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At

WADHWANI AI

(February 20th to May 17th, 2024)

"The Impact of Gender Bias in Artificial Intelligence: A Scoping Review and Framework for Promoting Opportunities for Women Empowerment and Representation in AI"

by

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PG/22/098

Under the guidance of

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Post Graduate Diploma in Hospital and Health Management 2022-24

IIHMR DELHI

INTERNATIONAL INSTITUTE OF HEALTH MANAGEMENT RESEARCH,

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The certificate is awarded to

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in recognition of having successfully completed his/her Internship in the department of

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and has successfully completed his/her Project on

The Impact of Gender Bias in Artificial Intelligence: A Scoping Review and Framework for Promoting Opportunities for Women Empowerment and Representation in AI
Date: 17 May, 2024

Wadhwani AI

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We wish him/her all the best for future endeavors.

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The Candidate has successfully carried out the study designated to him during internship training and his/her approach to the study has been sincere, scientific and analytical.

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The following dissertation titled "The Impact of Gender Bias in Artificial Intelligence : A Scoping Review and Framework for Promoting Opportunities for Women Empowerment and Representation" at "Wadhwani AI" is hereby approved as a certified study in management carried out and presented in a manner satisfactorily to warrant its acceptance as a prerequisite for the award of **PGDM (Hospital & Health Management)** for which it has been submitted. It is understood that by this approval the undersigned do not necessarily endorse or approve any statement made, opinion expressed, or conclusion drawn therein but approve the dissertation only for the purpose it is submitted.

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This is to certify that **Ms. Sadiya Siddiqui,** a graduate student of the **PGDM (Hospital & Health Management)** has worked under our guidance and supervision. She is submitting this dissertation titled **"THE IMPACT OF GENDER BIAS IN ARTIFICIAL INTELLIGENCE: A SCOPING REVIEW AND FRAMEWORK FOR PROMOTING OPPORTUNITIES FOR WOMEN EMPOWERMENT AND REPRESENTATION IN AI"** at **"WADHWANI AI"** in partial fulfillment of the requirements for the award of the **PGDM (Hospital & Health Management).**

This dissertation has the requisite standard and to the best of our knowledge no part of it has been reproduced from any other dissertation, monograph, report or book.

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Area of Dissertation: Monitoring Evaluation and Learning

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1. Supporting Monitoring & Evaluation activities
2. Support in gender initiatives

Deliverables:

1. Strengthening Preservation of Tibetan Culture project :
    a. Drafted indicator sheet for submission to USAID
    b. Drafted data collection protocol and data collection tools
    c. Conducted interviews with monks, nuns and other key stakeholders during MEL Baseline
2. Gender Initiatives
    a. Conducted a literature review on gender gaps in AI
    b. Drafted standard operating protocols for the organization to ensure gender-equitable AI solutions
    c. Drafted content on AI readiness for frontline workers

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ABBREVIATIONS

S.No	Abbreviations	Full Form
1.	AI	Artificial Intelligence
2.	GATI	Gender Advancement for Transforming Institutions
3.	GSMA	Global System for Mobile Communications
4.	ICT	Information and Communications Technology
5.	ITIs	Industrial Training Institutes
6.	IoT	Internet of Things
7.	LGBTQ+	lesbian, gay, bisexual, transgender, queer or questioning
8.	MeitY	Ministry of Electronics and Information Technology
9.	NASSCOM	National Association of Software and Service Companies
10.	NIScPR	National Institute of Science Communication and Policy Research
11.	NITI	National Institution for Transforming India
12.	NLP	Natural language processing
13.	NMEW	National Mission for Education for Women
14.	NSSO	National Sample Survey Organization
15.	POSH	Prevention, Prohibition and Redressal
16.	STEM	Science, technology, engineering, and mathematics
17.	WEP	Women Entrepreneurship Platform

"The Impact of Gender Bias in Artificial Intelligence: A Scoping Review and Framework for Promoting Opportunities for Women Empowerment and Representation in AI"

ABSTRACT

This scoping review investigates the concerning issue of gender bias within Artificial Intelligence (AI) and its applications. It explores how these biases manifest, their impact on women, and existing efforts to promote gender inclusivity in technology.

Background:

- Gender bias refers to the unfair treatment of individuals based on their perceived gender.
- AI systems are susceptible to inheriting biases present in their training data or the minds of their creators.
- Women are underrepresented in the technology sector, hindering their participation in developing and shaping AI.

Impact of Gender Bias in AI on Women:

- **Perpetuates Stereotypes:** AI systems can reinforce societal biases through biased data, impacting job recommendations, virtual assistants, and language models.
- **Algorithmic Discrimination:** AI algorithms may perpetuate historical biases, leading to unfair outcomes in loan applications, criminal justice, and online advertising.
- **Limited Access and Representation:** The digital divide disproportionately affects women, restricting their access to technology and opportunities within AI.

