

Equity and Inclusion in Science and Science writing



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Framework for this talk

I will share with you some thoughts based on my experiences in Scientific writing and publications.

in my capacity as

1) researcher

2)(ex) chief editor Pramana

3)a women scientist who has written about women in science

4)Chair of the committee which contributed to the chapter on Equity and Inclusion in the Science , Technology and Innovation policy of India, STIP-2020

My credentials for talking about E&I in Science

1) Author of survey-report: 'Trained Scientific Woman Power: what fraction are we losing and why?

Co- Editor (with R. Ramaswamy) of two books to encourage girls to take up Science:

2) *Lilavati's Daughters : Women in Science in India*
(Publisher: Indian Academy of Science, 2008)

3) *A Girl's Guide to Life in Science:*
(Publisher: Young Zubaan, 2010)

My credentials for talking about E&I in Science

4) Author of Chapter on India in the book

‘Women in Science and Technology brought out by

‘The Association of Academies and Societies in Asia
(AASSA)

5) As a contributor to various collections of
biographies of women in science: nationally and
internationally

6) Contributions to discussions in STIP 2020 on
E&I in STI

What will this talk contain?

A : Introduction

Provide context to the discussion of '**E&I in Science writing**' in the framework of this workshop. In other words , why a discussion of '**E&I in Science**' is important in the context of a Science Writing workshop.

B: Different aspects of E&I in Science and hence in Science writing

C: Thoughts about the lack of E&I in Science Ecosystem

Science Writing

Two parts to discussions of Science Writing:

- 1) Scientific Writing: Papers, reports etc.*
- 2) Writing about Science*

You will hear different talks on both subjects.

How a discussion of 'E&I in Science' is relevant to a Science Writing workshop?

Different Aspects of Science

Obvious aspect of science one imagines and thinks about while writing about science is 'knowledge'.

However, Science (*and hence science writing*) has many other dimensions: Social, political, economic!

What are these dimensions?

Social Aspects of Science

1] Ethics:

- a) Plagiarism: Ethics in presenting Scientific Results
- b) Granting authorship to people who did not contribute and deny it to those who did!
- c) Unethical behaviour in terms of misappropriation of funds, discriminatory behaviour based on gender, race...

Ethics (contd)

d) Scientific Developments which have revolutionary/evolutionary impact on Society:

- i) Cloning
- ii) GMO: Genetically Modified Organisms / BT crops
- iii) Contribution of Science to weapons and war efforts.

Science writers need to inform the community about such issues in a useful manner !

Diversity

2] Diversity in Science and its importance for Science .In general writing on the subject should involve 4/5 different aspects

a) Diversity: How important is diversity of practitioners important for development of Science

b) Diversity of gender? What are the numbers? What part of the discussion are an expression of feminism?

c) Diversity of Knowledge systems? (say Aurveda or traditional science/technology)

Diversity

Diversity issues:

- i) Whether belonging to a diverse group affects the way one does science ?
- ii) Does ones 'initial conditions' (cultural/racial/gender) background affect the choice of Science one does?
- iii) For example whether gender affects the treatment one gets in science; More importantly does it affect the treatment given by scientists to one's work?

What can the science writers do?

Example WiS:

Scientific Biographies of Women Scientists:

It is important to discuss:

What is the science contribution of women scientists in the past? Normally focus on discussions of personal battles fought and won! Even when one talks of famous mathematician Emmy Noether or Sonja Kowlaskya or field medalist Mariam Mirzakhani. *These discussions are necessary but not sufficient!*

What can the science writers do?

Need to pay attention to the diversity. Be alive to the issue in your science writing.

Write about science by women or research in traditional knowledge systems

If you are reporting comments on science by scientists try to see whether you can be a little more proactive about the gender/age/section of S&T Ecosystem of the person whom you ask for comments! DO NOT ASK women in Science to comment ONLY about WiS! OR ONLY ON Women's Day!

What can the science writers do?

Introspect when you are looking for information whether you are really tapping diverse sources or is your choice concentrating on a small group of elite male scientists in elite institutes?

Are you letting your biases affect the choice of topics/people in science you write about or the way you write about it?

(Give an example from Unesco report: IISER making sure they have Creches on campus to 'support')

What can the science writers do?

While one has to always evaluate critically any claim on science put for public consumption before writing about it, it is doubly or triply so for *E&I* (say *WiS*, traditional knowledge systems....)

Why?

Because these aspects are riddled with political/social prejudices, folk lores and so on.

