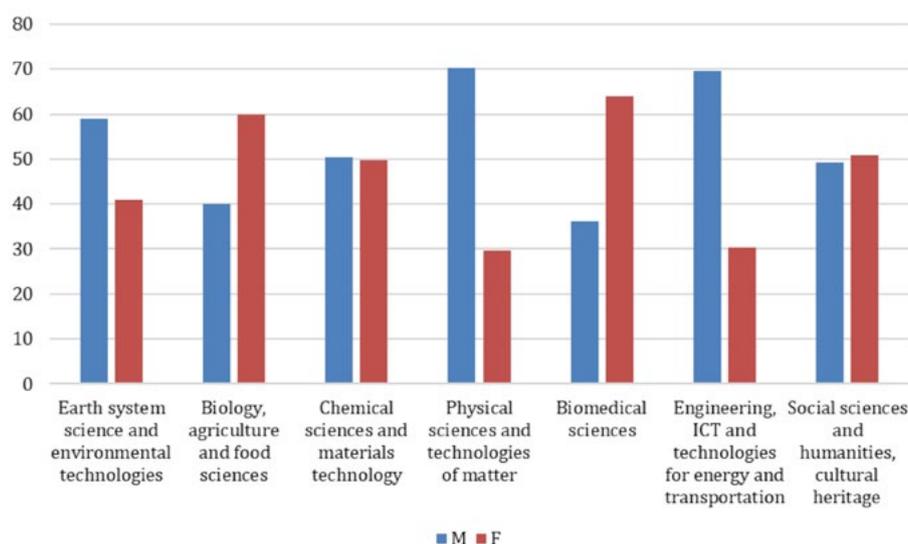
Source: Data from CNR Central statistical office

Furthermore, in line with the European situation, substantial gender inequality is registered concerning the career progression where, as shown in the figure below, at the higher level of job position, the percentage of women is dramatically low.

Figure 2. Total percentage of research personnel. Data discriminated by gender and levels
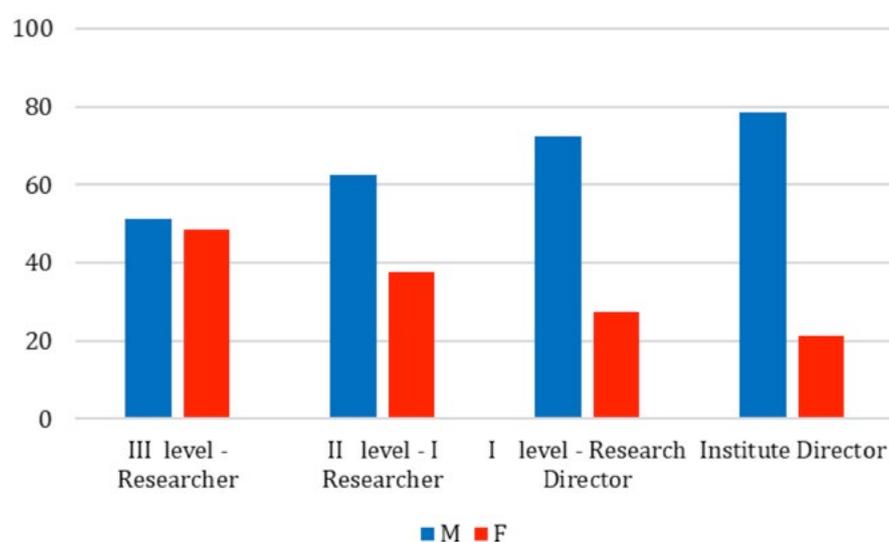
Source: Data from CNR Central statistical office

This study, defined as a *case study* aimed at exploring the *self-efficacy* concept in the research contest. Following the Thomas definition (2011):

> *Case studies are analyses of persons, events, decisions, periods, projects, policies, institutions, or other systems that are studied holistically by one or more methods. The case that is the subject of the inquiry will be an instance of a class of phenomena that provides an analytical frame—an object—within which the study is conducted and which the case illuminates and explicates.*