Existing Initiatives for Gender Inclusivity:

- **Education Programs:** Initiatives like Beti Bachao Beti Padhao and National Mission for Education for Women aim to increase girls' enrollment in STEM fields.
- **Workplace Policies:** The POSH Act protects women from harassment, and schemes like WEP support female entrepreneurs.
- **Community-Driven Efforts:** Organizations offer digital literacy training to bridge the digital gender divide.

Conclusion:

- Gender bias in AI poses a significant challenge.
- Understanding user interaction with technology and existing efforts for inclusivity is crucial.
- Intersectional approaches and inclusive design principles are needed to ensure AI benefits all.

PART A- ORGANISATION PROFILE

Introduction

Wadhwani AI is a pioneering organization at the forefront of artificial intelligence (AI) research and application, dedicated to harnessing the power of AI for social good. Founded in 2018 by Dr. Romesh Wadhwani, a prominent entrepreneur and philanthropist, Wadhwani AI strives to create AI-driven solutions to address some of the world's most pressing challenges.

Mission

Wadhwani AI's mission is to develop and deploy AI technologies to transform and improve the lives of millions of people globally. By leveraging AI's potential, the organization aims to drive innovation, accelerate economic growth, and enhance human welfare across various domains, including healthcare, agriculture, education, and more.

Research and Innovation

Wadhwani AI is committed to advancing the frontiers of AI research and development. Their team of world-class researchers, engineers, and data scientists collaboratively work on cutting-edge projects, exploring novel approaches and methodologies to tackle complex problems. Through interdisciplinary research and a strong focus on applied AI, Wadhwani AI aims to deliver practical and scalable solutions with real-world impact.

Areas of Focus

Healthcare: Wadhwani AI envisions a future where AI revolutionizes healthcare delivery, making it more accessible, affordable, and effective. The organization works on projects such as AI-based disease diagnosis, drug discovery,

personalized medicine, and healthcare analytics to improve patient outcomes and empower healthcare providers.

Agriculture: Recognizing the crucial role of agriculture in global food security, Wadhwani AI focuses on developing AI-driven solutions to enhance agricultural productivity, optimize resource utilization, and mitigate risks. Their projects include crop yield prediction, pest and disease detection, precision farming, and supply chain optimization.

Education: Wadhwani AI believes in leveraging AI to revolutionize education, making it inclusive, personalized, and adaptive. Through initiatives like intelligent tutoring systems, educational content generation, and data-driven insights, the organization aims to improve learning outcomes, increase access to quality education, and bridge educational disparities.

Social Impact: Wadhwani AI actively engages in projects that address societal challenges, such as disaster response, poverty alleviation, and sustainable development. By harnessing the power of AI, they seek to create scalable solutions that empower communities, enable data-driven decision-making, and drive positive social change.

Partnerships and Collaborations

Wadhwani AI understands the importance of collaboration in driving AI innovation. They actively foster partnerships with leading academic institutions, research organizations, government agencies, and industry stakeholders. By leveraging a global network of experts, Wadhwani AI promotes knowledge sharing, interdisciplinary collaborations, and the development of AI ecosystems worldwide.

PART B- PROJECT REPORT

“The Impact of Gender Bias in Artificial Intelligence: A Scoping Review and Framework for Promoting Opportunities for Women Empowerment and Representation in AI”

1. INTRODUCTION

Background

Gender is the socially constructed roles, behaviours, expressions, and identities of various genders, including girls, women, boys, men, and gender diverse individuals.[1]It is a complex phenomenon that encompasses how a person views themselves and exists as social constructs such as gender roles and norms.[2]

Gender bias refers to the unfair treatment of individuals or groups based on their perceived gender. This bias can manifest in various ways, from stereotypes and social expectations to discrimination and unequal access to opportunities.[3]

Artificial intelligence (AI) has rapidly transformed numerous aspects of our lives. AI systems are essentially computer programs trained on massive datasets to learn and make intelligent decisions. Artificial Intelligence (AI) has the potential to revolutionize various aspects of our lives, but concerns remain regarding potential biases within these systems. However, AI is not immune to inheriting the biases present in the data it's trained on or the minds of its creators. Gender bias in AI refers to the tendency of AI systems to reflect and amplify societal prejudices against particular genders.[4]

The integration of technology has significantly impacted individuals and societies globally, but gender disparity in the technology sector has been a long-standing issue. Women have been underrepresented in the field, facing challenges like limited access to education and societal biases. This underrepresentation affects career prospects and raises concerns about the potential for technology to perpetuate existing gender inequalities. Initiatives like the Women in Analytics Initiative, Women in Tech India and GATI (Gender Advancement for

Transforming Institutions) etc are addressing this issue by encouraging female participation and leadership in the technology sector.[5]

However, women still face numerous challenges, including bias, discrimination, lack of mentorship, and the industry's long hours and demanding schedules. These factorscontribute to burnout, hindering career progression, and feelings of isolation, hindering women from reaching their full potential.

