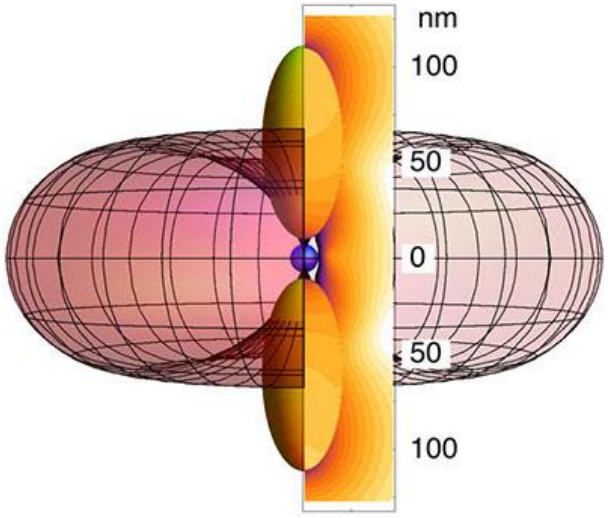
MP1403
COSTACTION

# COST Action MP1403
# Nanoscale Quantum Optics (NQO)

## Gender Survey 2016

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EUROPEAN COOPERATION
IN SCIENCE AND TECHNOLOGY

# 1 EXECUTIVE SUMMARY

The COST Association is the longest-running European framework supporting trans-national cooperation among researchers, engineers and scholars across Europe. The COST Nanoscale Quantum Optics (NQO) Action is one of many COST Actions within the EU.

It consists of a group of scientists from academia and industry with a traditionally unbalanced gender make-up. Only 16% of the COST members are women. The COST Action NQO is committed to improving this balance and ensuring equality of opportunity for both the present members and to improve the future gender balance in the field. To this end we have undertaken a survey of COST Action NQO members. Approx. 38% of the members answered the survey of 10 questions related to gender equality topics. Of these, 26% of respondees were women, and were 69% men. This means that men were over represented as a whole, but women were 1.6 times as likely to answer the survey.

**A summary of the key results of the survey revealed:**

- There is a clear imbalance in the opinions of men and women as regards to the status of women in the COST Action NQO: **59% of women believe that they do not have equal opportunities to men** with 14% of women believing this strongly. **However, 56% of men believe there is no difference in opportunities.**
- **The issue felt to be by far the most important was motherhood**: there was a broad agreement (67%) between men and women that mothers and other female carers experience disadvantages in their career. **36% of women felt this strongly**.
- There was a broad opinion **(37%)** that **women should be the key target group** of any future COST Action NQO gender balance actions, closely followed **(31%)** by an opinion that **outside parties such as schools and funding councils** should be targeted. **Only 17% felt that men should be targeted**.

Many of these opinions are at odds with statistical evidence available about gender issues in the STEM subjects. For instance:

- **Implicit or unconscious bias** of both men and women has been shown to have a **significant negative effect on womens' careers**. This is in contrast to 56% of men and 15% of women who do not believe that there is a problem.
- The latest research into gender equality policy has **shifted from focus on outreach in schools and mentoring of women, to focus on senior "gate-keepers" and achieving more flexible working**. This is not reflected in the attitudes or actions of most the respondees.
- However, **the perceived disadvantage of motherhood perceived by both men and women is well-founded** with much evidence to show that mothers are significantly disadvantaged compared to every other gender/family status group.

As a result of the survey and in light of external statistical evidence and policy research we propose the following as part of the COST Action NQO gender balance activities:

- Targeted support networks for **women, early-stage researchers, and parents**.
- Focussed support and training of **senior academics**
- Provide feedback to **funding councils** and other scientific institutions

# 2 WHY DID WE RUN THE SURVEY?

**Why do we have a gender balance action as part of COST NQO?**

Of all the members of the COST Action NQO, only approx. 16% are women. Even though this is "usual" for a physical science discipline it is still a worrying and unacceptable trend. Most worrying in the STEM disciplines (STEM = Science, technology, engineering, maths), is the fact that as women and men progress in their careers, more women than men leave academia, and more men progress to higher level appointments (tenure and full professor) than women. Even in subjects where the male:female ratio is equal (or where there are more women) at postgraduate level, men begin to overtake women in numbers from postdoc-level onwards, a phenomenon known as vertical segregation. What is more, these numbers have not significantly changed over the past decade. Until now, much of the work on gender balance has been somewhat top-down. Heads of institutions and of academic bodies (overwhelmingly men) implement policies that are clearly not working.

In the COST Action NQO we have a range of researchers, from postgraduate to professorial, and from many countries. We have the opportunity to address issues at a grass-roots level – by finding out what the problems really are for researchers who get lost in the leaky pipeline. Our network also contains academics at the highest levels – those who make hiring decisions and lead research groups, even contributing to decisions on nationwide and EU science policy. By facilitating dialogue between women and men and between junior and senior academics, we hope to form better and more effective means to ensure equal opportunities for all members of our scientific community.

**Why have we asked you to complete this initial survey?**

We are all scientists and, as such, we value data, evidence and an unbiased approach to assessing problems. However, when it comes to gender issues, opinions and anecdotes abound, while concrete knowledge of the relevant statistics and evidence is patchy. As we will see, the attitudes and opinions of most surveyed, both men and women, are not always supported by scientific studies and evidence. It is the contrast between perception and reality that we would like to explore here. We also aim to come to a consensus of opinion in order to move forward with concrete action. Male and female scientists rarely discuss gender issues together on an equal footing, and are therefore often quite ignorant of the challenges faced by the other gender. As this survey shows, there are often strong differences in the perceptions and opinions of men and women. It is only by being aware of these differences and discussing them that we can act as a community.

Note that this is not intended as a survey to solicit guidance as to how to proceed with this action, neither is this survey intended to be "democratic". This is for two important reasons: firstly, it is clear that the community is not able to make a well-informed decision without the availability of statistics and informed discussion. Secondly, any democratic decision would likely strongly over-represent the views of men and under-represent those of women, simply due to the imbalance in numbers. Well-intentioned though they may be, it would be the average male opinion that would dominate. Women opinions should have equal weight in the analysis.

Finally, at the end of the COST Action NQO a final survey will be sent. The aim will be to document any changes in attitudes or behavior as a result of the action we have taken in the COST network.

**Notes on the survey**

In this survey 10 questions were posed to the entire COST Action NQO membership. For questions 1-8 a statement was given and responses from "strongly agree" to "strongly disagree" were available. Aside from Q10 which asked about gender of respondent, for brevity we did not solicit information about seniority or nationality/country of residence. Question 9 had four options to choose from. Note that Q10 gave four possible responses to the question about gender. As well as "female" and "male", "other" and "prefer not to say" were given as possible answers. The only intention here is to cater for transgender and non-gender-binary scientists in the field. 2 respondents of the 150 declared themselves as "other", and 6 respondents "prefer not to say". Note that while not common - 0.3% of individuals are said to be transgender – one might expect one or two transgender people in the COST Action NQO community of approx. 400. It is likely that the 8 that responded "other" or "prefer not to say" are not all trans or non-binary gendered people, therefore these responses were not included in the graphs, although they are in statistical tables. This is to ensure equal weighting of male/female opinions.

**Gender make-up of survey participants**

In the survey, Q10 revealed 39 responses from women and 103 responses from men, with 8 as "other" or "prefer not to say". Thus 26% of respondees were women, and 69% men. Compared to 16% average numbers of women, proportionately, 1.6x as many women as men responded to the survey.

