
Executive Summary

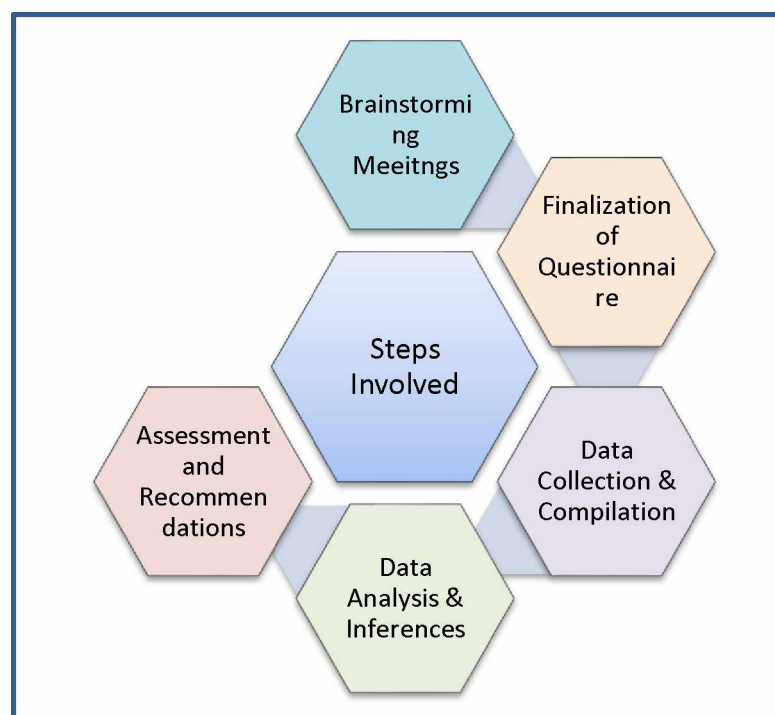
Since 2002-03, when gender mainstreaming programmes in science were initiated by Government of India, the pace of availing the schemes by women scientists had only gained momentum. It also led to the necessity of requiring insights into the issues and challenges that beneficiaries faced, so that essential changes and adjustments could be made to it.

With this need in mind and to further knock the gender gap in scientific contributions in Science, Technology, Engineering and Mathematics (STEM), the project entitled ‘Assessment of Government of India's Gender mainstreaming program for women in science’ was launched in 2018-19. It is a network mode project catalysed and supported by the CHORD (NSTMIS) Division, Department of Science & Technology (DST), Government of India. The aim of the project is to assess the impact of these gender mainstreaming programmes and suggest indicative framework for effective policy planning. The project results would assist in the identification of the measurement parameters and evaluation of the professional status of women scientists after availing the support for the project. The large-scale cross-sectional study was carried out for this. It has assessed, analysed and evaluated the overall effectiveness of a programme by collecting individual information from respective beneficiaries. This project results could also assist in identifying the limiting areas, easing the implementation, enabling the strategies to encourage suitable prospective women scientists to join the schemes. The data collection strategy involved a large-scale national level survey headed by 13 Regional Principal Investigators across 6 different zones: North Zone, North East Zone, East Zone, South East Zone, South West Zone, and West Zone. A national coordinator was appointed and entrusted with the responsibility to formulate project proposal and coordinate entire project all over the country.

The Methodology of the Project:

This cross-sectional study used a mixed-method research design approach. It is a procedure for collecting, analysing, and ‘mixing’ both quantitative and qualitative research and methods in a single study to understand a research problem. The broad steps involved:

Analytical Framework



- a) **Brainstorming meetings:** Brain-storming meetings with the stakeholders were conducted. Project theme, the structure, the questionnaire, time schedule was discussed.
- b) **Finalization of questionnaire:** To collect the information from the women beneficiaries, a questionnaire was designed for a primary survey. The pilot survey was conducted with help of a few women scientists with a purpose to modify and edit the designed questionnaire. The questionnaire was then prepared in the on-line format using Survey123, and was sent to all the women beneficiaries.
- c) **Data collection and compilation:** The responses were collected from beneficiaries of five schemes (WOS-A, WOS-B, WOS-C, BioCARE and UGC PDF) and followed up by actively thrustured Regional Principal Investigators (RPIs). The compilation was done by national coordinator from responded beneficiaries who availed the schemes during 2002-03 to 2018-19, i.e., seventeen years of span. There were total of 3530 beneficiaries as data received from the DST, of which about 48.5% of them, i.e., 1714 women scientists have enthusiastically responded and filled up the questionnaire completely. The data

collection strategy involved a large-scale survey headed by 13 RPIs across 6 different zones: North Zone, North East Zone, East Zone, South East Zone, South West Zone, and West Zone. The detailed analysis was carried out for five schemes, namely, WOS-A (2002-03), WOS-B (2002-03), WOS-C (2002-03), UGC PDF (2008-09), and BioCARE (2011),

