

From Individuals to Institutions: Scaling Up Women Scientists' Impact in the Global South

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Introduction

Efforts to close the gender gap in Science, Technology, Engineering and Mathematics (STEM) have increasingly emphasised the need for both individual empowerment and systemic reform. Global initiatives, such as UNESCO's 2024 call to action, have highlighted persistent disparities in women's participation in STEM, and have called for coordinated action to dismantle gender stereotypes, expand educational pathways and foster inclusive workplace environments. These goals reflect a dual challenge: ensuring that individual women are supported to pursue and thrive in STEM careers, while also transforming the institutional structures that continue to reproduce inequality.

In this chapter, we examine the activities and programmes of the Organization for Women in Science for the Developing World (OWSD) as a case study to explore how individual empowerment can drive systemic change in STEM across the Global South. Specifically, we ask:

1. How can investment in individual women scientists, through fellowships, awards and visibility, contribute to institutional transformation and the dismantling of gender stereotypes in science?

2. What mechanisms enable individual success stories to influence broader educational and policy environments, and how can these be scaled to promote gender equity in STEM?
3. What are the implications of OWSD's model for future funding strategies aimed at promoting women's leadership and participation in STEM fields?

Rather than providing definitive answers, this chapter offers insights drawn from OWSD's experience to illuminate these questions and inform future efforts to advance gender equity in science.

OWSD's mission, on the broadest scale, is to promote positive change in the opportunities available for women in STEM disciplines in higher education institutions throughout the developing world, based on evidence that the participation of more women in STEM improves both the quality and relevance of scientific research (Lleras, 2008). This research in turn can play a major role in mitigating the global challenges with which all citizens will be faced in the coming decades: climate change, disease and pandemics, food and water security, safe and affordable energy and housing. OWSD provides training and various activities, including access to scholarships and fellowships, to raise awareness and attract women to STEM fields. The organisation ensures that women have the resources and resilience needed to complete their education. OWSD provides networking support so that women scientists' experience and knowledge can be instrumental in both transmitting knowledge to their immediate and broader academic communities as well as implementing the results of their research within their wider communities.

In a world characterised by a predominantly knowledge-based economy, well-trained and highly qualified human resources are key to sustainable development. It is now recognised that education, especially higher education, is critical for economic growth, job creation, competitiveness in the global market, socio-cultural revitalisation, and improvement in the standards of living of the populations. To succeed in these areas, countries must make substantial and intelligent investments in various fields of higher education and scientific research to train qualified higher-level professionals and a technical workforce capable of meeting development needs. (ADEA, 2022)¹

1 The ADEA Triennale on Education is one of Africa's seminal high-level forums for political dialogue, knowledge sharing and fruitful experiences. It focuses on critical themes that transform Africa's education systems for sustainable social and economic development. Through the Triennale, ADEA fosters continental, regional and cross-country interactions in support of peer learning and knowledge exchange.

Background and context

The importance of women's participation in STEM

Why are we so keen for women to participate in STEM? Evidence suggests that if women are not involved directly in scientific research, we lose their specific experiences and local knowledge. In many countries across the developing world – as well as in parts of Europe and North America – women are at the forefront of major global challenges. For many, their daily routines are shaped by their roles as primary caregivers for children and the elderly. Women also make up the majority of agricultural workers, growing and harvesting food for their families and collecting fresh water for drinking. When women are included both as participants in scientific research and as its beneficiaries, the impact on children, the elderly and local communities is more likely to be meaningful, effective and successfully implemented.² In addition, there is a great deal of evidence to suggest that when women are not adequately represented in the design of research, the concerns and impact of the research on women are often left out of the methodology, creating inaccurate and often harmful, even lethal consequences (seatbelts not designed for pregnant women and diagnoses of heart attack symptoms based only on men, are only the best-known examples).³

Londa Schiebinger, founder of the Gendered Innovations project at Stanford University (USA), has argued that “sex and gender should be considered in each step of the research process from strategic considerations for establishing priorities and theory to more routine tasks of formulating questions, designing methodologies, and interpreting data” (Schiebinger, 2014, p. 3).

OWSD: Visible, active women in STEM

The Organization for Women in Science for the Developing World (OWSD) was founded in 1987 in Trieste, Italy, as a programme of The World Academy of Sciences (TWAS) and later established as a programme unit of UNESCO. From the beginning, the goal was to seek out existing and potential women scientists

2 “Why do we need women in STEM?”, the National Commission for the Promotion of Equality’s (NCPE) 7 February 2024 statement, as discussed by the 9th International Day of Women and Girls in Science Assembly (8–9 February 2024), under Women in science leadership: A new era for sustainability – Concept note and provisional agenda (https://www.un.org/sites/un2.un.org/files/2024/02/2024_idwgis_agenda_-_210124.pdf).

3 For more on which, see Tannenbaum et al. (2019). Londa Schiebinger’s case study reports for Stanford University are well known, and examples are included in the European Commission’s Directorate-General for Research and Innovation (2020) publication, *Gendered innovations 2*.

living and working in the Global South and encourage them to participate in a supportive network, *identifying the specific challenges they face and proposing means to overcome these challenges*. It was also important to ensure that women scientists were visible and represented in the notoriously male-dominated spheres of physics and maths. These goals of increased participation and visibility for women from the Global South in scientific research remain the bedrock of OWSD's mission. Importantly, through a global network of members and national chapters, OWSD has been able to ensure that women scientists are visible and included in research design and implementation at national, regional and international levels.