**Discussion of external statistical studies used in this report**

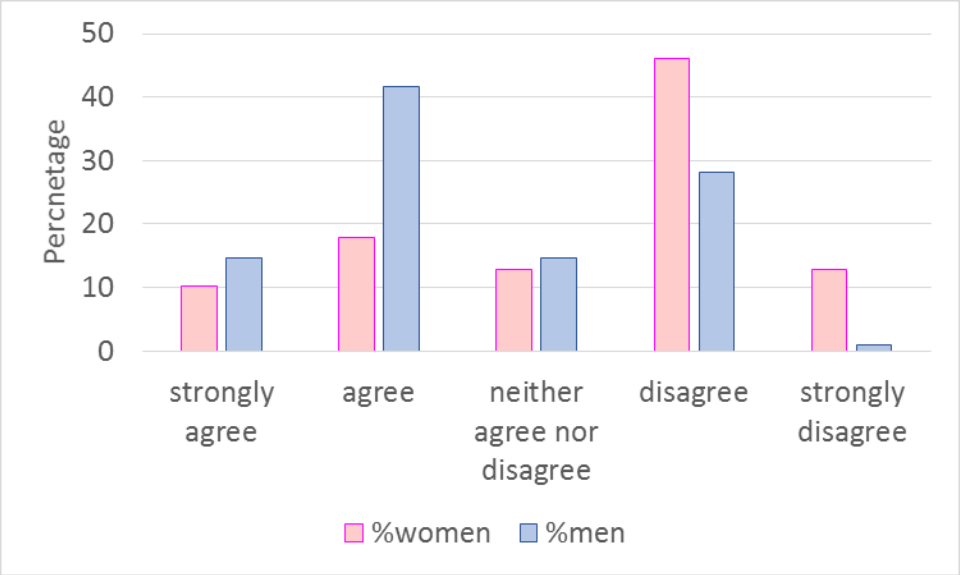
There are many studies on implicit bias and other areas of gender studies across different academic disciplines, in different countries and in society at large. However, studies on implicit bias in STEM subjects are inconsistent, in terms of which countries and which subjects are addressed. This makes it difficult to make definitive broad statements based on single studies. A cynic might also suggest that surveys with negative results that do not show bias, or show bias towards women, are not published or gain less attention. Nevertheless, in response to the now famous Swedish medical fellowship study[3], a meta-study across several disciplines have shown that while the effect is not as extreme, women with the same track record as men are consistently less successful in being awarded research grants[1], and in some fields the bias is still very strong.

Note that most of these studies do take factors such as seniority into account, some also take into account family status etc. One should also be careful of "Simpson's paradox". This is where overall the percentage of successful female applicants is less than for men across many subjects, but when individual subjects are viewed, the success rate is equal. This is well-known in the field of statistics. It can arise, for example, because more men choose to work in fields where they are more likely to be successful. Why men choose more successful fields is open to debate: could this be because they are driven to be more successful, or perhaps certain subjects are viewed by society as more valued, by virtue of the fact that more men do them (this is a well-establised theory in gender studies).

We have attempted draw on studies that are either wide-ranging enough to make significant statements (such as the Spanish White paper[15], which is a nationwide study across all STEM academic disciplines), or we use a study as a means to highlight where the evidence is very surprising and goes against the received wisdom. The motivation is not to provide definitive answers, but to highlight the complexity of some of these issues and where the "received wisdom" can go wrong.

# 3 SURVEY RESULTS

## 3.1 QUESTION 1: WOMEN AND MEN IN MY FIELD HAVE EQUAL OPPORTUNITIES FOR CAREER ADVANCEMENT.




| | Women | Men | Other/Prefer not to say |
|---|---|---|---|
| strongly agree | 4 | 15 | 3 |
| agree | 7 | 43 | 3 |
| neither agree nor disagree | 5 | 15 | 1 |
| disagree | 18 | 29 | 1 |
| strongly disagree | 5 | 1 | 0 |

- exactly 50% of respondents either “agree” or “strongly agree” that women and men have equal opportunities for career advancement
- 36% of respondents either “disagree” or “strongly disagree” with the statement.
- There is a clear imbalance between mens’ and womens’ views.
- **59% of women believe that they do not have equal opportunities to men. 13% of women believe this strongly**. **However, 56% of men believe there is no difference in opportunities.**

Clearly there is an imbalance in opinion here between the sexes. This difference is something that will be explored in future meetings. Either most women perceive a disadvantage to themselves that is unjustified, or they have access to direct experience of discrimination that is invisible to many men.

Indeed, peer reviewed studies appear to agree with womens' experience in this case. **Many studies of indirect and implicit bias show many cases of clear bias against women scientists and academics**, some strongly.

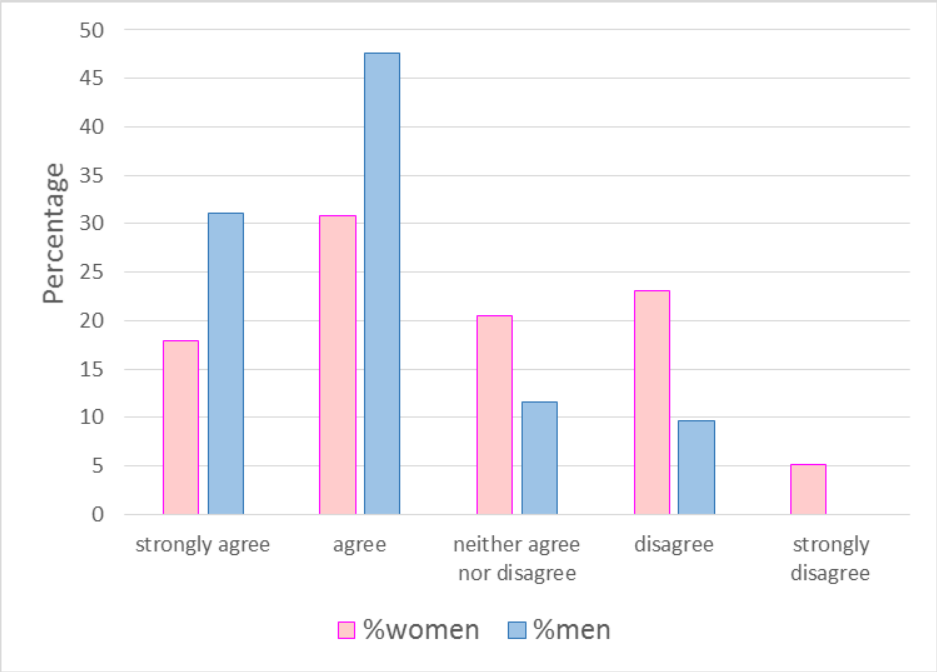
Studies show:

- A CV with a woman's name was assessed more negatively than an identical one with a man's name [2].
- A women had to be 2.5 times (= 3 more Nature papers) as productive as her male peers to be considered at an equal competence level for a fellowship in medicine in Sweden [3].
- Men are 2.5 times more likely than women to be promoted to full professor level with equal qualifications and family status in Spain [4].
- Reference letters for tenure track positions for men are more likely to contain "superlative" vocabulary, such as "excellent, outstanding" and are more likely to emphasize research, whilst womens' reference letters contain more words such as "hard-working, conscientious" and are more likely to emphasize teaching [5].
- Papers authored by women are more likely to be rejected during the review process than in double-blind review, in the field of behavioral ecology [6].
- Papers written by women are less likely to be cited than those by men [7,8].

