

# Credibility of **Women-led STEM** Startups Among Indian Masses

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# CONTENTS

Abstract	1
Aim, Hypothesis & Research Questions	2
Introduction	3
Methodology	5
Literature Review	7
Are women-led startups credible among Indian Masses	11
• Analysis of Research Survey	
• Gender Disparities in STEM Education	
• Government & Private Initiatives	
The Way Forward	17
Conclusion	18
References	20



## ABSTRACT

According to the AISHE Report 2020–21, the share of women in STEM-related jobs is 14%. While women constitute 43% of STEM enrollments in education, this number drops significantly to 3% in science Ph.D. programs and 6% in engineering and technology Ph.D. programs. This study delves into the influence of socio-structural factors on women's participation in business leadership within science and technology. Focusing on entrepreneurship and STEM fields, particularly regarding women, it examines how societal perceptions and structural barriers impede women's career choices.

This paper concludes by analyzing the various schemes and opportunities that are made available by the government to transcend structural restraints and further suggesting changes to make them more relevant or effective according to prevalent needs.

## KEY WORDS:

Gender role expectations, societal cultural dimensions, and the entrepreneurial environment.

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## AIM

To analyse the acceptability and credibility of women-led sci-tech startups among the masses and its structural causes.

## HYPOTHESIS

Startups in Science and technology led by women hold less credibility among the masses.

## RESEARCH QUESTIONS

- Do women in STEM pursuing entrepreneurship face an additional barrier due to the general socialization among the masses?
- What are the Policies introduced by the government of India for Women in science and technology and how far are they successful?
- What are the reasons for the low growth of the science and technology startups by women in this sector?
- To what extent do gender role expectations, societal cultural dimensions, and policies in the entrepreneurial environment impact that?

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## INTRODUCTION

Today's fast-paced world has two significant features etched in it: the fever of growing entrepreneurship and the ever-growing technology sector, with a market brimming with new gadgets, AI devices, and innovations. The choices made by the youth from both "developed" and "developing" regions indicate their influx in these sectors. Not only are they choosing STEM (Science, technology, engineering, and Medicine) subjects at secondary and graduate levels, but also careers in science and technology (Kuschel, Katherina & Ettl, Kerstin & Díaz-García, Maria & Alsos, Gry. 2020.)

However, when doing an analysis of the demography choosing these subjects and career paths, an interesting observation comes to light. It is the popular belief that "science and technology" are something that men are "naturally" talented in, and women, on the other hand, are more interested in "non-mathematical" subjects or in the humanities.

It has been argued that subjects involving a scientific temperament are traditionally linked with reason, and if we go by the historical trajectory, females have been associated with the "ethics of care" while males are associated with being more "rational" and "objective" in their temperament. There have been a few scholars who also argue that these societal perspectives get further solidified and perpetuated by the gender roles and expectations into which they are conditioned.

The aim of this paper is to identify how women with a STEM background employed in the field of entrepreneurship are affected by these popular perceptions. There have been studies that support the fact that women entrepreneurs could be seen as desirable given the emotional quotient that they bring with them, which is perceived to be lacking in the overarching objective view of men. However, this is only appreciated when they take up these leadership roles in traditionally indoctrinated jobs or sectors, for example, food and fashion. This paper tries to examine if women pursuing entrepreneurship in the

STEM field further creates an additional layer of a barrier for them and how acceptable people in general are to this role, which goes against their intuition conditioned under these entrenched patriarchal structures.

Entrepreneurs play a key role in any economy. These are the people who have the skills and the initiative to take some new ideas to market or provide a service and make the right decisions to make their ideas profitable. Technology and science are desperately needed in our world, but women, who make up half of the world's talent, are left out of experimenting with them. Women play an integral part in the growth of nations and the productivity of companies, so such a large potential workforce cannot be ignored. Between 40 million to 160 million women will need to transition between occupations by 2030, often into more skilled roles requiring more complex digital, cognitive, social, and emotional skills. More girls are in school today than ever before, but they do not always have the same opportunities as boys to complete and benefit from an education of their choice.

