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## Interventions of CSIR toward Gender Parity

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**Abstract:** *The progress of a nation is defined by the contribution of all its citizens and the role of women in its development cannot be undermined. Science and technology (S&T) are key to a nation's advancement. Thus women in S&T and S&T for women can help in wealth generation, improvement of the quality of life and real economic growth and transformation in any society. It is a well-known fact that the proportion of women in prominent Indian S&T establishments and universities is low and needs to be enhanced. The Government of India and many non-government research bodies have been working on promoting women in S&T by providing gender-specific schemes, including various scholarships and awards. This article discusses some significant initiatives and interventions of CSIR towards women's empowerment in supporting and boosting the S&T workforce. In addition, the CSIR laboratories' efforts for women's support and empowerment through society-centred efforts, including programmes and projects, have been emphasised. This is based on data collected through a primary survey conducted for a study. To fill the gaps in data, some information has also been procured through secondary sources. The study shows that several CSIR labs have been proactive in taking up programmes for women empowerment within the organisations; also the benefits of its programmes have reached the masses in its periphery.*

**Keywords:** CSIR, S&T, Gender Parity, Society, Women Empowerment, Economic Development.

### 1. INTRODUCTION

Women are an essential part of society and a vital workforce. Yet, women are found to be inconspicuous in most of the economic activities of the country especially those that require skill and intellect. Gender inequality hinders the inclusive progress and development of a country. The United Nations (UN) Sustainable Development Goal (SDG) #5 discusses gender equality, elucidating that Gender equality is not only a fundamental human right but a necessary foundation for a peaceful, prosperous, and sustainable world. Women and girls should get equal



access to education, health care, and proper representation in political and economic decision-making practices. This will work towards powering sustainable economies and promoting societies and humanity worldwide.

It is vital to have initiatives and programmes at various levels to encourage women to actively participate in the economic and developmental activities of the country. Society is at a loss if women cannot perform to the best of their ability, especially in Science and Technology (S&T). It has been widely reported that, due to various circumstances, women need to be better equipped to take up S&T and other activities. Though the participation rates of women in education and employment have been growing over a few years, they are still underrepresented in the major fields of S&T. Despite showing determination in concluding their education in science, only a few women manage to find suitable professional employment opportunities. There are several multidimensional hindrances and barriers to empowering these women like the sociocultural biases of gender bias during recruitment, balancing varied roles, the stigma of sexual harassment, along with the access to infrastructure and resources, etc.

The share of women in Indian S&T is lower than several other Asian developing economies. The role of India's stakeholders in supporting women in S&T is immense since they not only help promote India's national development and scientific advancement but also design innovative solutions to the problems faced by them. Meaningful intervention at the level of policy change is required to bring gender parity by involving more women at every level. Organisations should empower women in S&T through training, skilling, and providing an enabling environment. Kumar [1] has suggested major organisational changes in the structure and procedures and also changes in mindsets for a balanced gender equation.

S&T can support to solve the gender gap in various developmental activities of a country. It can also help train women to take up various jobs and contribute to society. The Government of India (GoI) and other stakeholders have been working on encouraging women through S&T and more importantly, supporting women in S&T. These efforts gender-specific schemes for all women.

Gupta [2] reviews the GoI schemes and programmes aimed at promoting women in S&T and discusses various programmes, scholarships, and awards to attract women in science. Bal [3] examines the issues related to women in academia and critically discusses achievements so far and the targets yet to be achieved. Various schemes and awards have been introduced from time to time for empowering women in S&T for a strong base and encouragement. Some of these efforts have been listed while other details of women of awards/fellowship can be accessed [4].

- Women Scientist Scheme by the Department of Science Technology
- Women Scientist Scheme by the Department of Biotechnology
- National Women Bio-Scientist Award
- SERB Women Excellence Award
- Post-Doctoral Fellowship for Women
- L'Oréal India For Young Women in Science Scholarships
- Indo-U.S. Fellowship for Women in STEMM



- National Post-Doctoral Fellowship
- Stree Shakti Science Samman Award
- Women Fellowship of Indian National Science Academy (INSA)
- Women Young Scientists of INSA

Non-S&T women can also be empowered through the use of S&T solutions. The GoI has been involved in uplifting women through S&T and the Council of Scientific and Industrial Research (CSIR) labs is one such organisation. It provides support to women through skill programmes and training with societal benefit by preparing women in various dimensions of life as mentioned in the coming sections.

