Why inclusion of women enhances the performance of men in STEM disciplines – a statistical approach

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A short reflection within the scope of FALCONESS about the importance of inclusion of women for both women and men, and why the exclusion of any group generally has a negative impact on societies.

Introduction

In a very limited number of professions, the physical difference between women and men can have an impact on the selection of staff, although even this can be put in question, as hardly jobs exist, where physical strength could not be compensated. For example, in most European countries female construction workers are a rare picture, however, on many African construction sites women who do the same job as men can often be found. Regardless whether jobs exist where physical differences between men and women can become relevant, for STEM professions, this is clearly not the case.

However, to date, in most STEM professions, no matter where in the world, mostly men can be found, and still today, girls are often taught that STEM disciplines are exclusively within the male domain. However, since STEM disciplines are among the most critical disciplines that can contribute to the most relevant global challenges, such as mitigation of climate change effects, responsible urbanisation and future technologies development, the imbalance of men and women in STEM disciplines needs to be revised. These pressing challenges require the most talented human beings from all over the world working selected based on criteria that focus on pure skill instead of bias and tradition. Excluding women from positions within the STEM domain, therefore is a limiting factor for societal development and climate change mitigation. Regardless of individual gender mindset, this can be proven purely using mathematics, as the following qualitative example shows:

Assumptions

We can classify the skill level as shown in Fig. 1a, which applies for men and women identically. 40% of the population can be classified as averagely skilled, 20% each are above and below average, and 10% stand out by either being excellently skilled for a job or by not being qualified for the position.
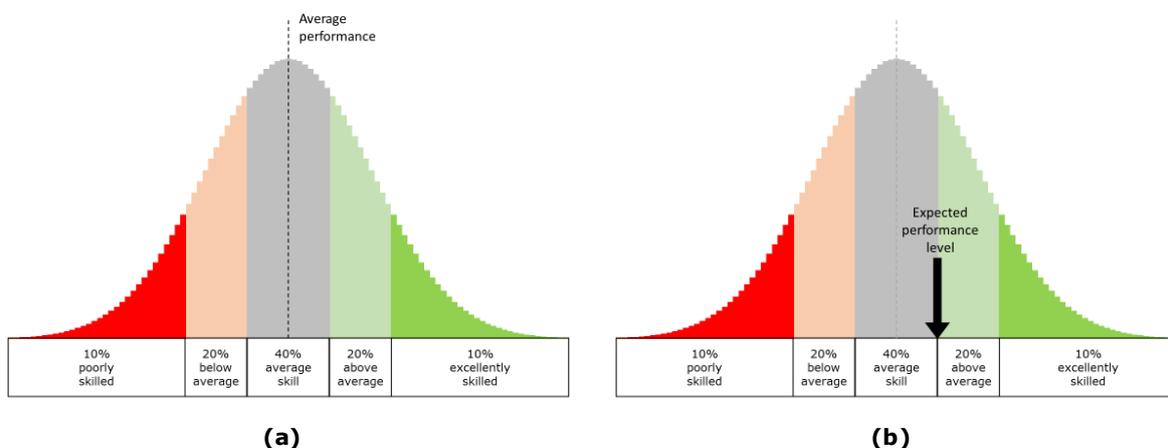

(a) **(b)**

Fig. 1: Gender neutral skill distribution and classification of sub-groups depending upon skill (a) and set expected performance level in this example (b).

The following assumption apply:

- Skill is normally distributed and in equal manner for both gender
- due to established male networks 90% of all men have access to a position that requires a specific skill, and
- due to gender bias, only the 10% most excellently skilled women have a chance to work in the respective position.

Discussion

If we assume for a society, which is strongly coined by male networking, male preference and female discrimination, only the 10% least qualified men will be sorted out in a selection process for a certain professional position, while there are only 10% women who are this excellent that despite the gender bias their qualification cannot be denied. Then Fig. 2a shows the group of men included and excluded from a selection process as well as at which skill level the average included man performs with respect to the skill level indicated at the abscissa. Since only 10% of men are excluded, the average performance is not significantly higher than the average of the overall population. Fig. 2b shows the same situation for women. Since only the most excellent 10% are included, the performance of an average included women is within the excellence region as well.

