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**Final Report**  
**Status of Women in Science among Select Institutions in India**  
**: Policy Implications**

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and conducted by  
Society for Socio-Economic Studies and Services (SSESS), Kolkata**

## Research Team

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<b>Project Management:</b>	<b>Scientific Team:</b>	<b>Advisors</b>
Sri. Sudhir Mallick (President)	Dr. Rajlakshmi Mallik (Project Director)	Sri. Siladitya Choudhuri
Sri. Nachiketa Roy (Secretary)	Dr. Aparajita Dhara (Research Analyst)	Sri. Alope Kar
Smt. Karuna Mukhopadhyay		

### **DISCLAIMER**

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# Preface

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The development of women and children has been at the forefront of policy making of Government of India for the last few decades. Two segments of female population are seen to be facing huge drawbacks in pursuing their dreams. First segment consists of those who get deprived of primary education; the other segment consists of the highly qualified women professionals. This report targets the second segment of women, particularly women in science and technology. The continuity of their education is crucial not only for the society, but for building the strength of the country. Many reports, conferences and seminars have been organized nationally as well as internationally to address this issue highlighting the need for female oriented policies in retaining more and more female scientists.

This study is focused on identifying the issues and challenges faced by women in science to pursue higher studies or research. It is based on all-India survey of women science professionals from premier institutes of science in six different zones: North, North East, Central, West, South and East, funded by NITI Aayog, Government of India.

The report has attempted to provide a detailed analysis of the severity of the situation regarding entry and retention of women in science and suggest some measures that might help the Government in making the higher educational sector more compliant to female scientific professionals. It provides a comprehensive view on the current status of women in science, their background and the problems faced by them in pursuing higher studies and research. It has tried to ascertain the incidence of breaks in career and employment and identify various causes of breaks from a purposive sample of 1500 women science professionals and female students of science.

The purpose of this report on ‘Status of Women in Science among Select Institutions in India: Policy Implications’ is to delineate suitable policies after capturing the unique challenges, obstacles, systemic issues, socio-cultural paradigms faced by highly educated women in science. The present report brings out three aspects of women in science: First is the gap in numbers between Ph.D. holders and women with Post-Doctoral research experience. Second aspect is determining the extent of dropout among the female students of science in higher education and research. The third aspect is assessing perception regarding impact of dual role on family commitments and on career advancement and identifying best practices for resolving the issue.

We are extremely grateful and extend our gratitude to NITI Aayog for making it possible to conduct the project.

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Rajlakshmi Mallik  
Project Director and Technical Advisor,  
Society for Socio-Economic Studies and Services

# Contents

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List of Tables (Appendix I) .....	4
CHAPTER 1: .....	17
Introduction .....	17
<b>1.1 Perspective</b> .....	17
<b>1.2 Scope of the Study</b> .....	20
CHAPTER 2: .....	21
Data Collection Design .....	21
<b>2.1 Definitions: Respondent Category and Instrument Development</b> .....	21
<b>2.2 Sampling Design and Data Collection</b> .....	23
CHAPTER 3: .....	32
Currently Working Women in Science: Career Aspirations, Attainment and Challenges .	32
CHAPTER 4: .....	71
Students of Science: Aspirations, Achievements and Enabling Factors .....	71
<b>4.1 Aspirations, Achievements and Enabling Factors</b> .....	71
<b>4.2 Respondent Profile: Student of Science</b> .....	71
CHAPTER 5: .....	90
Currently Unemployed and Dropouts: A Few Case Studies.....	90
<b>5.1 Currently Unemployed</b> .....	90
<b>5.2 Dropout from Higher Studies and Research in Science (without any academic work experience)</b> .....	92
<b>5.3 School Teaching and Occupational Choice</b> .....	93
CHAPTER 6: .....	96
Best Practices and Concluding Remarks.....	96
<b>6.1 Best Practices for Entry and Retention of Women in Science</b> .....	96
<b>6.2 Enabling Regulatory and Management Practices and Career Continuity of Working Women in Science</b> .....	96
<b>6.3 Enabling Features of Place of Work, Academic Productivity and Dual Role for Working Women in Science</b> .....	99
<b>6.4 Regulatory and Management Practices for Continuity of Higher Studies and Research in Science</b> .....	104
<b>6.5 Enabling Features of Place of Study for Academic Productivity and for Dual Role</b> .....	106
<b>6.6 Enabling Features of Place of Study favourable for Dual Role</b> .....	108
<b>6.7 Concluding Remarks</b> .....	109
References .....	119
Appendix-I: Tables – Primary data .....	A-1
Appendix-II: Questionnaires.....	A-42

## List of Tables (Appendix I)

Table No.	Description
<b>Chapter 2</b>	
Table 2.1	Zonal Distribution of Sampled Women in Science
Table 2.2	Distribution of Sampled Women in Science across Institute Categories
Table 2.3	Seniority (Current Designation) among sampled Currently Working Women Science Professionals
Table 2.4	Work Type (Current Designation) among sampled Currently Working Women Science Professionals
Table 2.5	Distribution of Student Respondents across Levels of Study
<b>Chapter 3</b>	
Table 3.1	Highest Degree Held by Sampled Working Women in Science
Table 3.2	Post-Doctoral Fellowship among Sampled Working Women in Science
Table 3.3	Distribution of Sampled Working Women in Science across Disciplines
Table 3.4	Social Group among Sampled Currently Working Women in Science
Table 3.5	Distribution of Sampled Working Women in Science across different Age Groups
Table 3.6	Marital Status among Sampled Currently Working Women in Science
Table 3.7	Number of Children among Sampled Currently Working Women in Science
Table 3.8	Job Contract Type among Sampled Currently Working Women in Science
Table 3.9	Work Type among Sampled Currently Working Women in Science
Table 3.10	Years in Current Designation for Sampled Currently Working Women in Science
Table 3.11	Number of Promotions in Current Institution for Sampled Currently Working Women in Science
Table 3.12	Distribution of Sampled Currently Working Women in Science across Number of Past Institutions where Employed
Table 3.13	Distribution of Currently Working Women in Science across Number of Past Institutions where Employed in Temporary or Part Time Positions