Global gender gaps persist in various domains, women are underrepresented including leadership, technology access, and participation in specific fields like AI. Despite being a significant portion of health workers and trainees, women hold only a fraction of leadership roles in global health.[6]

Furthermore, women also contribute to nearly half of global publications in AI but are vastly outnumbered by men as sole or co-authors. Women lag behind men in leveraging technology for basic uses, contributing to only 45% of publications worldwide, compared to almost 90% with at least one male co-author. This lack of representation exacerbates gender bias within AI systems, which often reflect and perpetuate existing societal inequalities. [7] [8]

India's gender gap in AI development and implementation is a significant issue. Women face significant disparities in technology access, education, and political representation. For instance, a 30% gap exists between phone ownership between men and women.[7] Political representation is skewed, with less than 7% of ministerial positions held by women. Literacy rates, at 65% for women versus 80% for men, further illustrate the educational disadvantage. This gap continues in higher education, with boys constituting 78% of undergraduate students in prestigious institutions. The tech industry, despite having 36% female representation, witnesses a drastic drop in women as they climb the corporate ladder. Finally, the economic burden is evident in the 30-35% gap in median full-time earnings between genders.[9] [10]

These prevalent gender disparities in India raise concerns about the potential amplification of existing biases through the development and deployment of AI systems.

However, there is a growing body of research and initiatives focused on addressing gender bias in AI and promoting opportunities for women in the field. These include efforts to develop more inclusive datasets, mitigate algorithmic biases, and increase the participation

of women in AI research and industry roles. Despite these efforts, significant challenges persist, necessitating further investigation and action. This scoping revies aims to analyse the impact of gender bias in AI on opportunities for women's empowerment and representation.

Rationale of the Study

Understanding and addressing gender bias in AI is crucial to ensure responsible and equitable technology development. This scoping review aims to contribute to ongoing discussions by critically analysing the existing literature and identifying gaps in addressing this critical challenge.

Objectives

- To identify and categorize common forms of gender bias in AI and its applications.
- To understand how different genders interact with technology, including access, usage patterns, and preferences between genders.
- To summarize existing policies, initiatives, and practices for promoting gender inclusivity in technology.