E&I discussions are culture specific

Cultural Specificity:

The discussion of 'Equity and Inclusion in Science' has massive dependence on the culture.

For example for WiS

In the USA a lot of discussion is centred around
How to increase number of women 'studying
STEM!'

Situation completely different in India. So let us
not follow material and studies available in the west
on the subject to decide what are the issues in India!

Need for E & I in Science

Of course, one of the motivations for E & I in science is to correct historical injustices and exclusion of the different groups from processes of science.

But it is equally important to realise that inclusion and diversity can only aid in increasing the efficacy of scientific processes by adding more dimensions to the scientific ecosystem which can lead to further excellence in S&T.

Diversity, E & I..all that

Diversity in scientific processes means participation of different diverse groups: it can be diversity of **gender**, language, **social/economic class**, geographical region, physical abilities, **knowledge systems**...

Some groups are underrepresented

Achieving diversity means **Inclusion** for those groups which are excluded, for historical reasons (example **traditional knowledge systems**) and **equity** for those under-represented groups where some inclusion exists (example **gender**)

Diversity and S&T

Questions:

Why discuss Diversity and S&T together?

Why should be lack of diversity in S&T be an issue at all?

How can it influence course of Science?

Another way of asking the same thing:

Does Diversity necessarily add to excellence?

I will answer by quoting from "An open letter to SCOTUS from professional physicists" signed by about 2000 physicists in the US in 2015 in answer to a question asked by Chief Justice of US Supreme Court.

Question asked by the Chief Justice of Supreme Court of the US in 2015 : “What unique perspective does a minority student bring to a physics class?”

Answer 1:

"Indeed, science relies heavily on consensus about acceptable results as well as future research directions, making diversity among scientists a crucial aspect of objective, bias-free science."

Answer 2:

They bring their background, ways of thinking, methods of applying physics to real world problems, and the potential to educate others through their unique perspective.

Niels Bohr and Inclusion

Niels Bohr who put forward the complementarity principle in fact had said about societies:

“Each culture represents a harmonious balance of traditional conventions by means of which latent potentialities of human life can unfold themselves in a way which reveals to us new aspects of its unlimited richness and variety.”

This is indeed true of different ways of looking at an issue and then it leads to ultimate aim of science “gradual removal of biases and a clearer understanding”

Some comments : gender equity

Are all people equal when it comes to all sciences?

Harvard President: Larry Summers

“Women lack capability in Mathematical and Physical Sciences”

True: In India we don't have our Larry Summers.

But we are still not inundated with women practicing science!

Impact of Gender Diversity on actions

Willmien Kets and Sandroni : (October 2015)

Diverse groups are less conformist and more willing to go against the status quo if that leads to better outcomes. Whether a physics graduate goes on to work at a tech company, becomes a scientist, or ends up as a manager, it will be critical for her success as well as her employer's whether she is an original thinker.

The url is:

fortune.com/2015/12/16/affirmative-action-u-s-supreme-court-diversity

Diversity and S&T

Diversity among practitioners of science is small across all sciences. Is that necessarily bad? Yes.

***Why?** it is certainly not the optimal use of humanity's intellectual potential. Diversity can only be good for science, as for any creative activity.*

1) Diversity of Knowledge Systems:

Use of traditional knowledge systems can lead to interesting innovations which can make important contributions to Sustainable Development Goals!

India is low in this list! We can discuss examples later.

Diversity and S&T

2) Racial Diversity:

In the USA of 1960 African American Women of the deep south made all important contributions to the US space program.

3) Gender Diversity:

*A story of invention of calendar (Sonia Toksvig):
According to Anthropologists the first calendar was a bone with 28 incisions. Clearly it was invented by a woman! But till it is pointed out explicitly one attributes this invention to 'men' or 'mankind'!*

It is not just a manner of speaking! Affects attitudes towards women in science! We will see examples!

Lack (gain) of diversity and loss(gain) of S&T

Clearly it is silly to say that lack of equity has impeded development of excellent science, which has been mainly led by white Caucasian males.

Question is can we point out something where the lack of opportunities clearly caused science to lose something . In other words achieving gender equity can avoid such losses. (*Sophie Germain*)

Also are there clear examples where gender/racial diversity was responsible for a gain! (*Hidden Figures*)

Sophie Germain (1776-1831)

Self taught. Had to fight against the family and society.

It was not proper for a 'middle' class girl to study mathematics and science! Family even took away her candles but finally relented.

Lack of formal training!