There is very substantial evidence that these differences are the result of implicit bias. Implicit bias occurs when we make fast, unconscious decisions based on intuition rather than rational thought. The amount of implicit bias a person shows is not a reflection of their personal morals, and implicit bias occurs in those most enthusiastic about gender equality. Rather, the implicit biases a person holds is due to a lifetime of exposure to an unequal society. There isn't anything anyone can do about this, but what we can do is be aware, and change how we respond to our unconscious bias. The UK Royal Society offers some tips about how to counteract implicit bias.[9]

There is a clear, well-documented bias against women in science that strongly affects their careers. But perhaps the largest barrier to change is the difference in opinion about this problem between the genders, and between individuals in our own COST Action NQO community. Clearly, a community divided in such a strong way is detrimental to agreeing a common route towards equality of opportunity for women and men. Clearly most women do not feel that they have equal opportunities, and most men do not feel that women have anything to complain about. No moves towards equality in opportunities can hope to be successful without the cooperation of the majority of the scientific community. This subject is being addressed, and will continue to be addressed, as part of the COST Action NQO.

## 3.2 QUESTION 2: IN MY DEPARTMENT, STAFF ARE TREATED EQUALLY REGARDLESS OF GENDER

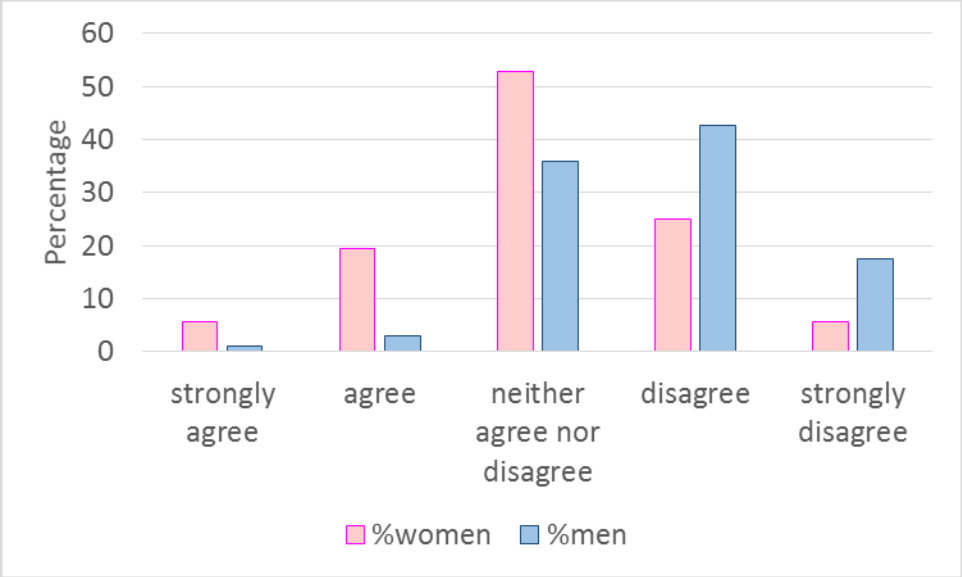



| | Women | Men | Other/Prefer not to say |
|---|---|---|---|
| strongly agree | 7 | 32 | 2 |
| agree | 12 | 49 | 2 |
| neither agree nor disagree | 8 | 12 | 1 |
| disagree | 9 | 10 | 1 |
| strongly disagree | 2 | 0 | 0 |

- 69% of all respondees believe that men and women are treated equally in their department.
- 79% of men believed that women and men are treated equally in their department or where they work, compared to 49% of women.
- However, 28% of women and 10% of men disagreed with this statement.

Unlike Q1, this question now deals with far more personal experiences in the scientists' everyday working environment. Interestingly, while in Q1, 30% of men believed that womens' opportunities for career advancement is less generally, only 10% of men believed that treatment is unequal in their own department. The majority of women also feel equally treated within their own work environment. Does this mean that most believe that inequality arises from outside their work environment or due to other factors? Data on implicit bias does not always agree with these perceptions (see for example the Spanish study on imbalance in promotion[4]). The fact that, despite the generally positive view, 28% of women do not perceive their working environment as equal, shows a significant minority are unhappy with their situation and that there is still a lot of work to do.

## 3.3 Question 3: The field of Nano- and Quantum-optics is particularly difficult for women compared to other Science and Engineering disciplines




| | Women | Men | Other/prefer not to say |
|---|---|---|---|
| strongly agree | 2 | 1 | 0 |
| agree | 7 | 3 | 0 |
| neither agree nor disagree | 19 | 37 | 1 |
| disagree | 9 | 44 | 6 |
| strongly disagree | 2 | 18 | 1 |

- There was a broad agreement that nanoscale quantum optics (NQO), the subject of this COST Action, is not more challenging for women, with 53% who disagree or strongly disagree that it is harder for women, and a further 38% who remain neutral.
- Only 4% of men consider NQO more challenging for women. However, 23% of women do believe is it more difficult field for them.

A note here about the wording of the question: it was pointed out after the survey was distributed that the wording of the question could be misinterpreted. The intention was to ask about the perception of the environment for men/women, not whether the subject area was considered more technically challenging for one gender over another. This may have affected the answers somewhat.

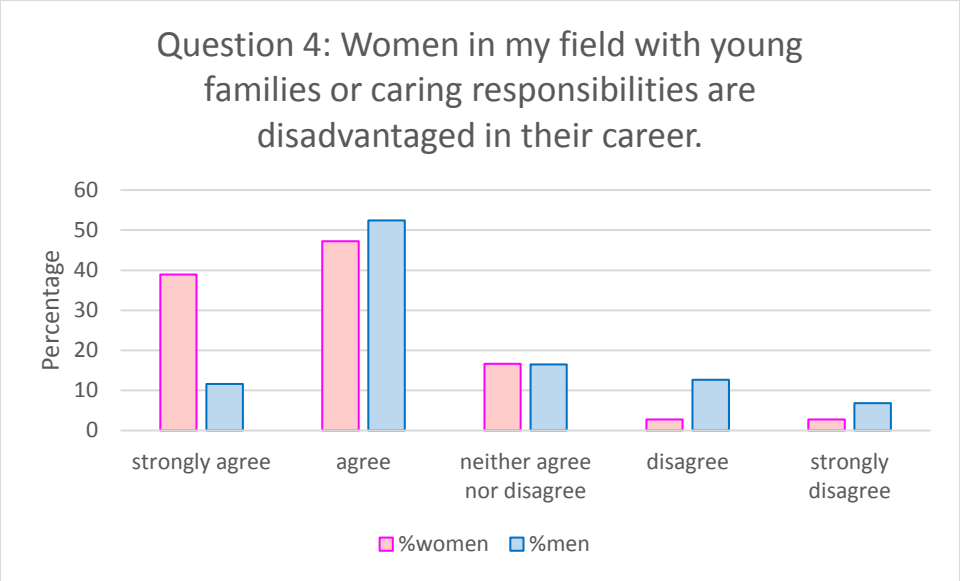
There is little in the way of perception of NQO being a difficult discipline/environment for women, but one should not forget that it is difficult for all participants to compare their experiences to other disciplines.