Research design and data collection

The study was addressed to Italian female scientists working at National Research Council in STEM fields. With the aim of producing rich empirical analyses that capture doubts, fears and potential weaknesses of female researchers, and in order to creating an empathetic and thoughtful climate towards interviewers (Alvesson et al., 2008), semi-structured interviews

were identified. The main goal was likely to convey depth, diversity and complexity of the issue. The purpose was to create a climate where participants were happy and secure to talk about their life and their professional path. Anonymity was also guaranteed. These aspects were important in order to illustrate as *candidness of revelations* as possible, which depends on the trust, is built up between researcher and participant (Fineman, 2001, p. 8). In defining qualitative interviews and following Seale (1998), two formal divide glosses have been accepted for the data treatment: interviews considered data-resource and interviews data-topic. The first one concerns that the data collected form interview are seen as reflecting interviewers' reality outside the interview. The second approach considers data as reflecting a reality jointly constructed by the interview and the interviewer (Seale, 1998). Face to face interviews enable a *special insight* into subjectivity, voice and lived experiences (Atkinson & Silverman, 1997).

The use of a flexible outline of questions enhances the freedom of the interviewer in following the interrogations, allows carrying out as much relevant information as possible and (Silverman, 2011) and this helped in attaining a rich and, in some cases, emotional data set. The protocol of the interview presents two main areas: one concerning the career progression (mobility, work environment, work-life balance, etc.) and one referring to the role of National Research Council in supporting gender equality. Interviewers were reached through a *request of participating letter* in order to accept to be contacted for the research study: *"Women and Science: a case study about National Research Council"*. The protocol aimed at exploring several areas such as: professional career path, mobility, work-environment, work-life balance, the role of CNR in supporting gender equality among CNR.

The data were collected in 2017 and consisted of 19 semi-structured interviews with female researchers. The selection of the interviewers could be defined as *sample,* but it is important to remind that the researchers were not selected following the probabilistic criteria, which means that the sample is not defined as *probabilistic* but as *rational*, led by rational thought and with the aim to cover the interested research areas.

The method of sampling was conducting considering the distribution of the research personnel through STEM disciplines and areas of affiliation. The group of interviewers was composed by three engineers, three chemistries, three mathematicians, five physicists and five biologists. A major number of physicists and biologists is present because they belong to the disciplinary field of study recording, through STEM, the lowest (in physics) and the higher (in biology) female presence.

Interviewers came from different Institutes spread on the national Italian territory (Pisa, Bologna, Rome, Naples, Lecce, etc.) and they range from

35 to 64 years. Concerning the level of the career, the selection involved concerned four *research fellows*, eleven *researchers* at the first level of the career, and four *first researchers*. A greater number of researchers at the first level of the career is due because, as statistical data show, it is the level embracing the greatest number of women within CNR.

Figure 3. Researchers' group composition

Education qualification	Affiliation	Contract typology
Physicist	Social sciences and humanities, cultural heritage	Research fellow
Engineering	Social sciences and humanities, cultural heritage	Researchers III lev.
Mathemathician	Engineering, ICT and technologies for energy and transportation	Research fellow
Engineering	Social sciences and humanities, cultural heritage	Researchers III lev.
Mathemathician	Biomedical sciences	Research fellow
Biologist	Biomedical sciences	Research fellow
Biologist	Biomedical sciences	Researchers III lev.
Chemistry	Chemical sciences and materials technology	Researchers III lev.
Biologist	Biomedical sciences	Researchers III lev.
Physicist	Earth system science and environmental technologies	Researchers III lev.
Physicist	Earth system science and environmental technologies	Researchers III lev.
Engineering	Biomedical sciences	Researchers III lev.
Biologist	Biomedical sciences	Researchers III lev.
Mathemathician	Engineering, ICT and technologies for energy and transportation	First Researcher
Physicist	Chemical sciences and materials technology	Researchers III lev.
Physicist	Earth system science and environmental technologies	First Researcher
Biologist	Biomedical sciences	Researchers III lev.
Chemistry	Chemical sciences and materials technology	First Researcher
Chemistry	Chemical sciences and materials technology	First Researcher

All interviews lasted between 50 mins and 80 mins, and were digitally recorded and fully transcribed. Despite respecting the protocol of interviews, participants were also invited to talk about themselves and about their relation with science and with the research system.