In 2025, OWSD counts nearly 11 000 members, and when membership in any one country reaches the threshold of at least 20, they can opt to establish an OWSD national chapter. At the time of writing (August 2025), OWSD counts 58 chapters throughout the Global South.⁴ These chapters offer outreach and training activities and foster a much needed and appreciated sense of belonging and community. More and more, they are valued also as a source of information and feedback for national education systems regarding best practices for women in STEM (OWSD, 2024b).

In addition to supporting the work carried out by the chapters at a national and regional level, the OWSD Secretariat allocates funding for scholarships for individual women scientists from developing countries. For nearly 30 years, OWSD has been designing, developing and implementing master's, PhD and early-career fellowships in STEM subjects for individual women, as well as recognising outstanding women scientists each year through an awards scheme. More than 400 women scientists from least developed and under-resourced countries have completed their OWSD PhD fellowships in other Global South countries through a South-to-South mobility scheme and a further 100 are currently completing their fellowships. Further, 124 early-career women scientists have received up to USD50 000 each to set up centres of excellence in their home institutes in the South, and 69 women scientists have been recognised for their outstanding contributions to science.

OWSD's cornerstone activity has been the South-to-South PhD fellowships programme, established in 1997 when the first agreement was signed with the Swedish International Development Cooperation Agency (Sida). This fellowship model covers fellows' monthly stipends, return travel, visa and health insurance costs (and tuition and registration fees where necessary). In addition, OWSD also provides earmarked funding for alumnae-specific research and development activities, which enhances their work's impact. Alumnae benefit

4 <https://owsd.net/national-chapters>

from ongoing training, networking opportunities and collaborative support through national chapters and international conferences. This ecosystem fosters connections across OWSD programmes, ensuring that alumnae remain integrated into the broader community and can continue to support each other's work.

However, due to funding cuts, OWSD paused its annual call for PhD fellowship applications in 2023 for the first time in 25 years. This unexpected setback allowed OWSD time and space to re-evaluate the programme's sustainability, and to conduct a comprehensive survey of the successes and challenges of the longstanding programme. The results of that re-evaluation have played a substantial role in the development of the recommendations presented in this chapter and led to the reassignment of remaining funds to a new programme for displaced women scientists, which is discussed in further detail below.

It is clear that whereas fellowships confer visibility through specific opportunities over the long term, a popular and more immediate way to boost the visibility of individuals is by awarding prizes. Focusing on women from developing countries at the early-career stage, the OWSD Secretariat has co-designed a high-profile awards scheme with The Elsevier Foundation. Since 2013, the annual OWSD-EF awards recognise and celebrate the achievements of five early-career women scientists in the South who have worked hard against social, economic and cultural pressures to achieve internationally competitive results. Each year, awardees receive USD5 000 and an all-expenses-paid trip to a relevant international meeting, to present their research, network with others in their fields and receive recognition for their award. While the award itself is modest, the awardees are celebrated in international and national media and are highly visible. As a result, past awardees are often doubly recognised and awarded, some have even been received by their country's presidents, others go on to receive more awards and fellowships, including the L'Oreal-UNESCO Award for Women in Science Fellowships and the British Council Award.

Impact data collected from awardees revealed that nearly all recipients of the OWSD-EF Award report a positive influence of the award on their visibility (in the media and within their own institutes), increased collaborations, additional fellowships and research grants, and invitations as speakers or panellists, or on expert committees and funding boards, according to a survey conducted in 2020 (OWSD, 2024c). Award recipients also report that the award made them more confident and more motivated to continue in their scientific careers and to seek out more leadership opportunities (OWSD, 2024b).

The impact of visibility: In the words of OWSD-Elsevier Foundation awardees

“After getting the award, I was invited as editorial board member by three journals. Most of the university students wanted to do their research work under my guidance. I was invited for so many national and international conferences and seminars as a resource person and I am now a member of a high-level drinking water quality standard revision committee.”

– Tista Prasai Joshi, 2019 award winner

“It’s been a roller coaster ride ... one minute I was working quietly and following my dreams ... and then I am on the news, social media, etc. The impact on my career and professional development has been amazing. I’ve become more competitive at grants (I’ve won 3 out of 5 applied for so far), I have been invited to sit on a WHO expert committee and Research Funding Boards and review panels, I’ve had some high impact publications and I am now collaborating with many more people. I have also now mentored more people. On a personal level, it’s been very humbling as I appreciate that the recognition from the Award is a privilege many black women do not have and so I use whatever platform and opportunity I have to be an ambassador for women scientists of colour.”

“The award made me more prominent in my immediate community and I am taken more seriously in the international community. In my personal development, I have developed more confidence in interacting in many forums. For my collaborations, I got exposure to many international communities in my field of interest. For example, through the visibility I gained through the award, I networked with organisations in my country, became a climate change consultant and got nominated as a member of the Group on Earth Observation GEO working group on Climate Change and Data.”