The gender balance in COST-NQO is approx. 16% female and 84% men. This is broadly typical for a physics/engineering subject, and we can assume that this broadly represents the field, although we may find that the proportion of women and men that put themselves forward for COST do not represent the ratio of nano/quantum optics scientists in general (for example senior scientists are likely to be overrepresented, which will affect the statistics).

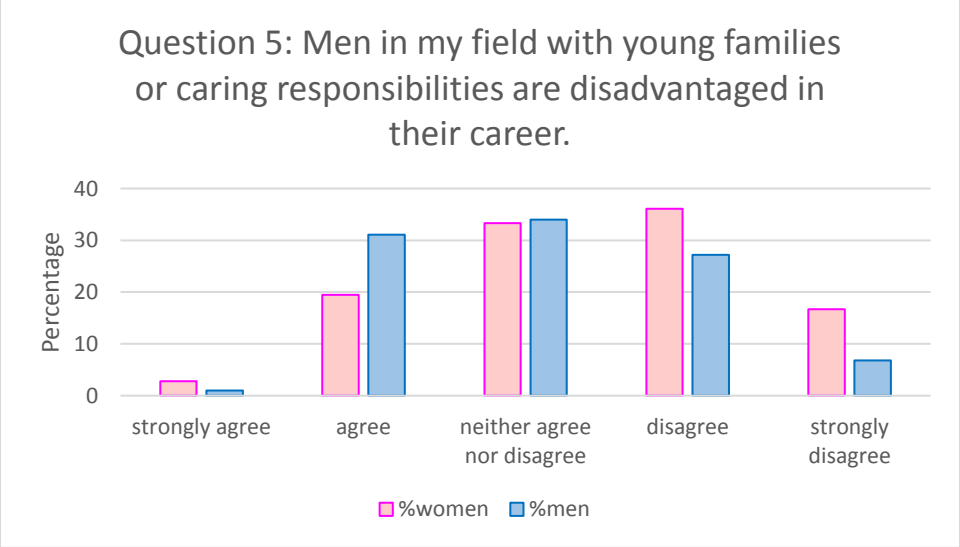
An interesting question arises as to how gender balance (in terms of percentage of women) affects how easy the environment is for women to operate in. Is a woman in a severely unbalanced discipline particularly disadvantaged? This is an important question as several measures have been suggested in the past to improve gender balance, with focus on equalizing the female to male ratio at early career stages. The implication is that by encouraging women to take up science and technology subjects early on in the career path, and possibly also implementing affirmative action (such as quotas) leads to a virtuous circle, where women beginning to fill senior positions leads to a more female-friendly environment. But what is the evidence for this?

It is now well-known that solving "horizontal segregation" does not lead to solving "vertical segregation". There are many fields where the imbalance in numbers has equalized many years ago at undergraduate level (eg biological sciences), while in higher levels (up to professor) men still dominate, and the statistics are not improving with time. Thus focusing on early career levels does not work by itself. However, in some cases it was found that when senior women are present at the important "gate-keeping" decision stages, they are more likely to identify more suitable women. One study[10] found that when a woman was on a selection panel for invited talks in microbiology, the number of invited women speakers averaged 43%, while all-male panels only had 25% female speakers. However, there is also evidence that a critical mass of women is required to implement structural change in an organization and to achieve the virtuous circle. For senior women to have influence, anecdotal evidence suggests at least 3 per committee or department are needed. The COST Action NQO management committee has 8 female members and therefore we hope we have enough critical mass to achieve structural change.

## 3.4 Question 4: Women in my field with young families or caring responsibilities are disadvantaged in their career.




## 3.5 Question 5: Men in my field with young families or caring responsibilities are disadvantaged in their career.



| | Women on female carers | Men on female carers | Women on male carers | Men on male carers | Other on female carers | Other on male carers |
|---|---|---|---|---|---|---|
| strongly agree | 14 | 12 | 1 | 1 | 1 | 0 |
| agree | 17 | 54 | 7 | 32 | 2 | 2 |
| neither agree nor disagree | 6 | 17 | 12 | 35 | 3 | 2 |
| disagree | 1 | 13 | 13 | 28 | 1 | 3 |
| strongly disagree | 1 | 7 | 6 | 7 | 1 | 1 |

- There was a **broad agreement (67%) that mothers and other female carers experience disadvantages** in their career.
- 79% of women highlighted this as a particular disadvantage, with 44% agreeing and 36% strongly agreeing that this is an issue.
- However, only 1% of all respondents felt strongly that male carers' experienced disadvantages.
- **49% of female respondents felt that male carers did not experience disadvantage**, 15% of them female respondents felt strongly about this. Only 15% of women felt that male carers did experience disadvantage.
- **Male opinions about male carers was more divided**. 34% of male respondents did not feel there was a disadvantage but 32% felt that there was a disadvantage.

Two very interesting results arise here. Firstly, it is clear that most respondents, both men and women felt that being a mother or female carer had a significant disadvantage in terms of career. It is notable in particular that 36% of female respondents felt strongly about this. This question had by far the greatest percentage who chose the most extreme ("strongly agree/disagree") option. In this survey it appears that of all the potential disadvantages for women, this is perceived as the most significant. However, it is notable that the disadvantage of being a parent or carer is perceived as being less for a man. This might appear surprising considering the fact many men are increasingly taking a more equal share of parenting and household responsibilities.

So how does this compare with available statistics and studies on parent and carer scientists? Does being a parent impact on ones' career? Most available data is for scientist parents, we found no statistics for other types of carers (eg of elderly or ill relatives). In fact, studies of the impact of parenthood on academic careers show some rather surprising results. The Spanish White Paper on women in science shows that there is a clear disadvantage after motherhood, but surprisingly, not fatherhood. Men with children are four times more likely to become full professors than women with children. Academic productivity and promotion success are decreased for women with children. The typical explanation for this is that women shoulder more childcare and home responsibilities, and therefore have less time to devote to work. However, the same study showed that, surprisingly, being a father actually increases career success. Comparisons between men without children and those with showed that fathers were 1.7 time more likely than their childless male colleagues to be promoted.

How can this be? Surely fathers have more responsibilities at home than their childless male colleagues, and should therefore be less productive. Something else must be happening that has nothing to do with

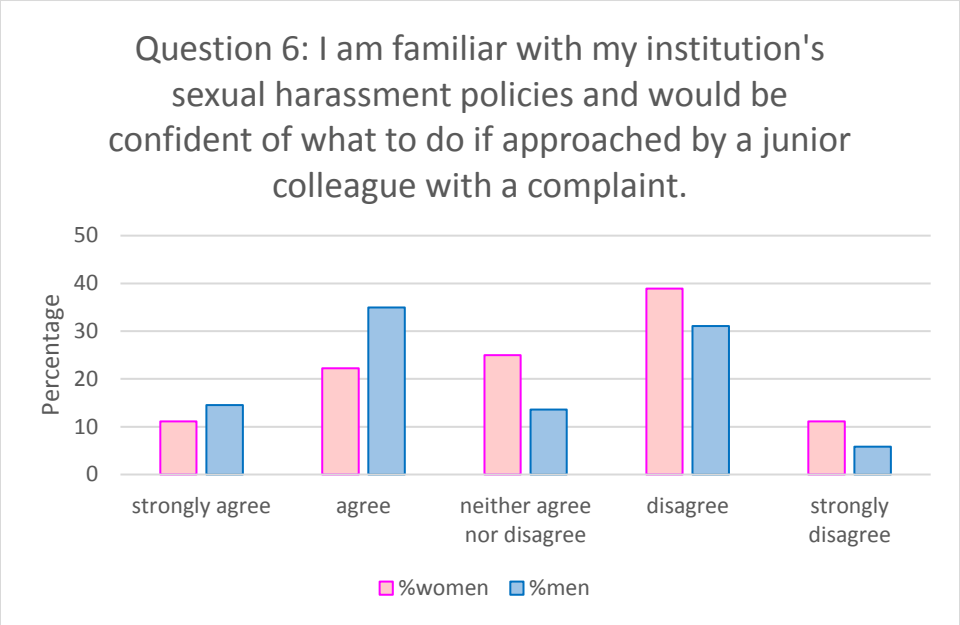
actual time spent at work. A revealing study of attitudes towards mothers and fathers indicates that it may be our societal differences in attitudes to mothers and fathers that gives women the disadvantage.[11] Participants in the study rated the two CVs of fictitious female job applicants, assessing their competency and commitment to the job, with the only difference in the CVs being that in one it was made clear the applicant was a mother. The mother was assessed as being less competent and less committed, and mothers were given a 7% lower starting salary. The same study of attitudes showed that mothers were held to harsher punctuality rules and performance standards[11].

