Women are change-drivers in the world - Women in science without borders (WISWB), excellence and impact as a way to change the world by science

Les Femmes sont les moteurs du changement dans le monde - Les femmes de science sans frontières - changer le monde par la science

Prof. Amal Amin Ibrahim Shendi

National Research Centre, Egypt

Abstract: Girls and Women are change drivers in the world, but they need encouragement and recognition of their roles. The same with females in science, whether scientists or students, they will act efficiently with more inclusion and integration, which may happen with active collaboration with males in order to achieve sustainable development goals including SDG-5 of gender equality, specifically in scientific communities in order to be a role model for total society and the globe. WISWB is a new initiative for males and females to attain sustainable development goals with science-based on scientific excellence across borders of gender, culture and any other restrictions or considerations. Briefly, it is an initiative to develop societies with science.

Résumé : Les filles et les femmes sont des moteurs du changement dans le monde, mais elles ont besoin d'encouragement et de reconnaissance de leur rôle. Il en va de même pour les femmes dans le domaine des sciences, qu'elles soient scientifiques ou étudiantes, elles agiront efficacement avec plus d'inclusion et d'intégration, ce qui peut se produire avec une collaboration active avec les hommes afin d'atteindre les objectifs de développement durable, notamment le cinquième objectif stratégique de l'égalité des sexes, en particulier dans les communautés scientifiques afin de servir de modèle à la société et dans le monde. WISWB est une nouvelle initiative pour les hommes et les femmes afin d'atteindre des objectifs de développement durable fondés sur l'excellence scientifique au-delà des frontières du genre, de la culture et de toute autre restriction ou considération. En bref, il s'agit d'une initiative visant à développer les sociétés avec la science.

Marie Curie (famous female Nobel Laureate in 1903 and in 1911) said that "*Life is not easy for any of us, but what of that ? We must have perseverance and above all confidence in ourselves. We must believe that we are gifted for something and that this thing must be attained*".

I mentioned this statement in celebration of the first physics Nobel Laureate in 2018, 55 years after the last one, in addition to another Laureate, in chemistry, 9 years after the last award. On this occasion, I would like to say that female scientists deserve more appreciation with respect to their numbers and efforts that have been growing across university laboratories and research institutes for years, without much recognition. Even though, if we look deeply, we may find now that females are key players in all aspects of life generally and in scientific fields specifically, including in research teams in several specialties. However, there is always little attention or focus on their roles which made me focus on the statement by Kathy Calvin, the United Nations foundation president and CEO: "Girls are one of the most powerful forces for change in the world: when their rights are recognized, their needs are met, and their voices are heard, they drive positive change in their families, their communities, and the world".

Indeed, that explains the role of girls or women in the progress of their societies and consequently of the World. The girls include daughters, wives, sisters and colleagues who may represent half of the societies or more. So, how could we ignore the role of almost 50 % or more of the main population in forming decisions or achieving significant progress? Practically, they need only good preparation and the right qualifications to drive the change in their societies with full preservation of their rights as equal human partners of their male counterparts.

Literally, that situation should be extended to the sustainable development goals which were specified by the UN as the main principles of human rights. Obviously, all goals may be affected by the contributions by women whether as family members or as active citizens in the society. Primarily, women are the ones most affected by bad actions, circumstances and disasters such as poverty, hunger, insufficient energy or clean water, or lack of education or medical care, whether as mothers or active family members, or sometimes as the main support of their families. However, their contribution is not always recognized or appreciated enough to give them the consideration as qualified persons able to efficiently serve their societies and raise their children in a professional way. Accordingly, women must be effectively empowered in order to improve their qualifications in all fields, including science, to give them a greater impact on their life prospects.

In this context, the situation for women in science is shocking since, according to a UNESCO report [6], only less than 30 % of all researchers are women with variable percentages worldwide, ranging between 30.4 for sub-Saharan Africa to 32.2 for North America and 39.9 % for the Arab states. Surprisingly, the dominant female contribution is obvious among majors in life sciences such as medicine and nursing compared to remarkably low percentages in engineering, math and natural sciences where the number of males surpasses that of females. Additionally, the number of women in higher education and research decreases gradually and drastically from the

undergraduate stages to the postgraduate ones according to a concept called "leaky pipeline" (fig. 1). The number of female students may reach 50 % at the university level concentrating on special majors in life sciences more than natural sciences or engineering. Paradoxically, the number decreases at Ph.D. levels and drops at higher levels reaching 6 % with respect to leadership, higher levels of academia and to the number of total members of national academies. Also, the number decreases with increasing family commitments such as marriage or having children.