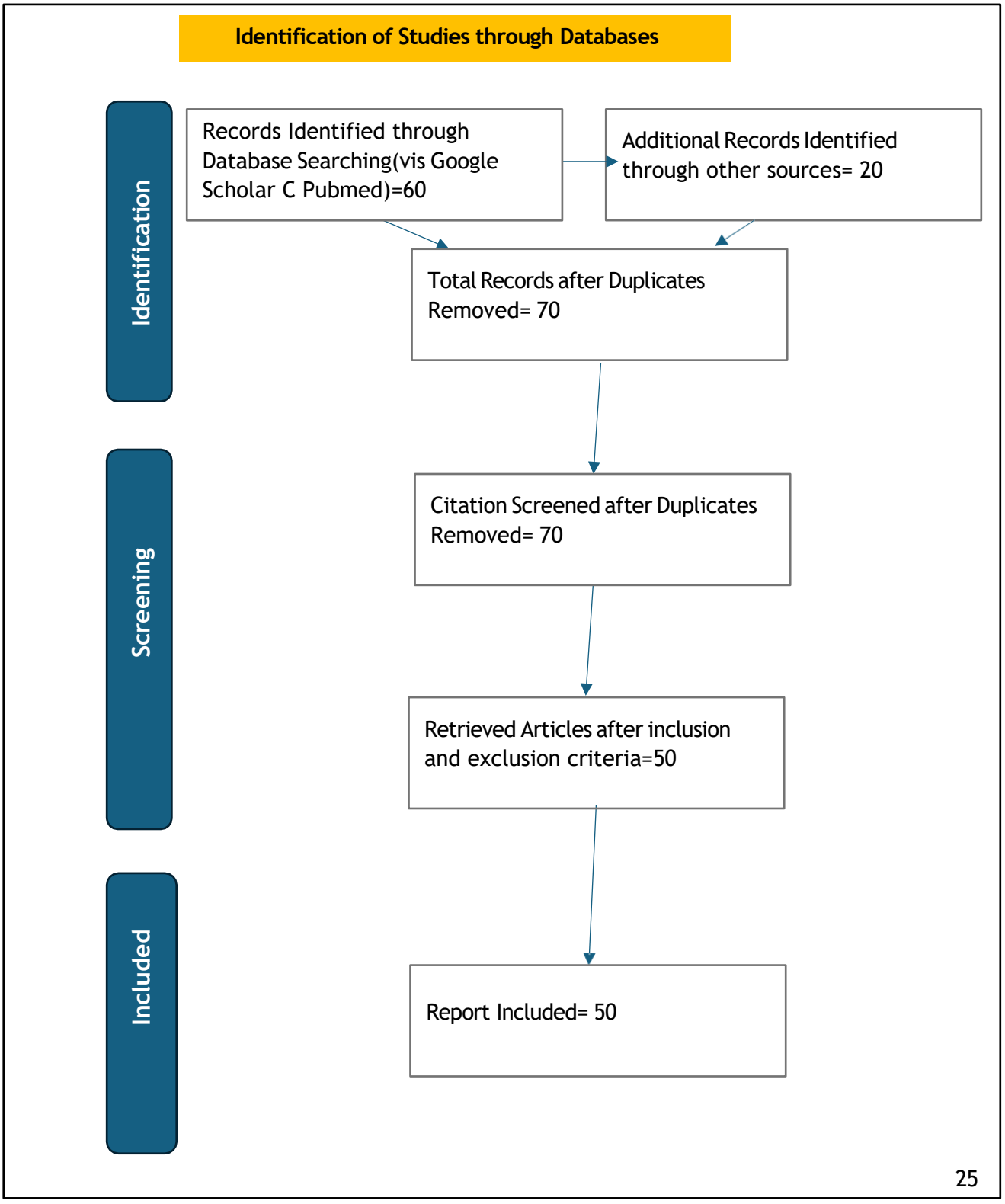
2. METHODOLOGY

S.No.	Method	Description
1.	**Data Collection**	
a)	**Source**	i) PubMed, Google Scholar, Medline open access source was used to gather relevant research articles, conference papers, and reviews related to AI and gender bias in AI. ii) Articles published in non-academic sources (e.g., blogs, news articles, journals, press release) were also considered. iii) List of references of retrieved articles was searched for relevant literature
b)	**Search Terms**	The following search terms related to AI and gender bias was used in various combinations: <u>Terms related to AI and its applications</u>- Artificial Intelligence Machine Learning Algorithm Bias Mobile phone usage patterns Digital gap Facial Recognition STEM Education and workforce development Access to technology Initiatives in Tech Fairness and Bias in Artificial Intelligence <u>Terms related to gender bias</u>-

		Gender Bias and AI Women Empowerment Gender Representation in Technology Gender Stereotypes Women's Rights Gender gap in digital skills Gender Participation in AI Women's Participation in AI Initiatives for Women in Tech Gender Bias in facial recognition Gender Equality or Women **Will be utilizing Boolean operators (AND, OR NOT) to refine the search and ensure relevant results. Additionally, MeSH terms (Medical Subject Headings) specific to Scopus will be explored for further precision.**
2.	**Selection Criteria**	
a)	**Inclusion Criteria**	i) Research articles published in academic journals were reviewed. ii) Articles that directly addressed the impact of gender bias in AI on women's empowerment and representation were selected. iii) Studies employing qualitative, quantitative, or mixed methods research designs were included. iv) Non-academic sources like blogs, news articles, journals was also conducted. v) Published post-1980s.
b)	**Exclusion Criteria**	i) Articles written in languages other than English (unless translations are readily available) were excluded.
3.	**Data Analysis**	**Analysis was done using narrative analysis method:** i) This involves summarizing and organizing the findings from the included studies. ii) Evidence was summarized based on research questions. iii) Tables, figures, and text were used to present key findings and identify any gaps in knowledge.

	Study Duration	The study was conducted for the period of 3 months (Mid-Feb to Mid-May)

3. PRISMA FLOWCHART



4. QUALITATIVE OVERVIEW

The studies (50 in number) are published in various sources ranging from academic journals, industry reports, government publications, and articles from organizations like the National Science Foundation, International Labour Organization, UNESCO, and prominent media outlets such as Business Today and Harvard Business Review.

This overview provides a structured understanding of the focus areas, settings, and sources of studies on gender bias in AI, gender interaction with technology and existing policies, initiatives, and practices for promoting gender inclusivity in technology showcasing the breadth and depth of research in this critical domain.

Domain	Study Focus	Number of Studies	Settings	Publication Source
A) Gender Bias in AI				
Gender Bias in AI		40	India & Global	Research Paper, Newspaper Articles, Blogs, Website, Surveys, Government Sources
Participation and Representation	STEM Workforce	5	India	Research papers, Industry reports
	STEM Education	4	India	Research papers, News articles
Barrier to Entry	Gender roles, stereotypes, work-life balance	5	India	Research papers
Stereotypes	Reinforcement of traditional gender roles through AI systems	5	India & Global	Research papers, News articles, Blogs
Image Recognition	Misidentification of women, bias in AI tools	5	India & Global	Research papers, News articles
Algorithm Fairness	Discriminatory outcomes in loan applications, criminal justice, online advertising	3	India & Global	Research papers, Industry reports