Table 3.14	Job Contract Type when Joined First Job for Sampled Working Women in Science
Table 3.15	Continuing Education for Sampled Currently Working Women in Science
Table 3.16	Dropout among Sampled Currently Working Women in Science
Table 3.17	Resumed and Completed Education after Break among Sampled Currently Working Women in Science
Table 3.18	Reasons for Break in Education among Sampled Currently Working Women in Science
Table 3.19	Reasons for Resuming Education among Sampled Currently Working Women in Science
Table 3.20	Number of Breaks in Employment across Sampled Currently Working Women in Science
Table 3.21	Timing of Break in Career across Sampled Currently Working Women in Science
Table 3.22	Duration of Break in Career across Sampled Currently Working Women in Science
Table 3.23	Type of Break in Employment among Sampled Currently Working Women in Science
Table 3.24	Pre-marriage Employment Break among Sampled Currently Working Women in Science
Table 3.25	Post-marriage Employment Break among Sampled Currently Working Women in Science
Table 3.26	People involved in marriage decisions among Sampled Currently Working Women in Science
Table 3.27	Marriage Timing Influenced by Career Considerations among Sampled Currently Working Women in Science
Table 3.28	Factor influencing marriage timing among Sampled Currently Working Women in Science
Table 3.29	Social Attitude to Dual Role Women In Science related to Marriage and Career among Sampled Currently Working Women in Science
Table 3.30	Highest Education in Own Family (Parents and Siblings) Other than Self among Sampled Currently Working Women in Science
Table 3.31	Number of Members in Own Family (Parents and Siblings) in Academic Occupation among Sampled Currently Working Women in Science
Table 3.32	Highest Education of Spouse among Sampled Currently Working Women in Science
Table 3.33	Highest Education in Spouse's Family (Parents and Siblings) Other than Spouse among Sampled Currently Working Women in Science
Table 3.34	Number of Members in Spouse's Family (Parents and Siblings) Other than Spouse in Academic Occupation among Sampled Currently Working Women in Science
Table 3.35	Occupational Status of Spouse among Sampled Currently Working Women in Science
Table 3.36	Spouse Occupation is Academic of Sampled Currently Working Women in Science

Table 3.37	Direct Family among Sampled Currently Working Women in Science
Table 3.38	Commute from Family Residence among Sampled Currently Working Woman in Science
Table 3.39	Frequency of Visit to Family Residence among Sampled Currently Working Women in Science
Table 3.40	Nature of Family Commitments and Household Responsibilities among Sampled Currently Working Women in Science
Table 3.41	Family Commitments and Household Responsibilities Shared by among Sampled Currently Working Women in Science
Table 3.42	Perception Regarding Effect of Career on Family Commitments and Household Responsibilities among Sampled Currently Working Women in Science
Table 3.43	Refused Challenging Career Opportunity with Higher Pay and Prestige among Sampled Currently Working Women in Science
Table 3.44	Reasons for Refusing Challenging Career Opportunity Sampled Currently Working Women in Science
Table 3.45	Career Aspiration among Sampled Currently Working Women in Science
Table 3.46	Career Aspiration: Desired Work Type among Sampled Currently Working Women in Science
Table 3.47	Dream Job Designation among Sampled Currently Working Woman in Science
Table 3.48	Dream Job in Public or Private Sector among Sampled Currently Working Women in Science
Table 3.49	Dream Job Type of Institution among Sample Currently Working Women in Science
Table 3.50	Perception Regarding Career Attainment with Respect to Career Aspiration among Sampled Currently Working Women in Science
Table 3.51	Perception Regarding Effect of Family Commitments and Household Responsibilities on Career Attainment among Sampled Currently Working Women in Science
Table 3.52	Factors Affecting Career Choice as Science Professional among Sampled Currently Working Women in Science
Table 3.53	Factors Influencing Choice of Current Employment among Sampled Currently Working Women in Science
Table 3.54	Working Hours among Sampled Currently Working Women in Science
Table 3.55	Work from Home among Sampled Currently Working Women in Science
Table 3.56	Avail Institutional Non-Academic Infrastructure – Accommodation among Sampled Currently Working Women in Science
Table 3.57	Avail Institutional Non-Academic Infrastructure - Transport among Sampled Currently Working Women in Science
Table 3.58	Avail Institutional Non-Academic Infrastructure - Family Care among Sampled Currently Working Women in Science
Table 3.59	Perception Regarding Interaction with Male Peer among Sampled Currently Working Women in Science

Table 3.60	Perception Regarding Interaction with Female Peer among Sampled Currently Working Women in Science
Table 3.61	Perception Regarding Gender Equality at Workplace among Sampled Currently Working Women in Science
Table 3.62	Perception Regarding Incidence of Sexual Harassment at Workplace among Sampled Currently Working Women in Science
Table 3.63	Experience Regarding Restriction on Female Mobility (other than Family) among Sampled Currently Working Women in Science
Table 3.64	Achievement Indicators among Sampled Currently Working Women in Science
<b>Chapter 4</b>	
Table 4.1	Highest degree: Stream among Sampled Student Respondents
Table 4.2	Social Group of Sampled Student Respondents
Table 4.3	Age across Sampled Student Respondents
Table 4.4	Marital Status of Sampled Student Respondents
Table 4.5	Number of Children of Sampled Student Respondents
Table 4.6	Highest Education among Own Parents and Siblings of Sampled Student Respondents
Table 4.7	Number of Members in Academic Occupation among Own Parents and Siblings of Sampled Student Respondents
Table 4.8	Highest Education of Spouse of Sampled Student Respondents
Table 4.9	Highest Education among Spouse's Parents and Siblings of Sampled Student Respondents
Table 4.10	Number of Members in Academic Occupation among Spouse's Parents and Siblings of Sampled Student Respondents
Table 4.11	Status of Employment of Spouse of Sampled Student Respondents
Table 4.12	Nature of Occupation of Spouse of Sampled Student Respondents
Table 4.13	Who Do you Live With among Sampled Student Respondents
Table 4.14	Nature of Family Commitments and Household Responsibilities of Sampled Student Respondents
Table 4.15	Support and Sharing of Responsibility for Family Commitments and Household Duties of Sampled Student Respondents
Table 4.16	Effect of Career and Study on Family Commitments and Household Responsibilities of Sampled Student Respondents
Table 4.17	Highest Career Aspiration of Sampled Student Respondents



Table 4.18	Career Aspiration Desired Work Type of Sampled Student Respondents
Table 4.19	Designation and Organisation Type for Dream Job of Sampled Student Respondents
Table 4.20	Perception Regarding Effect of Family Commitments and Household Responsibilities on Performance and Achievement in Studies of Sampled Student Respondents
Table 4.21	Perception Regarding Effect of Family Commitments and Household Responsibilities on Performance and Achievement in Studies of Sampled Student Respondents
Table 4.22	Perception Regarding Factors that are Important in Taking Up a Job among Sampled Student Respondents
Table 4.23	Resumed and Completed a Full-time Course of Study or Research in the Past After a Break of Sampled Student Respondents
Table 4.24	Reasons for Break in Education among Sampled Student Respondents
Table 4.25	Reasons for Resuming Education among Sampled Student Respondents
Table 4.26	Avail Institutional Housing or Hostel Facility at Current Place of Study of Sampled Student Respondents
Table 4.27	Avail Institutional Transportation Facility at Current Place of Study of Sampled Student Respondents
Table 4.28	Perception Regarding Attitude of Male Students as Academic Peers of Sampled Student Respondents
Table 4.29	Perception Regarding Attitude of Female Students as Academic Peers of Sampled Student Respondents
Table 4.30	Perception About Equality of Opportunity for Career Advancement for Male and Female Scientists with Similar Qualifications and Experience of Sampled Student Respondents
Table 4.31	Perception Regarding Incidence of Sexual Harassment in Place of Study of Sampled Student Respondents
Table 4.32	Social Restrictions on Female Mobility of Sampled Student Respondents
<b>Chapter 6</b>	
Table 6.1a	Regulatory and Management Practices Helpful for Career Continuity and advancement
Table 6.1b	Policy and Infrastructure Features Favourable for Career Continuity and Advancement
Table 6.1c	Policy and infrastructure features favourable for career continuity and advancement with scope for development
Table 6.2a	Work-place Features Favourable for Enhancement in Research Productivity and Professional Excellence
Table 6.2b	Work-place Features Favourable for Research Productivity and Professional Excellence with scope for development
Table 6.3a	Workplace features favourable for dual role