- d) **Data Analysis:** Analysis was carried out from the primary data of received questionnaires filled by women scientists. The analysis addressed the nature of support, programme specific areas, geographical spread, affiliated institutes, and improvement in the project deliverables. The success stories of women scientists were selected based on the parameters such as their achievement level, societal contribution, their education, and professional growth. Compilation of these success stories served as a driver of inspiration for aspiring young women scientists.
- e) **Assessment and recommendations:** An assessment on performance, advancements, issues, challenges, and opportunities that could help establish i) social support dimensions of women, and ii) educational progression, iii) career progression, iv) entrepreneurship and innovation activities was analysed and discussed. The project outcome-based recommendations were given.

Of the total 3530, about 48.5% i.e.,1714 women scientists have enthusiastically responded and filled up the questionnaire completely. The following are details of composition out of total responses (1714-woman scientists) and decreasing order of respondent **participation percentages of each zone: South West Zone with highest zonal respondent participation rate of 59%** and constitute 13.4% (236 respondents) of total respondents (1714) received. The **second highest was West Zone with zonal respondent participation rate of 52%** constitute 16.7% (285 respondents) of total responses received. The **East Zone stood third with respondent participation rate 51.5%** constitute 13.1% (232 respondents), the **North-East Zone with zonal respondent participation rate 51.2%** and constitute 4.5% (78 respondents) of total responses received. The **North Zone with zonal respondent participation rate 46%** and constitute 32.5% (541 respondents) of total responses received. The **South East Zone had least zonal respondent participation rate 42%** and constitute 19.8% (342 respondents) of total responses received. The analysis was carried out on these datasets

of the available responses and assumed to represent the total population of woman beneficiaries.

The following are details of composition out of total responses (1714-woman scientists) and decreasing order of respondent **participation in percentages of each scheme**: The **highest was WOS-B with respondent participation rate of 56%** constitute 6.76% (116 respondents) of total responses received. The **WOS-A stood third with respondent participation rate 48.7%** constitute 6.56% (1038 respondents) of total responses received. The **BioCARE scheme had respondent participation rate 47.53%** and constitute 7.87% (135 respondents) of total responses received. WOS-C the participation rate of **38%** and constitute 16.9% (291 respondents) of total respondents (1714) received. The **UGC PDF had least respondent participation rate 21.96%** and constitute 7.81% (134 respondents) of total responses received from the women scientists.

The reasons of non-response of woman scientists were several. Of the multitude of factors, the predominant reasons were: changes in postal addresses, email ID, and mobile numbers. Some woman scientists were unable to access required documents and faced inaccessibility of their formal communication channels also owing to global pandemic outbreak which disallowed their institutional presence. Apart from problems like inapproachability to mentors, other issues like indifference and reluctance towards sharing details was also noticed.

The four important aspects were analysed from the information gathered from the respondent women scientists. Those are i) Social Support Dimensions, ii) Educational Progression, iii) Career Progression and iv) Entrepreneurship and Innovation Activities considered as a Professional Dimension. Each of those are explained as below:

Social Support Dimensions:

The women education inequality is not uniform across all social strata. It is obvious that within complex stratification systems in India and social categories, the relative status of women is more obscure within the more disadvantaged segments of the population. (Dunn, 1993) Several initiatives are taken by the Government of India to

provide support to the researchers belonging to the Scheduled Caste and Scheduled Tribe including the frontier areas of science and engineering. **Of total responses received 4.5% of the women scientists belonged to SC and ST category.** The percentage of women registered in SC and ST categories was lesser in all the zones in comparison to other castes except for the North East Zone. Around 10% of the total beneficiaries belonged to this category. **UGC PDF had the highest percentage (17.9%) of beneficiaries belonging to the SC and ST category.**

Family support is an important parameter for scheme. Among zones, **beneficiaries from East zone (87.41%) had highest family support.** Among schemes, **beneficiaries from WOS-B (84.6%) had highest family support.**

Mentor support is an important opportunity for beneficiaries to develop research aptitude. Among zones, **beneficiaries from South West Zone (68.95%) had highest Mentor support.** Among schemes, **beneficiaries from WOS-B (78.65%) had highest Mentor support.** BioCARE is starkly different from rest of zones as almost one-fifth have poorly rated mentor support.

