



Inclusivity and Gender in Science - An Uphill Climb

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Science is not the exclusive domain of any gender or group. It is universally acknowledged that the nature of science is unbiased, inclusive and without prejudice. While this is the ideal paradigm under which science should function, the messy reality of our world is that the scientific community globally is fraught with inclusivity and equity challenges. We explore the current situation to frame a context around inclusivity and gender in the Indian scientific setting. Using the gender lens, we then take a deeper look at the existing set of policy and programmatic interventions aimed at 'fixing the leaky pipeline'. We find that the current interventions have had marginal effect on the participation of women in science. While India has almost reached gender parity in terms of Science, Technology, Engineering and Mathematics (STEM) education, the share of women researchers in the workforce is low. The equal participation of all members of society is essential to bring about the social and economic transformation necessary to address the global challenges we face today. In conclusion, it is a social, moral and economic imperative to improve inclusivity and gender in science. We suggest recommendations for the same.

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Science is not the exclusive domain of any gender or group. It is universally acknowledged that the nature of science is unbiased, inclusive and without prejudice. Ideas can come from anywhere, from anyone. While this is the ideal paradigm under which science should function, the messy reality of our world is that the scientific community globally is fraught with inclusivity and equity challenges. Equity, diversity and inclusion (EDI) remain elusive ideals despite the increasing loud voices demanding the normalisation of these values. As with the rest of the world, India too faces its own share of inclusivity and gender challenges that are rooted in societal, political and economic structures. In this piece, we explore the situation and imperative to do more to improve inclusivity and gender in the Indian scientific community.

The EDI landscape in the country is quite bleak. India has one of the lowest women's labour force participation in the world. The Global Gender Gap rankings measure the gender gap across economic participation and opportunity, educational attainment, health and survival, and political empowerment. India ranked 140 out of 156 countries in

the 2021 Global Gender Gap report, dropping from 112 in the previous year's ranking. The report found that women's labour force participation rate in India fell from 24.8% to 22.3%. In addition, the share of women in professional and technical roles is low at 29.2%. The share of women in senior and managerial positions has also remained low showing a modest increase from 13.7% in 2020 to 14.6% in 2021 while the percentage of firms with female top managers stayed static at 8.9%. It must also be said that such poor rankings in similar indices have been the norm for India, rather than an exception.

Policy efforts to address inclusivity and gender challenges

In the past few years, the Government of India has made several policy and regulatory announcements in a bid to address such inclusivity and equity challenges. Notably among these are the Rights of Persons with Disabilities Act, 2016, the Transgender Persons (Protection of Rights) Act, 2019, the Maternity Benefit (Amendment) Act, 2017, the Code on Social Security, 2020

and equal pay initiatives under various Acts and schemes. The draft Science, Technology and Innovation Policy 2020 dedicates an entire section to equity and inclusion.¹ The Constitution of India itself prohibits discrimination on the grounds of religion, race, caste, sex or place of birth.² There is indeed a loud and persistent call at all levels to actively address these persistent inclusivity and equity challenges.

Even with such welcome initiatives and safeguards, these inclusivity and equity challenges continue to be a seemingly unbreakable barrier. We are a long way away from making any significant dent in addressing these issues. Take for example, the simple idea of having an equity, diversity and inclusion cell in our government institutions. While the intent is to provide access and impetus for an all inclusive workforce, in our discussions, it appears that a number of institutions lack EDI cells or committees. The low awareness around some of these easy-to-implement initiatives is detrimental to the country's growth. To be fair, there are various institutions that go above and beyond current initiatives to walk the talk. A case in point is the recent setting up of an Office of Diversity and Inclusion (ODI) and a Dean position to run the Office at IIT Delhi.³

1 https://dst.gov.in/sites/default/files/STIP_Doc_1.4_Dec2020.pdf

2 B. R. Ambedkar, "The Constitution of India," 1950. [Online]. Available: <http://lawmin.nic.in/olwing/coi/coi-english/coi-indexenglish.htm>

3 <https://www.news18.com/news/education-career/iit-delhi-to-set-up-office-of-diversity-and-inclusion-creates-new-dean-position-4663286.html>