They are particularly underrepresented in STEM education (science, technology, engineering, and mathematics), and consequently, in STEM careers. This gender disparity is alarming, especially as STEM careers are often referred to as the jobs of the future, driving innovation, social well-being, inclusive growth, and sustainable development. Encouraging the learning of STEM education empowers girls to cultivate a mindset of innovation, while simultaneously enhancing their proficiency in literacy and numeracy. Furthermore, it enhances their ability to develop transferable skills that will enable them to thrive in a rapidly changing job market and entrepreneurial endeavours. In order to make half of the world's workforce ready as potential human resources in an upcoming tech-savvy society, revolutionary changes at the policy and the social level in terms of enabling ecosystems and mentality respectively are required. Following that, the paper discusses various policy interventions made to maximize the potential of the entrepreneurial sector

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## METHODOLOGY

The paper uses secondary research in the form of a literature review of works focussing on the entrepreneurial sector for women and is supplemented with the primary data collated from the questionnaire circulated. This paper employs an inductive approach to draw some generalized analytical conclusions on the environment of women entrepreneurship in STEM in India. The secondary data was collected from sources such as National and International Journals by UNICEF, published reports by the World Bank, Reserve Bank of India, NITI Ayog, National newspapers, and reports by various entities (Government and non-governmental). In this research, the content analysis of the pre-existing data of various articles, reports of various institutions, and books is used to bring forth useful and appropriate information. In terms of academic valuation, the research provides analytical analysis, based on the primary survey conducted, of structural causes for the credibility issue for women-led science and technology startups among the masses.

The Questionnaire used for Primary data collection contains the following questions:

- **Name of the respondent**
- **Name of the institute of the respondent**



- Did you like Maths in High school?
- Who comes to your mind when you hear words like "Entrepreneur" or "Startup"
- Did you ever wish to be an entrepreneur yourself? (Yes or No)

### Case Study

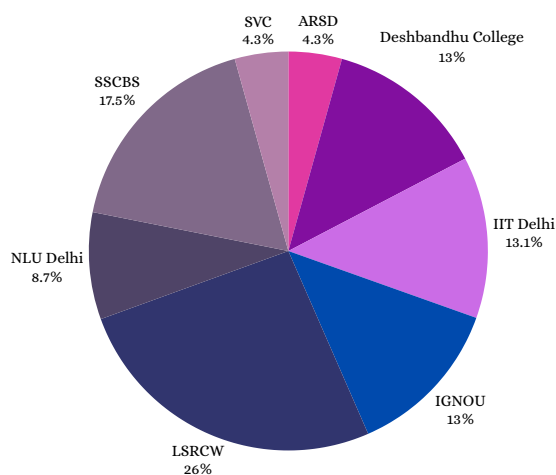
- A is a woman in her 40s who made an AI device but previously she had a break in her career for some years, and this is her possible comeback with this device.
- B is a man in his 20s, in the early years of his career and he also comes up with an AI device more or less similar to the one made by A.

### Hypothetical Situation:

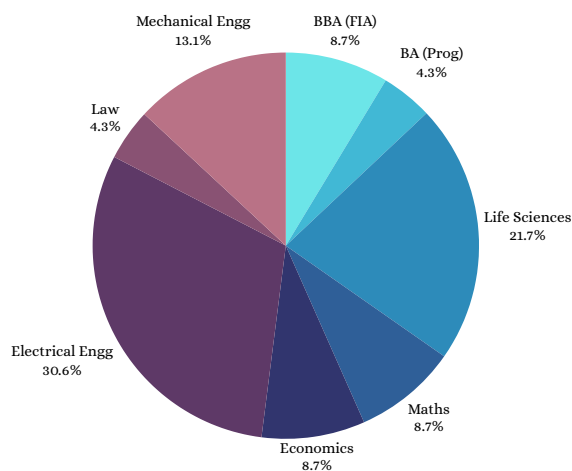
If you were to buy one of the AI devices, which one would you prefer?  
(Made by A or B)