Pointing at the structure the variety of gender-based discrimination experienced by women, a conceptual framework has been produced. This framework is established on the different level of the *intensity* of the gender-based discrimination and it is the result from a logical trial, commonly denominated by sociologists' *property space* (Hempel, 1965). The provided property space does not aim to be exhaustive or to present exclusiveness conceptual classes, on the contrary each class is characterized to be permeable so they can contain overlapped discrimination typologies. The supporting hypothesis behind is that gender-based discrimination could be differentiated between relational or psychological and they could exhibit themselves with different level of intensity: *blatant, covert, and subtle.* The rationale behind the scale is inspired by the "Attitute towards women scale" (Spence et al., 1973) and the "Modern sexism scale" (Swim et al., 1995). These two scales differentiate from each other in the sense that the first one was conceived with the purpose to notice discriminations and sexists, whereas the second one was built in order to highlight more subtle forms of gender-based discrimination (Swim et. al., 1995). The first scale is based on the old-fashioned gendered cultural model of the beginnings of the '70 and the other, the modern one, of the '95, was developed by noticing factors of more deceitful or latent discrimination. The combination of the scales allowed covering a wide range of discriminatory factors. The application of these two inspiring scales was extremely important above all for items specifically addressed to emphasize subtle discrimination episodes, enabled to identify hidden discrimination factors, because explicit questions concerning discrimination could stimulate fake answers or, even worse, could push women to deny to have been victims of gender discrimination (Britton, 2016). The exercise was directed to catch any signals or clues that could furnish a more truthful and realistic framework concerning the object of study.

Results

This section of the paper is dedicated to spread results gained from the analysis of the data. It is divided into two main parts: a first one referring to the classificatory attempt made in order to categorize classify gender-based discrimination reported by women.

A second part is focused on the gender awareness role in enhancing or inhibiting the access and/or the progression of women in science and

it could be considered as one instrument of *doing gender* and improving self-efficacy.

Gender based discrimination typologies

Subtle Discrimination

- *Relational:* gender discrimination is often unnoticed and it fits with what people have internalized as normal or natural. It includes social attitudes considered as «acceptable» and for this reason naturalised in the dominant culture.

> *Chemistry, 44: "It happened that I went to an organized meeting by the head of the department and I noticed that I was the only woman, often, in general it happens that the youngest as well.. and you introduce yourself or you display your ideas/data you can catch the astonishment on the eyes of the bystanders others.. I used to move on about these and other perceptions but it is not so easy...".*

- *Psychological:* gender discrimination is more innocent or manipulative, intentional or unintentional, well-meaning or malicious. It is a kind of discrimination well hidden in the traditional culture and within the traditional job role division.

> *Physicist, 52: "I do not know if it is the status to be a doctor to push them to overestimate themselves or if it is the status as a men...".*

> *Biologist: "I would like to conciliate private life and work but I don't know if having a baby could be satisfied with high level research because it seems that research calls for commitment at 100%. Everything should also be reached in very restricted time, so a woman must be more talented than a man in order to manage work and family with professional success. Since a woman can dedicate less time, she must have more talents because she has other things to worry about".*

Covert Discrimination

- *Relational:* gender discrimination is hidden, purposeful, and difficult to prove. It is very common and embedded in the culture. It is not easy to prove because it is strictly connected to the organisational culture of scientific work.