Table 6.3b	Workplace features favourable for dual role with scope for development
Table 6.4a	Regulatory and management practices helpful for continuing studies
Table 6.4b	Regulatory and Management Practice Features Favourable for Continuity of Higher Studies and Research
Table 6.4c	Regulatory and Management Practice Features Favourable for Continuity of Higher Studies and Research with Scope for Development
Table 6.5a	Features of place of study favourable for academic attainment and research productivity
Table 6.5b	Features of place of study favouring academic attainment and research productivity with scope for development
Table 6.6a	Features of place of study place favourable for dual role
Table 6.6b	Features of place of study favourable for dual role with scope for development

*Note: For each table there is an identically titled and numbered figure in the main text.*

# Executive Summary

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**Project Name:** “Status of Women in Science in Select Institutions in India: Policy Implications”

**Objective:** The study is designed to understand the reasons for the loss of trained female scientists from scientific manpower in India. It also aims to identify strategies and provisions to promote entry and to retain them in Science by analyzing the effectiveness of policies and practices, and thereby delineate the best practices and also make new policy recommendations based on the findings from the newly generated data set.

**Sampling Design:** The present study is mainly based on responses collected from women in science. The respondent group consists of female science professionals (991) across different categories, ranks and experience and aspiring female scientists or students of science (518) who would be the beneficiaries of future policy changes. Among the currently working science professionals few teachers (6) working in schools and colleges have been interviewed to gather facts about the career choice decision. The survey also covers a few currently unemployed scientists undergoing a break in career (4) and also dropouts from higher studies and research in science without any work experience (2). Four different questionnaires were used for the four respondent groups mentioned above.

The survey has been conducted across India covering premier institutes under eight ministries and autonomous departments under the Government of India along with few schools and colleges. A purposive sampling approach was adopted for the survey. Selection of respondents was made by purposive sampling to ensure an adequate sample size of women in science, with appropriate representation across the zones and category of institutes. Participation has been voluntary based on institutional and individual consent. Data has been collected through personal interview based on a structured questionnaire.

Institutions from the following categories have been covered: DST, DBT, CSIR, Central, State and Deemed Universities, IIT, IISC, IISER, NIT, IIIT, NITTTR, Other Central Institutes, ICAR, ICMR, ISI, DRDO, DAE and ISRO. Sample of 20 respondents per institute have been targeted initially; while final numbers covered vary depending on their presence, availability and willingness to participate in the survey.

**Methodology:** In order to have a comprehensive assessment of the impact of dual role on performance and career attainment of women in science the questionnaire has been designed to gather data on both objective aspects as well as a few subjective parameters. The former consists of quantitative and qualitative variables related to socio-economic and demographic profile of women in science,

educational qualifications, occupation and career track details, specifics of breaks in education and employment, work place academic and non-academic infrastructure and facilities, work environment and peer group interaction, intra-household sharing of responsibilities, dual role related to marriage and family care along with achievement indicators such as publications, projects completed, awards etc. The subjective parameters are related to career aspiration, perception about professional attainment, perceptions about best practices and policies that are favourable for maintenance of dual role and hence for career continuity and advancement for female scientists and students of science.

The analysis is focused on all-India level. Exploratory and descriptive analysis for major variables of concern is presented separately for currently working women in science and for students of science. Respondent views on best practices for retaining women in science, career attainment and dual role are studied using the technique of examination, exploration, content analysis and thematic classification of responses given and views expressed on this issue. Finally observations from detailed interviews of a few currently unemployed with previous work experience, few dropouts without work experience and a few school teachers are discussed in case study format.

### **Survey Results and Main Findings:**

*Of the 991 currently working female science professionals-*

#### **Respondent Profile:**

- 66 % have Doctoral degrees; 25% have Post graduate degrees; 7% have Bachelor's Degree; 2% have a diploma or certificate as their highest education.
- Among working women holding Ph.D. degrees, 34% have completed Post-Doctoral research and 9% are continuing post-doctoral.
- Biology, health and allied sciences is the dominant discipline (33%) followed by Engineering and Computer Science (19%)
- About a third (32%) of the sampled women in science is from the age group of 21-36 years whereas 34% are from the age group 36-41 years; another 34% is from the age group of 46 years and above.
- 80% are currently married, 16% never married and 4% reported 'other' marital status.
- 69% have one or more children
- 81% are from General category and 19% reported other social group

#### **Nature of Employment and Promotions**

- 82% have full-time permanent jobs; 14 % have full-time contractual jobs; 4% are in part-time or temporary positions

- 69% and 27% are working in their current designation for less than 3 years and less than 6 years respectively
- 30% of respondents have worked in more than two institutions; Among those with past work experience with other organisations 32% started in full-time contractual position; another 23% have reported of starting their career with part-time or temporary positions.

#### **Breaks in Education and Employment**

- 24% are continuing education in part-time mode; 7% reported of dropout from full-time course of study in the past; 50% of dropouts would like to resume education; 25% have a resumed and completed education after a break in the past;
- 18% have had one or more breaks in career mostly due to being out of employment; breaks of less than one year is most common and duration of break increases with number of breaks; family care and change of location being the primary cause of break for post-marriage breaks in career.

#### **Dual Role: Effect on Career Attainment and Fulfilment of Family and Household Responsibilities**

- Perception about the effect of career on family commitments and household responsibilities: While a large number 41% (403) said that it had “no effect”, 30% (290) and 3% (33) expressed that it affected the family commitments “somewhat adversely” or “very adversely”. A relatively smaller number 26% (254) said it affected their family commitments “somewhat positively” or “very positively”.
- Perception about effect of family responsibilities on career attainment: Among the sampled women science professionals 42.5% responded that family responsibilities have no effect on career attainment as they can balance both; 32.1 % of them said they were somewhat adversely affected; 16.7% of them responded that due to household support the effect is somewhat positive for them. 5.8% have cited very positive effect and 2.8% have mentioned very adverse effect.
- There are 217 reported instances of refusing a challenging career opportunity among sampled currently working women in science. In some cases there has been more than one refusal. Refused post- marriage after first child birth is most common (101), whereas there are 86 instances of pre-marriage or post-marriage before first child birth refusals. The most commonly cited reason being family care (134), followed by change in job location (67), time commitment involved in job (46) and family objection (24).