A snapshot of programmatic initiatives for women

While there are multiple lenses to look at diversity and inclusion, we have chosen to explore the gender lens here. The recent UNESCO Science report highlights that despite a shortage of skills in most of the technological fields driving the Fourth Industrial Revolution, women still account for a small share of the technical workforce.⁴ The World Bank report, *'Equality Equation : Advancing the Participation of Women and Girls in STEM'* talks about how gender gaps in STEM can have broader negative consequences by influencing the products that STEM brings to economies and society.⁵ The leaky pipeline metaphor has been used ad nauseum for the gender gap in STEM wherein almost equitable gender balance is observed at the start or entry level positions, followed by perceptible drops as one moves to more senior positions. Structured interventions in increasing the number of women researchers in scientific agencies help create a skilled talent pool as highlighted by different studies such as

UNESCO's work on girls' and women's education in STEM.⁶

We map existing programmatic interventions for women across the innovation pipeline, looking at education, research workforce and entrepreneurship in Figure 1. The Department of Science and Technology runs programmes and schemes to address the 'leaky pipeline' issue under one umbrella known as "KIRAN" (Knowledge Involvement in Research Advancement through Nurturing). The 'Women Scientist Scheme' (WOS) provides career opportunities to women scientists and technologists, especially those who had a break in career, for pursuing research in frontier areas of Science and Engineering, under three major components namely, WOS-A, WOS-B, WOS-C.⁷ WOS-A focusses on gender mainstreaming for entry-level scientists, WOS-B focuses on opportunities for women scientists to address a well-identified societal challenge and deliver possible solutions and WOS-C focusses on training women scientists in the field of Intellectual Property Rights (IPRs) and their management. Other DST initiatives include the 'Consolidation of University Research through Innovation and

Excellence in Women Universities (CURIE)' Programme aimed at women universities, Mobility Scheme for relocation issues of working women scientists, the SERB-POWER (Promoting Opportunities for Women in Exploratory Research) scheme to mitigate gender disparity in science and engineering research funding and the 'Vigyan Jyoti' scheme to encourage girl students of Class 9 to 12 to pursue an education and career in S&T.⁸

Similarly, the Department of Biotechnology (DBT) runs the Biotechnology Career Advancement and Re-orientation Program (BioCARE) for women scientists to enhance the participation of Women Scientists in Biotechnology Research.⁹ Some scientific ministries have instituted awards for women scientists such as the 'Anna Mani national award for woman scientist' by the Ministry of Earth Sciences and the 'Janaki Ammal-National Women Bioscientist' award by DBT. Some departments such as the Department for Atomic Energy, DST, Ministry of Electronics and Telecommunication and Ministry of Earth Sciences also include gender budgeting for a few of their programmes.¹⁰

4 <https://www.unesco.org/reports/science/2021/en/women-digital-revolution>

5 <https://openknowledge.worldbank.org/handle/10986/34317>

6 <https://en.unesco.org/women-and-girls-in-science/initiatives>

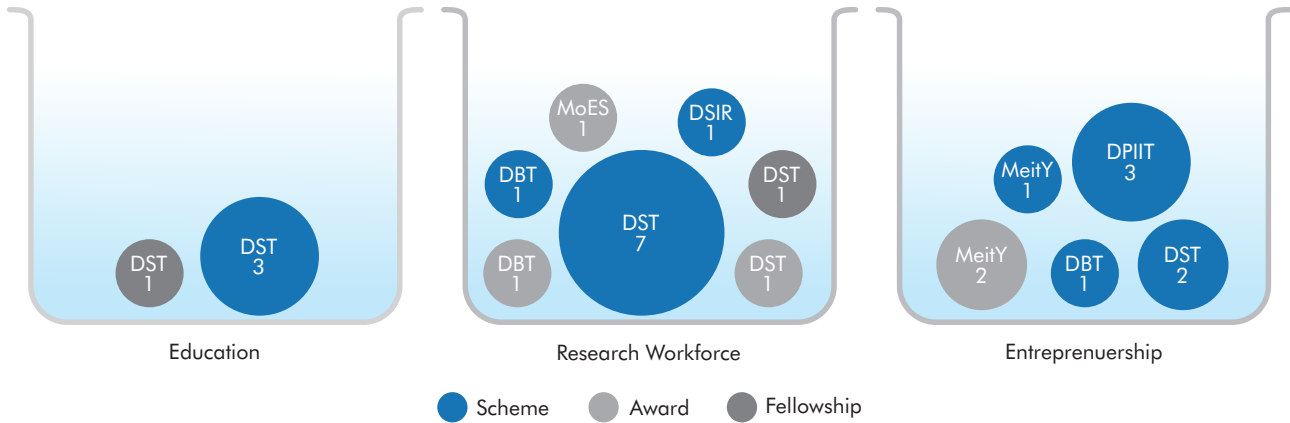
7 <https://dst.gov.in/scientific-programmes/scientific-engineering-research/women-scientists-programs>