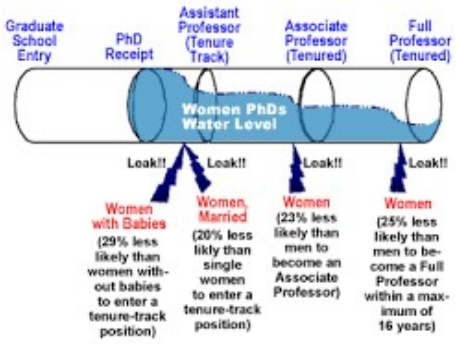


Figure 1 – Leaks in the academic pipeline for women [7]

Moreover, the number of female Nobel Laureates is lower than that of males specifically in physical and biological sciences i.e., 3 in physics, 5 in chemistry and 12 in medicine and physiology compared to 111, 109 and 108, respectively for the total numbers..

On the other hand, the Elsevier report [2] highlighted the females' scientific achievements including 5.5 million papers and 27.3 million authorships, where it was found that males produced 70 % of the total publications with 66 % first authorships even in the developed countries. Only 13 % of highly cited authors in 2014 were women, but the number varied by discipline from 3.7 % in engineering to 31 % in social sciences. Generally, women are underrepresented with respect to innovations where the global share of women as inventors in PCT (the patent cooperation treaty) applications was only 14 % in 2011-2015. The percentage of patents with at least one woman among the inventors was 28 % in 2011-2015.

Indeed, a real and deep analysis of the situation reveals several causes for the underrepresentation of women in science such as societal commitments as family member, whether as mothers or as sponsors. Also, a bad and unfavourable view by collaborators of the work done by women in research or activities may help to explain that low percentage of the female contribution in scientific communities. Sometimes, male researchers see the female contributions as extra burdens, not really helpful in achieving the required and planned scientific goals in projects or routine lab or scientific work, as we have seen in remarks by Tim Hunt, winner of the 2001 Nobel prize in physiology/medicine, who recommended that scientists should work in gender-segregated labs and he said that "***Let me tell you about my trouble with girls . . . three***

***things happen when they are in the lab ... You fall in love with them, they fall in love with you and when you criticize them, they cry.*"**

Additionally, in some cases, stereotypes or racism identify some fields as specifically for women more than for men, as was obvious in recent remarks (2018) by the Italian researcher (Prof Alessandro Strumia) of Pisa University during a workshop on "High Energy Theory and Gender" at CERN who said that *"Physics is invented and built by men, it's not by invitation"* and "*male scientists were being discriminated against because of ideology rather than merit"*.

Also, we cannot deny the role of educational programs which are sometimes designed to prepare women as future mothers and for special jobs rather than to become future healthy citizens who can freely choose their way. Therefore, the systems do not help to support the self-confidence of females from childhood. Additionally, females themselves sometimes help to ignore their rights by not claiming them or chasing their dreams and accepting their situation with no further steps or efforts to change or to develop themselves. Also, in some cases, they are afraid that if society looks on them as strong independent individuals, they will not find a husband or form a family. Unfortunately, sometimes females themselves do not support each other in the work place and fail to build successful business networks to support their careers at their workplaces as is the case of their male partners. That happens in spite of the natural gift of women to communicate with others outside their professional careers as, for example, in scientific communities whether in academia or research.

For all these reasons, several programs were built to empower and encourage women in scientific communities to increase their participation and to help them to achieve scientific progress or development. But, in spite of all these efforts, we still have the same situation which brings us to the question, *what more should we do?* Or in other words, is there anything missing which prevents us from attaining our goal and solving all problems related to women in science?

Those questions may be answered if we replace the expression "empowerment of women in science" by "gender equality" as the fifth sustainable development goal to enrich diversity in scientific communities, where we may share the problem of women in science with their male counterparts who may help to find real solutions and answers to these questions. Briefly, we cannot ignore the role of men in solving the problems related to the subject of women in science where it is a responsibility shared between males and females.

"We need all hands on deck, and that means clearing hurdles for women and girls as they navigate careers in science, technology, engineering and math", Michelle Obama (2011).

Therefore, as a woman scientist, I consider that it is time to have effective integrated relations and cooperation with male colleagues where most successful women scientists may find some help from men whether as family members, father, brother or husband, or in the workplace from colleagues and leaders. So, I have made several efforts to empower women in science through the movement of young academies where I have co-founded both the global young academy and the Egyptian young academy to empower

young and mid-career scientists, including women, as main players in the movement away from any partiality. I have established a women-in-science working group in the Global Young Academy (GYA) and have become a member of several mentoring programs where I have learned that part of the problems of women in science lies in the lack of role models and success stories, which may encourage and guide the new generations to give them inspiration and self-motivation for a better future, which may help to convince them to complete the long road through post-graduate studies and then higher degrees.



Figure 2 – Logo of WISWB

Lastly, from my experience, I have concluded that a new movement should be established such as active model for cooperation between males and females on a scientific basis away from any other considerations and concerned only with scientific merit and excellence, taking science as the common language.