> *Physicist, 47: "It is not because we are women but it is because it exists an embedded cultural issue. Men tend to speak from the top to the down with us, only because we are women, but this is everywhere. When during a meeting people strike you by speaking.... These are not episodes of discrimination, these are their standard behaviours.. Many men used to treat women as "dolls/bambolette" or.. If women speak up,*

as a virago.. virago only because you simply say what you think. I used to see women doing secretarial activities, and I developed a mental mechanism that leads me to treat them as they are all secretariats. And this is true for me too, I can notice that during meetings, they not even look at me when I speak".

Mathematics 39: "In my laboratory there is a greater presence of men whereas the roles of women are often at the reception office. My institute is an institute of computer science so there should be more men probably because there are more men graduated in computer science that women. In my opinion, this could be related also to the fact that men tend to move more easily than women could. In my group also men with children go abroad, I wonder how they would logistically do if they were women."

- *Psychological:* this kind of discrimination refers to the broader behaviours put in place often by people convinced that they support gender equality but who engage in behaviours that intentionally undermine women, as well.

    Physicist, 52: "No one told me you are a woman, what do you want to go? What do you want to do? Even if a colleague of mine went through these kind of things. Openly nobody told me gender discrimination but in a more ambiguous way there were lots of attitudes against women and against me..."

    Physics 47: "This is another problem because women do not have the lobbies because they are not enough ... I do not refer in having a loggia masonic but something... as a group of support. I see that it worked for my male colleagues. When one of them has a contest or he applies for a European grant; the whole supportive group sustain him.... Women do not have this kind of supporting group and this is for many causes, for example women, at the majority of the times, they have to ask help to males colleagues and.. you know...it could be complicated".

Blatant Discrimination

- *Relational:* this kind of gender discrimination is typically intentional, quite visible, and easily documented. It is the clearest kind of gender discrimination and it often embraces sexual harassment and sexual abuse.

    Biologist, 56: "Because I did not give into his advances I stayed without contract for months".

    PhD Student: "Meeting by meeting he started trying to get hands around me, on my knees, on my legs and when I was writing at the computer he often tried to touch my hands in an allusive way that

I would not well how to describe it, even if in my mind it was not so inappropriate (…). He started looking in my eyes deeper and caressing me on my cheeks and he was keeping on repeating me "we have to do a beautiful job; we have to do a beautiful job". I was standing still and I was not able to say anything when he suddenly kissed me. I took all my stuff and left. I was shocked. He could not have done that in his office, in the university department!!! I have never talked with anyone about this neither at the university neither in my workplace".

- *Psychological:* this kind of gender discrimination, as above, particularly refers to sexual harassment. It includes many exclusion factors pushing away women to the professional context. These factors could be related to the mobbing pressure, to the permissive climate towards sexual harassment, to the code of silence established around victim.

Biologist, 56: "After I got my job I experienced a serious mobbing episode which hindered me to work for lot of time. I was just hired and my head of department starting harassing me. I tried to stay away from him, to take off my body his hands, but his requests were getting heavier. I tried to surrender, after my refusal, he took revenge. I got way with this problem only by changing my research topic even if everything was managed with layers. Such an ashamed story!! This was because I refused sexual attentions coming from my head of the laboratory. Of course, I cannot prove that but this is my experience. Everything started because the only peaceful relationship I had was with the laptop. The other colleagues disliked my presence and it was clear at me. Moreover, this was from both women and men. This man was cunning and he had created around me a climate of hostility and exclusion. A colleague of mine told me: "sorry for this but I got paid from his funds and I have to do what he says". Only one woman out of 20 researchers came to me. The rest of them simply started ignoring me. So I decided to file a lawsuit, otherwise I had to leave my job!"

The role of gender awareness

Findings from interviews shown that it exists a strong relation between gender-based discrimination and the awareness of gender bias dynamics. The presence of the *gender awareness* factor has been considered as crucial to put in place positive and detached attitudes and behaviours versus gender discrimination.