CSIR is the largest premier R&D organisation in India, covering diverse S&T areas, and is ranked 37<sup>th</sup> among government institutions globally. It has a vibrant setup of 37 nationwide laboratories, various outreach centers, Innovation Complexes, and research units, spread all over the country. CSIR has been instrumental in taking up dedicated projects for women, organising skill enhancement workshops including those for entrepreneurs and rural women. There have been many science outreach programmes in practice to encourage female students toward science to balance gender disparity in S&T. AcSIR, the Academy of Science and Innovative Research was formed in 2011, largely based on CSIR, though other national scientific institutions have been involved. AcSIR is enlisted in the Ministry of Human Resource Development website under "Institutions of National Importance". Currently, the Academy has around 2,500 faculty members from CSIR Labs and around 6700 students enrolled in various programmes, mostly in PhD and in different integrated programmes.

In this paper, we present significant initiatives and contributions of CSIR labs in supporting and boosting women from (i) S&T and (ii) outside the domain of S&T for their empowerment through skill, training, etc., thus enabling them to be self-reliant and economically independent.

## **2. METHODOLOGY/ RESEARCH ELABORATIONS**

This article is based on a study [5] conducted for CSIR women in Science, Technology Engineering, and Mathematics (STEM). The purpose of the survey-based study was to gather information about the status of women's workforce in STEM in CSIR labs. One of the outcomes was a compilation of significant initiatives and contributions of CSIR labs in promoting and encouraging the S&T women workforce. In addition, the survey also sought inputs about significant initiatives of CSIR labs in encouraging and supporting women for economic empowerment through better livelihood avenues. In this way, data collection was extended to initiatives of CSIR labs towards skills and training for non-S&T women for the benefit of society.

About half of the CSIR labs provided detailed information about initiatives, especially for the betterment of women. To fill up the gaps in the data of the labs that did not respond to this part of the questionnaire, an attempt was made to gather information on the remaining labs through their annual reports. The reports available on each institute's website were browsed to collect the gender-based initiatives and the projects undertaken by these labs for a holistic view.



## **Findings**

It has been reported that many CSIR labs have been working aggressively on research domains related to women-related concerns with specific livelihood promotion and lifestyle improvement for women, and have also taken up various initiatives for promoting gender in S&T. Some of these projects have been helping communities (mainly women) with extra income, ensuring their livelihood security and self-reliance. Prominent work has been done in the areas of health, sanitation, hygiene, nutrition, etc. which have been important issues and have been dealt with under these projects. CSIR along with other agencies has been instrumental in funding projects to women Project Investigators [6].

Few CSIR labs have stated that cognizant efforts have commenced to pursue an enabling working environment for women S&T staff and students. These initiatives have contributed towards improving the quality of work-life of women. Many schemes and projects for encouraging women are already in the process of implementation. Currently, around 30% of women Scientists have been empowered with leadership positions in various facets of the institutes. These include women holding chairmanships of various committees and membership of committees of labs.

To bring out a comprehensive description, the wide-ranging data on Initiatives has been grouped into various categories for a better representation of CSIR efforts towards this cause and discussed in detail below:

1. Skill Development programmes: Skill development and training programmes for entrepreneurship have been considered a key solution to the problems and challenges that women face. CSIR has organised various women-centric skill development programmes both for its staff and for society. Presently, the CSIR Integrated Skill Initiative is in Phase II. Some institutes conducted outreach, training, and skill development programmes, including short-term training sessions on topics of socially and economically beneficial areas as mentioned below:

- Some training programmes for Women Scientists were the Programme on Electrochemical Biosensor: Design and Application on “Soil & Water Testing Lab Assistant”; Online Training Programme on “Climate Change: Challenges and Response; Training Programme on Leadership and Organisational Development for Women Scientists and Technologists. In one lab, around 60% of the total manpower trained over the past three years in various skill development and training interventions are women.
- Training programmes for societal benefit where women members of the MSME Cluster were provided training on computer-aided drawing to enable them to develop intricate designs of mangalsutras by a CSIR lab.
- Skill training workshops on skill development have also been held in fisheries and aquaculture, participants of the workshop included the stakeholders (primarily women), fishermen, and entrepreneurs.
- A skill development programme focused on basic and applied skills for biochar production was held in 2021 which included 10 women farmers in a lab.