B) Gender Interaction with Technology

Access to Technology	Gender gap in mobile and internet access	5	India	Surveys, National Reports, Industry Reports
Usage Pattern	Differences in technology usage between genders	3	India	Surveys, National Sample Survey Organization
Preferences	Comfort level and preferences in technology usage	5	India	Surveys, Market Research Reports
Gender Stereotypes in Technology Usage	Impact of gender stereotypes and biases in tech usage	3	India	- NSSO
C) Existing policies, initiatives, and practices for promoting gender inclusivity in technology				
Education, Workplace, Community	Gender Inclusivity in Technology	3	India	Research Paper
Education Initiatives for Gender Inclusivity	Beti Bachao Beti Padhao, NMEW	3	India	Government Site,
Workplace Diversity and Gender Inclusivity	POSH Act, WEP	2	India	Government Source, Newspaper Article
Community Driven Digital Literacy	Digital Empowerment Foundation, Digital Sakhi	4	India	Official Sites
Future Technologies and Gender Inclusivity	• Inclusive AI Design by NASSCOM • Job Displacement and Skill Development	6	India	Official Site, News Article

5. RESULTS

A) Gender Bias in AI

This review delves into the identified forms of gender bias within Artificial Intelligence (AI) and its applications, drawing insights from 40 relevant articles, blogs,research papers and industry reports. Our analysis aims to categorize these biases and provide clear definitions with supporting examples to advocate for gender equality in the field of AI.

i) Participation and Representation

a) STEM Workforce

Women in STEM fields make up nearly half of the total workforce, but only represent 26% of the workforce. In 2016, they represented 59% of the workforce, but only 30% at major technology companies globally.

India's technology fields are experiencing significant underrepresentation of women, with NASSCOM indicating that women make up 36% of the tech workforce. However, only 7% of women hold executive positions, with 13% in director roles and 17% in mid-level management.[11]The National Science Foundation's 2019 research shows low girls' participation in computer science courses at the high school level, restricting the pool of women entering tech careers.[12] Despite a six-fold increase in AI talent availability between 2016 and 2022, the rise in female representation within AI roles has been gradual, further highlighting the ongoing disparity in India's tech industry.[13]

b) STEM Education

Despite increasing emphasis on STEM education, women remain underrepresented in the tech sector. Despite initiatives to address underrepresentation, women face difficulties in careers in science and technology. Without more women in technology, 2050 could be the most backward year in a century.[14] Girls are still less likely than boys to have digital skills, with internet access changing among the younger generation. The gender gap and generational gap are more concerning in lower middle-income nations, where 21% of women are online compared to 32% of men and 39% of young people use the internet.[15] Although girls outperform boys in most

STEM subjects at graduate level, the number of young women choosing to study STEM at A levels and at university falls significantly behind that of their male counterparts.[16] Women's participation in the ICT and digital sector is not improving significantly, and women produce interesting research in the AI field.[17] It is important to lead actions to make visible the valuable work of female researchers in different STEM sectors, especially in AI, which is now having an increasing influence in the construction of the new digital society.[18]

ii) Barrier to Entry

Research also shows that India's tech sector faces several barriers to women's representation. These include stereotypes and gender bias, which perpetuate the perception that tech is male-dominated, a lack of female role models in senior leadership positions, and work-life balance challenges. These factors discourage girls from pursuing STEM education and careers in technology. CSIR-National Institute of Science Communication and Policy Research (NIScPR) (2022) and the International Labour Organization (2020) highlight the societal beliefs about gender roles, which discourage girls from pursuing STEM education. Additionally, societal expectations around childcare and household responsibilities create challenges for women in balancing work and personal life.[19]

iii) Stereotypes

Stereotyping involves the reinforcement of traditional gender roles and attributes through AI systems, which can perpetuate societal biases.

AI can perpetuate harmful stereotypes by reflecting the biases present in training data. For instance, research by Harvard Business Review highlights gender bias in NLP systems like Alexa and Siri. These systems often associate "man" with "doctor" and "woman" with "nurse," reinforcing outdated gender roles.

Examples:

a) **Virtual Assistants:** AI virtual assistants like Siri and Alexa often have female voices and are programmed to perform tasks that align with traditional female roles, such as setting reminders or playing music. Research indicates this design choice reinforces the stereotype of women as submissive and service oriented.[20]

b) **Job Recommendations:** AI-powered job recommendation systems might favor men for leadership roles and women for administrative positions.[21]

c) **Chat Bots:** Chatbots perpetuating gender stereotypes through their language and responses.[22]

d) **Language Models:** AI-powered language models often exhibit bias in word association, favoring masculine terms for leadership roles and feminine terms for domestic tasks.

iv) Image Recognition

Image recognition bias occurs when AI systems disproportionately misidentify or fail to recognize images of women compared to men.