On the other hand, men with children were subject to more lenient standards than either their childless male peers or mothers[11]. They were allowed to be late more often and were offered higher salaries. In addition, fathers were perceived as being more well-rounded, approachable, and committed to their work than their childless male colleagues. So it seems that it is not the extra demands put on parents that slows their careers, it is the attitudes towards parents in society and as employees that may be having the greatest effect on career progression.

So, does this mean that fathers have no concerns? To answer this one should consider whether men have equality of opportunity in childcare provision and responsibilities. To make a fair comparison of fathers and mothers, one should compare to a father that wishes to take between 50% and 100% of the caring responsibilities for their child. In many countries men do not have the same legal rights as women to parental leave. This already makes their situation difficult. If a man chooses to take a equal share of the parenting, will he still experience the "fatherhood advantage"? Or will this occur only if he does not stray from a more traditional family model? Certainly, many men report that on the birth of their children they are expected to resume their work activities without any adjustments, and many did not feel they could request flexible working hours. The answers are not clear – we were not able to find good statistics on parent scientists as a whole.

There are also other factors to consider. The requirements of academics to be itinerant in their 20s and 30s, along with the long hours culture pushes the academic towards a hyper-traditional family setup. Having children often reduces the ability to be mobile and take up short-term posts in different countries, vital to obtaining a permanent position. The choice for many academic parents is either to severely compromise their chance at a permanent position by not moving, or one partner becomes the "trailing spouse", compromising their own career. The trailing spouse often by necessity becomes the main child carer while their academic spouse, by necessity in order to be competitive, focusses on their career rather than any domestic duties. This is often not the choice of either of the partners! This "traditional" setup has stayed the norm in academia much longer than in wider society, making it difficult for anyone in a non-traditional family setup to compete. Unconscious bias against anyone not in this traditional setup ensues, and significant practical barriers also arise. For instance, parenthood also reduces the ability to travel to conferences and for research stays: an IOP study of parents highlighted these difficulties for both men and women[12]. Finally, while fathers' careers may progress more quickly than others, this does not reveal satisfaction with work-life balance and the ability to spend time with their family - for either men or women. A UK UCU study showed that on average, an academic with a permanent position works on average 51hrs a week in the UK, and notably, part-time academics work significantly more hours pro-rata[12]. And a recent study of denied parenthood (where people are not able to have as many children as they would like) shows that male scientists have more regrets than female scientists when they have fewer children than they would have liked.[13]

## 3.6 Question 6: I am familiar with my institution's sexual harassment policies and would be confident of what to do if approached by a junior colleague with a complaint.




| | Women | Men | Other/prefer not to say |
|---|---|---|---|
| strongly agree | 4 | 15 | 0 |
| agree | 8 | 36 | 3 |
| neither agree nor disagree | 9 | 14 | 3 |
| disagree | 14 | 32 | 2 |
| strongly disagree | 4 | 6 | 0 |

- 30% of women reported being familiar with sexual harassment policies, while about 50% of men reported the same.
- But 37% of men and 46% of women reported that they would not know what to do.

Why ask this question? A recent survey[14] of academics (from undergraduate to faculty) undertaking field work away from the university showed that sexual harassment, for both sexes, is a significant problem. 70% of women and almost 40% of men reported experiencing sexual harassment.[14] Sexual harassment in this case was defined as "unwelcome sexual advances, but also offensive remarks about a person's sex". Only 5% of women and none of the men who reported harassment were aware of mechanisms to report such incidents. Approximately 20% of women and 15% of men reported that this occurred regularly, i.e. more than once a week. Only 7% of women and 0.7% of men reported the harassment. The fact that most of these cases remain unreported remains an important issue. Why this may be the

case is for several reasons: it may be due to a lack of awareness of how to report it, or the belief that if reported, they will not be believed, or it will affect the victim's career.

**Case Study**

To highlight why such harassment cases are not reported, one only needs to look at the case of Geoff Marcy of the University of Berkeley, USA, a very well-known astronomer who was known in the community as a serial harasser for decades. It was generally known by the community that he sexually harassed women, and in fact, junior women were often warned away from working with him. Individual women had reported him before, but he only received a mild sanction. After four women jointly raised a complaint against him, he was mildly sanctioned by the university, but not dismissed. Indeed, a letter was written by his senior (male) colleagues at Berkeley, who said that sanctions against him were too harsh, and an article in the New York Time treated Marcy very favourably and did not mention the effect the harassment had on the victims, many of whom had left astronomy as a consequence.

In frustration, many female members of the astronomy community finally highlighted the case on online media site "Buzzfeed". The resulting media storm generated from online coverage and discussions finally put pressure onto Berkeley to dismiss Marcy outright. Other very well-known academics have been similarly dismissed after pressure from the online media.

This case highlights why victims of harassment may not come forward. The SAFE field study showed that in general it is junior scientists who are the victims of harassment. These scientists need to retain good relationships with senior members to progress in their career. This was the case with many junior female astronomers, who gave up their academic career after being harassed. In addition, there is an innate instinct by senior men in the community to protect their own, and for the employers institution to protect its financial interests: Marcy was a *very* well-known astronomer who attracted a very large amount of funding for Berkeley.