The following testimony synthesizes what has just been discussed just discussed:

Physics 52: "When I received the first articles with negative comments my reaction was" what did I do?!?" etc. instead, my male colleague said "those reviewers did not understand nothing". The attitude of my col-

league was totally different and this difference of attitude is important in the research system. He believed to be right and he went on his way. I, on the other hand, was considering to be wrong, I might have not well communicated, etc. (…) When I went in another city for a mobility period, I felt like an impostor. For this and other reasons, the passage from the personal to the social, is fundamental because if you remain on the personal level, you can feel as a charlatan an imposter, but if you went through and you take awareness that discriminatory episodes are the consequences of the male- traditional dominated culture, it means that you have stepped forward!"

The *crucial switch point* considers the transition from internalise gender based discriminations from something affected the individual, as identity, to something affected the *gender dimension* of the individual.

As shown in the figure below the attempt is to differentiate this path discerning two slots: where the transition has not taken place (*Not abstraction from personal dimension to collective dimension*) and where has already happened (*Abstracting from personal dimension to collective dimension*).

The first slot includes negative reactions to gender based discrimination, which results in setting bad reactions (*acting out negative reactions)* such as: to scream, to rebel, to oppose, etc. which represents a bad way to engage with the others. It includes also, in a more introspective way, the internalization of negative feelings (*internalizing negative feelings*) such as indignation, discouragement, anger, sense of guilt, etc. which represents a wicked way to engage with the others.

The second slot includes positive reaction to gender-based discrimination and it results from an embedded gender awareness (*Acting out positive reactions*) such as to smile, to express own opinion, etc. which is a good way to play and to interact with the others. On the other hand (*internalizing positive reactions*) such as safety, comfort, strength, confidence, etc. represent a relevant step forward to obtain confidence and more self-consciousness.

A graphic representation, in the figure below, shows "*the passage from personal dimension to collective dimension*".

Figure 4. Graphic representation on how to react to the gender based discrimination

- Gender awareness +					
Not abstraction from personal dimension to collective dimension			**Abstracting from personal dimension to collective dimension**		
Acting out negative reactions	**To scream, to rebel, to sabotage, to ask, to oppose**	*Physicist, 60: "I suffered from gender-based, discrimination for this reason I also changed institute because I had a director who considered female researchers as second league and only men were progressing career and **he asked only to female to carry out secretarial activities** if there were. **But I always refused and questioning** why don't you ask to your male employees, why should always us fulfil secretarial activities. I was always tough from that point of view. But this what happened to me especially in Italy, not abroad".*	**Acting out positive reactions**	**To smile, to openly express his/ her own opinions**	*Chemistry, 44: "Throughout years, going to conferences organized by our department, I established important relationship within CNR and this is why I realised that these kind of things have their impacts and their relevance for the team as a whole, (…). Now I am sure saying that our director is support us and **he push me a lot to show me off and stand out** in order **to make myself known otherwise it would not be my attitude**. With all of his defects he supports me a lot and I know that I can count on him".*
Internalising negative feelings	**Indignation, discouragement, anger, sense of guilt, dissatisfaction**	*Physicist, 52: "Sometimes you refused responsible and powered roles which can change your position because **you don't measure up**. When I was in Bologna **I felt myself as an imposter**!"*	**Internalising positive feelings**	**Comfort, safety, pride, strength, joy**	*Physicists, 47: "I studied in a very male-dominated field of study such as engineering where over 200 students we were only 15 female. Then, I would say that you make your bones and it is difficult to be crushed by this type of prejudices, to me, sexist environment has not created rather never me limits on certain aspects everything other. But I am not one who it allows to limit in this sense and I has learned a long time ago of it. (.) Belonging to feminist group has widened my shoulders and, besides the education received from my family, we are two sisters and a brother, our parents have always told us that we all three could make the same things. I have always practised this in my the life and I always tell that to everybody. However, also **the feminist experience helped me**, at least it gave me the tools to not be wounded and to have a certain authoritativeness in the sense that I don't get scared me. Even if I am not according with some kind of things.. but this is another issue… actually **I don't get scared**."*

Discussion

Several studies explored how people in organizational structure and in the relation between asocial and self-definition, construct their identities (Ybema et al., 2009; Watson, 2009). Social processes implicate that the construction of self-identity is always "under constriction"; and it involves processes of negotiation between the social actors and the institutions, the "self" and the "other", the inside and the outside. These routines permit simultaneously, the construction of their personal identities and their public identities as social actors (Ybema et al., 2009).