#### **Career Aspiration and Attainment**

- Desired type of work. 66% of respondents in this group have chosen “research” as their career aspiration. On the other hand 22% have responded that they would like to go for

“teaching”. 7% have expressed interest in academic administration”. Only 4% respondents aspired to be in “research support services” and 1% reported “other responsibilities”.

- Perception regarding career attainment: 43.1% of the sample working women responded partially achieved; 24% responded somewhat achieved; 23.1% of the respondents said they have fully achieved their goal; 9.1% responded far from the goal and lastly 0.7% responded that they will never achieve their aspiration.
- 68% have responded “observing successful professionals and/or desire to contribute professionally” or “love for the subject” as the reason for their choice. Whereas another 34.9% respondents from this group have said that they have been “influenced by parents”; this is encouraging in terms of societal attitude to entry of women into science;
- Factors influencing choice of current employment of sampled currently working respondents: 62.2% respondent selected “Good workplace academic infrastructure and support services” thus making it the dominant factor in selecting current employment; 57.6 % selected “Prestige associated with the position and institution” ; next 22.5% cited “Time commitment involved in job including travel time” as their reason to pursue current job; 17.3% preferred the “Workplace non-academic infrastructure and support services” of present job; and 4.7% responded “Outstation Travel Involved” as their reason. Lastly 12.2% provided some “Other” reason behind choice of present employment.
- 72.4% of the sampled working women received the membership of professional bodies and 72.1% of the sample respondents have received professional award. 35.4% female respondents held position in academic administration. 35.2% and 28.9% female respondents professionally visited abroad for long duration and short duration (only for last two years) respectively.

*Of the 518 students of science –*

### **Respondent Profile**

- 70% are Ph.D. students. This is the level at which is break in education and research is likely to take place. Remaining 30% of the sample consists of Master’s students and a few students pursuing undergraduate studies.
- The two dominant age groups are “21-26 years” and “26-31 years” and constitute 46% and 47% of the sample respectively. The latter category comprises mostly of doctoral research fellows which is the segment of interest for their proneness to dropout.
- 78% of sampled female student respondents have reported “never married”; 21% are “currently married”. The “Other” category consists of 1% of the sample.

- While most (93%) of the student respondents have reported that they do not have a child, 6% have reported as having one child and 1% have two children
- 77% of students interviewed are from General category, while 23% are from “Other” category.
- Biology, health and allied sciences is the dominant discipline with more than one-third (36%) of the female students of science being from this discipline. The other three common disciplines are Chemistry and allied sciences (15%), Physical sciences (14%) followed by Engineering and Computer Science (13%).

### **Educational and Occupational Profile of Family**

- Highest education among own parents and siblings of sampled student respondents: 52% M. Phil. or Master`s degree; 36% have Bachelor`s degree; (6%) have a family member with a Doctoral degree and 5% have family members with Post -Doctoral research experience.
- Number of members in academic occupation among own parents and siblings of sampled student respondents: A majority of students (58%) have reported that none of their family members are connected with the academic profession. Remaining has one or more members in the profession.
- A significantly higher proportion of student respondents have (i.e. 56%) M. Phil. or Master`s degree as the highest academic degree of their spouse. 23% have Bachelor`s degree, 14% have spouses with Ph.D. Only 7% have selected Post-Doctoral option. With regard to occupation of spouse 81% of sampled students have reported that their spouses are in “Service”, Major proportion of student respondents (67%) has reported that their spouses are engaged with the non-academic profession.

### **Breaks in Education**

- 15% of sampled student respondents have reported that they have resumed and completed a course of study after a break in education. 85% have reported that there has been no break in their education.
- The commonly cited factors for break are not prepared for entrance examination (28) and need to earn or financial problems (22). The students who have cited the former reason basically have a gap year between two consecutive degrees. There are a few instances of break (8) due to marriage and related issues, family care (6) and family objection (3).

**Dual Role: Effect on Academic Performance and on Family Commitments**

- Nature of family commitments and household responsibilities for sampled student respondents: care for the elderly, household chores, household maintenance and care for children are the commonly cited responsibilities.
- 50% of students reported that their career and study commitments did not have any effect on their family commitments and household responsibilities. For these respondents dual role has not had any adverse effect on their family life. Significantly larger proportions 22% and 14% respectively have responded that their career and study commitments have had a somewhat positive and very positive effect on their family commitments and household responsibilities. Many of the respondents volunteered information that the positive effect was associated with financial support for family. Overall the proportion of respondents reporting adverse or very adverse effect of study and career on family commitments is small compared to those reporting an adverse effect.
- The effect of family commitments and household responsibilities on performance in career and higher studies is perceived to be nil by near about half (49%) of the respondents. 38% student respondents have claimed that the family commitments have had a positive effect on their performance in higher studies. Among the 13% who have reported that the effect has been adverse only 3 student respondents have said that the effect has been very adverse.

**Career Aspiration**

- A large percentage of respondents (92%) have reported academics, as their highest career aspiration. Only a small percentage (9%) has cited non-academic profession as career aspiration.
- Desired type of work: 60% of respondents have chosen research as their career aspiration. On the other hand 31% have responded that they would like to take up teaching. 6% have expressed interest in academic administration. Only 1% student respondents have said that they would like to stay with research support services.
- In terms of institution type for dream job, 40% student respondents would like to get job in research institute and 29% in university. 15% were indifferent between university and research institute jobs. 4% expressed interest in industry job while 1% said they preferred self-employment.
- Factors that have influenced them in choice of science as a stream of education. Most have responded “observing successful professionals and/or desire to contribute professionally” or “love for the subject” as the reason for their choice. More than one-third have said that they have been “influenced by parents”; this is encouraging in terms of societal attitude to entry of women into science.



- Factors influencing choice of future employment of sampled student respondents. Workplace academic infrastructure and support services emerge as the most important factor (324) followed by prestige associated with the position and institution (241). Time commitment involved in job including travel time (189) and workplace non-academic infrastructure and support services (162) are the two other commonly cited criteria along with outstation travel (71).