Women not allowed in Ecole Polytechnique

Used a pen name of a friend to communicate with Lagrange, Gauss.

Important work on theory of elasticity and Fermat's last theorem . First woman to win a prize from French Academy



Sophie GERMAIN (portrait de), à P.

Hidden Figures behind the US space program

Hidden Figures (Margot Lee Shetterley)



Dorothy Vaughan

1910-2008



Katherine Johnson

1918-2020



Mary Jackson

1921-2005

Traditional Knowledge System and innovation

This example is from a talk on 'Shodhyatra' by Prof. Anil K. Gupta of HoneyBee network, SRISTI... (gian.org) .



How to harness waste heat.
Andhra Pradesh (SY-21)



How to harness waste heat to dry damp wood :
Meghalaya (SY -26)

Gender diversity and knowledge gain (recent example)

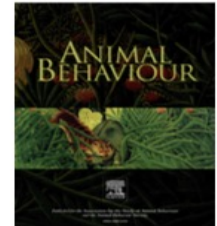
Animal Behaviour 168 (2020) 19–24



Contents lists available at [ScienceDirect](#)

Animal Behaviour

journal homepage: www.elsevier.com/locate/anbehav



The role of diversity in science: a case study of women advancing female birdsong research

Casey D. Haines a, *, Evangeline M. Rose a, **, Karan J. Odom b, Kevin E. Omland a

Our case study suggests that women are making a greater contribution to the emerging field of female birdsong. This discrepancy demonstrates the importance of diversity in addressing previously understudied areas of science

Who we are affects what science we do!

Of course science is objective and universal!

Newton's law would have been the same by any other name. Why is the diversity then important?

Issues in science one chooses to investigate, processes that are put in place can be influenced by cultural or racial or gender background!

Shalini Arya (ICT) and her work is one very good example of this.

Who we are affects what science we do and how!

1)The first woman doctor from India to get her degree in the USA,
Anandibai Joshee did her thesis on gynaecological problems of women because she herself had lost a child at its birth, when she was 14!

2)Another interesting news item (research by **Joy Boulamwini**)

Facial recognition programs are accurate only if you are white!

Likely wrong as much as 35% if you are an african-american, woman

3)Science administration:

News item in DH, online application form needing father's name

How to achieve diversity and how to measure Equity?

Easy to see lack of diversity and equity in science.

How to cure things and **How to judge what level of diversity and equity is correct?** Is there such a thing as 'correct' level?

Lack of numerical representation is a symptom and achieving numerical targets does not mean problems are solved! Achieving numerical targets necessary but not sufficient.

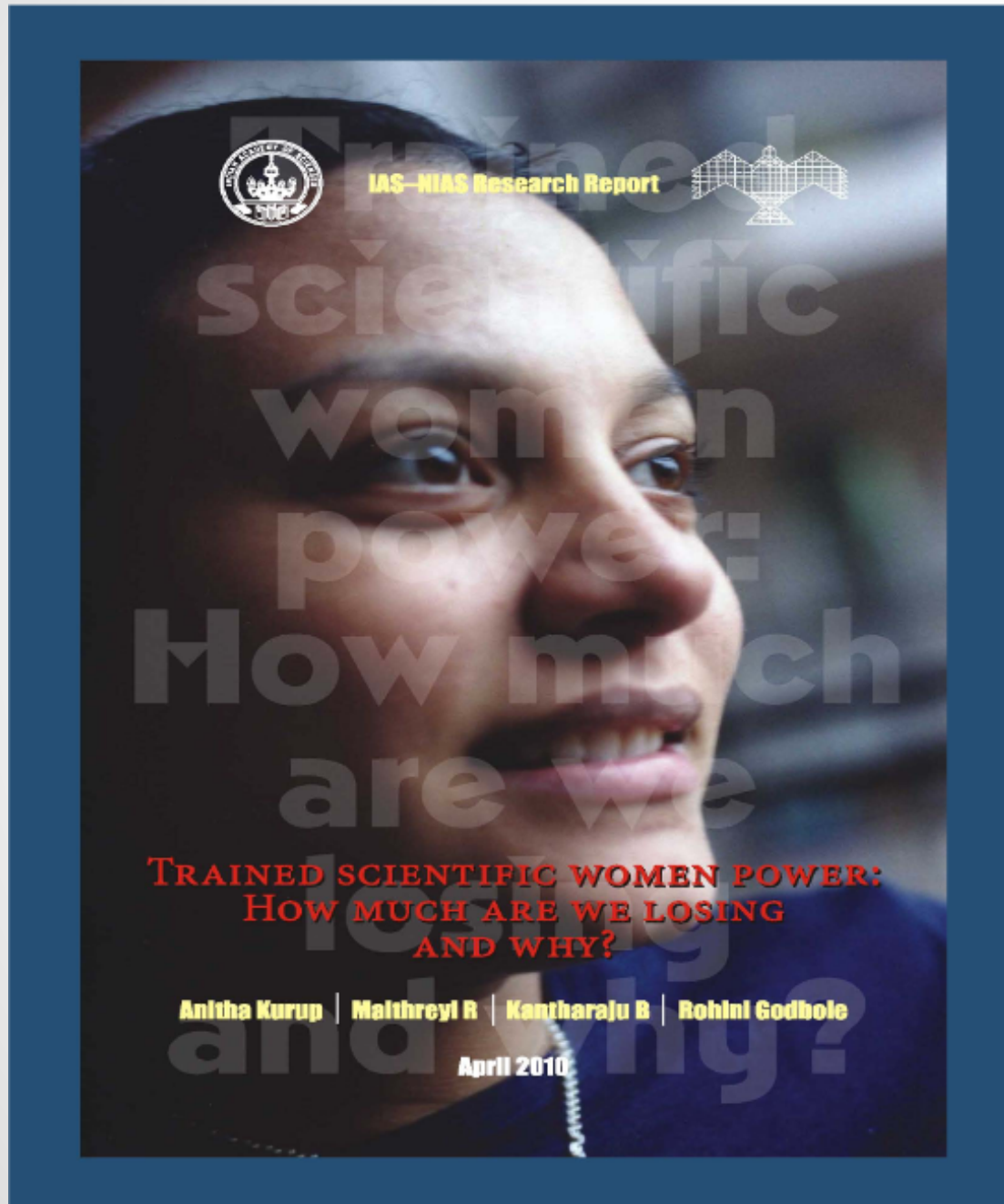
One has to get at the roots of the issue!