Examples:

a) **Facial Recognition System:** Studies have shown that facial recognition systems have higher error rates for women, particularly women of color. One study found that error rates for identifying darker-skinned women were up to 34.7%, compared to 0.8% for lighter-skinned men.[23]Google's AI tool Gemini, which generates images, faced criticism for biased outputs. It produced images of Blackfounding fathers and same-sex couples for generic prompts. Google stopped users from generating human images with Gemini and admitted it needs improvement to ensure diverse and accurate portrayals. This highlights the challenge of avoiding bias in AI, as these tools can reflect prejudices found in their training data.[24]

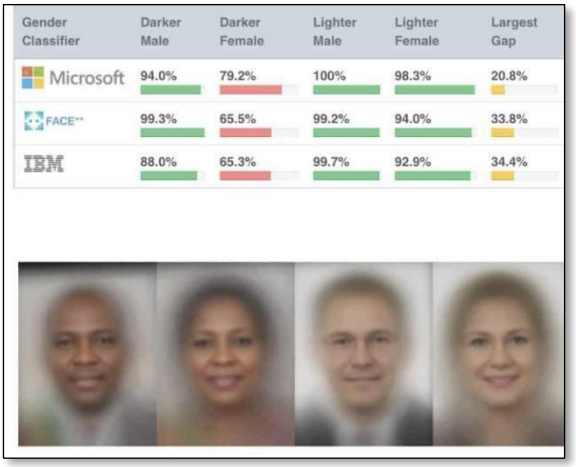


Image 1- Gender Bias in Facial Recognition System
(Fighting algorithmic bias in artificial intelligence – [Internet]. Physics World. 2021)

b) Photo Tagging Algorithms: Algorithms used in social media platforms for tagging photos often misclassify women or fail to recognize them entirely, reflecting a bias in the training data. [26]

v) Algorithm Fairness

AI algorithms are not inherently unbiased and can perpetuate historical biases present in the data they are trained on. This can lead to discriminatory outcomes, such as loan denials or biased job recommendations. Research by IPI Global Observatory underscores the importance of scrutinizing algorithms for fairness to ensure they don't disadvantage women.[27]

Domain	Potential Bias	Impact
Loan Applications	Algorithmic bias against female entrepreneurs	Difficulty obtaining funding for businesses
Criminal Justice System	Facial recognition software misidentifying women	Unjust incarceration or harsher sentencing
Online Advertising	Targeting based on gender stereotypes	Limited career opportunities or exposure to relevant information

Table 1- Potential Impact of Algorithmic Bias on Women
(September 29. HeForShe summit discusses gender bias in AI and how to encourage male feminist allies [Internet]. UN Women – Headquarters.)

B) Gender Interaction with Technology

i) Access to Technology

Technology significantly impacts individuals and societies, but its interactions with different genders vary. India's digital landscape is characterized by a significant gender gap in technology focusing on access, usage and biases in design and development.

A significant gender gap exists in internet access across India.

The India Internet Report 2023 highlights a persistent digital divide in India[28], with women having lower access to and utilization of the internet compared to men often due to economic limitations, social norms, and lack of digital literacy training.

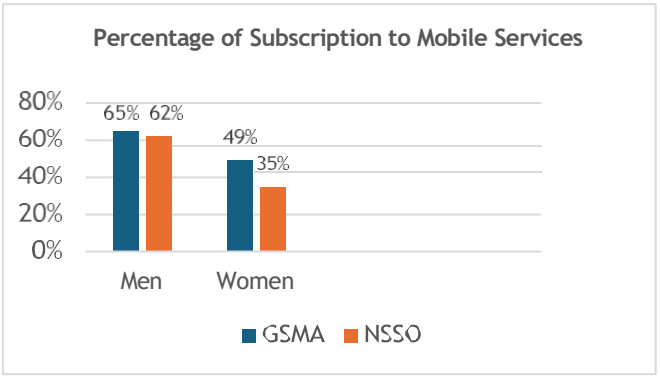


Figure 1- Subscription to Mobile Services
(BestMediaInfo Bureau. 759 million Indians active internet users, to reach 900 million by 2025: IAMAI-Kantar report [Internet]. BMI. 2023)

According to GSMA's "The Mobile Economy India 2023" in 2022, 65% of men compared to 49% of women in India subscribed to mobile services.[29] Similar to mobile access, a gender gap exists in internet usage. GSMA's "The State of Mobile Internet Connectivity Report 2023" reveals that as of 2022, 62% of men compared to 35% of women in India used mobile internet.[30]

The National Sample Survey Organization (NSSO) research in 2018 suggests differences in how men and women use technology, with men using it for entertainment, information seeking, and communication, and women more likely for education, online payments, and accessing government services. Gender stereotypes also influence

technology use, with women being less likely to engage in fields like coding and gaming due to societal perceptions linking these areas to masculinity.[31]

ii) Usage Patterns

Usage patterns also showed distinct differences between genders. Males reported spending more time on average using technology for both work and leisure. Studies reveal differences in how men and women use the internet in India.