- A training programme focusing on mushroom cultivation and commercialization was conducted to empower rural Tribal women with income-generating opportunities. Training programme on Ragi and value-added products from Ragi was conducted in 2021 for women SHG supported by WASSAN and District Mineral Foundation, Keonjhar under Odisha Millet Mission. A Skill Development Programme, for BSc, Food Science students was done.
- Other training programmes include those relating to Designing and making Leather Goods; and programmes for Women Polytechnic students. 40 prospective women entrepreneurs were trained for CSIR-CFTRI technologies during the Entrepreneurship and Skill Development Programme, from various Self-help groups (SHGs) working in the U.P. under the women's empowerment programme of NABARD.
- Training on Knowledge Resources and Information Technology has been conducted for women from economically weaker sections. Training programmes were conducted for the technologies transferred to the women Self Help Group (SHG) identified by GRAAM at Bilikere village, Mysuru. Scientific and technical assistance for machinery specifications and product protocol were provided. Women empowerment through a skill development programme was on making incense sticks from used flowers.
- Training, and skill development programmes on home gardening, bonsai preparation, and dehydrated flower techniques were aimed to empower youth and women in various villages.
- Training and demonstration of natural disinfectant surface cleaner where 18 women participated from various self-help groups and some local officials of Mission Shakti.
- Training and awareness programmes for skill development where 28 awareness cum training programmes on cultivation and value addition technologies of floricultural crops were conducted from June 2021 to March 2022 for unemployed youth, rural women and farmers. Similar such programmes where 41 awareness cum training programmes on cultivation and process technologies of aromatic crops were conducted during 2019-2020 and more than 763 unemployed youth, rural women and farmers were trained.
- Two weeks of training on E-Waste Collection and Deconstruction under the Nimat-Entrepreneurship Training Programme was held with more than 50 participants. In another Entrepreneurship Development program, 26 diploma girl students from Women's Polytechnic Institute participated.
- Farmer-centric activities /APEDA Programme – about 50 farmers mostly women participated in the hands-on training programme on food processing in Karnataka. Also, training programmes on post-harvest handling and value additions of produce for the benefit of farmers/FPOs. 380 farmers including 159 women farmers from Karnataka, Kerala, Maharashtra, Andhra Pradesh, Tamil Nadu, West Bengal, Meghalaya & Mizoram, from Farmers Producer Organisations and SHGs attended these training programmes.
- Various Female experts delivered lectures in online programmes related to Training/Skills/awareness on various topics related to environmental science and engineering. As many as 800 female participants from different parts of the country participated in these programmes. Boost up CSIR- Agro-technology through awareness cum training Programme including women participants.





2. Agriculture and Rural-based programmes and projects: India is an Agriculture-based economy and about two-thirds of the total population resides in rural areas of India. Accordingly, CSIR also focuses its projects and related activities around this theme. Several labs have worked for the betterment of rural areas, especially with a focus on women's livelihood. The predominant CSIR Aroma Mission and CSIR Floriculture Missions are some of these efforts. Women empowerment under the Aroma Mission has boosted the economy of rural women. CSIR's "Harnessing Appropriate Rural Interventions and Technologies" programme focuses on enhancing income generation and improving the quality of life of rural communities, especially artisanal women thus catalysing and bringing socio-economic development through CSIR interventions/technologies. There have been many rural development projects improving the livelihood of women. Other such activities taken up by various CSIR labs with a focus on gender upliftment are as under:

- Establishing a Rural Women Technology Park to promote women entrepreneurs and their participation in STEM.
- Empowering the rural population through the dissemination of agro-technology of flower crops in Himachal Pradesh. Cultivation and processing of aromatic crops for socio-economic development in rural areas of Himachal Pradesh. Preparation of People's Biodiversity Register at the Panchayat level for Himachal Pradesh. Training for Improvisation of the traditional practices of night soil composting using microbiological intervention for sustaining agro-ecosystems in the Lahaul Valley of northwestern Himalaya.
- Capacity Building of North Eastern Region Community Resource Management Society on the cultivation of Low Chilling Varieties of Apple and its Post-harvest Management.
- Seaweed cultivation for benefitting coastal women in areas like Tamil Nadu and Gujarat.
- Utilisation of Natural Gums as low-cost material for the development of sanitary napkins and awareness of health & menstrual hygiene issues in rural areas.
- Setting up of Sumbuk Shiitake Mushroom and other food processing clusters in South Sikkim and West Sikkim.