OWSD is enhancing and expanding programmes to further strengthen the impact and influence of women in STEM. This requires tracking and evaluating the impact of existing individual fellowship programmes, not only on the recipients themselves but also on the broader systems they interact with, including their institutions, research environments and local communities. By examining how these fellowships contribute to long-term systemic change, we can better understand and strengthen the pathways that enable more women to thrive in STEM leadership and drive transformative progress. This entails acknowledging that however successful any one individual may be, funds can only reach a limited number of individuals, and action needs to be taken at the structural level for changes in perception, access and promotion of women in STEM to occur. We suggest, however, that even at a structural level, the role of individuals can be decisive: by supporting and identifying outstanding women scientists, science granting councils and national educational programmes can have direct dialogue with women who have successfully navigated their own national systems and can recommend best practices as well as identify challenges and gaps. As ‘insiders’, fellowship alumnae are ideally placed to contact and liaise

with other key players in the system. Moreover, as previously mentioned, they serve as influential role models for other women in their communities, creating a powerful multiplier effect that inspires and enables more women to pursue opportunities in STEM.

Methodology and framework for analysis

Methodology

This chapter draws on a mixed-methods approach, combining structured evaluations and qualitative testimonials to assess the impact of OWSD programmes on women's participation and leadership in STEM across the Global South. Structured data sources include:

- OWSD's 2023 comprehensive evaluation of its South-to-South PhD fellowship programme, which involved a survey of 176 alumnae and in-depth interviews with selected fellows.
- Impact surveys conducted by OWSD and the Elsevier Foundation on award recipients, measuring visibility, career progression and institutional influence.
- Quantitative data on fellowship distribution, graduation rates and chapter growth, extracted from OWSD's internal reports and publications.
- These structured evaluations are complemented by individual testimonials from OWSD fellows and awardees, which provide rich, narrative insights into personal experiences, challenges and achievements. While these stories are not generalisable, they illustrate the broader ripple effects of individual empowerment on institutional and community-level change.

The combination of structured data and personal narratives enables a nuanced understanding of how visibility, support and leadership development contribute to systemic transformation in STEM education and research environments.

Key stakeholders in STEM reform

STEM education reform is highly complex and must be adapted to diverse cultural, educational, geographical and political contexts. Its design and implementation require the engagement and coordination of a wide range of stakeholders. An inclusive and participatory approach is essential, ensuring that decision-making processes acknowledge and incorporate the expertise of

those historically marginalised in shaping educational and scientific agendas – focusing, in this case, particularly on women. Equitable partnerships, both locally and globally, are critical to this process, requiring ethical collaboration that prioritises shared leadership, resource distribution and long-term systems change rather than extractive or one-sided engagement. Such stakeholders may include: institutional researchers (who act both as students and as teachers promoting and implementing change in the curriculum and pedagogy); academics and professors; institutional governors and policymakers (heads of departments, deans and vice-chancellors); as well as those involved in the nationwide creation and implementation of educational policies, including the various relevant national ministries (e.g. ministries of higher education; research and development; or science and technology). Additional critical actors are those who can provide specifically earmarked funds for the three interlinked areas of women, science and development, including cooperation agencies (e.g. GIZ, IDRC, Sida, UKRI⁵), foundations linked to corporations (MasterCard, IKEA, Ford, Elsevier Foundation, etc.) as well as private foundations and individuals (e.g. Bill & Melinda Gates; William and Flora Hewlett). Instrumental too are women in science organisations and associations who have on-the-ground experience of challenges and best practices. OWSD national chapters, for example, are key players here, not least because they are linked to a network across the Global South. Science granting councils also play a key role in determining how limited national research funds are distributed, and how success is evaluated, having a direct impact on which disciplines and research areas are promoted and supported. Critically, research councils can promote – during the design and implementation of programmes – greater inclusivity and diversity for the sake of excellent science.⁶

All these players and strategies can be brought together to determine an integrated nationwide strategy for implementing impactful higher education strategies. In order to effect institutional change to impact multiple parts of the STEM education system, teams of ‘change agents’ may select multiple strategies and tactics to enact at one time and over multiple years of a project.

5 GIZ – Deutsche Gesellschaft für Internationale Zusammenarbeit (German Agency for International Cooperation); IDRC – International Development Research Centre (Canada); Sida – Swedish International Development Cooperation Agency; UKRI – UK Research and Innovation.

6 The Athena SWAN Charter is an example of a successful mechanism for highly impactful change for diversity and inclusion in higher education, developed by a United Kingdom-based not-for-profit called AdvanceHE. See the Athena Swan Charter (<https://www.advance-he.ac.uk/equality-charters/athena-swan-charter>). See also, Wilkinson (2019) on the role Athena SWAN can play in gender equality and science communication.

Visibility and gender-transformative strategies

When women scientists from developing countries are increasingly visible on national and international stages as leaders and innovators in research, their presence becomes not only more accepted but also more valued, creating a ripple effect. This visibility fosters greater inclusion of women in research projects, breaking down barriers of bias and representation. Visibility also challenges entrenched gender norms and stereotypes, reshaping social perceptions of women's roles in science (Breda et al., 2023; González-Pérez et al., 2020). As women scientists gain recognition, the broader social, cultural and institutional structures around them become more supportive, leading to more equitable opportunities and fostering systemic change in research environments. The visibility of women scientists functions as both a symbolic and practical intervention: it challenges normative assumptions about who can be a scientist, while also altering the institutional and cultural landscapes that sustain gender inequities in science (Schiebinger & Schraudner, 2011).