- Rate the credibility of A's device (On a scale of one to five)
- Rate the credibility of B's device (On a scale of one to five)
- Name 3 entrepreneurs in the STEM field that you admire.
- Do you believe that gender inclusivity is a concern in the STEM entrepreneurial ecosystem?
- If yes, what could be the concerns? (Yes or no)

### Respondent Profile



*Institution*



*Stream*

## LITERATURE REVIEW

Women constitute close to half of the nation's workforce and they account for 57% of the nation's college graduates. Still, women are under-represented in the STEM industries.<sup>1</sup> In India 20.37% of women are MSME owners which accounts for 23.3% of the labour force.<sup>2</sup> STEM includes the Science stream (including Mathematics) and the Engineering and technology stream. The Enrolment in STEM (at U.G., P.G., M.Phil. and Phd. levels) is 94,69,022 out of which 53,74,237 (56.8%) are males and 40,94,785 (43.2%) females, according to 2020-2021 report of the All India Survey on Higher Education (AISHE).

They are considered to be the backbone of the economy. According to McKinsey Global, India can potentially add US\$ 700 billion to the global GDP by increasing women's participation in the labour force. India produces the highest number of graduates in Health and STEM but their education does not translate into employability.

According to (AISHE) 2020-21 report, out of 43% of the total STEM enrollments of women in the country, only 3% of women enrol in a PhD in science and 6% opt for a PhD in Engineering and Technology. Furthermore, their share in STEM jobs in India is just 14%. This is in line with NASSCOM (The National Association of Software and Service Companies) findings earlier this year, which showed that there is just a 36% female workforce in the Indian tech ecosystem i.e. 1.8 million women. While data (UGC annual report 2016-2017) shows that enrollment of women in science and technology disciplines has grown with time the number of women earning doctorate degrees in different fields of science and technology is growing every year, and there are fewer women scientists entering the workforce.<sup>4</sup> Women own only 20% of all enterprises in India. 82% of these women-led enterprises are micro units, run as sole proprietorships, while most are concentrated in the informal sector. About 6.36 million enterprises of the total 8.05 million are in livestock, manufacturing, and retail trade.

Studies suggest that available data overrepresents true entrepreneurship among women—10% to 30% of enterprises registered as women-owned are often not run by women. In terms of technology-based startups also categorized under MSMEs, an RBI survey of 1,246 startups finds that 5.9 per cent of the participating startups were founded by only females in comparison to 55.5 per cent founded by only male founders. The paper delves into assessing various factors behind the gender gap in science and biases like education as a family decision, economic factors, gender stereotypes, gender roles, conformity to social expectations, male-dominated environment, and lack of role models. The lack of role models continues to become an obstacle in shaping the career choices of girls away from STEM.

Sociological and social-psychological research on the gender gap focuses on explanations based on widely shared gender beliefs and stereotypes that have implications for housework and child-rearing, math, and science ability, occupational selection, and career trajectories.

In our society, both boys and girls perceive occupations in a sex-stereotyped fashion. According to cognitive development theorists, after the 'sex assignment' that occurs after birth, the next major event of sex-typed development occurs at the age of two or three years when the child develops self-categorization as a girl or as a boy. Freud's theory of psychosexual development could be helpful in understanding how issues in childhood development can affect adult lives. Ultimately, it's a way to help us become more conscious of the way we parent and raise our children, along with giving us insight as to how and why we act the way we do. A girl's self-concept is not what she is or she 'should' be, but what society wants her to be. Attachment of the homemaker role and the institution of marriage with girls also shape their career choices.

When it comes to psychoanalytical barriers to women's growth in an entrepreneurial environment, biological differences in abilities and interests are emphasized. Thus, it made it appear natural for men to excel in tech-led endeavors and the opposite for women.

