Examples of S&G Analysis in Practice: STEM

Why are sex and gender important in scientific research?

Recently, gender studies have mainly developed in the humanities and social sciences. To overcome prejudice, however, it is necessary to integrate gender analysis into scientific research and combine this approach with strategies aimed at increasing the number of women and transforming institutions. Science, engineering, medicine and environmental sciences need to introduce the sex and gender dimension to propose innovations that consider the needs and requirements of the entire population. The point is not just to increase the number of women scientists; it is to find technical and technological solutions that meet the needs of all and thus improve the living conditions of large sections of the population.

The idea of gender innovations is to use gender as a resource to create new knowledge and to achieve excellence in science. In addition to identifying bias and understanding how it operates in science, medicine and engineering, it is necessary to recognise that its presence within the workplace could threaten any productive strategy. Sexual and gender bias in science is socially damaging and expensive. It is essential for gender experts, natural scientists and engineers to work together to develop methods of analysis that can be used to understand the role of gender in research and how it can best be used.

Case Studies

Current innovations do not always adequately meet the needs and expectations of women. Therefore, experts need to go beyond simply recognising gaps and shortcomings and examine concrete examples demonstrating that proper treatment of gender differences has a real impact and improves research. Case studies offer new insights into science, engineering and technology development, environmental issues, medicine and transport. For example, failure to use appropriate samples of male and female cells, tissues and animals in medical research produces erroneous results. In urban planning, the inability to collect data on care work leads to inefficient transport systems.

In summary, it is of paramount importance to identify gender bias and understand how it operates in science and technology and then offer methods through which scientists and engineers can introduce sex and gender analysis into their work. By incorporating these methods into research, it is possible to limit the pitfalls and risks involved when building products for use by individuals with different needs and characteristics.

We consider some case studies and concrete examples from different scientific fields that demonstrate how to harness the power of sex and gender analysis to generate inclusive innovations and sophisticated technologies.

The first field of application of gender analysis is the field of medical research. Introducing gender analysis into medical research and testing means looking at men and women as biologically different subjects with different social behaviours. Gender medicine investigates the possibility that diseases to which men and women are subject require treatment and prophylactic solutions that consider their sex differences. Considering gender as a biological variable is a necessity arising from the evidence that drugs and medicines fail more frequently for women. Innovations open the field to research and production of new treatments and new medical aids capable of meeting the different demands of patients with other characteristics. This is the case with knee implants. Although two-thirds of the 500,000 knee replacements performed worldwide in 2007 involved women, the standard reference model for the construction of replacement prostheses is that of a limb of a normal-weight male subject. Considering a single standard model for both sexes has negative consequences for rehabilitation therapies and the recovery of mobility. In this specific case, gender analysis allows us to question the traditional model of one-size-fits-all prostheses and opens up the market for prostheses with different morphological characteristics suitable for men and women. From this diversification of solutions comes a significant improvement in the quality of life of patients and the creation of new employment opportunities.

A further example is related to the diagnosis of skin cancer. A group of scientists at Stanford University has developed an algorithm using artificial intelligence to diagnose skin cancer. However, the machines are more accurate in identifying cancer in men than in women, and the algorithm recognises light skins well but not so well dark ones. This is because the data on which the algorithm was trained consists mainly of cases of white males.

Introducing gender analysis into research is not a strategy that can promote the inclusion of women and minorities. The same discrimination in the medical field can also affect men, as in the case of osteoporosis diagnosis. Osteoporosis has been primarily considered a disease of postmenopausal women; this assumption has affected the treatment, diagnosis and screening of the disease in patients. That said, osteoporosis has a far from negligible impact in men, which can have devastating consequences for the patient, aggravated by the fact that, in most cases, the disease goes undiagnosed and untreated. Although fragility fractures are more common in women, mortality rates following a fracture are higher in men, and men are more likely to suffer severe consequences after the event.

The analysis of sex in medicine is so critical that in 2016 the National Institute of Health (NIH) in the US implemented a policy that all publicly funded research must consider sex as a biological variable. It was only in 1993 that the NIH established the obligation to include women in trials. The problem is that

pre-clinical research continues to be conducted on male animals, cells and tissues, a choice because the menstrual cycle of female animals interferes with the data. A 2011 study on pre-clinical experiments showed that male animals are used more frequently than female animals except in reproduction and immunology. Moreover, many experiments do not take the sex of the animal into account, making the research unnecessary and potentially dangerous.
Between 1997 and 2000, ten drugs were withdrawn from the US market due to life-threatening health effects, eight of which were most dangerous for women. The marketing of drugs costs billions of dollars, and when they fail, they can cause death, suffering, and significant economic loss. Conducting trials and research that do not underestimate the biological gender variable is a responsible way of doing science that can save many lives, avoid suffering and save a lot of money.
A further case study refers to engineering design that often takes the male body as the norm. One example is crash test dummies that are used in car safety tests. These are rubber and metal reproductions of human beings built according to the criteria of biomechanics to accurately simulate the human body and assess the stresses that the various organs can withstand, such as acceleration and compression. The dummies are equipped with sensors that, at the end of each test, make it possible to determine whether the occupant would have survived the impact and, if so, with how many injuries. The most commonly used dummies are those that model the average male body at the 50 percentile. In 1966, a five-percentile female dummy was introduced, representing a scaled version of the male dummy. However, there is no dummy that models women's bodies at the 50 percentile: those currently used are not designed to simulate the injury tolerance typical of the female body and do not consider the different reactions different bodies can have to impact. When accident data are analysed by gender, age, height and weight, it is not surprising that men who fit the profile of the standard model suffer the fewest injuries in car accidents. Older drivers, obese drivers, and women are more likely to suffer serious injuries, even when using seat belts. National data on US motor vehicle accidents from 1998 to 2008 revealed that a female driver is 47 per cent more likely to suffer severe injuries than a male driver involved in an accident of similar proportions. A further problem occurs in the case of pregnant women. Conventional seat belts do not fit pregnant women properly, and injuries caused by seat belts could be dangerous to the foetus even when mothers are not injured. Faced with these problems, researchers in the field are stepping up their efforts to create real and virtual crash test dummies capable of modelling the human population with more variety and including those who do not fit the standard.
Case studies show that the differences between the needs, behaviours and attitudes of women and men do matter. Considering them and ensuring that these differences find a place in research makes them relevant to society.