Let us now consider how this applies to the key ideas introduced at the beginning of the chapter. The goal declared by UNESCO in 2024 was ensuring that “girls are never discouraged from pursuing their aspirations to become scientists” and to “dismantle the barriers that hinder women from realising their full potential in science” (UNESCO, 2024, p. 2).

On the one hand, a focus on visibility characterises the classic and effective role-model approach: highlighting successful women working in STEM, rewarding them for their achievements, publicising their success, asking them to manage outreach and passing on guidelines for how to reproduce these achievements, through word of mouth, thereby enabling others to achieve as they have done.

The second approach requires identifying and working with all the different actors in the systemic framework that ‘prop up’ scientific careers in any one country to provide awareness of challenges, suggested best practices and tool-kits for action that can lead to policy change. Other chapters in this collection deal with the kinds of policies that might be introduced – but ultimately, policies are needed, for example, concerning the description and timing of courses, availability of places and grants, schedules, additional training and flexible career paths (see Chapter 3 for in-depth discussion on gender policies in African universities, or Chapter 9 for a scoping review of pedagogical efforts to address gender disparities in sub-Saharan Africa). Such policies can raise awareness of the barriers facing women in science among practitioners and decision-makers in higher education and ensure there are tools to overcome these barriers.

Benefits and challenges: The broader ripple effect of fellowships on research and communities

While individual awards offer significant opportunities for the women who receive them, upscaling such initiatives presents challenges. The number of fellowships awarded in any given programme is limited, meaning the overall impact on the number of women entering STEM fields is constrained by the number of available scholarships and awards. Additionally, PhD fellowships are long-term commitments (typically at least four years), and their results become visible only years after completion. This delay means that the impact on an individual's career can only be measured through surveys and longitudinal data gathered over time. Furthermore, funding priorities may shift over time, influencing the continuation of such programmes.

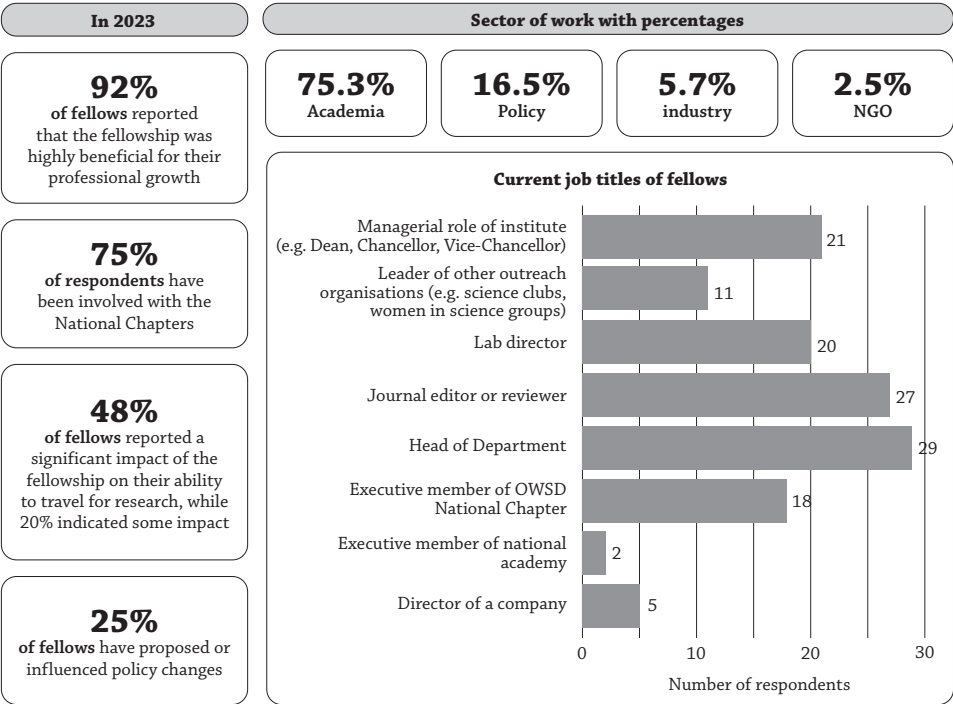
Despite these challenges, surveys conducted by OWSD reveal that our South-to-South PhD fellowships programme has been highly successful, with 576 fellowships awarded to women from Scientifically and Technologically Lagging Countries (STLCs) to study at host institutions in the South. By the end of 2024, 406 fellows had graduated, with 99 continuing their studies. Personal accounts from fellows illustrate how fellowships are both life-changing for recipients and can have measurable impacts on science policy and on communities. For example, Priscilla Nyadoi, an OWSD alumna (PhD 2011), used the knowledge she gained during her PhD to become a key advocate for wildlife conservation in Uganda. As Executive Director of the Uganda Wildlife Society, she influenced national legislation, including the Uganda Wildlife Act (2019) and the Community Conservation Policy (2020). Her work demonstrates how an individual fellow's expertise can shape national policies, ultimately benefiting both local ecosystems and global biodiversity conservation efforts. This case highlights how fellowships can have a ripple effect that extends well beyond the recipient.