According to a report from the American Association of American Women commissioned by the National Science Foundation, it is noted that there is nothing at all natural about the STEM gender disparity.<sup>9</sup> Instead, the report said, the disparity has much to do with culture and learning environments and how our society cultivates interests and abilities. Taking policy initiatives for promoting women entrepreneurship in India into consideration, various schemes have been initiated by the Government. 'Startup India initiative' 2016 for nurturing India's startup culture. The Women Scientist Scheme (WOS) was launched in 2002, and the 'Knowledge Involvement in Research Advancement through Nurturing (KIRAN)' Scheme 2014 addresses the challenges faced by women in the startup sector due to various reasons. Various such schemes are working for similar causes. The Vigyan Jyoti program, launched in December 2019, seeks to sharpen young girls' interest in science and move toward careers in the discipline. Initiatives like women's technology parks, fellowship programs, and trends in investment in women's component plans, amongst others, are analysed to track the impact of these initiatives in bringing change to the ground.

Looking forward to Global Best Practices for Women in STEM, The African Girls Can CODE8 Initiative is a four-year initiative with the goal of empowering young African girls and women between the ages of 17 and 20 to work as programmers, designers, and innovators creating computers and encouraging more girls and young women to pursue studies and careers in the ICT field industry, Germany's Girls day Initiative where businesses and organizations open their doors to female students so they can complete a one-day internship in a STEM field. Indus Entrepreneurs (TiE's) Special Interest Group for Women



Entrepreneurs (SIGW) identify and bring to the fore women founders in niche areas. TiE Delhi-NCR, in collaboration with Power2SME and with the Biotechnology Industry Research Assistance Council (BIRAC), recognizes women who are working towards developing innovative products and businesses by providing them with the Spirit of Manufacturing Award.

The Women Entrepreneurship and Empowerment (WEE) Foundation is leveraging India's STEM education ecosystem to assist its pool of women founders. It is leveraging the support and infrastructure of premier technology institutes in India to implement its programs on a large scale for a huge mass of women founders. These institutes offer classroom facilities, mentoring faculty, and incubation centres for prototyping to support founders. The problem of stagnated women's entrepreneurship could not be resolved through isolated approaches. The adoption of an ecosystem-based approach by governments to support female entrepreneurship is necessary. According to the 2022 report by NITI Ayog six critical needs are identified for building an enabling ecosystem for women in the Entrepreneurial sector

- a)** Entrepreneurship promotion, which includes creating awareness and knowledge of different entrepreneurship opportunities
- b)** Easy and affordable access to finance
- c)** Training and skilling in technical and business skills
- d)** Mentoring and networking from industry experts to guide and incubate budding entrepreneurs and peer networking;
- e)** Market linkages with domestic and global markets and;
- f)** Access to business, legal, digital, and other higher support services for better efficiency and productivity.

The Indian Government must pay particular attention to ensure female entrepreneurs can equally access the benefits of “all entrepreneurship support schemes” against only those that specifically target women. Entrepreneurship promotion using public resources needs a fundamental transformation, from a set of