Activity	Male (%)	Female (%)
Work-Related Tasks	60	50
Social media	20	30
Entertainment	15	10
Education and Learning	5	10

Table 2- Internet Usage patterns of different gender (Gsma.com).

iii) Preferences

Research suggests a growing comfort level with technology among Indian women, particularly in urban areas.

A study by GSMA Intelligence (2020) found that women increasingly prefer mobile phones for internet access due to their affordability and portability.

However, a lack of digital literacy and awareness can limit women's ability to fully utilize the potential of technology.[32]

Activity	Male	Female
Work-Related Tasks	High	Moderate
Social media	High	High
Entertainment	Moderate	Moderate
Education and Learning	Low	Moderate
Communication Tools	Moderate	High
E-Commerce	High	Low

Table 3- Gender Differences in Internet Usage Patterns (India)
(Gsma.com).

Aspect	Male	Female
Access	Higher	Lower
Usage Patterns	More time online, focus on education, job search, e-commerce	Less time online, focus on communication, social media
Preferences	Technical functionalities, gaming, finance, technology news	User-friendly interfaces, communication, social interaction

Table 4- Summary of Gender Differences in Technology Interaction
(Gsma.com).

C) Existing policies, initiatives, and practices for promoting gender inclusivity in technology

This scoping review examines gender inclusivity in technology, focusing on effective policies and AI implications, highlighting the potential for technology to equalize, but also highlights historical biases and underrepresentation of diverse voices.

India, with its diverse population and rapidly growing technology sector, faces unique challenges in ensuring gender inclusivity in the field. This review aims to explore 15 existing studies focusing on effective policies, initiatives, and practices within the Indian context, while also examining the future implications of emerging technologies on gender inclusivity.

Some of the effective policies and initiatives in India are:

i) Education

a. Beti Bachao Beti Padhao (Save the girl child and educate the girl child) initiative has aimed to increase girls' enrolment in primary and secondary education, leading to a notable rise in female participation in higher education.

b. National Mission for Education for Women (NMEW) provides scholarships and other support programs to promote access to quality education for women in STEM fields.

c. Skill India Mission: The Skill India Mission, launched in 2015, aims to address India's skill gap and improve youth employability. It focuses on empowering women through skill development, recognizing that increased women's participation in the workforce can boost the economy. The mission provides market-relevant skills, encourages women to take non-traditional roles, and establishes Industrial Training Institutes (ITIs) exclusively for women, with over 15,042 ITIs across India.[33]

ii) Workplace Diversity

a. **The Sexual Harassment of Women at Workplace (Prevention, Prohibition and Redressal) Act, 2013:** The POSH Act, 2013, in India, aims to prevent and address sexual harassment of women in the workplace by establishing a complaint redressal framework and ensuring a safe and respectful work environment and address gender-based discrimination.

b. **Schemes like the "WEP" (Women Entrepreneurship Platform) by NITI Aayog** offer financial and infrastructural support to women entrepreneurs, encouraging their participation in the tech sector.[34]

iii) Community Driven Initiatives

a. Organizations like "Digital Empowerment Foundation" and "India STEM Foundation" focus on providing digital literacy training and resources to women and girls, bridging the digital divide.[35] [36]

b. Digital Sakhi: This initiative by the Ministry of Electronics and Information Technology (MeitY) trains women in rural areas on digital literacy and entrepreneurship, aiming to bridge the digital gender divide.[37] [38]

c. Women in Tech India: This global movement works to close the gender gap and empower women in tech through education, entrepreneurship, and community building.[39]

iv) Future technologies and gender inclusivity

The rise of emerging technologies like Artificial Intelligence (AI) brings both opportunities and challenges for gender inclusivity. AI algorithms can perpetuate existing biases if not developed with a diverse and inclusive lens.[40]

While AI holds immense potential, concerns exist about its potential to perpetuate gender biases present in training data and algorithms. Studies by the National

Association of Software and Service Companies (NASSCOM) the need for inclusive AI design principles and promoting ethical development practices.[41]

With the rise of automation, robotics, and the Internet of Things (IoT) raises concerns about potential job displacement for women in sectors with high automation. However, there's also an opportunity for skill development and upskilling women to participate in the development and deployment of these technologies, ensuring equal access and representation[42].

India's efforts to promote gender inclusivity in technology face challenges, involving collaboration between government, industry, academia, and civil society to address gaps and create a truly inclusive tech ecosystem.

6. DISCUSSION

The impact of gender bias in Artificial Intelligence (AI) and its applications has become a critical area of study, given the increasing reliance on AI across various sectors. This chapter discusses the findings of a scoping review on gender bias in AI, comparing and contrasting them with previous studies. The objectives of the research were to identify common forms of gender bias in AI, understand gender interactions with technology, and summarize policies and initiatives promoting gender inclusivity in technology.