Based on respondent feedback on Best Practices the following observations emerge:

- 85% of sampled 991 women science professionals and 93% of sampled 518 students of science have mentioned that the overall regulatory and management practices have been helpful for continuity of career and higher studies.
- Work environment and regulatory features considered crucial for continuity of women in science.
- Academic infrastructure is considered to be critical for academic productivity and professional attainment although some observations are there that non-academic infrastructure would help to improve academic productivity.
- Institutional provision of non-academic infrastructure particularly with respect to housing, transportation, family and health care related support services are considered enabling for dual role. There are a few suggestions regarding work from home and flexi hours which are considered helpful for dual role.

# CHAPTER 1:

## Introduction

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### 1.1 Perspective

There is a growing concern among policy makers regarding the entry and retention of women in science. Although female academics in science are moving more towards equal representation they are still under-represented in leading positions or in institutes of higher education with post graduate teaching and research.

International data during the past decade suggest that the number of women in most areas of science and engineering has continued to grow by leaps and bounds. Quantitative surveys however indicate persistence of gender-gaps, in terms of opportunities, salaries and career advancements and this remains a challenge that needs to be addressed (Dehdarirad et al., 2015 Ginther, 2003; Ginther and Hayes, 2001).

In India, despite the increasing number of women in higher education in science, women's participation at higher levels of science in tenured research positions has shown little increase. Women constitute over one-third of the total science graduate and post-graduate degree holders, but comprise only 15-20% of the tenured faculty across research institutions and universities in India, (INSA Report, 2004). Science career begins at the early stage soon after PhD and it is important for women to establish themselves during their early 30s. But this period coincides for most Indian women with marriage and family commitments. Breaks or temporary research positions of 3-5 years during this period do not provide the advantage of moving up the ladder at a later stage when family commitments take less time. Thus, as a compromise, a large number of qualified women scientists opt for undergraduate or school level teaching assignments, while others completely drop out of science.

#### *1.1.1 Women in Science: Policy Issues and Evidence*

Among the various issues that the empirical studies on women in science addresses, two major recurrent themes are that of (a) entry and retention of women in science and (b) gender differences in career attainment among scientists, with female scientists showing lower levels of attainment vis-à-vis their male peers.

**Entry and Retention:** The problem of losing women power starts at the level of higher studies with enrolment or *entry* into post-graduate and doctoral degrees programs in science. To start with, the percentage of female enrolment in total enrolment in post-graduate and research degrees in science is much lower for females compared to males, as the various government official statistics will show (MHRD, All India Survey on Higher Education 2013 - 16; Educational Statistics at a Glance, 2011 - 16).

A quick scan of secondary data from government sources, as also casual observation, will show that the percentage of female enrolment in total enrolment in higher studies in science is on the rise, but post-entry the problem persists as many female students drop out of higher studies and research before completion and forfeit their degrees (MHRD reports; 2011-16).

The other aspect of the problem of entry and retention of women is related to *retention after entry*. It is evident in the context of women who, after having obtained their doctoral degrees, either fail to pursue a career in science or undergo a break in employment after commencing a career. This is reflected in the larger difference between number of women and men doctorates pursuing post-doctoral research in comparison with the differences in numbers at the doctoral level; or the percentage of female scientists in tenured positions being lower than percentage of females holding doctoral degrees (Chandra et al. 2008; Martinez et al. 2007). Even those who manage to start a career in science fail to continue and undergo career breaks.

**Career attainment:** The issue of retention of women practicing science is related to the second policy issue in these area viz. gender gaps in career attainment among male and female scientists. Career attainment measured in terms of nature and duration of employment contracts (fixed-term contractual vis-à-vis permanent tenured positions) or rank and seniority or salary shows large differences across genders (Dehdarirad et al., 2015; Ginther, 2003; Ginther and Hayes, 2001).

### *1.1.2 Dual Role, Entry and Retention of Women in Science in India*

The problem of impact of dual role related to family care and marriage on career continuity and attainment of women in science in India begins at the stage of higher studies and research in science. Data reveals that a large number of women **dropout** from higher studies and research in science (Kurup, 2016, Chandra et al, 2008; Martinez, 2007).

In the Indian context there have been several studies on the problems related to retention of trained scientific women power sponsored by INSA, IAS and NIAS (Kurup et al., 2010; DST,GOI, 2010; Chandra et al, 2008; Pooncha and Gopal, 2004). These studies conclude that the complexity of developing interventions to retain women in Science stems from the diversity in the characteristics of women scientists across the different sub-groups of women in Science. The differences also, perhaps, stem from the different priorities the groups have because even with several commonalities among demographic profiles of the women, differences on important aspects such as professional prospects vs. childcare or family responsibilities are seen. The studies have come up with policy recommendations and interventions related to organizational and infrastructural provisions and policy changes with regard to recruitment, selection and evaluation procedures in terms of greater

transparency, mandatory disclosures, time bound recruitment, policies related to “two body”<sup>1</sup> problems and long term schemes for re-entry.

### *1.1.3 Schemes and Measures Related to Researchers in Science and Women Scientists*

The major eligibility criteria for recruitment of staff for short term research project (technical support, research support and administrative support) or permanent scientist / researcher /consultant positions for the various categories of government institutions may be classified under the following heads –

- Minimum required qualifications in terms degree held which increases with rank and duration of job contract.
- Work experience in terms of minimum required number of years (1-3, 5, 10) in related field and specific designation or in a specific type of organisation, which again increases with rank. Some substitutability is allowed between years of work experience and academic qualification.
- Upper age limit (25/28/30/32/35/40/45 yrs) which again increases with rank or level of appointment and also with nature and duration of job contract. There are provisions for concession to age limit applicable often for SC, ST, OBC, retrenched government employees, departmental candidates, ex- servicemen, physically challenged and in some cases for women.
- Restrictions on maximum number of years between application and award of degree (in case of fresh applicants for post-doc)
- Women specific maximum age relaxation of two to five years is specific to certain types of job categories or designations e.g. scientist and researcher positions such as JRF, SRF, Post-doc, RA, Visiting Scientist etc.
- Other women specific measures / schemes include maternity leave, child care leave, women specific research grants e.g. DST Women Scientist Schemes of 2 to 3 years duration (WOS-A and WOS-B for unemployed women scientists and unemployed women scientists below 55 years age); DBT Bio-care Research Grant Opportunity 3+2 years duration for Ph. D. (age limit 55 years) women scientists who are employed, or unemployed or desirous of coming back after a break with
- Selection procedure is through interview and/or selection test in most cases.

Broadly speaking, existing schemes and measures specific to women in science address the issue of dual role of women scientists primarily in terms of relaxation of (i) upper age limit, (ii) special leave provisions and (iii) special research grants for women undergoing a career break.

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<sup>1</sup>The term “**two-body**” **problem** is used in the context of working couples particularly among the academia and refers the difficulty of both spouses, wishing to stay together, obtaining jobs at the same university or within a reasonable commuting distance from each other.