The gender mainstreaming programs are about providing support to women who desire to return to the mainstream after a career break into the scientific profession. There are four predominant issues considered in the questionnaire: i) family issues, ii) maternity or health issues iii) marriage and iv) mobility as ‘reasons for break’. **Out of total responses received 77.1% of women beneficiary had revealed a break in career.**

The decreasing order of zonal percentages of respondents having ‘family issues’ as the reason for break is as follows: **North-east (27.27%), North (27.16%), South East (26.28%), West (21.86%), East (18.58%), South West (17.89%).** The decreasing order of zonal percentages of respondents having ‘maternity or health issues’ as the reason for break is as follows: **South West (32.16%), South East (31.09%), West (27.13%), North (20.49%), North-east (14.29%), East (26.28%).** The decreasing order of zonal percentages of respondents having ‘marriage’ as the reason for break is as follows: South West (16.58%), West (12.96%), South East (12.18%), North (12.10%), North-east (10.39%), East (10.38%). The decreasing order of zonal

percentages of respondents having ‘**mobility**’ as the reason for break is as follows: **South West (8.04%), West (5.67%), East (2.73%), North-east (2.6%), South East (2.56%), North (2.47%)**. The decreasing order of zonal percentages of respondents who had ‘**no break**’ is as follows: **East (49.18%), North (23.21%), North-east (19.48%), South East (16.35%), South West (16.08%), West (14.17%)**.

The decreasing order of scheme-wise percentages of respondents having ‘**family issues**’ as the reason for break is as follows: **WOS-A (26.78%), WOS-B (23.28%), UGC PDF (14.18%), BioCARE (8.89%)**. The decreasing order of scheme-wise percentages of respondents having ‘**maternity or health issues**’ as the reason for break is as follows: **WOS-A (26.97%), BioCARE (16.3%), WOS-B (15.52%), UGC PDF (13.43%)**. The decreasing order of scheme-wise percentages of respondents having ‘**marriage**’ as the reason for break is as follows: **WOS-B (15.52%), WOS-A (14.35%), UGC PDF (5.22%), BioCARE (3.7%)**. The decreasing order of scheme-wise percentages of respondents having ‘**mobility**’ as the reason for break is as follows: **WOS-B (8.62%), WOS-A (3.85%), UGC PDF (2.24%), BioCARE (1.48%)**. The decreasing order of scheme-wise percentages of respondents who had ‘**no breaks**’ is as follows: **BioCARE (62.96%), UGC PDF (47.76%), WOS-B (17.24%), WOS-A (14.26)**.

The **increasing** order of zone-wise “**duration of break**” in months by the women scientist respondents due to ‘**family issues**’ as the reason for break is as follows: **South East (26.61), East (28.58), North (36.6), South West (37.3), North-east (42.19), West (43.12)**. The increasing order of zone-wise ‘duration of break’ in months by respondents due to ‘**maternity or health issues**’ as the reason for break is as follows: **West (24), East (25.5), South West (26.07), North (28.24), South East (28.79), North-east (38.54)**. The increasing order of zone-wise ‘duration of break’ in months by respondents due to ‘**marriage**’ as the reason for break is as follows: **East (34.26), South East (41.64), North (42.06), South West (45.15), West (56.31), North-east (56.87)**. The increasing order of zone-wise ‘duration of break’ in months by respondents due to ‘**mobility**’ as the reason for break is as follows: **South West (27.62), East (30.2), North (31.2), West (35.71), South East (40), North-east (90)**.

The **decreasing order of scheme-wise ‘duration of break’ in months** by respondents due to **family issues as the reason for break** is as follows: **WOS-B (39.51), BioCARE (39.20), WOS-A (34.5), UGC PDF (30.52)**. The decreasing order of scheme-wise ‘duration of break’ in months by respondents due to **‘maternity or health issues’ as the reason for break** is as follows: **WOS-B (32.4), WOS-A (27.94), UGC PDF (24.66), BioCARE (20.27)**. The decreasing order of scheme-wise ‘duration of break’ in months by respondents due to **‘marriage’ as the reason for break** is as follows: **WOS-A (46.66), WOS-B (42.38), BioCARE (42), UGC PDF (16.57)**. The decreasing order of scheme-wise ‘duration of break’ in months by respondents due to **‘mobility’ as the reason for break** is as follows: **WOS-B (49.7), WOS-A (34.15), BioCARE (12), UGC PDF (6)**.