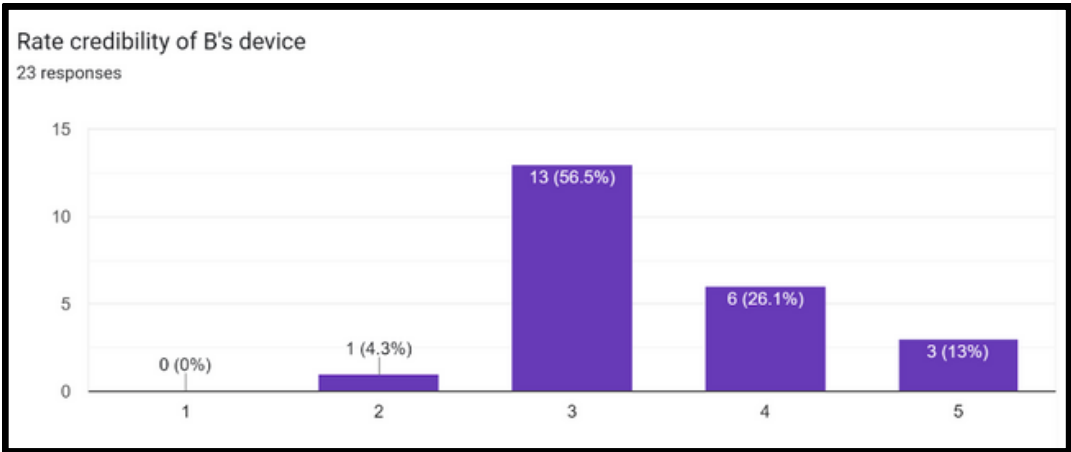
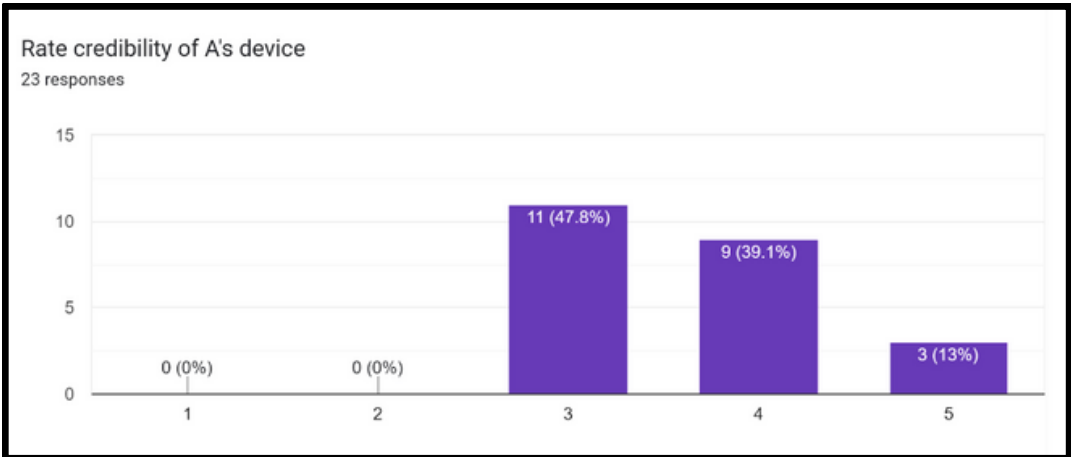
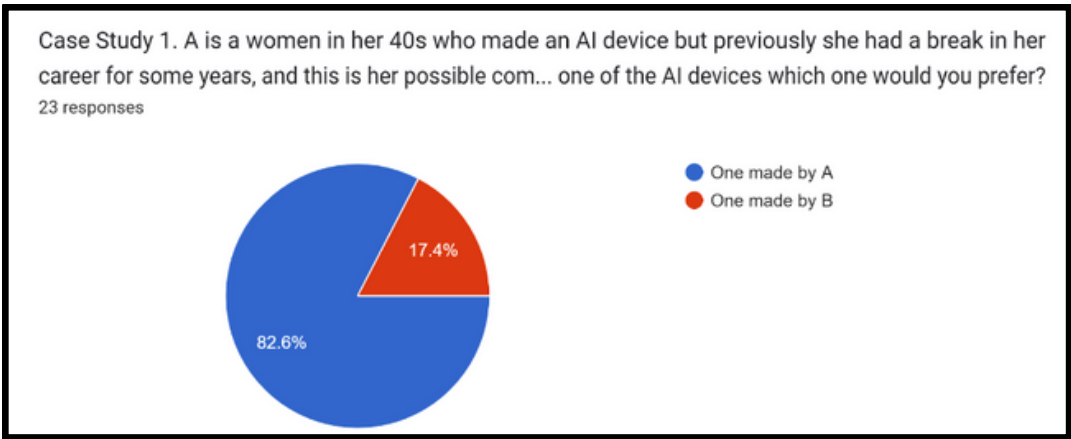
fragmented schemes to an integrated system that can provide a continuum of outcome-oriented support across the six ecosystem needs. To complement these efforts, a societal mindset revolution is also needed to ensure true equity.