## **1.2 Scope of the Study**

The study is designed to understand the reasons for the loss of trained female scientists from scientific manpower in India and the gender gap in professional attainment among scientists. It also aims to identify strategies and provisions to promote entry and to retain them in Science by analyzing the effectiveness of policies and practices already in place, and thereby delineate the best practices and also make new policy recommendations based on the findings from the newly generated data set.

The specific objective and scope of study is as follows:

- (1) To explore, document and measure the incidence of (a) female students **dropping out** from higher studies and research in science before completion of their course or research and (b) **breaks in career** and low career attainment among female scientists.
- (2) To identify the factors related to **dual role** viz., family care, household duties and marriage which are responsible for dropout, career break and low career attainment among women in science. Career attainment is measured in terms of career graph – e.g. number and gap between promotions, rank or seniority etc. and also research productivity, collaborations, professional recognition and awards – e.g. number of completed projects, published research papers, conferences attended membership of professional bodies and advisory boards etc.
- (3) To critically examine **best practices** for promoting and retaining women in science among the different types of higher education institutions in the country. The report also highlights the policy implications to ensure continuation, strengthening and spread of such best practices as could be located or experimented with.

The finding of this study is expected to inform policy design and help in formulation of favorable program framework for the willingness and need for women to stay active in research despite their other responsibilities which by creating a trade-off between family and career considerations hamper their entry or continuity in science profession.

# CHAPTER 2:

## Data Collection Design

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### **2.1 Definitions: Respondent Category and Instrument Development**

In keeping with the study objective and scope of research, the respondent group consists of only female respondents including female science professionals who are currently working, students of science along with a few dropouts from higher studies and research in science and few currently unemployed science professionals undergoing a break in career. The composition of currently working is designed to cover various categories of science professionals such as scientists, faculty members, laboratory technicians, technical assistants and other research support staff in different designations and work responsibilities. The currently working respondents are mostly from the institute categories identified in sub-section 2.2 below. However some female faculty teaching in schools and colleges have also been covered to identify factors leading to their career-choice decision.

The survey of female students currently enrolled in higher studies and research in science has been critical as they are the aspiring female scientists of tomorrow's India and are likely to be the cohort that is going to be the beneficiary of any policy change.

Four questionnaires corresponding to four categories of respondents – Schedules W, S, D& U – were used for data collection:

**SCHEDULE W** has been used for interviewing “Currently Working” female scientists, laboratory technicians, engineers and teachers working in research institutes, laboratories, universities and government departments. Some female science teachers, teaching in schools and colleges have also been covered by this questionnaire to capture factors in career-choice decision.

Given the possibility that some of the currently working respondents (covered by Scheduled W) might have undergone a break in employment or higher studies in the past, questions on this issue have been included in Scheduled W.

**SCHEDULE S** has been used for interviewing “Students of Science” who are pursuing full time higher studies or research in science. So, this Schedule covers students enrolled in or continuing study in Doctoral, Master's and Bachelor's degree programmes in science.

**SCHEDULE D** has been used for “Dropouts from Higher Studies and Research in Science”. This category of respondents included students who have discontinued higher studies or research in science before completion and without any further work experience. Since respondents for the survey were

captured through educational institutions and the drop-outs are not currently attached to any, it was difficult to get a good sample of them for the present study. Only three such respondents could be covered in the survey. The names of these respondents (drop outs) were obtained from the Heads of Department or faculty and student members of Science departments, covered by the survey.

**SCHEDULE U** has been used for “Currently Unemployed” but with previous work experience i.e. for respondents who are currently undergoing a career break or break in employment.

The data collected through these questionnaires cover both objective observable parameters as well as a few subjective parameters related to perception and attitudes. The first group consists of both quantitative and qualitative variables, such as

- achievement indicators regarding projects undertaken,
- number of papers published and
- career track details such as
  - years of experience,
  - current rank,
  - promotions,
  - intra-household sharing of responsibilities,
  - Family profile in terms of education, occupation etc.

The second group consists of questions on perceptions and attitudes such as

- level of ambition,
- acceptability in workplace,
- Sense of achievement etc.

Evidently, the primary data collected in the survey cover aspects of dual role spanning a period of five years prior to the date of survey (2011-2016). For the present study, these are supplemented by secondary data pertaining to current scenario available for the period 2000 to 2016.

The questionnaires have been designed to cover some or all of the following major themes:

- **Occupation and Career Track** details with regard to current employment, past employment, first job, *breaks in education and employment* and years of work experience.
- **Marriage, Family and Career** details to capture interrelationships if any between career and marriage decision and between family-profile, family commitments and career. This latter section is meant to address the dual role issues faced by women in science.
- **Career Aspiration, Achievements and Priorities** deals with levels, of ambition factors influencing career-decision and perceptions regarding career achievement.
- **Best Practices** with regard to regulatory framework and management practices and also with regard to infrastructure, facilities, systems and processes in place of work which have helped

female science professionals and students to (a) maintain their dual role and avoid breaks in education or career and (b) achieve excellence in profession.

- **Work-environment: Features and Experience** that capture details about actual use of academic and non-academic infrastructure and facilities in place of work and perceptions regarding work-environment.
- **Achievement Indicators** in terms of number of publications, projects and consultancies completed, research supervision, conferences attended, travel abroad, administrative responsibilities held, memberships of professional bodies and awards, honours and distinctions. These are standard performance assessment indicators for career advancement.

All the four questionnaires were structured with most questions in multiple choice formats. A few questions about best practices were kept open-ended to get women scientist's feedback about policies that would be favourable for maintaining dual role and hence ensuring career continuity and advancement for female scientists and students of science.

## **2.2 Sampling Design and Data Collection**

The study is based on both secondary and primary data. The secondary data from official sources such as government reports and independent surveys, websites of different ministries of Government of India and the websites of institutions covered by this survey has been used to get a basic idea about the presence of women in science, the profile of female academicians in science and higher education in the country and the institutional profiles.

Field level primary survey data has been collected through personal interview method based on a structured questionnaire (with provisions for comments by respondent). A purposive sampling approach was adopted for the survey<sup>1</sup>. Participation has been voluntary and based on institutional and individual respondent consent.

In addition, to have a comprehensive coverage of various categories of institutes, six ministries and two autonomous departments of Government of India were identified. From the official websites of these ministries various categories of institutes<sup>2</sup>, universities, laboratories etc. under these ministries were identified of which 19 categories were selected: DST, DBT, CSIR, Central, State and Deemed Universities, Institutes of National Importance, IIT, IISC, IISER, NIT, IIIT, NITTTR, Other Central Institutes, ICAR, ICMR, ISI, DRDO, DAE and ISRO (State Private were not considered in view of the importance of other categories and to keep the focus on public institutions). A sample of 991 currently working women in science and 518 students of science were selected for interviewing from institutes covering all the 20 categories. A small part of the sample of 991 women in science was

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<sup>2</sup>The category of an institute has been determined as per information available on (a) official websites of Government of India and institute websites during October to November 2016 and (b) as reported by respondents.



selected from those teaching in selected government schools to identify factors leading to career choice decision among women in science teaching in schools.