Educational Progression:

As a result of supported projects under these schemes, by the **end of duration of project** beneficiaries’ education level from bachelor to master level incremented by 2, Masters to PhD level incremented by 370 whereas PhD to Post-Doc level incremented by 239 in numbers. There was a total increase of 0.91% (2) Master degree holders, 67.33% (371) PhD degree holders, 615.38% (240) Post-Doc holders by the end of sanctioned project due to research enabled and supported by the DST schemes considered here for the study here. The beneficiaries’ current education levels progressed further after the project completion, Masters to PhD level incremented by 69 whereas PhD to Post doc level incremented by 16. There was increase of 7.73% (70) PhD degree holders, 5.73% (16) Post Doc degree holders as of **time of survey** since their project completion.

The zone wise percentage increment of education level **from masters to PhD degree** is **North (69.75%), South East (64.48%), South West (61.32%), West (60.40%), East (57.14%), North-east (46.88%)**. Among the zones, the North Zone observed a major hike in the Ph.D. holders. The zone wise percentage increment of education level **from PhD to Post-Doc degree** is **North (44.07%), West (30.66%), South East (28.69%), South West (28.57%), East (11.28%), North-east (9.09%)**. As seen, there is higher increment of women beneficiaries from the North Zone to Post Doc degree holders.

The scheme wise percentage increment of education level **from Masters to PhD degree is BioCARE (83.33%), UGC PDF (77.78%), WOS-A (65.06%), WOS-B (36.84%)**. Among the schemes, the BioCARE observed a major hike in the Ph.D. holders. The scheme wise percentage increment of education level **from PhD to Post-Doc degree is UGC PDF (68.85%), WOS-A (26.58%), BioCARE (15.70%), WOS-B (10.34%)**. As seen, there is higher increment of women beneficiaries from the BioCARE to Post Doc degree holders. The above statistics show that beneficiaries have progressed significantly in improving their level of education due the opportunity provided by these schemes and to carry out the research projects by the women scientists.

‘**Publications**’ is one of the important ‘achievement parameters’ for the beneficiaries. The number of respondents’ publications ranging from one to five was quantified as percentage within each respective zone. The **decreasing order of zonal percentages** of respondents with **five publications** is as follows: **North (20.24%), South East (20.19%), West (17.81%), East (15.84%), South West (11.55%), North-east (10.39%)**. The decreasing order of zonal percentages of respondents with **four publications** is as follows: **North (10.86%), South West (10.55%), South East (8.33%), North-east (7.79%), West (6.07%), East (4.91%)**. The decreasing order of zonal percentages of respondents with **three publications** is as follows: **South East (16.98%), East (14.75%), North (14.07%), West (12.55%), South West (10.55%), North-east (10.38%)**. The decreasing order of zonal percentages of respondents with **two publications** is as follows: **North-east (20.78%), South East (18.91%), West (18.22%), North (16.54%), East (16.39%), South West (13.57%)**. The decreasing order of zonal percentages of respondents with **one publication** is as follows: **East (24.04%), South West (23.11%), North-east (22.07%), West (19.83%), South East (16.98%), North (16.79%)**. The decreasing order of zonal percentages of respondents with **no publications** is as follows: **South West (30.65%), North-east (28.57%), West (25.51%), East (24.04%), North (21.48%), South East (18.59%)**.

The decreasing order of **scheme-wise** percentages of respondents with **five publications** is as follows: **UGC PDF (30.59%), WOS-A (17.91%), WOS-B (10.34)**

%), **BioCARE (7.4%)**. The decreasing order of **scheme-wise** percentages of respondents with **four publications** is as follows: **UGC PDF (11.94%), WOS-A (8.76%), BioCARE (6.66%), WOS-B (4.31%)**. The decreasing order of **scheme-wise** percentages of respondents with **three publications** is as follows: **UGC PDF (15.67%), WOS-A (14.45%), BioCARE (13.33%), WOS-B (6.89%)**. The decreasing order of **scheme-wise** percentages of respondents with **two publications** is as follows: **WOS-A (17.63%), WOS-B (17.24%), BioCARE (17.04%), UGC PDF (13.43%)**. The decreasing order of **scheme-wise** percentages of respondents with **one publication** is as follows: **BioCARE (25.18%), WOS-B (21.55%), WOS-A (19.17%), UGC PDF (14.17%)**. The decreasing order of **scheme-wise** percentages of respondents with **no publication** is as follows: **WOS-B (39.66%), BioCARE (30.37%), WOS-A (22.06%), UGC PDF (14.18%)**. There was a positive significant correlation of the 'Age' and 'Number of Publications' observed, with an increase in the age, there was an increase in number of publications.