3. Focus on the Health and Nutrition of Women: This is an essential component for the fulfilment of SDGs especially in the context of women. CSIR's initiatives in this regard have been outlined in this section.

- Pan CSIR Cancer Research Programme has covered various studies like: Making cancer care affordable empowering women's health with a focus on breast and gynaecological cancers of Indian relevance; Studies on Female contraception, Breast and Cervical Cancer; Profiling of differential expression pattern of metastatic suppressor genes in breast cancer- As Identification markers for early malignancy; Novel non-invasive cancer biomarkers for early diagnosis of cervical cancer in women; Graphene-based Electrochemical Detection Breast Cancer Biomarker; Drug deliver- HR+/HER-2 metastatic breast cancer – diagnosed in women. A survey was conducted concerning Cervical cancer factors among women at King George's Medical University.
- Reproductive Health Research:



- Management of polycystic ovarian syndrome through natural products for women with PCOS.
- Genetics of reproductive dysfunction in women.
- A novel herbal product for Vulvovaginal candidiasis.
- Genetics of reproductive dysfunction in women
- Understanding Molecular Mechanism of Intergenerational Programming of Diabetes in Offspring of Women with Gestational Diabetes Mellitus.
- Effect of pre- and peri-conceptional maternal micronutrient intervention on children's DNA methylation.
- Novel Variations in beta-Myosin Heavy-Chain Gene (beta-MYH7) and its Association in Indian Women with Cardiomyopathies.
- CSIR Nutraceuticals and Nutritionals Mission:
  - POSHAN MAITREE - A pilot scale supplementation of micronutrient-fortified food products developed at Maitree, a pilot scale nutrition supplementation programme funded by the Directorate of Women and Child Development. Study on nutritional status in selected villages- malnourished women who may require S&T intervention. S&T Interventions to combat malnutrition in women and children, e.g. nutritionally rich fruit bars to combat malnutrition among women and children, Nutraceutical and functional foods to combat malnutrition in women and children. Development of low-cost Nutrifoods for breakfast.
  - Nutraceutical and functional foods to combat malnutrition in women and children. Study for Combating Iron and Zinc Deficiency using microalgae-based foods. Poverty alleviation through the popularisation of locally available medicinal-dietary plants for the prevention of malnutrition among SC/ST children and women.
  - CSIR Phytopharmaceutical Mission- Investigation of novel Formulation approaches for improving the bioavailability of Dietary phytochemicals.
  - New food formulation from bamboo, Amla, and apple cider vinegar. Development of different fruit candies.
  - Evaluation of micronutrient fortification and menu diversity on the health indices of children attending Anganwadi.
  - Novel Variations in beta-Myosin Heavy-Chain Gene and its association in South Indian Women with Cardiomyopathies.

4. Awareness and Gender Sensitization: Gender sensitization is of utmost importance for the achievement of gender parity. CSIR labs have been continuously working towards the cause during the past years which can be noted from the programmes and initiatives they have been organising from time to time.

- Regular awareness programmes/workshops on gender Sensitization and Sexual Harassment of women in the workplace have been organized regularly in various CSIR labs. Various science outreach programmes under 'Jigyasa' have been organised across all CSIR labs to encourage female students toward science for balancing gender disparity in S&T. Time-to-time talks and conferences organised to uplift and empower women in the realms of S&T fostering their growth and participation.