8 <https://pib.gov.in/PressReleaseIframePage.aspx?PRID=1694537>

9 <https://dbtindia.gov.in/pressrelease/department-biotechnology-supports-women-scientists-achieve-sdg5-towards-gender-equality>

10 <https://www.indiabudget.gov.in/doc/eb/stat13.pdf>

Figure 1: A Snapshot of Programmatic Interventions



Ministry/ Department	Type of intervention	Education	Research Workforce	Entrepreneurship
Department of Science and Technology	Scheme	Vigyan Jyoti Consolidation of University Research through Innovation and Excellence in Women Universities (CURIE) Gender Advancement for Transforming Institutions (GATI)	“KIRAN” (Knowledge Involvement in Research Advancement through Nurturing) Women Scientist Scheme WOS-A WOS-B WOS-C Mobility Scheme SERB – POWER Research Grants	Women Entrepreneur Quest (WEQ) Women Technology Park (WTP)
	Fellowship	Indo-U.S. Fellowship for Women in STEMM	SERB-POWER Fellowship	
	Award		SERB Women Excellence Award	
Department of Biotechnology	Scheme		Biotechnology Career Advancement and Re-orientation Program (BioCARE)	BIRAC-TiEWInER (Women In Entrepreneurial Research)
	Fellowship			
	Award		Janaki Ammal-National Women Bioscientist Award	
Department of Scientific and Industrial Research	Scheme		Technology Development and Utilization Programme for Women (TDUPW)	
	Fellowship			
	Award			
Ministry of Electronics and Information Technology	Scheme			MeitY-NASSCOM Tech Women Entrepreneur Accelerator Program
	Fellowship			
	Award			MeitY-NASSCOM Women Startup Entrepreneurs Awards Amrit Mahotsav Shri Shakti Challenge

Ministry of Earth Sciences	Scheme			
	Fellowship			
	Award		Anna Mani national award for woman scientist	
Department for Promotion of Industry and Internal Trade	Scheme			Women Entrepreneurship Platform (WEP) Women Capacity Development Programme (WING) Fund of Funds*
	Fellowship			
	Award			

Source: Various Ministries, Centre for Technology, Innovation and Economic Research (CTIER)
 *10% of the fund (Rs 1000 crore) in the Fund of Funds operated by SIDBI has been reserved for women led startups

Note: The above figure captures only a snapshot of women-centric schemes and awards specific to promoting women in science and technology. Other generic schemes, programmes and awards for improving the overall R&D landscape, implemented by various ministries are not captured here. Some women-centric schemes that are targetted at overall education by the Ministry of Education and Ministry of Women Child Welfare are also not included. Lastly, entrepreneurial schemes by the Ministry of Agriculture are not included.

There has also been an interest in encouraging women tech entrepreneurs in the last few years. DBT, for example, runs the BIRAC-TiEWInER (Women In Entrepreneurial Research) award to promote women entrepreneurs in the biotechnology sector. The Department for Promotion of Industry and Internal Trade (DPIIT) has various schemes for encouraging women-led startups.¹¹

Women in Science: a worrisome picture

Despite these policy and programmatic interventions, the statistics present a worrisome

picture of the leaky pipeline. As seen in Figure 2, progress has been made towards gender parity for STEM graduates.¹² Looking at AISHE data for (Engineering & Technology, IT & Computer, Science), we see a steady increase in the share of women graduates at all levels - undergraduate, postgraduate and PhD - from 2012-13 to 2019-20. In fact, one sees a notable jump in the share of women postgraduates in science that has increased from 52.9% in 2012-13 to 64.8% in 2019-20.¹³