Career Progression:

To study the career progression of the beneficiaries, the nature of the employment of the respondent women scientists was analysed. The beneficiaries were asked about the nature of their employment in terms of 'Employed' or 'Unemployed' before the project and also at the time of filling up the questionnaire (current). By the end of the project availed, 64% of women beneficiaries were employed. Of the surveyed population, around 30.7% worked in academics, 22.3% as scientists, 17.8% were research scholars, and 5.8% were 'others' includes Freelancers, Vocational Instructors, Data Coordinators, Analysts, etc. The remaining 23.3% of women were unemployed who were either 'searching for jobs' or were 'housewives'. It was interesting to note here that the **average level of satisfaction of job was found maximum among Scientists (3.86 out of 4 scale) and Academicians (3.85 out of 4 scale)**. These averages indicated more than 'Good' level of satisfaction among Scientists and Academicians. The average of level of satisfaction was found relatively less among Research Scholars (3.67 out of 4 scale).

The employment details the time of survey (in 2018-19) were collected. **Among the schemes in decreasing order, as of 2018-19, about 42.64% women who have been**

beneficiaries under WOS-B scheme have gained highest employment growth with change in number and change percent of positions as academicians 25 to 29 (16%), research scholars 26 down to 21 (-19.23%), scientists 3 to 37 (1133.33%) and others 15 to 10 (-33.33%) as compared to before scheme. **About 23.89% of Women who have been beneficiaries under WOS-A scheme have gained employment growth** with change in number and change percent of positions as academicians 255 to 312 (22.35%), research scholars 295 to 174 (-41.01%), scientists 45 to 239 (431.11%) and others 53 to 58 (9.43%) as compared to before scheme. **About 13.41% women who have been beneficiaries under UGC PDF scheme have gained employment growth** with change in number and change percent of positions as academicians 42 to 30 (-28.57%), research scholars 29 to 50 (72.41%), scientists 4 to 6 (50%) and others 8 to 7 (-12.5%) as compared to before scheme. **About 1.72% Women who have been beneficiaries under BioCARE scheme have gained employment growth** with change in number and change percent of positions as academicians 59 to 66 (11.86%), research scholars 34 to 9 (-73.52%), scientists 17 to 36 (111.76%) and others 6 to 7 (16.7%) as compared to before scheme.

Among the zones in decreasing order, as of 2018-19, about 74.07% women who belong to East zone have gained highest employment growth with change in number and change percent of positions as academicians 35 to 53 (51.42%), research scholars 31 to 30 (-3.22%), scientists 7 to 46 (557.14%) and others 9 to 12 (33.3%) compared to before scheme. **About 24.07% women who belong to West Zone have gained employment growth** with change in number and change percent of positions as academicians 66 to 79 (19.69%), research scholars 69 to 35 (-49.27%), scientists 12 to 63 (425%) and others no change in 24 (0%) as compared to before scheme. **About 22.72% women who belong to North-east zone have gained employment growth** with change in number and change percent of positions as academicians 8 to 23 (187.5%), research scholars 29 to 7 (-75.86%), scientists 3 to 20 (566.67%) and others 5 to 4 (-20%) as compared to before scheme. **About 20.64% women who belong to North Zone have gained employment growth** with change in number and change percent of positions as academicians 90 to 110 (22.22%), research scholars 123 to 74 (-39.83%), scientists 25 to 89 (256%) and others 13 to 25 (92.3%) as compared to before scheme. **About 9.73% women who belong to South East zone have gained**

employment growth with change in number and change percent of positions as academicians 136 to 117 (-13.97%), research scholars 64 to 67 (4.68%), scientists 8 to 57 (612.5%) and others 19 to 7 (-63.2%) as compared to before scheme. **About 7.97% women who belong to South West Zone have gained employment** growth with change in number and change percent of positions as academicians 46 to 55 (19.56%), research scholars 68 to 41 (-39.70%), scientists 14 to 43 (207.14%) and others 12 to 10 (-16.7%) as compared to before scheme.

The employment growth details the after project completion and current status of the beneficiary for each zone and the scheme were compared.