In addition, very small samples of sizes 4 and 2 of respectively currently unemployed women with science degrees and dropouts without work experience were selected for the study. As the survey is primarily institution based and not household based, only a few such cases could be identified. Specifically references of three dropouts without any work experience and three currently unemployed respondents with previous work experience could be obtained from the currently working professionals and students of science. These are presented separately as case studies.

Participation of individual respondents has been based on both institutional and personal consent in response to invitations. A representative number of female respondents from each institute were interviewed through structured questionnaires **depending upon their presence, availability and willingness to participate in the survey.**

Sample of twenty respondents per institute have been targeted initially; while the number finally covered was varied, depending on their presence, availability and consent. For each institute, efforts were made to interview female respondents at senior, middle and entry level under the following categories were considered: (a) Scientists or Faculty (senior such as scientists G, F or Professor; middle ranking such as Associate Professor or scientists C, D or Research Associates etc.; entry level scientist or faculty such as scientist B or Assistant Professors or Post-docs) (b) Research Support Staff (i.e. lab or technical assistant) (c) Ph.D. students (d) post graduate and under graduate students.

More than 620 institutes and universities from the nineteen categories identified above and including government schools were invited to participate in the survey. Among these 121 institutions expressed interest to participate from which over 1800 respondents were initially registered for the survey. The final sample includes 991 currently working science professionals and 518 students enrolled in higher education and research in science.

**Table 2.A** below shows the zonal participation of the 19 categories of institutes covered by the survey.

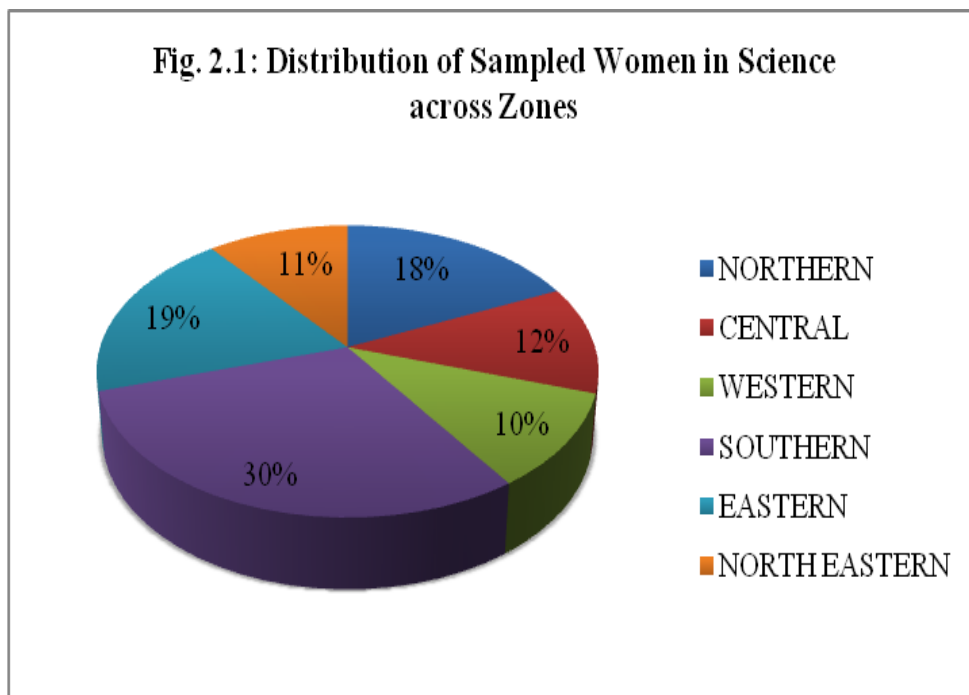
<b>Table 2.A: Zonal Coverage of Institute Categories</b>																			
ZONES	DBT	DST	CSIR	Cntrl. Univ.	St. Univ.	DEEMED	IIT	IISC	IISER	NIT	IIIT	NITTR	Other Cntrl.	ICAR	DRDO	DAE	ISRO	ISI	ICMR
N	P	P	P	P	P	P	P		P	P				P	P				P
C	P	P	P	P					P		P	P		P		P			
NE	P	P			P		P			P	P			P			P		
E		P	P		P		P						P	P		P		P	P
W		P	P	P		P	P							P	P	P			P
S	P	P	P			P		P						P	P		P		P

P: indicates that the category of institute has been covered from a zone

For Central, Eastern, Southern and Western Zonal Councils, 9 out of 19 categories of institutes have been covered by the survey while for the North Eastern and Eastern Zonal Councils the corresponding numbers are 8 and 12 respectively.

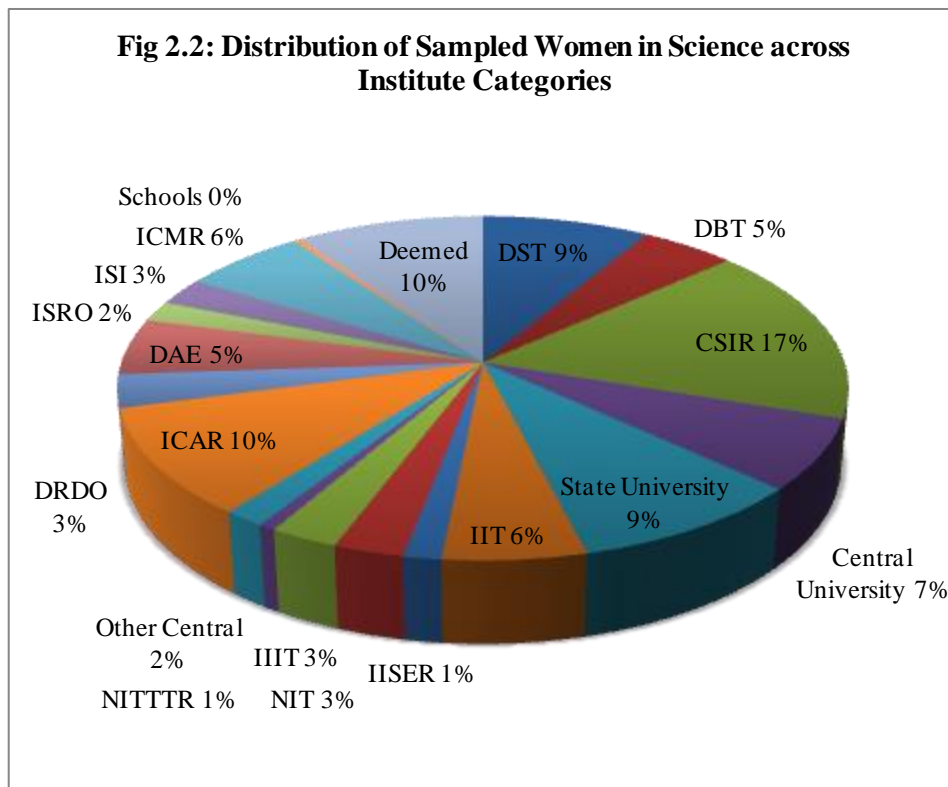
The composition of the sample across zones, institute categories, currently working respondent categories in terms of work type and seniority and student composition according to level of study for 1509 working women and students of science from 121 institutes from 21 states and Delhi NCT are given below in figures 2.1 to 2.4 (Refer Tables 2.2 to 2.5 in Appendix II).