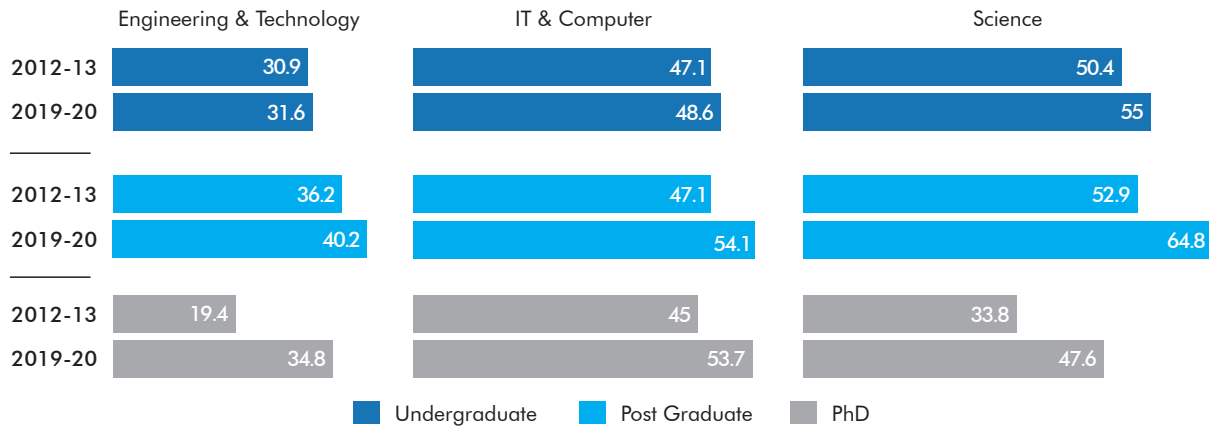
However, if we look at the statistics from DST over the last ten years, the change in participation of women researchers is disappointing.

While there may be multiple social, cultural and economic reasons for the low participation of women in the research workforce, it is a matter of concern that despite producing a large number of graduates in STEM, the share of women in overall participation of the research workforce is low as seen in Figure 3. The increase in the share of women researchers in the institutional sector and the industrial sector is a good sign, the flat trend of the higher education sector bodes worry for the future.

Moreover, for any kind of real world impact, we will have to see a massive jump as opposed to the marginal increase observed now.

11 <https://yourstory.com/herstory/2019/05/news-women-entrepreneurship-dipp/amp>
 12 <https://www.unesco.org/reports/science/2021/en/women-digital-revolution>
 13 Compiled Data, AISHE (to source)

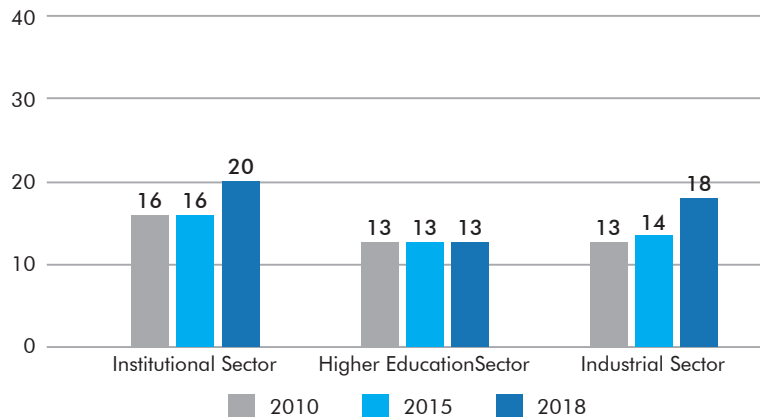
Figure 2: Share of Women in STEM graduates (2013-2020)



Source: All India Survey of Higher Education (various years), Ministry of Education, Government of India, Centre for Technology, Innovation and Economic Research

Note: Only a subset of STEM subjects are included here.

Figure 3: Share of Women Researchers in Workforce (2010-2018)



Source: R&D Statistics, Department of Science and Technology, Government of India, Centre for Technology, Innovation and Economic Research

Note: Institutional Sector consists of Major scientific agencies, Central government ministries/departments and State governments

Industrial Sector consists of Public sector including joint sector, Private sector and Scientific and Industrial Research Organisations

Getting past 'tokenism': Structural Interventions and Disruptive Pilots

The question to be asked then is where are we lacking in implementation? How can we get past the 'tokenism' of participation? How can we ensure that the passion for STEM our young girls have is not smothered by cultural and workplace barriers? What can be done differently from the past to ensure our actions are louder than words?