Additionally, the influence of OWSD fellows can reverberate within their communities in unexpected ways. For instance, Myo Ma Ma Than, a 2004 alumna from Myanmar, has used her PhD research to drive women's empowerment within the agricultural sector. Through her 'female-led farming' projects, she challenges traditional male-dominated decision-making in rural communities and empowers women across the agricultural value chain. Despite significant infrastructure challenges in Myanmar, her work has demonstrated that empowering women in agriculture not only enhances livelihoods but also boosts food security in remote areas. Her contribution underscores how fellowship recipients can transform sectors traditionally dominated by men, improving both the local economy and women's social standing.

Furthermore, women who study abroad as part of these fellowships often bring back valuable knowledge and insights to their home countries, enhancing the relevance of local research to national and regional needs. Marycelin Baba, a 2005 alumna, exemplifies this broader impact. As a leading Nigerian virologist, she focused her research on underdiagnosed arboviruses such as West Nile, dengue and Zika. Her research has had profound implications for public health in Nigeria, where she has also played a crucial role in eradicating polio as head of Nigeria’s WHO polio lab. Marycelin’s work on neglected diseases highlights how a fellowship recipient’s knowledge transfer can lead to significant improvements in healthcare outcomes, demonstrating the far-reaching effects of individual scientific contributions.

These case studies demonstrate that while fellowships promote individual careers, their broader impact is far-reaching, affecting not only the fellows themselves but also the scientific communities and policy landscapes of their home countries. Quantitative data further emphasise the benefits of fellowships (see Figure 1).

Figure 1: OWSD fellowship benefits in numbers



Note. Data and graphs are from an internal document (OWSD, 2024a).

An internal report (OWSD, 2024a) explored the findings of a comprehensive evaluation conducted in 2023, including a survey of 176 OWSD PhD alumnae and a series of in-depth interviews with select alumnae. The report highlights fellows' transformative achievements and significant contributions to science and society over 25 years. Through both numbers and narratives, OWSD demonstrates the profound and lasting impact of sustained investment in women scientists.

These case studies also illustrate the incidental and non-systematic nature of the impacts that investment in an individual can bring, reliant on selection processes that ensure women are selected for awards because of their all-around contribution to the scientific endeavour. In order to scale up the impact such fellowships can have on the entire scientific ecosystem, we need reliable, repeatable methods at the structural level. Can resources focused on individual women in STEM effectively 'change the system', or are they rather more limited to promoting individual women's careers?

OWSD's comprehensive review of the PhD programme's impact, conducted in 2023, shifted from primarily reporting quantitative results (such as the number of fellows and countries represented) to capturing long-term outcomes. This includes the personal growth of fellows – such as promotions, increased research recognition and leadership roles – and the systemic changes at their institutions, such as gender policy reforms. The focus on these long-term effects not only reinforces the programme's value but also strengthens the case for continued funding and partnerships.

Accelerating institutional change through individual fellowships

In 2024, in recognition that conflict and climate change in many countries were causing additional and complex challenges for women to participate and remain active in scientific research, OWSD partnered with host institutes in Jordan and Türkiye to launch an innovative science, gender and displacement programme. Twenty-four women from conflict-affected countries have already begun this two-year programme in 2024 and OWSD works alongside the host institutes (Hashemite University in Jordan and Aydin Istanbul University in Türkiye) to ensure that the institutions themselves identify the specific challenges faced and resources needed, equipping academic supervisors and university administrators with the skills, frameworks and systems necessary to integrate refugee women scientists into their student populations. This approach aligns with the United Nations Refugee Agency (UNHCR) 15by30 Roadmap, which sets

out strategic actions to achieve 15% refugee enrolment in higher education by 2030.⁷

This model of institutional support alongside individual fellowships is highly effective. For women refugee scientists, accessing a master's programme is not merely a step in their educational journey but a vital bridge between learning and earning, between dependence and self-reliance. It determines whether their talents are lost to brain drain or channelled into meaningful contributions to their host countries, diaspora communities, the global scientific community (through the right to science), and eventually, their home countries when conditions allow their return. Investing in institutions that can systematically support the inclusion of refugee students ensures that education is not an isolated opportunity but a sustainable, long-term mechanism for integration, capacity-building and resilience.

By supporting institutions that are committed to these goals, OWSD is helping to create a more inclusive academic and research environment where displaced women scientists are not just accommodated but actively empowered to contribute to science and society.

Interventions to promote systemic change

Creating centres of excellence through OWSD fellowships

OWSD early-career fellowships (funded by IDRC since 2017) are intended to create research centres of excellence in the Global South, focused on one outstanding individual. The fellowship is a highly flexible grant (up to USD50 000) to be spent on a broad range of training, teaching and technical assistance, communication skills, equipment, laboratory set-up and management, and linking with industry, that will allow the individual scientist to continue her research at an advanced level. To be eligible, she must have been residing in one of the eligible STLCs for at least five years and be already employed at an institute there as the grant does not cover the researcher's stipend. Although the programme has only been in place for a short period, its impact is already visible, with 124 fellowships awarded to date, and ongoing fellows contributing to long-term change.