The east zone (20.98%) recorded highest percentage of respondents who gained employment growth among all zones after their project completion. WOS-A (4.43%) recorded highest percentage of respondents who gained employment among all zones after their project completion.

Entrepreneurship and Innovation Activities:

About **64.23% beneficiaries** out of total responded positively to the **special contributions/achievements** by them as result of their research. **West Zone had the highest (70.85%) and North Zone had the lowest (58.20%) beneficiaries** who claimed special contributions/achievements. **Across the schemes, WOS-B had the highest (68.1%) and UGC PDF had the lowest (58.20%) beneficiaries** who claimed the special contributions/achievements.

Science is one of the most important channels of knowledge. It has a specific role, as well as a variety of functions for the benefit of our society: creating new knowledge, improving education, and increasing the quality of our lives. About **46.7% beneficiaries** out of total responded positively to the research that led to **societal benefits** as result of their research. **South East zone had the highest (75.86%) and East zone had the lowest (35.55%) beneficiaries** who claimed contributing to society through technology research. **Across the schemes, WOS-B had the highest (75.86%) and BioCARE had the lowest (35.55%) beneficiaries** who claimed contributing to society through technology research.

About **34% beneficiaries** out of total responded positively to the research that led to **technology dissemination** of science and technology. **South East zone had the highest (42.3%) and East zone had the lowest (20.76%) beneficiaries** who claimed contributing to the technology dissemination. **Across the schemes, WOS-B had the highest (66.4%) and BioCARE had the lowest (22.96%) beneficiaries** who claimed contributing to the technology dissemination.

About **59% beneficiaries**, out of total responded positively to **skill development** as a result of project under scheme. **South West Zone had the highest (73.36%) and East zone had the lowest (37.70%) beneficiaries who claimed skill development. Across the schemes, WOS-A had the highest (62.13%) and BioCARE had the lowest (51.85%) beneficiaries who claimed skill development.**

Overall, the decreasing order of best ranking of zones averaging the four parameters of entrepreneurship and innovation activities from what is claimed by respondents is as follows: South East, South West, West, North, North-east, East. Similarly, the decreasing order of best ranking of schemes averaging the four parameters of entrepreneurship and innovation activities from what is claimed by respondents is as follows: WOS-B, WOS-A, BioCARE and UGC PDF. *(Note: this ranking is based solely on the responses from beneficiaries related to their contribution in entrepreneurship and innovation activities. Any unrealistic responses from beneficiaries may lead to biased results.)*

SWOT Analysis:

SWOT Analysis for the gender mainstreaming programme of Government of India was intended to identify beneficiaries related as well as programme related factors that were favourable and unfavourable to the success and growth of the programme. The SWOT analysis would not only promote or inhibit successful implementation of necessary strategic changes but would also be helpful in assessing the use and distribution of available resources. The two variables were considered for SWOT analysis: i) Achievement parameters of beneficiaries and ii) Satisfaction Levels (of beneficiaries)

with the programme. To quantify achievement of beneficiaries, scores of questions (from the questionnaire) were summed up.

Achievement parameters to calculate Beneficiaries Score: 1) Awards/Honours received, 2) No. of publications, 3) No. of International Seminars Attended, 4) Papers Presented in International Seminars, 5) No. of National Seminars Attended, 6) Papers Presented in National Seminars, 7) No. of International Workshops attended, 8) Papers Presented in International Workshops, 9) No. of National Workshops Attended, 10) Papers presented in National Workshops, and 11) H index.

Score to calculate Satisfaction levels of beneficiaries with the Programme, the variables considered: 1) Satisfaction with the Programme, 2) Respondent Women Scientists' Rating on Programme; where the Level of Satisfaction: Range from 1 to 5, of this 1 being Not satisfied to 5 as Excellent level of satisfaction. This is expressed as, 1 = Not Satisfied; 2 = Average; 3 = Good; 4 = Very Good; 5 = Excellent.

As mentioned above, the eleven parameters of achievement allow calculating of achievement score of each respondent. **The median of observed achievement scores has been found to be 11 and has been taken as a threshold value for an individual to be considered having research achievements.** To construct the categories of 'High Achievement' and 'Low Achievement', the score was divided into two categories with the help of median. Beneficiaries scoring 'Above 11' were categorized as 'High Achievers' and those who scored '11 and Below' were categorized as 'Low Achievers' as the median was calculated as 11. For satisfaction score the total ranged from 2-10 with the mean of 8.6. Mean was used to form two categories: 'High Satisfaction' and 'Low Satisfaction'. The beneficiaries scoring '9 and Below' were categorized as 'Low Satisfaction' and beneficiaries scoring 'Above 9' were categorized as 'High Satisfaction'.