Consequently, in 2016, I took the first steps to found and establish the new movement for women in science without borders (WISWB) whose main basis is to encourage gender equality as sustainable development goal number 5 (i.e. SDG-5) by increasing cooperation between women and men inside scientific communities as a model for the whole society to achieve sustainable development, specifically in developing countries. WISWB's main principle is: *"It is not a matter of women or men scientists, but it is a matter of increasing cooperation between both sides for the sake of sustainable development"*.

Meanwhile, the main aspect for WISWB is to hold an annual gathering to collect excellent contributions based on cutting-edge research presented by both female and male scientists to be displayed and discussed on a free basis to open future cooperation in support of scientific research and to increase the impact of science on society. WISWB began with STEM fields (science, technology, engineering, math, including medicine and related social studies). The first meeting was held in 2017 at Cairo, Egypt, under the patronage and supervision of several reputable organizations such as Egyptian young and senior academies (organizers), the Welcome trust, Elsevier, ISC, EU, L'Oréal, GYA, etc.



Figure 3 – WISWB, 2017, Egypt.

Students‘ competition, WISWB 2017

WISWB is a free-of-charge meeting to allow all categories interested in science including scientists (senior or young), NGOs, Industry, Entrepreneurs, policy makers, stakeholders, practitioners, etc., to attend according to the concept of “science for all” and as a good opportunity to increase science literacy and the impact of science on society. Surprisingly, the number of applicants was very high with a good male-to-female ratio (27:73 %) in all disciplines of STEM with respect to the first conference and with a good distribution from younger generations to seniors (85:15 %) from all academic and educational levels.



Figure 4 – WISWB 2018 South Africa

Student competitions were held during that conference in six fields related to sustainable development goals i.e., food, water, energy, environment, education and health. The main aim of the students‘ competitions was to increase the awareness of sustainable development goals among younger generations in addition to building and increasing a new culture of cooperation among them.

It was obvious that the idea of WISWB was inspirational since one of the 2017 Conference attendees (Prof. Sonali Das) offered to transfer the idea and organize the WISWB 2018 conference in South Africa, where the idea expanded to include establishment of a sustainable movement of WISWB for males and females based on scientific merit and dialogue between all partners inside scientific communities with a logo of “science for sustainable development”.

In 2019, the movement has held its conference in Egypt again, in its new image as a complete international forum for women in science open to males and females, with the theme of “science diplomacy for sustainable development”.

The conference was co-organized with the Arab science and technology foundation (ASTF) and sponsored by Sanofi, Johnson & Johnson, etc., with its broad name as “*world forum for women in science*”. Several organizations participated at the conference as GYA, JST, ISC, TWAS-TYAN, NEF, Brazilian Academy of sciences, etc.).



Figure 5 – Science Diplomacy workshop (World forum for women in science), WISWB, Egypt, 2019

New initiatives to support new generations accompanied the main conference where capacity-building by training on science diplomacy was provided for young scientists (males or females) from developing countries to equip them with important skills to act as science diplomats, a future necessity for international cooperation. Additionally, students‘ competitions were organized on sustainable development goals as previously planned. Several sessions were dedicated to display problem-based ideas to solve real existing problems. Generally, the conference is always run *via* five main tracks as: biology & medicine & pharmacy, materials & engineering & energy, Agriculture & veterinary & food, Environment, gender issues & sustainable development & science

diplomacy/science advice. The plan is to transform that movement into a complete community development-based experience to introduce science to the entire society.

Luckily, my contributions with respect to young scientists and women in science and other issues have been recognized in several publications such as the NASAC book of women in science, relating inspiring stories from Africa.



Figure 6 – Students' competition (World forum for women in science), WISWB, 2019

Finally, I dream of spreading education which is the only way to empower not only girls but humanity as a whole, and the only way to change the world for the better, as Nelson Mandela said: "*Education is the most powerful weapon which you can use to change the world*". Indeed, providing education for every child whether girl or boy is a noble and ideal target, but, it is time to focus on the quality of education as the real engine of development in order to train the new generation to think and to develop their societies in the right way, as Einstein said: *"Education is not the learning of facts, but the training of the mind to think"*. Once we have these new well-educated children with their bright minds, we will no longer need to speak of conflicts or human rights or gender equality. We will have a better world to live in and to produce together for the sake of humanity. Actually, this is my dream.

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Abbreviations

ASRT: Egyptian academy for scientific research and technology

ASTF: Arab science and technology foundation

BUE: British University in Egypt

EYAS: Egyptian Young Academy

GYA: Global Young Academy

ISC: International science council

JST: Japan science and technology agency

NEF: Next Einstein Forum

NGOs: Non- governmental organizations

PCT: the patent cooperation treaty

TWAS-TYAN: TWAS network for young scientists

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