## ARE WOMEN-LED STARTUPS CREDIBLE AMONG INDIAN MASSES?

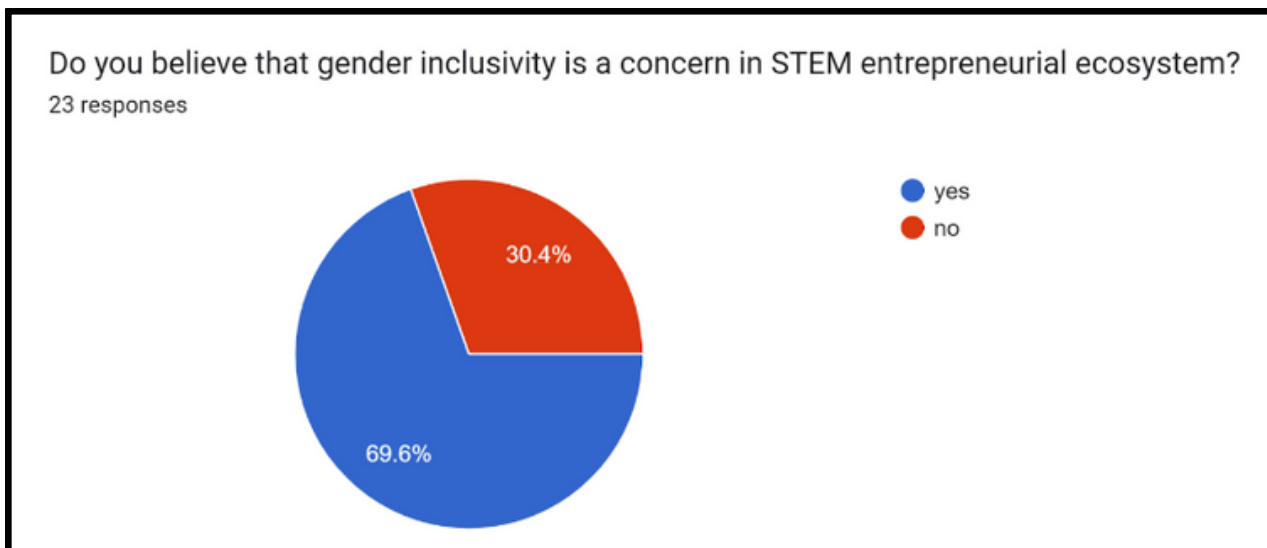
### 1. ANALYTICAL INFERENCES FROM THE RESEARCH SURVEY

In order to assess the mood of the millennials and Gen Zs towards the idea of women entrepreneurship in STEM, a survey has been conducted among undergraduate students enrolled in various tech/non-tech related fields of IIT Delhi, and Delhi University respectively. An inductive approach has been applied to the paper to come out with certain generalised analytical conclusions based on the observation of the responses recorded.

Out of all the people we surveyed asked about their preferences to take up entrepreneurship as a profession in their career there were mixed responses that we got from both males and females about not choosing it as a career prospect in the later part of their life. However, there was a significant difference between the reasons associated with such choices. One respondent wrote that “she doesn’t feel like she is tech-friendly and often asks her older brother to help her with any tech-related tasks”. Another respondent wrote that devices made by women are less credible, hence, the choice.



Another important observation was that most of the people who agreed and were of the opinion that there is no need for gender inclusivity in the STEM entrepreneurial ecosystem were males. This observation could be helpful in analysing the role of socialisation in a patriarchal society on people and how the benefactors from this structure may not even realise the problems faced by women or could downplay their problems as insignificant matters.



## 2. GENDER DISPARITIES IN STEM EDUCATION

Women fall out of science, technology, engineering, and mathematics (STEM) areas for a variety of reasons- explicitly and implicitly some of these are as follows:

- ***Accessibility to Education***

Educational decisions in our country are generally family decisions and not individual choices, as education involves an investment of collective family resources with collective impacts. Decisions are primarily based on the projected impact on the collective family welfare. For a daughter's education involves family resources, status, and marriage considerations and these become too important to leave choices in the hands of individual students. Family and social consequences become more significant in the case of a girl child rather than her interest and will.