Solutions have to address the reasons!

A short pause

My own view is that one of the important step in this process is becoming aware of some not so obvious issues!

Invisible bias feeds into visible!



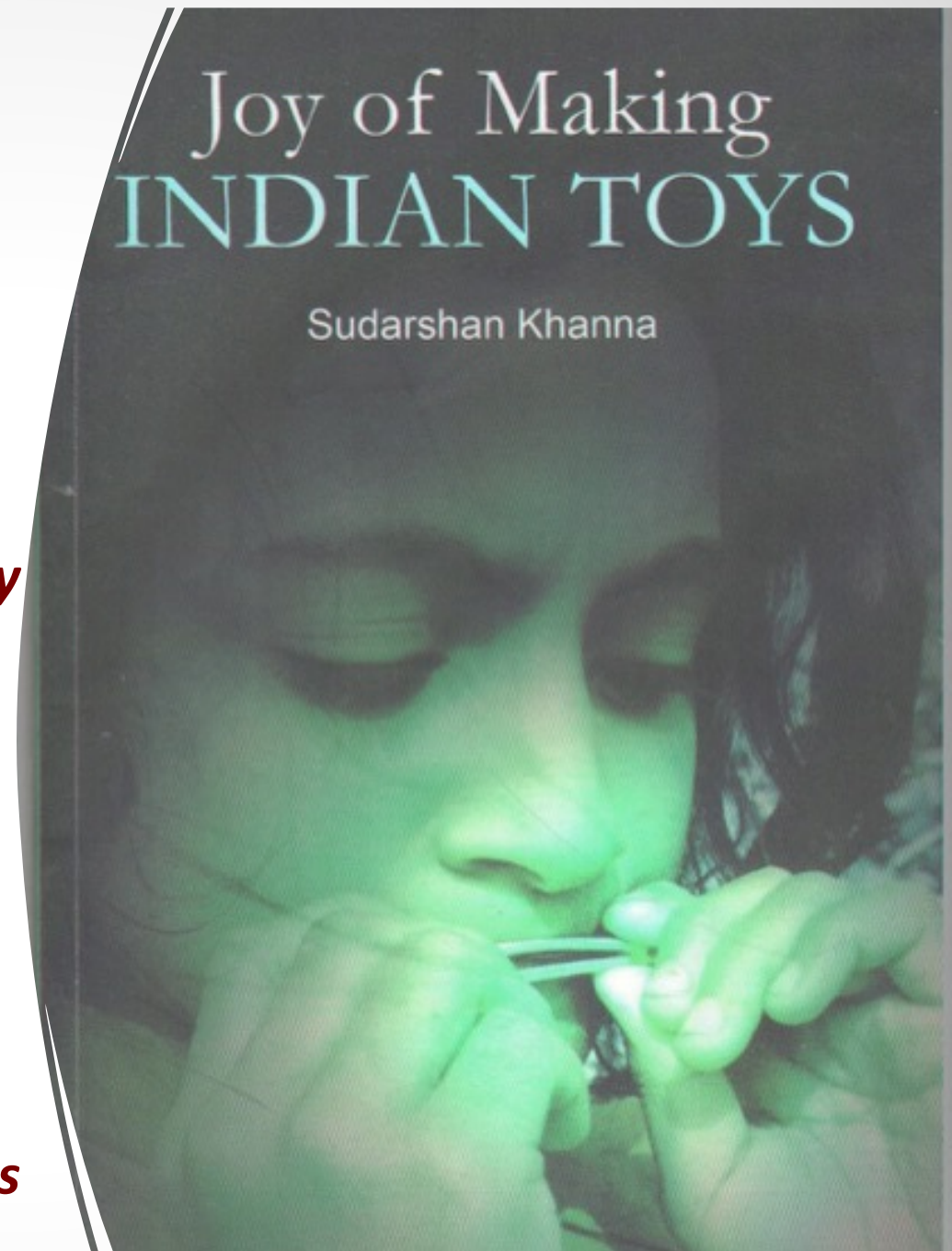
Loss of trained scientific woman power: How much are we losing and why?