- Some mega exhibitions on women empowerment have been organised to attract “Women to science”.
  - Summit on Women in Technology, SHG programmes for women.
  - Awareness Programme on Nutrition for Women-Special kits comprising information on medicinal plants and capsules containing drumstick plant powder distributed to 350 women. Awareness Programme about Tuberculosis treatment and vaccination amongst pregnant women.
  - A three-month Female Literacy Drive programme for 30 illiterate/semi-literate women staff of the laboratory.
5. Other CSIR Initiatives: Most CSIR labs are giving equal opportunities for women without any gender discrimination and provide excellent career opportunities to women scientists in the field of S&T. Efforts are made to ensure women's representation in all major scientific and administrative committees of various labs. Giving equal opportunities for women without any gender discrimination, and excellent career opportunities to Women scientists in the field of S&T.
- Solar dryers (for value addition of fish, resins, and rubber) and development of improved methods for high-purity solar salt production (where women work with families).
  - Development of a biodegradable and biocompatible nanoceramics/ bioactive glass-polymer composite material with antibacterial properties for use in female sanitary hygiene products
  - Development of remunerative organic waste management systems for colder regions of India with the intervention of psychrophilic aerobic and anaerobic microbial consortia.
  - CSIO-INYAS organised a webinar series 'She Inspires' for female students in STEM. It covered the journey of young female scientists to get directions on handling challenges in STEM fields as a role model for girl students.
  - Almost every year International Women’s Day is celebrated by almost every CSIR lab, some have even included Yoga. International Women's Day -National Chair, Translational Health Sciences & Technology Institute (THSTI) Faridabad, a special lecture delivered that shared the successful leadership experience of various women achieving high success in S&T.
  - International Women in Engineering (WIE) Day is celebrated by some CSIR labs every year. The student branch WIE affinity group was established under the mentorship of women scientists.
  - A CSIR lab has brought out a Compendium of all its women Scientists serving as a conglomeration of their professional achievements and contributions.
  - CSIR-NAL’s women scientists have brought accolades to the laboratory through participation in Aero India.
  - A lab specifically mentioned the Ladies' club Activities: - "The ladies' club hosts women's empowerment programmes, celebrates festivals like Teej, Dussehra, Diwali, and Lohri, and organises monthly meetings with experts from fields like medicine, beauty, kitchen etc. to address members' issues and queries." The staff club regularly organises a lot of sports events to encourage the participation of women in sports.





- Out of the total artisanal workforce placed by CSIR-CLRI in the industry over the past 3 years, 60% are women.
  - Institutional participation: Female representation in different internal institutional committees for active participation of women has been reported by several labs. Women are being encouraged to take Leadership in R&D Programmes. Several Women Scientists have been promoted to the level of Heads of Scientific Divisions, area coordinators, and also as Administrative Heads where they provide a leadership role to the Organisation
  - Women scientists are being given seed money to motivate them to take up R&D projects. For scientific advancement and mentoring of female scientists, they are regularly involved in grant review committees to review intramural and extramural grant proposals. Equal opportunity is being provided in research and academic programmes (via AcSIR PhD programmes and various project positions). Engagement of the workforce in various Women Scientist Schemes launched by the Government of India. A lab reported a study on Gender-Based Appraisal of Mode Choice Decisions. Technical services and facilities offered, including a resource lab for the DST-TIFAC KIRAN-IPR (Women Scientist) internship.
  - Women Scientists' and Entrepreneurs' conclave was conducted highlighting "Role of Women in Atma Nirbhar Bharat", as part of IISF 2020, CSIR- CLRI's women scientists were part of this initiative and successfully conducted the programme. A summit on Women in Technology was conducted titled Role of Women in Sustainable Technology and Climate Change. "Women in Science" in March 2020 inviting prominent women Scientists from the country, marking a pioneering initiative towards glorifying National Science Day. The invitees were prominent women scientists from the country including many eminent women. On various occasions/events like Foundation Day, National Science Day, etc., special lectures, talks, essay writing, and poster-making competitions have been organised with the theme "women in STEM".
  - Few labs have specifically reported providing a well-maintained crèche/day-care facility on campus for kids of the employees. Efforts like these are very beneficial to women staff and provide support towards maintaining the work-life balance.
  - Efforts to provide a safe and secure work and stay environment to women students, project staff, and research scholars wherein they are provided accommodation inside the institute premises.
  - Common facilitation centres for women entrepreneurs have been created.
  - A self-help group programme for women was conducted wherein hundreds of women benefited from the programme.
  - A lab has mentioned a special lecture entitled "Mahatma Gandhi and Empowerment of Women"
  - Literacy programme for women staff (permanent and temporary) spreading over 4 months organised.
  - Wax Production Technology helped the unemployed youth and women in the North Eastern Region to set up MSME/Cottage industries.
- A cognizant effort of CSIR to improve the gender parity index is in the form of incorporating more female students in different programmes of its AcSIR across all its subject clusters. Equal opportunities in research and academic programmes are offered (via



AcSIR PhD programmes and various project positions). From our survey as mentioned above, the number of student applications and selections from 32 institutes of AcSIR (covered in our study) for various courses gender-wise during the period of ten years, i.e., 2011-2020 has been compiled and is shown in Fig. 1. It can be seen that the percentage of student selections for all the subject clusters over a time span has remained more than 35% and noticeably the biological science cluster has almost 50% female students. Wakdikar & Sharma [7] have also highlighted the performance of the students in AcSIR to show that fewer female students have dropped out of the doctorate programme than male students. Around 50% of the Doctoral students accommodated in a few labs currently are women, augmenting potential women leaders in Science.