The social attitude towards the education of girls is generally not positive. Education for girls is considered unimportant. On the one hand, the girls are not prepared (socially) to join further education or training and on the other hand, there are institutions and facilities available to them. At places where the institutions or training facilities for girls are available, the courses offered to girls are traditional and lack market value.

- ***Economic Factors***

Economic factors play a major role in academic decisions and are major constraints for women in pursuing science. Even for families with greater resources, economic considerations affect the pursuit of a science degree as a science or engineering degree is generally a more expensive option than an arts or a commerce degree.

- ***Gender Stereotypes: Role Expectations***

Gendered family responsibilities and emphasis on homely traits for daughters make the situation less favourable to study science. Family life in Indian culture is patriarchal, with gender roles differentiated and women taking care of all household responsibilities. Individual women's goals and interests get merged for collective family welfare and the smooth functioning of household activities. In fact, she is taught from the beginning that her career is of secondary importance

and her first priority is to look after her home. The occupational preference of women for 'typical' women's fields suggests two motives operating: Firstly, girls think of marriage and societal approval before they plan for a career. Secondly, women are highly motivated to avoid success. They perhaps feel secure if they opt for more traditional occupations than for non-traditional ones. It is generally believed that the more successful a man is in his job, he will make a desirable husband, the more successful a woman is, the more most people are afraid she may not be a successful wife.

- ***Male-Dominated Environment***

In STEM fields, women are among the most visible minorities. The male-dominated social context of science and engineering is a major constraint on women's participation. While more women are pursuing STEM fields, in general girls feel uncomfortable in a male-dominated environment. This further transcends into less number of women opting for a job/ career in a predominantly male environment.

- ***Lack of Role Models***

It is much easier for girls to pursue science and imagine a career there when they see more successful women examples. The lack of role models continues to hinder the career choices of girls away from STEM subjects.

The above factors show clearly that women's career orientations and career motivations are different from those of men and are based on their indoctrinated needs, aspirations, and attitudes toward careers and marriage. In fact, the career patterns of women are determined by their cultural and educational backgrounds.

### **3. GOVERNMENT & PRIVATE INITIATIVES**

The support and initiatives by both governments and private organizations play a crucial role in empowering and promoting women's entrepreneurship in India. These efforts aim to address the challenges faced by women entrepreneurs and provide them with the necessary resources, mentorship, and opportunities for growth.

- ***Government Schemes***

The Indian government has launched various programs and policies to support women entrepreneurs. Initiatives like Stand-Up India, Women Entrepreneurship Platform, MUDRA Yojana, and Atal Innovation Mission provide financial assistance, collateral-free loans, skill development training, and mentoring support to women entrepreneurs (Ministry of MSME, 2021; Department of Financial Services, 2021).

#### **WOMEN ENTREPRENEURSHIP PLATFORM**

This is a flagship platform started by NITI Aayog to promote women's entrepreneurship. As an aggregator platform, WEP hosts information and services relevant to women entrepreneurs. WEP enables key



partnerships to bring crucial content, workshops, campaigns, and other avenues of learning and growth to its users from trailblazers in the industry. Through its partnerships, services are provided in 6 main focus areas:

- Funding
- Incubation and Acceleration
- Mentoring and Networking
- Market Linkages
- Business Development Service
- Research and Innovation

### **PRADHAN MANTRI MUDRA YOJANA**

Even though the scheme was started to help anyone looking to set up a micro/small enterprise get an institutional credit of up to Rs. 10 lakhs (US\$ 13,240). The government has launched a special loan program for women entrepreneurs under the Pradhan Mantri Mudra Yojana scheme, known as the Mudra Yojana Loan Scheme or Mahila Udyami Yojana. This initiative offers women entrepreneurs approximately Rs 10 lakh loans, free from collateral requirements and featuring low-interest rates with flexible repayment tenures.

- ***Incubation Centres and Skill Development***

Governments and private organisations have established incubation centres and skill development programs specifically for women entrepreneurs. These centres provide access to infrastructure, networking opportunities, training programs, and mentoring to help women develop their entrepreneurial skills and scale their businesses.