The Strength considered: High Achievement but Low Satisfaction, Opportunity where High Achievement and High Satisfaction. Weakness included Low Achievement and Low Satisfaction and Threat where the women scientists have responded Low Achievement but High Satisfaction.

It was observed that highest proportion (27.2%) of total beneficiaries of North Zone was found in the category of 'Weakness'. In East (32.8%), North East (38.9%) and South East (28.8%) zones the highest proportion of beneficiaries were in the 'Threat' category where they expressed High Satisfaction with the programme but they were Low Achievers. In South West (33.2%) and West (29.9%) zones highest percentage of beneficiaries were from 'Weakness' category.

In BioCARE (28.1%) and WOS-B (32.8%) it was evident that majority – consisting highest number/proportion of beneficiaries were in the 'Threat' quadrant. There were 37.3% of beneficiaries of UGC PDF who were in the 'Opportunity' quadrant. There were 28.6% of beneficiaries of WOS-A who were in the quadrant of 'Weakness'. It was noteworthy here that, similar to this, 27.3% beneficiaries were in the 'Threat' quadrant.

Probability Analysis:

SWOT Level of Achievement:

The Logistic Regression (LR) method was used to statistically fit logit function and calculate the probability of occurrence of event which in our case is that beneficiary can move to higher quadrants of SWOT, i.e., have higher **score of achievement**. There were eleven parameters that were used in SWOT analysis for calculating achievement score of each respondent, score of 11 being median of observation has been taken as a threshold for achievement. The Logistic Regression is more suitable in this achievement dataset because the distribution of scores is more skewed. **The method calculates the probability of a beneficiary to ascend to what can be called an achievement and sets as qualification criteria for each of each of eleven parameters or their optimum combination.** For example, the higher achievement score (i.e. higher than 11 points) could also be realized with the different values of the single parameter namely 'Number of Publications' or a combination of parameters to assess research output of an individual. Assume a certain case of beneficiary with 'No. of Publications' equal to 1 yield 28% achievement probability, 'No. of Papers presented in International Seminars/Workshops' presented equal to 1 yields 33% achievement probability and 'No. of National Seminars/Workshops' attended equal to 2 yields 37% achievement probability. Hence, summing them up, with a total of 98% Probability,

higher achievement may be fructified. **The probabilities of a parameter are additive in case of combinations of parameters.**

This would help to decide the policy makers to develop such a combination of the probabilities for different variables that would lead to higher achievement scores by the beneficiaries availing the schemes and ascend to higher quadrants (along axis of achievements) in SWOT.

SWOT level of Satisfaction:

It was also tried to calculate probabilities with respect to **score of satisfaction** of beneficiaries. The variables such as Age, Family support, Mentors' support, Institutional support, 'duration of break', No. of projects done, change in their Employment were entered in to Logistic Regression model. **None of the above mentioned variables turned out to be significantly related with the satisfaction of the beneficiaries.** Hence, it was not feasible to predict the probability associated with the increase in the satisfaction level.

Ranking the Zones:

Rank analysis was carried out for the zones separately for all parameters within variables. Ranks are calculated for each dimension or parameter within variable and are summed up for each zone to assess performance of zone. These variables considered for **Social Support Dimension** Ranking were 'duration of break', No of Projects undertaken, Mentor's Support, and Institutional Support, Family Support. Among the Social Support Dimensions, South West Zone was ranked one zone followed by North and South East both on 2nd position. North East stood third, East fourth and West Zone the last rank.

The other ranks were identified zone wise for the respondent women scientists' **education progression**, before and after the project availed. The variables considered to rank the education progression were Current Education Level, Change from Masters' to PhD, PhD to Post-Doc. Calculating the overall rank for the Educational Progression variables, North Zone secured first position, West zone second rank, South East, East,

South West and North East Zones availed third, fourth, fifth and sixth ranks respectively.

The third aspect of the respondent women scientists for zone wise ranking was **Career Progression**. The variables considered were level of satisfaction with Current Employment, Employment Growth after the Project, Employment Growth as of 2018-19 (current), and Women Scientists' Involvement in Extension Activities. For the Career Progression, it was observed that East zone was at 1st position, West on 2nd, South West achieved third rank, fourth rank was shared by North and South East Zone. North East Zone ranked the lowest.