A striking example of the programme's success is Elizabeth Bandason, an OWSD Early-Career Fellow from Malawi. She was able to overcome a significant barrier in her research – access to equipment – by using the fellowship

⁷ <https://www.unhcr.org/uk/media/15by30-roadmap-expanding-higher-education-skills-and-self-reliance-refugees>

to acquire the tools she needed to continue her groundbreaking work in insect control in Malawi. Elizabeth was determined not to leave Malawi for a post-doctoral opportunity, as she saw her potential to create change in her home country. This commitment to staying and building a research team highlights how the fellowship has helped to support individual women scientists in their pursuit of excellence while contributing to the scientific capacity in developing countries. Beyond her research, Elizabeth's leadership in the OWSD Malawi Chapter and mentoring of young women scientists in Malawi exemplify the ripple effect of empowering individual women in STEM. Her contributions are not only transforming agriculture but are also fostering a new generation of female scientists in her country.

When I got awarded the PhD, my next question was, what next? I desperately wanted to continue what I was doing in Michigan back home in Malawi, but I couldn't because there was no way I could access the equipment I needed. Either I let my dreams go down the drain and do what I could in Malawi, or I went back to the United States to continue working with my supervisor (she had offered me a postdoc). But I knew that if I went back there, I would be denying myself an opportunity to grow as an African woman scientist – and I would delay the changes in insect control I wanted to see in Malawian farming. I had to find a way to stay in Malawi and build a team. OWSD gave me that once-in-a-lifetime opportunity! (Elizabeth Bandason, OWSD Early-Career Fellow)

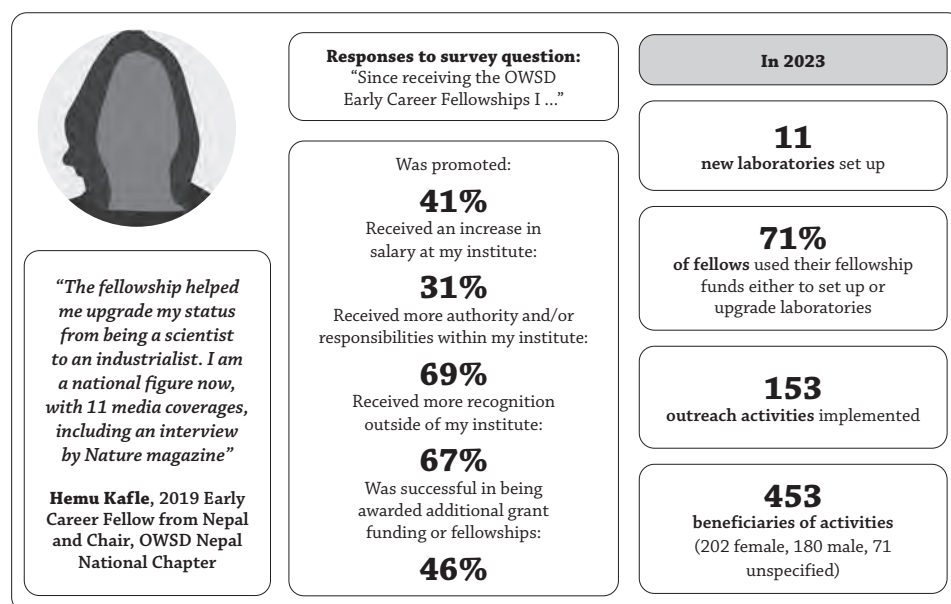
The fellowships are not only about supporting individual careers; they are also about creating centres of research excellence that can address regional challenges. Early-career fellows are selected using the scientific community's standard parameters to determine how competitive their research is (e.g. international publications, peer-reviewed journals, collaborations) but also additional 'soft skills' such as leadership qualities, evidence of mentoring and training, ability to communicate her science to diverse and non-specialist audiences, and to go beyond academia to link with industry, the private sector and policymakers. Only with these skills can her work have the broadest impact and ultimately become sustainable.

Pendo Bigambo, a lecturer at the University of Dar es Salaam, is addressing the environmental impact of cotton farming through her innovative research in textile technology, materials science and mechanical engineering. As co-founder and vice-chair of the OWSD Tanzania National Chapter, she actively advocates for women in STEM, organising conferences and workshops to

inspire and empower future generations. Her groundbreaking work focuses on developing sustainable cotton recycling processes to reduce the environmental footprint of cotton farming. By offering alternatives to traditional cotton farming, which competes with food crops for limited land and resources, Pendo is driving sustainable textile solutions that benefit both the environment and local communities. Her work is an example of how science can provide innovative, locally relevant solutions to global challenges.

Visibility again plays a crucial role here. OWSD fellows, having seized opportunities to enhance their science communication and leadership skills, are well-versed in advocating for STEM education for women and presenting their own cutting-edge research. They are increasingly sought after as articulate, confident panellists whose dynamic presence directly challenges the dominant international academic practice of favouring male, Western scientists. This practice often relies on the unfounded rationale that exceptional women scientists from developing countries are difficult to find.