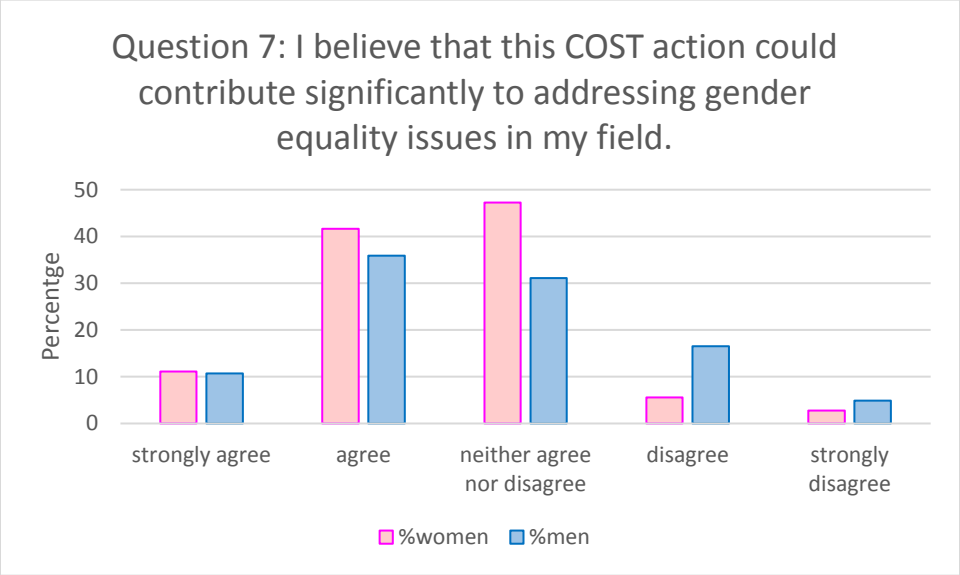
This issue was already discussed as part of the COST gender balance discussions. A discussion amongst approx. 10 women revealed that sexual harassment is an almost universal experience: as one senior woman put it: "it happened to me and to every other woman I know in the field". A young woman is almost certain to experience some kind of sexual harassment during her early career, likely from a senior male academic who will have an influence on her career. A separate men only discussion revealed that they were unaware of the extent of the problem, and moreover, did not understand the issues that women have in coming forward with such complaints.

However, it was also discussed (in later private discussions) that amongst men there is a general fear of false accusations. While there are no statistics on this that we are aware of on this issue, the author has heard of three separately incidences of junior women reporting sexual harassment after their supervisor brought up complaints about their scientific competency or progress.

**Conclusion?**

Clearly this is an important issue that needs clear guidelines about how to deal with such incidents. It is important that victims feel that they will be heard and that complaints will not have a detrimental effect on their career, whilst it is also important that any investigations into such allegations follow a clear procedure and are fair to all sides. It appears that a code of conduct that is available to all and closely followed is not available at many institutions. There is a large variation in policy and practice, and policy is often not followed.

## 3.7 QUESTION 7: I BELIEVE THAT THIS COST ACTION COULD CONTRIBUTE SIGNIFICANTLY TO ADDRESSING GENDER EQUALITY ISSUES IN MY FIELD.

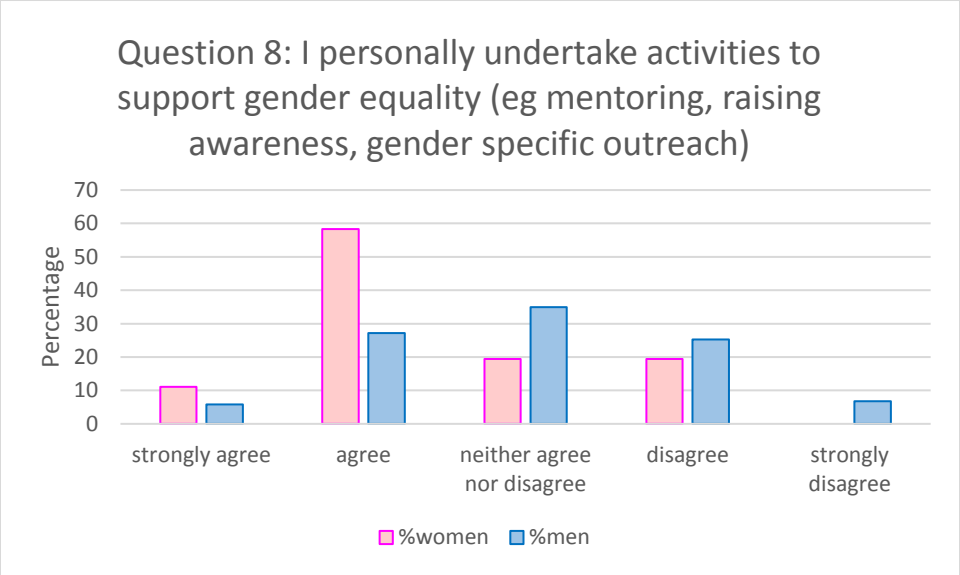



| | Women | Men | Other/prefer not to say |
|---|---|---|---|
| strongly agree | 4 | 11 | 0 |
| agree | 15 | 37 | 5 |
| neither agree nor disagree | 17 | 32 | 3 |
| disagree | 2 | 17 | 0 |
| strongly disagree | 1 | 5 | 0 |

- Approximately half of men (47%) and women (49%) felt that this COST action could contribute to gender equality in the field.
- A minority (8% of women and 22% of men) disagreed with the statement.
- However 44% of women and 31% of men neither agreed nor disagreed with this statement.

The purpose of this question was to gauge the enthusiasm of the COST membership to engaging in gender balance activities. The good news is that only a minority actively disagree that the COST action can improve the situation, although there is a significant number that appear more ambivalent towards the action. Why this is the case is presently not clear, but we hope that by the end of the project, some tangible changes will have taken place, and that a final survey will reveal a change in attitude.

## 3.8 QUESTION 8: I PERSONALLY UNDERTAKE ACTIVITIES TO SUPPORT GENDER EQUALITY (EG MENTORING, RAISING AWARENESS, GENDER SPECIFIC OUTREACH)




| | Women | Men | Other/prefer not to say |
|---|---|---|---|
| strongly agree | 4 | 6 | 1 |
| agree | 21 | 28 | 3 |
| neither agree nor disagree | 7 | 36 | 3 |
| disagree | 7 | 26 | 0 |
| strongly disagree | 0 | 7 | 1 |

Respondents were invited to give details of actions they undertook. A summary of common responses were:

Women: 12 gave details. These include:

- 7 reported mentoring junior (female) colleagues or students, either formally or informally
- 2 reported formal leadership roles involving gender equality, eg being on a gender equality board or a formal contact at the institution or serving on national panels.
- 5 reported undertaking gender-specific outreach activities.
- 2 women report raising awareness of gender issues
- One woman reported going out of her way to keep PhD students who become pregnant or have parental responsibilities on the PhD programme.

Men: 25 gave details. These include:

- 6 reported acting as mentors to junior women, either formally or informally
- 6 reported raising awareness of gender issues
- 4 reported actively ensuring that women were well represented when compiling lists of invited talks or committees.
- 7 reported taking steps to improve female recruitment (from PhD to faculty positions)
- In other miscellaneous comments, men reported giving lectures on equality, one man reported being a member of a feminist organisation, one reported that he treats all member of the group in the same way, another that he just tries to have the correct behaviour at work.
- Only one man explicitly reported that he did not feel any gender related issues in his institution and therefore did not feel the need to take any action.