Environmental factors and personal factors, gender included, contribute in creating motivational and self- regulatory differences in individuals. Researchers found that some areas, such as STEM field, are considered as a male-domain within students (Eisenberg et al., 1996). In these fields of study, a masculine orientation is correlated with a higher confidence and achievement than girls who commonly express lower confidence in their academic capabilities (OECD, 2015).

In line with the sociological literature sustaining the importance of the processes of primary and secondary socialisation (Bagnasco et al., 2007), interviews highlighted that professional path in STEM field represents a huge challenge for women, mostly because of the centred *monastic male* culture. This vision is based on the prototype of men who can stay at work for long working hours and who can schedule travels and mobility plans more freely than women. Science world includes many of these men, which are the standard role models and let the young generation suggest social scheme unfavourable to women (White, 2014). Negative stereotypes lower self- assessments of STEM-related abilities as well as their performance and their professional aspiration (Falco, 2017). In the social systems, the interactions among people reproduce the traditional gendered role system (West & Zimmerman 1987). This is enhanced also for concepts like *gender blindness* and *gender neutral,* which, under the label of the naturalisation of the roles and the social status, reproduce some unwelcome gendered effects. Doing gender and doing science it should, for these reasons, consider as the natural way of the social civilisations process (Gherardi *&* Poggio, 2003).

Findings from interviews show furthermore that, within women who succeed, there is a tendency to attribute their own professional achievements to the luck. Relevant quotes are *"I have had the fortune", "I was very lucky",* "*there were very lucky events*", "*I was almost ashamed because in reality... I have had fortune of", "it was incredibly", "it was unexpected."*

Besides that, having a network of supporting people can positively influence the personal and professional development of career. Bourdieu defines this concept in terms of *social Capital* as "*the aggregate of the actual or poten-*

tial resources which are linked to the possession of a durable network of more or less institutionalized relationships of mutual acquaintance and recognition. These provide each of its members with the backing of the collectively-owned capital, a "credential" which entitles them to credit, in the various sense of the word" (Bourdieu, 1998). Having a consistent social capital is necessary especially when the maternity leaving period ends and women have to come back to work. Indeed, the return after the maternity leave is perceived as a period where women do not have the same interest at job as versus the newborn. Unfortunately, this can produce a vicious circle because perceiving a situation as real might produce consequences in reality (Merton, 1949). Traditional embedded male-centred vision could generate, among women, auto-identification mechanisms such as the sociological *Thomas theorem*, which states: "*if men define situations as real, they are real in their* consequences" or the metaphoric "*looking-glass self*" that is appraisal of others acts as a mirror reflections that provide the information we use to define our own sense of self. This means that we tend to become what we think other people think we are (Pajares, 2002). In gender studies, these self- regulatory practices could cause negative feelings and destructive psychological patterns known as the *imposter syndrome* considered as a disease essentially because it consists in an embedded fear of being exposed as a "fraud". In fact, if the expectations change, people tend to conform to new expectations so, if colleagues think that, for example, new-mums are less productive, they can actually behave less efficiently. In this perspective, work and childbearing do not seem to communicate and motherhood seems not to be legitimate within organizations (Gherardi & Poggio, 2003). Besides the re-entry period after maternity leave, another important obstacle is connected with the mobility abroad because when it's time to come back home, the fear of having lost the previous work responsibilities comes up.

Cultural influences deeply affect personal behaviour and they can influence life's choices. This helps to answer to the question on why there are so few women in science and why this is considered a cultural problem. Indeed, frustrated feelings could involve the beginning of the career and/or the progression and they could push women to feel like imposters or to attribute their own successes to the lack or to the fortune (Di Tullio, 2018).