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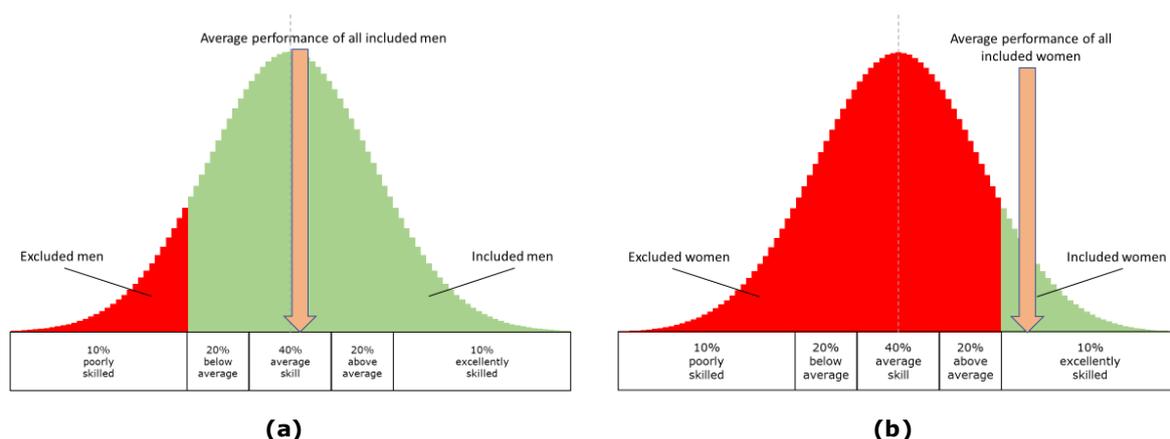<tr><td>(a)</td><td>(b)</td></tr>
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Fig. 2: group of men included and excluded assuming that only the least qualified men are not considered as suitable for a specific professional position (a), and group of women included and excluded assuming that only the most excellent 10% of women will be considered as suitable for a specific professional position (b).

If the performance levels of an average included female and male are merged with the expected performance level for a specific professional position (Fig. 3a), it is getting very clear that an average man in the given scenario underperforms in comparison to the expectation, while an average women clearly outperforms the expectation. This does not mean that women generally perform better than men. The difference in average is purely based on the larger number and variety of men who are included and the tiny little fraction of women who are only included based on their excellent skill. The same excellence fraction exists for men as well, but the average is shifted by the large group of less excellently performing men.

With more inclusion of women, less underqualified men will be included in the selection for a specific job. The inclusion of a wider range of women beyond the 10% excellent women, certainly, the average performance of women will be reduced, but at the same time, due to the exclusion of less qualified men, the average performance of men increases. Fig. 3b shows the same example with to best 30% of women included and the lowest qualified 30% of men excluded. As can be seen, the average male performance is getting closer to the above average level, at the price of a slight reduction of the overall female performance level. At full gender equity, the average male and female performance would be located in the same position.
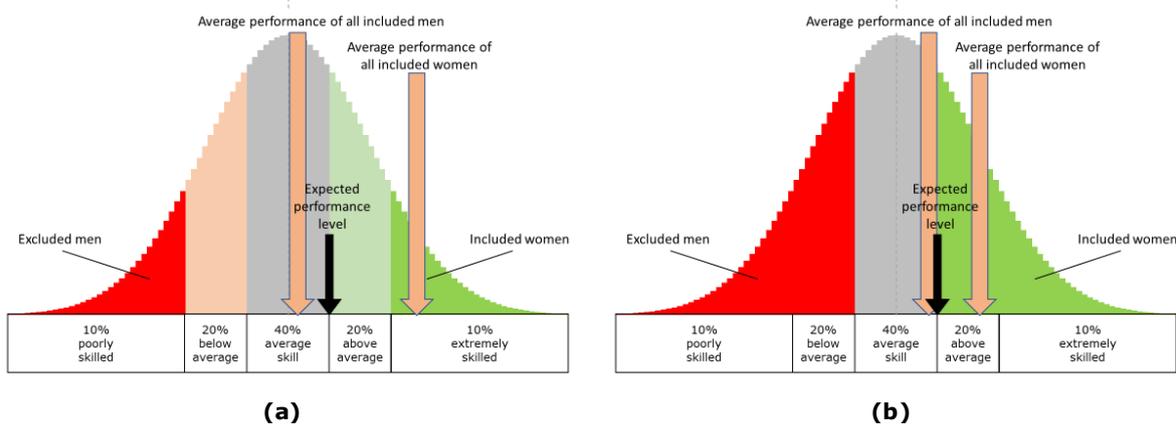
Fig. 3: average male and female performance compared to a set expectation level with only 10% men excluded and 10% women included (a), and under the assumption that 30% underperforming men are excluded and 30% women above average are included (b).

Conclusions

Certainly, the given example is just a random normal distribution with arbitrary classification and criteria for exclusion, inclusion and expected skill requirement criteria. For every profession, framework and decision-making process other parameters will apply, which, however, qualitatively derive the same conclusion.

The generic example shows that exclusion of women automatically reduces the average performance of men, and that in return, the inclusion of more women enhances the average male performance. It is important to notice that the example is not limited to the exclusion of women. The same conclusion can be drawn for societal groups that are excluded due to other aspects than gender, for example colour of skin, age, religion, sexuality, or origin.

In the light of the challenges humanity faces, such as climate change, rapid urban development, resource depletion, unequal distribution of wealth and the linked consequences such as social unrest, migration, and extinction of biodiversity, the global society requires every talented person who can contribute toward a brighter future perspective. No society in the world can afford excluding skilled and motivated talents. And, thus, creating a framework of gender equitableness is the best starting point for an immediate change towards a brighter future.

Acknowledgement