To summarize the results of this question:

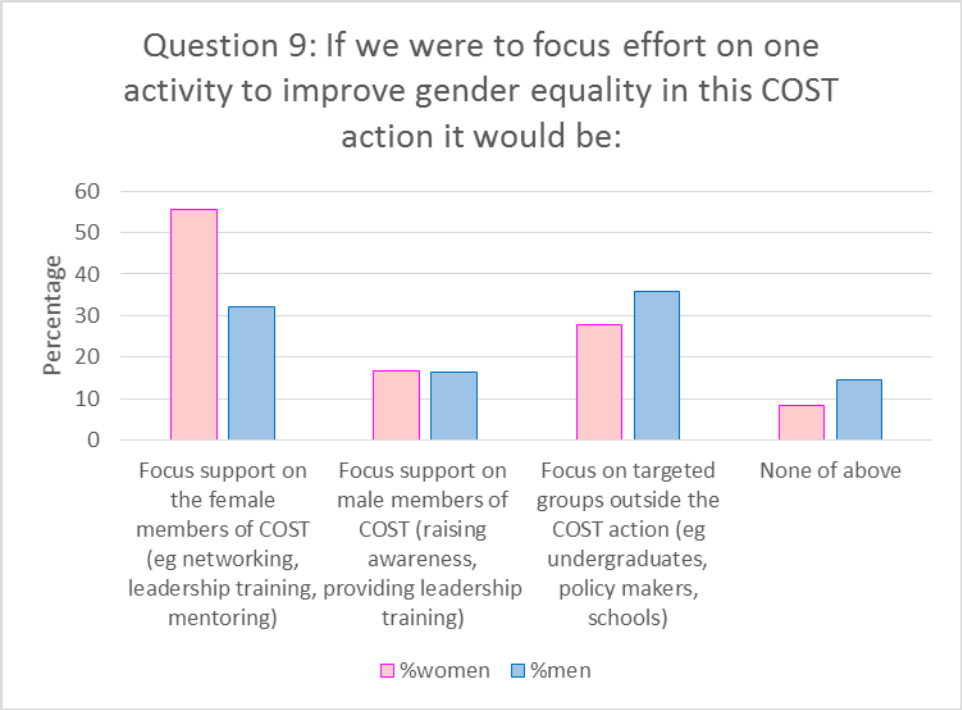
- **A high percentage of women (64%)** reported undertaking some kind of activity related to gender equality.
- **Approximately half the percentage of men (33%)** reported the same.
- Acting as a **mentor** was the most common activity reported by **women**, followed by **outreach** activities.
- **No women** reported taking an active role in addressing gender balance in **invited talk lists**, nor in ensuring **fair recruitment** of women.
- In contrast, the most common activities reported by **men** were in ensuring gender balance in **invited talk lists** and **recruitment**, as well as awareness raising.

The results for this question show some interesting trends. Active involvement of men in promoting gender equality appears to be far lower than for women. It is not clear why this is: certainly the results of Q1 indicate that many men (>50%) do not feel that there is a problem. However, other reasons for inaction may be due to a lack of awareness of what action to take.

The action taken will also vary strongly depending on seniority. For example, ensuring fair recruitment to positions and invited talks is an activity that only senior people can undertake. It is likely that there are more senior men than women answering the survey, thus partially explaining why only men report these activities. On the other hand, acting as a female role model during outreach activities, or providing specific experience as a woman when mentoring junior colleagues, can only really be done well by a woman. Nevertheless, it is still important that senior men, with their contacts and knowledge, also act as mentors to junior women, who can often be left out of the informal networking to which junior men are exposed.

Some men reported simply raising awareness of issues, or trying to behave in the correct way themselves. For those in junior positions this may be the only realistic way that they can be a positive influence. Nevertheless, just being aware of issues, and passing on that awareness to others is a very important first step, and these men in particular should be applauded for their efforts!

## 3.9 Question 9: If we were to focus effort on one activity to improve gender equality in this COST action it would be:




| | Women | Men | Other/prefer not to say |
|---|---|---|---|
| focus on women | 20 | 33 | 3 |
| focus on men | 6 | 17 | 3 |
| focus outside COST | 10 | 37 | 0 |
| none of the above | 3 | 15 | 2 |

- Most respondents felt that **more focus should be on women rather than men**. 51% of women and 32% of men felt that this would be the most useful.
- The **least popular option was to focus on men.** Only 15% of women and 17% of men felt that this would be most useful.
- Many felt that focusing on **groups outside of the COST Action NQO** would be most useful (29% of women, 36% of men)
- A minority (8% of women, 15% of men) felt that either none of the options put to them were worth pursuing, or mentioned other specific areas of focus.

The results of this question were quite clear: most people felt that we should focus our attention on supporting women (in terms of networking, mentoring, leadership training), followed by addressing

undergraduates, policy makers and schools. The least popular option was to raise awareness and provide leadership training for men.

The results of the survey reflect underlying attitudes towards gender equality actions that have been prevalent for the past 2 decades. Much effort has been put into outreach into schools, while in the workplace, specific programmes to provide mentoring to women are often implemented. However, evidence[15] shows that these are not working, and policies have shifted towards new strategies. Now key policy makers recommend more emphasis on supporting families and flexible working, and focus on the "gate-keepers". These are the senior people at the top of an organization who make the most important policy decisions. The McKinsey report,"Women Matter", shows that only when an organization puts gender equality in the top 3 of its strategic priorities does institutional change occur.

This question deliberately asked for one activity: an option "focus on men and women" was deliberately not put forward. This is because what one would do for men and women might be very different. Before answering the question of what we should do in light of evidence let us consider how traditional gender equality activities address different groups, what the evidence is for success, and why specific groups are targeted.

From our survey, undertaking gender specific outreach to schools and to young people was the second most common activity amongst female scientists in Q8. This reflects a trend in the past two decades to attempt to increase the numbers of girls and women participating in STEM subjects at undergraduate level[15]. However, as an example, the number of girls taking A-level Physics (at age 16-18) in the UK has plateaued at around 20% for the past decade. The trend in many other European countries is similar. While most female scientists, particularly senior women, are encouraged to undertake outreach, clearly, as a strategy to increase female participation it is not working, even at undergraduate level. Are outreach activities ineffectual? Exposure to female scientists is known to inspire younger women, but perhaps it is simply a matter of sheer numbers: there are simply not enough female scientists available to target all schools and educational institutions. Because the COST Action NQO is small (approximately 400 people) compared to the number of school-age students in Europe, the possibility to make a significant impact is small.

In addition, statistics clearly show that for those subjects where female:male parity is reached or exceeded at undergraduate level, men overtake women by postdoc level and the female:male ratio of professors in most STEM subjects is fairly independent of undergraduate numbers. This continued vertical segregation problem means that improving numbers at undergraduate level will, by itself, not help reach parity in the higher academic ranks.

The most popular target group in the COST action was women. 37% of all respondents thought this would be most useful. However, it is not clear how useful this would be. Certainly a female network would reduce the isolation amongst women in the field. However, is it clear what women particularly need? For example, do they need specialist leadership training? It has become common to send women on specialist training courses to teach them how to "cope" with the male dominated environment, training them to amend their behavior to meet the traditional expectations of the gatekeepers in scientific society. Much of this training revolves around the perception that women lack confidence, and that they therefore need to be encouraged to take up STEM subjects, apply for promotion etc, and to display more "assertive" behaviour. However, there is very little real evidence that women lack confidence. For instance, the well-known book "*Lean In*" by Sheryl Sandberg, states that men would

apply for a job when only 60% qualified, while women would only apply when 100% qualified, thus showing a relative lack of confidence in women. However, when investigated, it was found that these "statistics" come from anecdotal reports by male senior executives with no real basis in statistical fact.[16] In contrast, a recent survey of 4600 workers in 840 workplaces in Australia[17], comparing the numbers of women and men requesting a pay rise or promotion for similar jobs and working hours, no difference was shown between the two groups. However the study did show that men were 25% more successful at being awarded a pay rise. Yet again, we observe that, in fact, it is implicit bias that leads to the differences in promotion rates of men and women.