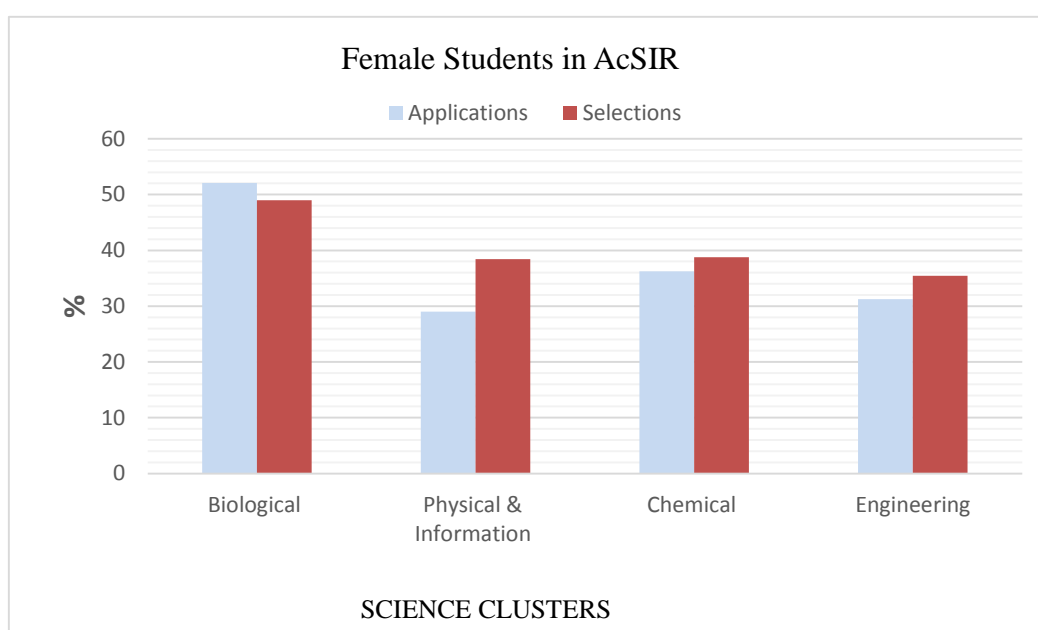


Figure 1: AcSIR female student applications and selections during 2011-2020

### 3. CONCLUSIONS

Shanti Swarup Bhatnagar (SSB) Award is the highest and most prestigious scientific award for outstanding S&T contributions in India given by CSIR. Out of a total of 594 awards so far, only 20 awards have been conferred to women scientists since 1958. This is a sheer 3.3% of the total SSB awards. Consecutively for the last two years, not a single woman has received this award which has become a concern for the scientific fraternity of the country.

To improve the quality of life and the economic development of a country, an enhanced and equal participation of women in developmental activity is required. The role of S&T in the development of a nation is well-known and a well-established fact. So it is important to have women in S&T and also make the best of S&T for women empowerment.

The major challenge for the Indian science establishment lies not in educating and training women but in recruiting and retaining them in jobs. A conducive environment with some basic facilities for women is also required to retain them. So, providing multiple measures to get past



these concerns and creating systems to keep track of their implementation appears to be a significant concrete option. It is imperative to have additional initiatives and programmes at the government and the private level to encourage women to enter and stay in S&T fields.

CSIR labs have taken up various initiatives for promoting gender in S&T as well as putting in a conscious effort to take up research on women-related issues. Many schemes and projects for encouraging women are already in the process of implementation. Several labs have provided various opportunities to their women S&T with a conscious effort in bringing out gender parity while they have also focused on the upliftment of women in society by organising skill development and training programmes. Health and nutrition of women, awareness on different aspects be it gender sensitization or literacy drive, CSIR has therefore been constantly working for the betterment of women in S&T and women in society with the help of S&T.

The initiatives for women empowerment of the society or that of the women workforce as seen from the study, shows that CSIR is on the path of narrowing the gap and moving towards sustainable development by achieving the SDGs # 5, 8 & 10.

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