Gender Bias in AI

The review identified several common forms of gender bias in AI, including biased data, algorithmic discrimination, and gendered representations in AI applications. Biased data often stems from historical and societal biases that are ingrained in the datasets used to train AI models. For instance, Bolukbasi et al. (2016)[43] demonstrated that word embedding models trained on large text corpora exhibit gender stereotypes, associating men with professions like "doctor" and women with "nurse". This aligns with findings by Mehrabi et al. (2021)[44], who noted that AI systems trained on biased data perpetuate and even amplify these biases.

Algorithmic discrimination occurs when the decision-making processes of AI systems disproportionately affect one gender over another. A notable example is Amazon's recruitment algorithm, which was found to downgrade resumes that included words typically associated with women, such as "women's chess club captain". Similarly, research by Buolamwini and Gebru (2018)[45] highlighted that facial recognition systems exhibit higher error rates for women and people of color compared to white men, raising concerns about the fairness and equity of these technologies.

Gender Interactions with Technology

Understanding how different genders interact with technology reveals disparities in access, usage patterns, and preferences. The digital divide remains a

significant issue, with women in many parts of the world having less access to digital technologies compared to men. According to a report by the International Telecommunication Union (ITU)[46], the global internet user gender gap stood at 17% in 2019, with the gap being more pronounced in developing countries.

This gap affects women's ability to leverage digital tools and resources, hindering their participation in the digital economy.

In terms of usage patterns, studies have shown that men and women use technology differently, influenced by social and cultural factors. For example, a study by Pew Research Center[47] found that women are more likely to use social media platforms for communication and networking, while men are more inclined towards using technology for information and entertainment.

These differences necessitate the design of gender-sensitive technologies that cater to diverse needs and preferences.

Policies, Initiatives, and Practices for Gender Inclusivity

The review also summarized existing policies, initiatives, and practices aimed at promoting gender inclusivity in technology. Various organizations and governments have implemented measures to address gender bias in AI and technology. For instance, the European Commission's Horizon 2020 program includes specific actions to integrate gender perspectives into research and innovation processes. Additionally, initiatives like the Women in AI (WAI)[48] network work towards increasing the representation and participation of women in AI through mentorship, advocacy, and education.

Corporate practices also play a crucial role in promoting gender inclusivity. Companies like Google and IBM have established diversity and inclusion programs that focus on recruiting, retaining, and advancing women in tech roles.

These programs often include bias training, mentorship opportunities, and policies aimed at creating an inclusive workplace culture.

Comparison with Previous Studies

The findings of this research are consistent with previous studies that highlight the pervasive nature of gender bias in AI. For instance, the work of West et al. (2019) corroborates the presence of gender biases in AI applications, emphasizing the need for systemic changes in the way AI systems are designed and deployed. Furthermore, the recognition of differential access and usage patterns aligns with earlier research by the World Wide Web Foundation[49], which reported significant gender gaps in digital access and skills.

However, this review extends the discourse by providing a comprehensive framework for addressing gender bias in AI, emphasizing the importance of intersectional approaches that consider other forms of discrimination, such as race. This is crucial for developing holistic solutions that promote gender inclusivity in AI and technology.

7. LIMITATIONS OF THE STUDY

A scoping review is a comprehensive study that provides an overview of existing research on gender bias in AI and its impact on women's empowerment and representation. However, it has limitations such as a broad scope, limited analysis of individual studies, and lack of intersectionality. The review could explore gender bias in sectors like healthcare, finance, and governance, examining its intersection with other forms of discrimination and the role of social and cultural factors. More research is needed to understand the specific problems faced by marginalized communities, particularly women from rural and LGBTQ+ areas, in the tech sector.

8. CONCLUSION

This scoping review has shed light on the concerning issue of gender bias in Artificial Intelligence (AI) and its applications. The analysis identified prevalent forms of bias, including skewed data sets, algorithmic discrimination, and gendered representations within AI systems. These biases can have significant ramifications, perpetuating existing societal inequalities and limiting opportunities for women.

The review also explored the interaction between genders and technology, highlighting the digital divide that disproportionately affects women's access and utilization of technology. Understanding these different usage patterns is crucial for designing inclusive AI systems that cater to diverse needs and preferences.

Furthermore, the study examined existing policies, initiatives, and practices aimed at promoting gender inclusivity in technology. These efforts by governments, organizations, and corporations offer a glimmer of hope in addressing the gender gap in AI and related fields. However, there's a need for continuous evaluation and improvement of these initiatives to ensure their effectiveness.

In moving forward, a crucial takeaway from this review is the importance of adopting intersectional approaches that acknowledge the interplay of gender with other forms of discrimination. By fostering collaboration between stakeholders and implementing inclusive design principles, we can work towards developing a more equitable and representative AI landscape. This will not only empower women but also ensure that AI serves as a tool for progress, benefiting all members of society.

9. ETHICAL CONSIDERATION

The study was presented before the Students Ethics Board of International Institute of Health Management Research, Delhi. The student's ethics board approved the study as this is a public deidentified freely available data in the public domain exempted from ethical issues.

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