There is also evidence to show that negatively stereotyping women as lacking confidence is damaging. The very well-known phenomenon of "stereotype threat" applies here. This is a psychological phenomenon where a member of a group can be made to perform more poorly at a task, simply by telling them that their group is stereotyped as being worse at that task. This is true even if there is no statistical difference in performance for that group. It is therefore likely that telling a confident woman that she lacks confidence is a self-fulfilling prophecy. In general, lack of confidence arises when people are exposed to unequal treatment systematically. Men are generally not exposed to such systematic negativity about their abilities when attempting to progress their career.

We therefore do not suggest that outreach to schools, or specialist training for women is beneficial. However, the fact that over half the women believe this would be helpful indicates that they feel a strong need for support. We will investigate further to find out what support is really desired by this group by running women-only discussion sessions. However, if general leadership training is requested by the community, we will not restrict this to women only, unless there is a very good reason to do so.

What we do suggest is targeting of specific groups. In the summary of findings we will discuss these target groups. We will target senior leaders (gate-keepers), early-stage researchers of both genders, and policy-makers and funding bodies.

# 4 SUMMARY OF FINDINGS: WHAT NEXT?

**Summary of findings**

The findings in this report show several interesting results. Comparing these results to what is known from gender research and staticists allows us to formulate a plan of action. To summarize:

- Men and women in the COST disagree significantly about the severity of inequality of opportunity in the science and engineering.
- There is a significant deviation from the opinions and beliefs held by the COST ActionNQO community and the statistical evidence available to on gender equality in STEM subjects in academia.
- In particular over half of men do not think women are at a significant disadvantage, despite very strong evidence to the contrary in gender research. This likely means that many are unaware of the problems of implicit bias, and their contribution to inequality.
- By far the strongest opinions were held on the impact of motherhood on scientific careers. 35% of women felt *strongly* that this was a problem. This opinion is substantiated by statistical evidence that motherhood does indeed negatively affect careers. But there is less support for scientist fathers by the community, and it is not clear that a fair comparison is made on a like-for-like basis in gender studies.

**What steps should we take and why?**

The suggestion is that the COST Action NQO focuses on these areas:

- **Provide effective advice for senior scientific leaders**. Most senior scientific leaders are men, the target group that was felt to be least important to target by this survey. However the decisions made about structure of the working environment, who to hire and promote, are overwhelmingly made by senior men, “gate-keepers” who have by far the greatest influence in the community. The evidence that implicit bias strongly affects the decisions made by senior leaders, both male and female, is overwhelming. Targeting these people will have the greatest influence by far.

- **Providing an effective support network for women**. Over half the women felt that this was needed. However we will explore what type of support is needed, and avoid the usual pitfalls of negative assertions about lack of confidence and need to amend their behavior. Certainly, simply reducing isolation will be beneficial.

- **Provide an effective support network for carers.** This was the most important issue highlighted by the respondents. We will target both mothers and fathers, as well as other carers. Our first focus will be to establish “easy wins” – achievable actions that do not require broad institutional change but that can provide support to parents and other carers.

- **Provide an effective support network for early career scientists**. All early career scientists are at a vulnerable stage in their career: progression to the next level is highly competitive. In

particular, balancing parenthood with the long hours culture and an itinerant lifestyle will be addressed for both genders.

- **Promote dialogue between male and female scientists about gender issues**. There is clearly a gender divide about the opinions in this survey that likely arises due to a lack of knowledge. Womens' fear of how discussing such issues will affect their career and status is well-founded, as is mens' fear of being negatively judged for expressing their opinions. Promoting dialogue in a safe environment, and making sure that all members of the community agree on courses of action is vital to ensuring that action is implemented effectively.

- **Provide feedback and recommendations to institutions and funding councils**. It is clear that the COST Action NQO by itself can only implement some changes to our policies to improve gender equality. However, a strong and united voice from both women and men has more chance to chance policy in our own institutions. Key to this will also be influence on funding councils. The EU is fully committed to achieving better gender equality in Horizon 2020. We hope to provide grass-root evidence of the problems faced by scientist in the community, and how the community best feels these could be tackled.

# 5 About the Author

**Dr. Ruth Oulton** is a Senior Lecturer at the University of Bristol, UK. After a PhD at the University of Sheffield, UK, she spent some time as an Alexander von Humboldt Fellow at the TU Dortmund, Germany, before returning to Sheffield as a postdoctoral researcher. In 2008 she moved to Bristol with an EPSRC Career Acceleration Fellowship to start her group. She presently holds an EPSRC Quantum Technologies Fellowship, with the aim of taking semiconductor quantum optical physics to technological applications. As well as being the Gender Balance Advisor for the COST Action Nanoscale Quantum Optics, she is also one of the UK representatives. She gives presentations on issues regarding gender balance at all COST Action NQO workgroup meetings.

## References and useful links

[1] L.Bornmann, R. Mutz, H.-D. Daniel "Gender differences in grant peer review: A meta-analysis", J. Informetrics V1, p226 (2007).
[2] Moss-Racusin *et al*. "Science faculty's subtle gender biases favor male students" PNAS **109,** 16474 (2012). (see also follow up paper Handley et al., PNAS **112**, 13201 (2015) about the gender divide in *reactions* to gender studies such as these)
[3] Wenneras and Wold, "Nepotism and sexism in peer review" Nature **387**, 341 (1997)
[4] WHITE PAPER on the Position of Women in Science in Spain http://www.idi.mineco.gob.es/stfls/MICINN/Ministerio/FICHEROS/UMYC/WhitePaper_Interactive.pdf
[5] Schmader *et al.* "A Linguistic Comparison of Letters of Recommendation for Male and Female Chemistry and Biochemistry Job Applicants" *Sex Roles*. ***57*****,** 509 (2007)
[6] A.E. Budden *et al.*, "Double-blind review favours increased representation of female authors" TRENDS in Ecology and Evolution Vol.**23**, p4 (2007)
[7] V. Larivière *et al.*, "Bibliometrics: Global gender disparities in science" Nature **504**, 211–213 (2013)
[8] D. Maliniak, R. Powers, B. F. Walter "The Gender Citation Gap in International Relations" International Organization vol **67**, 889 (2013)
[9] Royal Society briefing and animation on implicit bias: https://royalsociety.org/topics-policy/publications/2015/unconscious-bias/
[10] Casadevall and Handelsman, "The presence of female conveners correlates with a higher proportion of female speakers at scientific symposia" mBio 5(1):e00846-13 (2013).
[11] Shelley J. Correll, Stephen Benard, and In Paik. 2007. Getting a job: Is there a Motherhood Penalty. *American Journal of Sociology*.
[12] Institute of Physics (UK) "Study on Childcare" (2010) http://www.iop.org/publications/iop/2010/page_45280.html
[13] Damaske et al., "Male Scientists' Competing Devotions to Work and Family: Changing Norms in a Male-Dominated Profession", Work and Occupation, Vol**41**, p477 (2014).
[14] Clancy et al., "Survey of academic field experiences: trainees report harassment and assault" PLOS One **9**, 102172 (2014).
[15] M. Caprile (coord): European Commission Meta-analysis of Gender and Science Research, 2012.
[16] http://curt-rice.com/2014/04/22/what-happens-when-under-qualified-women-apply-for-jobs-and-why-sheryl-sandberg-and-mckinsey-wrongly-think-we-dont-know/
[17] http://www2.warwick.ac.uk/fac/soc/economics/research/workingpapers/2016/twerp_1127_oswald.pdf

The most comprehensive studies of gender equality in science are references [4], which contains a comprehensive survey of academics across Spain, and [15] which contains a meta-analysis of research into gender and science with focus on the countries in the European Union.