One of the key things to remember is that there are no simple solutions to the complex mix of structural, cultural and institutional factors that produce barriers for inclusivity and

gender in science. At the very least, equal participation from men and women is required to make any intervention work. A key drawback of most programmatic interventions to address gender in science is that it often puts the onus of participation on already burdened women. Any effective design to address this issue should consider impacting change at the institutional level.

In this, DST's latest programme, the 'Gender Advancement for Transforming Institutions' (GATI) pilot, offers hope. Intervention in this pilot is looked at the institute level, thus bringing ownership to all members of the institute rather than a specific group. GATI aims to nudge institutions of higher education and research towards supporting diversity, inclusion, and the full spectrum of talent for their own success and progression.¹⁴

However, for effective structural change, a range of actions is required at multiple levels. Policymakers need to recognise that gender issues are not the mainstay of any one department - the traditional siloed approach is unlikely to yield success beyond a point. It will take policy, priority and programming efforts of all departments, whether it is

education or trade, to address these long standing issues for women in STEM. These include:

- Creating an enabling workplace environment for everyone - through increasing awareness of gender inequity and broader diversity issues, the introduction of flexi-hours and other top-down and bottom-up approaches¹⁵
- Addressing recruitment barriers through focused recruitment drives and hiring incentives
- Addressing retention and career progression through targeted interventions to improve the visibility and leadership skills of women, designing mentorship and sponsorship programmes for career progression
Improving gender balance on committees and decision making spaces
- Funding a wide range of innovative pilots that address gender and inclusivity challenges and supporting successful pilots that can be taken to scale

Gender disaggregated data: a missing piece of the puzzle

We do not collect enough data on gender disaggregation, whether it is in education or at the workplace. Data on gender equality at all levels is essential to better understand the issues at the intersection of gender and other aspects of identity such as sexuality, race, disability, age and religion.¹⁶ In cases where national gender disaggregated data is available, as seen in the AISHE data, it is not available at the regional level thus posing a barrier for designing any regional interventions to address these gender disparities.

It is possible nowadays using new tools and methods to capture timely, accurate and relevant data on gender and inclusivity which would be a great service for policy correction. The DST data above may reflect the 'leaky pipeline issue', however more detailed information by sector or area of research would help design more effective interventions.

¹⁴ https://dst.gov.in/sites/default/files/Gati%20detailed%20advertisement_0.pdf

¹⁵ The NITI Aayog report, 'Status of Women in Science among Select Institutions in India: Policy Implications' has several recommendations on making the workplace less hostile to women.

¹⁶ <https://health-policy-systems.biomedcentral.com/articles/10.1186/s12961-020-0527-x>

Inclusivity and Gender: A social, moral and economic imperative

The effort of the scientific community has to go further in terms of trying to address the invisible biases that exist throughout the system, be it in academia, research, industry. In a world increasingly transformed by automation and globalisation, a lot depends on a country's ability to produce enough technical capability in the science, technology, engineering and digital sectors. This has far reaching implications for the role women play. There are a lot of hopes

and ambitions pinned to India's demographic dividend. It is important to remember that this demographic dividend includes a large number of women, who risk being rendered invisible and thus exacerbating the leaky pipeline issue.

Moreover, the global challenges of climate change, poverty, hunger, and access require a variety of perspectives and solutions. In thinking of mission oriented research, or addressing issues around sustainable development goals, there is a better chance at making good progress if one is more inclusive and equitable.

Science and technology are important drivers of

economic growth. The "inclusion dividend" is being established as a real and significant business advantage by progressive companies who advance inclusion and diversity.¹⁷ Underrepresentation of women in STEM, whether in the public or private sectors, hurts the country's economic prospects. We are staring at the lost potential of a large chunk of our population, undesirable by all yardsticks. Thus, applying an inclusivity and gender lens to all our policies, programmes and regulations to address gender and inclusivity challenges is an ethical, moral and economic imperative that requires immediate attention.

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