Figure 2: OWSD early-career fellows' achievements in numbers



In this regard, the value of visibility for individuals participating in and presenting at key scientific events cannot be overstated. These events are where reputations are built, collaborations are initiated and groundbreaking publications emerge. For women scientists from developing countries, their visibility

at these stages not only shifts perceptions but actively disrupts entrenched biases, fostering a more inclusive and diverse scientific landscape. The ultimate aim, indeed, of these fellowships is not only to support individual careers but to create lasting, self-sustaining research centres that contribute to regional development and generate innovative solutions relevant to the needs of their countries.

The visibility and recognition of outstanding women scientists are crucial in igniting this transformation, serving as the catalyst for the establishment of research centres of excellence, attracting talent, resources and institutional support to sustain their impact.

Training workshops for systemic change

OWSD's Early-Career Fellowships are enhanced by training workshops that aim to foster systemic change in STEM, focusing on empowering women scientists and advancing gender equity. These workshops have produced significant outputs and introduced innovative practices that support OWSD's broader mission of creating more inclusive and equitable research environments.

The annual Orientation Workshop, for example, run by OWSD for incoming early-career fellows, serves as a critical starting point, providing training in essential areas such as grant management, leadership, communication and intellectual property. This workshop ensures that fellows possess the skills necessary to manage their research projects, navigate academic systems and engage with the broader professional landscape effectively.

An additional core component of OWSD's training efforts offered to early-career fellows is the Gamechangers Workshop, an innovative platform designed to equip women scientists with the tools needed to engage with policymakers and advocate for institutional change. The workshop emphasises advocacy, leadership and policy engagement, empowering fellows to initiate and influence gender-responsive policies in STEM. A notable innovation within this workshop is the use of gamification, where fellows participate in a specially developed board game, *Best in Her Field*, created in collaboration with the Humanitarian Engineering Department of the Royal Melbourne Institute of Technology (RMIT). The game simulates the challenges faced by women scientists in developing countries, offering an interactive experience that helps participants brainstorm policy solutions and best practices. This gamified approach fosters deeper engagement with real-world issues, allowing for a more creative and collaborative exploration of potential policy solutions. The workshops have also demonstrated a significant impact on the fellows'

professional visibility and policy influence. For example, after participating in the Gamechangers Workshop, one fellow was invited to contribute to her country's national climate adaptation policy, illustrating how visibility and expertise gained through these workshops can translate into tangible changes in policy at both the national and global levels.

Through these workshops, OWSD not only strengthens the technical and research skills of women scientists but also builds their leadership capacity, ensuring they are well-equipped to drive systemic change. By combining technical training with leadership development, these workshops provide a comprehensive approach to fostering both personal and professional growth. Moreover, they create a platform for women scientists to connect with policymakers and international funding agencies, amplifying their voices in global discussions on STEM and gender equity.

The role of OWSD national chapters

While OWSD has been offering fellowships since 1998, the organisation was established in 1987 as first and foremost a membership organisation, with (by the end of September 2024), close to 11 000 members – all women with postgraduate degrees in (natural and social) science subjects living and working in developing countries. The spread of countries where members can be found is impressive (115 out of a possible 152 developing countries). But even more impressive is that this membership is consolidated and activated through the establishment of national chapters.

Currently, OWSD has 58 national chapters and aims to reach 60 by 2026 (see Figure 3 below). These chapters are grassroots organisations that empower local women scientists by providing a platform for advocacy, networking and leadership development. To establish a chapter, a country must have at least 20 OWSD members. Once formed, chapters elect an executive committee and conduct surveys to understand the unique challenges women face in STEM, providing tailored solutions.

National chapters have demonstrated significant success in organising STEM outreach events and public lectures, which enhance the visibility of women scientists. For example, the OWSD Ghana National Chapter hosts an annual Women in Science Forum that attracts policymakers, educators and journalists, resulting in increased media coverage of women-led research. Similarly, the OWSD Nigeria National Chapter has successfully advocated for female scientists' inclusion in national science advisory boards, reinforcing their role in decision-making spaces.

Figure 3: OWSD national chapters around the world



These efforts contribute to shifting societal perceptions of women in STEM, making it more likely for young girls to see female scientists as role models and pursue STEM careers themselves. In fact, many chapters have also launched initiatives that connect women scientists with young students to encourage participation in STEM fields. For instance, the OWSD Rwanda National Chapter organises outreach activities where female mathematicians visit schools to inspire girls by sharing their personal stories.

One of the key strengths of OWSD's national chapters is their ability to collect data and advocate for policy change. Through initiatives such as the National Assessments and pilot studies in Zimbabwe, Rwanda and Bolivia, chapters are collecting and analysing sex-disaggregated data on women in STEM, which is crucial for identifying gaps and shaping policies that support female scientists.

OWSD chapters have been organising local and national events since the first chapter was established in 1994 but since 2022, chapters have been encouraged to apply for small awards of USD1–3 000 to support activities of their choice, including synchronised events throughout the Global South on the International Day of Women and Girls in Science (11 February). Beyond this small ‘startup’ contribution, chapters are expected to do their own fundraising or attract/ provide in-kind support. These small but impactful initiatives are not only instrumental in increasing the number of women applying for fellowships but also in creating a network of support that extends beyond individual achievements.