Interesting lessons learnt :

Biases are also a reason for the loss, not only the family responsibility!

Bias is induced unknowingly and starts early!

- *Story of a young girl. Parents definitely did not have any bias in the upbringing of the child. They had only a girl child.*
- *Gave her a book 'Joy of Making Indian Toys' By Sudharshan Khanna*
- *She made only a few of the toys!*
- *When asked 'why'? Her answer was 'I made only those where girls were shown making them!'*



This is the modified cover after the little girl's comment

Invisible and Unconscious bias

In fact ,even Royal Society displays this on their webpage!

A film 'Picture A scientist' brings this out through interviews and conversations. **(Available on Netflix) (give example)**

Further, not a propriety only of gender inequity.

Think how often we do not pay attention to the suggestions of a person because he/she is not fluent in English, because he/she is from a rural background or is trained in India..

So, in our lives we need to look at the content of the message that we hear in an exchange. It should not be '**coloured**' by our biases about the messenger.

Suggestion: '**Introspect** and **autocorrect**' for invisible bias!

Is that the only cure?

That is certainly not the case.

Again, it is necessary but FAR from sufficient.

In fact, one needs advance on two fronts

1) Policies

Need to make sure policies themselves are not affected by the bias!

2) Changes in social attitudes and conventions.

Being aware of one's own invisible bias is just one of them!

This awareness is necessary for successful implementation of policies themselves!

STIP-2020?

Science, Technology and Innovation Policy (**STIP**) of India released in January 2021 has taken a big step by having a separate discussion of **E&I**

The discussion cuts across all issues ..previously one had a separate discussion for **gender equity** another for including **those on margins of society** in the march on path of science etc..

A holistic approach can take towards our aim perhaps faster and better.

STIP- Inclusion of E & I

The point being that considerations of E & I should be an overarching feature of **ALL** the policy discussions.

Importantly it focuses on '**equity**' and not '**equality**'.

The goal of the E & I policy is two fold:

- 1)To facilitate inclusion for the groups that ARE under-represented in the processes of Science.
- 2)To facilitate equity for groups where inclusion exists to some extent.

Successful implementation

Successful implementation requires both Institutional processes and change as well as change in societal processes and mindset.

Commitment from different structure is necessary

That can come only from creating awareness.

Awareness that this is beneficial not just for the excluded groups but also for science and that It makes pragmatic and economic sense

This thinking has to be part of our Ecosystem!

What do we learn?

Introspect and autocorrect for your invisible biases in your professional and personal lives!

We need to be inclusive! It begins at home as to how you treat your spouse, your children!

All of us, individuals, scientists, science administrators all need to be inclusive in all we do and constantly strive to increase the awareness around us!

Science writers indeed have a very special role to play here

Last word

The path to go to a situation when we will just speak of scientists/engineers and not their gender, surprisingly, goes through the path of being very aware of the same for a while!

(R.G. Current Science Editorial)

Science writing plays a very important part in raising this awareness!