Conclusion

The analysis carried out from the interviews highlighted that it exists a strong relationship between gender-based discrimination against women and the perception of the women self-efficacy. Women tend to react at discriminatory episodes in different ways and in this paper the hypothesis sustained is that the intervention variable is the *gender awareness.* This means

that women who have developed a great sense of gender awareness tend to set positive behaviours and they positively react because they associate discriminatory behaviour to the social sphere and they are aware about the existence of a masculine dominated culture. On the contrary, women who are not aware about gender disparity dynamics tend to interiorize and to re-act adopting negative behaviours and discouragement attitudes. The crucial point is the *switch* from interiorize gender-based discrimination as some-thing personal to understand that they mostly refer to the condition of being woman.

Above all, we sustain that he/she who has not developed the called "pas-sage from the personal o the social" is more inclinable to doubt about his/her abilities and competences. The *passage from personal to social* helps to manage reactions and consequences when people are discriminated. If we are not aware about gender perspective we can risk to create conceptual heuristic which are based on the traditional stereotyped gender role and lead us to simply consider women as less able to fulfil scientific role.

Since an agentic perspective is embedded in human agency, the hypoth-esis is that self-evaluated people indicators predict actions and beliefs of personal efficacy is central among human agency. This is why a performa-tive dimension of gender is considered rooted in the social cognitive theory (Bandura & Locke, 2003). Even if substantial progresses have taken place in the STEM research scenario, this study confirms the importance to ex-plore, in a cultural and intersectional way, the binomio *women and science* because it cannot be considered overcome. A first step forward is the statis-tical knowledge of the data, that shows the situation among the institution and let to emphasize gender gaps. An appropriate analysis of statistical data enhances the possibility to answer to thorny research questions and grant the possibility to supply useful tool for the design and the implementing of public policies.

In line with this hypothesis, the English sociologist Hilary Rose proposed the slogan "No data, no problem, no policy" at the first lecture of the 1998, organized by the European Committee "Women and science".

Raising awareness among decision makers is strictly related to the im-portance to collect and analyse data. This is meaningful especially in the STEM field, which is one of the most attractive sectors for national and in-ternational financial support for these reasons a lack of female scientists has to be considered as a damage and a waste of talents for the whole research system. Furthermore, it is necessary to increase the number of women at the top position because the presence of women with a great reputation could arise the confidence in achieving great success in the young generation.

This is important because as stated by the International Conference on Women in Physics (IUPAP): "*not simply as the opportunities for exercising*

leadership that occur at all stages of career, but rather as formal position with control over allocation of human and financial resources and over the research notebook" (Williams et al., 2005).

The knowledge of the statistical data is the starting point to get closer to gender equality problem and, even if the findings of this study cannot be generalized, they can offer specific qualitative focus to go deeper inside the problem. As results of the personal female researchers' storytelling, findings of this study confirm that the relationship between women and science is still more conflictual and full of prejudices and gender-based discriminations. These and other reasons could create a *divario* between women and science and could affect, in a negative way, personal choices in educational path. Alongside with the literature proposed, the study supports the idea that self-efficacy is an effective predictor of career exploitation and progression (Blustein, 1989).

Besides that, integrating a gender perspective in public policies means eliminate the waste of talents and promoting innovation, which is considered mandatory for the economic and sustainable growth (Kamberidou & Fabry, 2012).

Limitation

The study is limited to a sample of women scientists working in STEM fields but it could be useful to promote a deeper analysis on the differences between variables such as age, social capital and how it could be promoted and enhanced passion among STEM fields. Furthermore, it could be interesting analysing how discrimination works among STEM disciplines (physics, information technology, and engineering).

Sustaining that a greater gender awareness could enhance and promote a bigger participation of the women in science does not mean that it is the only reason. Nevertheless, the aim of the paper is to underline the importance on gender awareness since it is seen as he starting point in considering a career in STEM field.

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