The fourth aspect for ranking the zones was **Entrepreneurship and Innovation Activities** carried out by the respondent Women Scientists. The variables included were their Special Contributions, Societal Benefits, Technology Disseminations, and any skills acquired. The South East zone stood in the first position for Entrepreneurship and Innovation Activities. South West Zone stood in the second position. Third rank availed by the West Zone, followed by North, North East and East Zone with fourth, fifth and sixth ranks.

Aggregate of abovementioned four aspects, the ranks i.e., Social Support Dimension, Education Progression, Career Progression and Entrepreneurship & Innovations, revealed the zone wise status. South East zone stood first overall in ranking mainly driven by strong entrepreneurship and innovation activities as well as social support dimensions. North Zone stood second mainly driven by education progression and social support dimensions. South West Zone also stood second overall in ranking mainly driven by social support dimensions and entrepreneurship and innovation activities. West Zone stood fourth mainly driven by education progression and career progression. East zone stood fifth mainly driven by career progression. North-east is stood sixth driven by social support dimensions.

Discussion:

In the above analysis, the variations across zones as well as schemes-wise were clearly reflected. Especially the regional imbalances of researchers were visible across the

zones. East zone had a demography with tremendous potential for growth in scientific research and tops in terms of family support and employment gain but needed improvement in i) education progression, ii) research outputs and iii) Entrepreneurship and Innovation Activities. The researchers required more employment opportunities. The growth of educational, research and development institutions may thrust the opportunities for research and development in private sector as well. The WOS-B had women with more ‘duration of break’ than others with WOS-A being only second from it. The age differences reflect clearly in terms of aspirations and research outputs. **The younger generation in WOS-B are ambitious and have zeal to contribute to the society through their research whereas scheme like UGC PDF have more experienced and mature researchers who are adept to making significant contributions in terms of research outputs like scientific publications.**

Publication of research papers have remained very important for the respondent women scientists; publications enhance the visibility and network among the subject fraternity. Indirectly this may help in career enhancement and professional progression. It may be suggested that the women beneficiaries ‘must’ attend the ‘writing workshop’ at least 2 in case of three-year duration of the project. **The ‘writing workshop’ may be arranged by the DST periodically, one in six months by the eminent and expert institutions or the established publishers like, Springer, Tylor & Francis or any other.** Emphasise may also be given in regard to the improvement in the quality research, similar to the ‘writing workshop’ at regional level with the help of IITs and other universities a ‘research methodology workshop’ may also be made mandatory to be attended by the project awardee women scientists.

There is need for regional sensitization workshops to attract young talent in regions that need improvement. Such initiatives are needed for talented young women scientists who are prospective or aspiring candidates, can draw more candidates where more participation is needed in certain schemes. The same may be organised periodically in close **collaboration with institutions** and with **a robust mechanism for talent identification** to make sure that schemes are availed to the most deserving only.

The **committees and teams of experts** who can provide in valuable inputs to bring in more awareness in young women scientists in institutions from **two-tier and three-tier cities** will pave for much difference in their further careers. Besides, this will improve the participation **from areas which have been traditionally lagging due** to various reasons in research. The able and deserving candidates may be **made aware of research facilities, utilities and their availabilities** that can be useful for their research studies.

The **directory of institutions and research projects** may be made accessible to all with a periodic review status update. The **best performing women scientists may be rewarded and encouraged**. The successful women scientists can be enabled to act as **ambassadors for promoting research** in science and technology.

Research training can act as an important means of equipping the woman scientists with necessary skills and knowledge helpful in carrying out research and develop **research writing useful for publishing** as well as skills needed presenting their work. The woman scientists may be familiarized with publication practices and requirements. The **guidelines and manuals** will be resource that can help solve the bottlenecks in research methodology. The material may be prepared for research ethics and practices. The **coffee-table books** consist of best practices, success stories adding with common mistakes and expert guidance will help allaying misunderstandings and doubts. Encouraging **the active presentation and speaking in conferences** can support the researcher in taking suggestions, crucial observations of others. The productivity of the work is directly affected by these skills which learned can score points to further advance and rise in research field.

The **professional and scientific societies and associations** which are actively organising science and technology related activities may be encouraged to conduct programmes **at national and regional level** targeting increase in women representation in research. Very specific emphasise may be given to the project awardee women scientists. This enhances the spread, outreach motivated by renewed collective conscience for gender balance in scientific research and professional involvement in India.