Notably, 15% of the executive members of national chapters are recipients of OWSD fellowships or awards, illustrating the strong 'give-back' culture within the community. These alumnae are not only shaping the future of OWSD but are also mentoring the next generation of women scientists, reinforcing the organisation's mission to promote systemic change.

The national chapters represent a dynamic force for change, empowering local women scientists, driving policy reforms and fostering a community of collaboration and mentorship that influences the broader STEM ecosystem.

There has always been a strong correlation between the number of applications for fellowships received and the presence of national chapters. These numbers increase significantly around the establishment (both pre- and post-) of new chapters, when visibility and promotion of the chapter are at their peak.

Conclusion

The OWSD community of scientists, by being highly visible role models, can make substantial inroads into traditional and cultural expectations of appropriate career paths for women. Their visibility not only challenges stereotypes but also encourages other women to consider STEM careers, seeing first-hand what is possible. Additionally, the support and mentorship provided through national chapters further motivates applications. Mentoring helps women navigate professional challenges and boosts their confidence, while the community's encouragement fosters a sense of belonging and purpose. Together, these factors create a strong, reinforcing cycle where role models and support systems drive more women to pursue and succeed in STEM fields.

EC fellowships emphasise mentoring researchers and students so that their scientific capability is grown. After taking part in this project, two of my researchers have received full scholarships to pursue PhDs in immunology and virology in reputed universities in the US, and this is a huge asset for the country as well, because these researchers plan to come back to Nepal after their training. For me science is not just about what it can do today, but how it will shape the type of just and prosperous world that I would like our future generations to thrive in. (Prativa Pandey, OWSD Early-Career Fellow, Nepal)

OWSD's impact studies are evidence that prioritising individual women scientists can have profound, far-reaching effects. The work of research fellows not only pushes the boundaries of scientific knowledge but also shapes policy,

fosters community development and enhances educational systems. By highlighting the intersection of individual achievements and broader societal impact, it becomes clear that empowering women in STEM catalyses transformative change at multiple levels. Ultimately, upscaling the impact of women in STEM requires a dual approach: supporting individual careers while simultaneously dismantling the systemic barriers embedded in educational and policy frameworks. The work of OWSD over the past four decades underscores this approach, showing that, when provided with the right opportunities, women scientists are not just contributors to scientific advancement but leaders capable of driving sustainable, lasting change within their communities and on a global scale.

While fellowships focused on individual women scientists are essential, systemic change necessitates addressing the broader context in which these individuals operate. This chapter highlights that investing in women scientists leads to systemic change in STEM. While individual fellowships are crucial, long-term transformation requires working with all stakeholders at a national level to identify challenges and collaborate on tailored solutions for attracting and retaining women in STEM fields.

The connection between individual and systemic change is vital in creating a sustainable and inclusive STEM environment. As women scientists succeed, they not only transform their own careers but also serve as catalysts for broader shifts in institutional and societal structures. Their leadership and contributions challenge entrenched norms, influence policy reforms and inspire future generations of women. At the same time, by addressing systemic barriers, such as unequal access to resources, mentorship and leadership opportunities, we ensure that the successes of individual women scientists can be replicated on a larger scale, fostering a more equitable and inclusive scientific community. This integrated approach is essential for lasting change that benefits both individuals and the larger ecosystem they are part of.

We conclude this chapter by outlining recommendations that are relevant both to our organisation, which is constantly evolving, and to others who are considering or have already implemented similar initiatives. These recommendations, drawn from the data presented above as well as our experience and reflections over nearly 30 years of activity at OWSD, aim to summarise some of the key ideas discussed in this chapter.

Recommendations for future initiatives

- **Promote long-term partnerships between funders, institutions and networks** to ensure sustainability and scale. Encourage science granting councils and development agencies to integrate gender-transformative criteria into funding mechanisms.
- **Support award and mentorship programmes** that connect fellows with early-career women scientists, fostering long-term professional development and creating strong networks of support within the scientific community.
- **Enhance collaboration with policymakers** to ensure that women's contributions in STEM are recognised, valued and integrated into national development strategies and research agendas.
- **Engage women scientists** by implementing additional community-building programmes (e.g. OWSD's national chapters).
- **Begin collaboration with science granting councils** to ensure their priorities align with efforts to increase the participation and recognition of women in STEM.
- **Develop robust frameworks to track both individual and institutional outcomes of fellowships and awards**, while using both quantitative and qualitative data to inform adaptive programme design and policy advocacy.

Beyond supporting individual scientists, key national actors in higher education such as academic institutions, science granting councils and programmes like OWSD's national chapters can play a critical role in shaping environments that enable women in STEM to thrive. Institutions and organisations that are aware of their own research priorities and national development agendas can align their policies, funding mechanisms and institutional cultures to better support women scientists. By embedding gender equity considerations into hiring practices, research funding and leadership pathways, these institutions and organisations can create a more level playing field and reinforce systemic progress. Ultimately, when visibility is matched with structural commitment, women's presence in STEM ceases to be the exception and becomes an expected, integral part of the scientific landscape – strengthening not only those who lead, but the science they help to advance.

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