- ***Women Entrepreneurship Cells***

Several educational institutions and organizations have set up Women Entrepreneurship Cells (WECs) to promote and support women entrepreneurs. These cells provide guidance, mentorship, networking platforms, and business development support to aspiring and existing women entrepreneurs.

- ***Financial Institutions & Venture Capitalism***

Financial institutions and venture capital firms are increasingly recognising the potential of women entrepreneurs in India. They are launching specialized funds and programs to provide financial support, investment opportunities, and market access for women-led businesses.

- ***Networking & Collaboration***

Private organisations and industry associations play a vital role in fostering networking and collaboration among women entrepreneurs. They organize events, workshops, and platforms for women entrepreneurs to connect, learn from each other, and access new markets and opportunities.

## THE WAY FORWARD

- ***Access to Capital and Government Benefits***

There are multiple government schemes like NIDHI, WEP, and other similar ones that are working towards making accessing capital requirements more efficient. WEP is a Niti aayog's initiative which is a platform where all the information regarding startups and central schemes is aggregated in one place. However, there is a need to create a link that bridges the gap between entrepreneurs and resources to empower them and make it more accessible to large groups of the population. One such way to ensure this accessibility is via the improvement of user experience of various schemes that can be availed online. Beneficiaries should have an option for end-to-end digital as well as physical or assisted access to all schemes.

- ***Break the Bias***

While men are naturally groomed to hold leadership roles in families, women need to make an extra effort to overcome hurdles, develop leadership abilities, and translate them into business success. They

also lack access to markets, funds, and groups due to existing stereotypes such as being over-emotional or sensitive in tough situations. There is a need for collaborative efforts at a personal and societal level to support women to break the biases. Awareness and sensitization programs across all levels can further drive positive change and encourage female business leaders to achieve better results.

- ***Mentorship and Peer Community***

Entrepreneurship is a tough journey and women entrepreneurs need mentors who can give the right guidance and advice to prevent them from failure and double their chances of business success. The mentors can help them in networking, connect them with investors, and guide them through the funding process along with various other supports.

Therefore, all stakeholders including policymakers, investors, industry leaders, academicians, and customers should come together and create a conducive environment where this much-needed positive change of rise in women entrepreneurship can thrive. This will not only support India's economic ambitions but also multiply the chances of employment and revenue generation for holistic development.

## CONCLUSION

The rise of women in entrepreneurship in STEM fields in India marks a pivotal moment in the country's trajectory towards innovation, gender equality, and economic growth. Through this research, it is evident that while significant strides have been made, there are still substantial challenges hindering the full potential of women in these sectors. Women in India are breaking barriers, challenging norms, and driving change in STEM entrepreneurship, contributing to a more diverse and inclusive landscape. However, systemic issues such as societal biases, lack of access to funding, limited networking



opportunities, and a scarcity of role models persist, impeding the acceleration of women in these fields.

There are also various limitations to the paper. Due to the paucity of time, google forms have been circulated among the institutes instead of field-based interviews to collect the data. There are also limitations of generalisation and participant bias since due to paucity of time only a few respondents were reached out to and their responses are in the digital form of surveys so the biasedness is something that won't get accounted for to a large extent.

The recommendations drawn from this research emphasise the critical need for targeted support mechanisms, mentorship programs, educational initiatives, and policy reforms. Encouraging a culture of inclusivity, providing equal opportunities, and fostering an ecosystem that promotes and supports women in STEM entrepreneurship will not only benefit the individuals involved but will also fuel innovation and economic development for the nation as a whole.

This research underscores the imperative of collaborative efforts from government, academia, industry, and society at large to create an ecosystem where women in STEM entrepreneurship can thrive.

By addressing these challenges and embracing the potential of women in these fields, India can harness a wealth of untapped talent, driving innovation, economic prosperity, and societal progress. In conclusion, while there's been remarkable progress, there's still a journey ahead to achieve true gender parity and harness the full potential of women in STEM entrepreneurship in India. It's a collective responsibility to pave the way for a more inclusive, diverse, and innovative future.

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November 2023