### 2.2.1 Zonal Distribution of Respondents



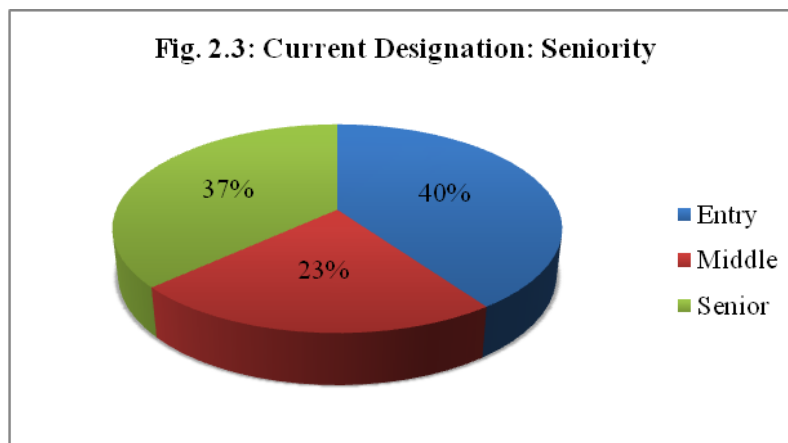
**Figure 2.1** shows the zonal distribution of currently working women science professionals covered in the sample. Out of total 1509 working women science professionals (scientists, faculty, engineers, post doctorates, research support staff divided into three categories- entry, middle and senior level - and students of science pursuing doctoral, Master's and Bachelor's degree studies) 30% belongs to southern zone, 19% to eastern zone, 18% to northern zone, 12% to central zone, 10% to western zone and 11% to north-eastern zone. This clearly indicates that the sample consists of respondents from all the six zones and that the zones are fairly well represented in the sample

### 2.2.2 Institute Category wise Composition of Sample



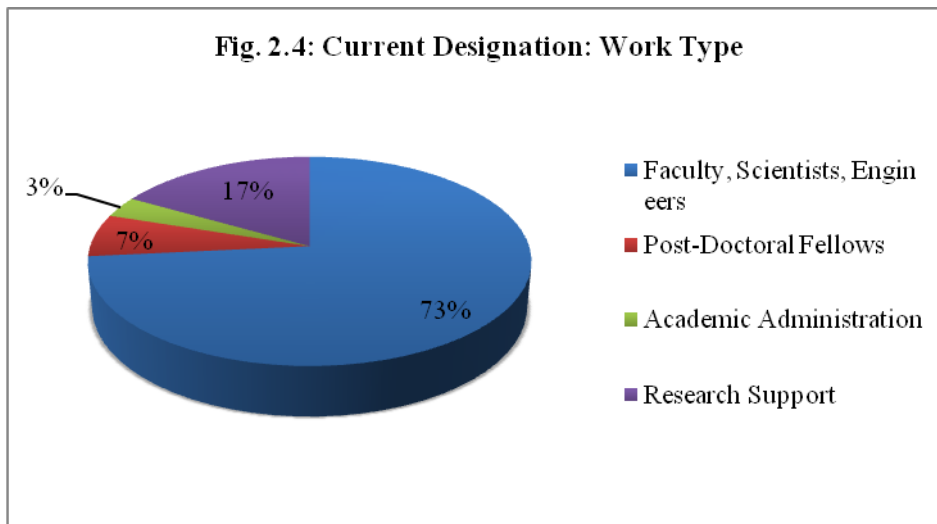
**Figure 2.2** highlights the distribution of sampled women in science across 20 different institute categories. Out of a sample of 1509 women professionals and female students of science 30.1% of them are from DST, DBT and CSIR institute combined; 40.2% from technical institutes and the universities (central, state and deemed) under MHRD; DRDO, DAE and ISRO have contributed 10.3%; and the remaining one-fifth of the sample is accounted for by ICAR (10.1%), ISI (2.6%) and ICMR (6.3%).

### 2.2.3: Seniority in terms of Current Designation of Working Science Professionals



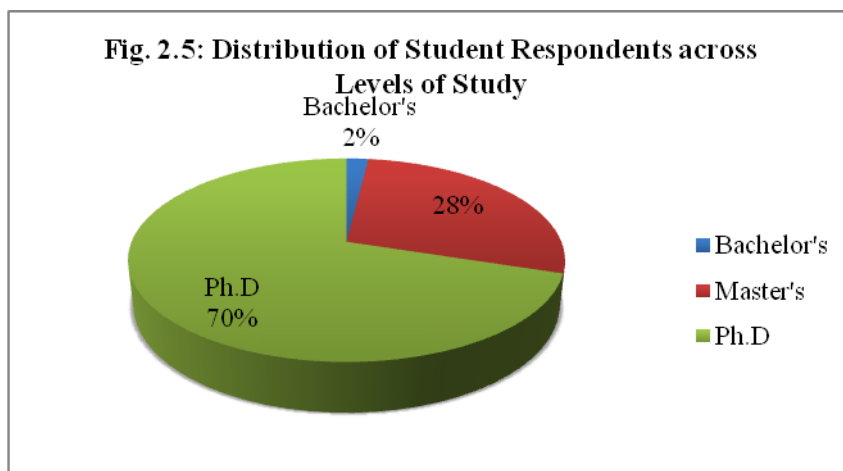
**Figure 2.3** highlights the sample composition in terms of rank or seniority level of currently working women science professionals into senior, middle and entry level positions which constitute 40.3%, 36.8% and 22.9% of the sample respectively.

**2.2.4: Currently Working Respondent Category: Work Type**



**Figure 2.4** shows the composition of the working women science professionals in terms of their work type. 728 i.e. 73% of the working respondents are faculty, scientists and engineers. Post-doctoral fellows are shown separately and constitute 7% of the sample. For a few i.e. four out of the 65 female scientists currently working as post-doctoral fellows this is their second turn as post-doctoral fellow. 32 (3%) of working female professionals covered by the survey are involved in academic administration as Head of Department, Director, Dean, Senior Administrative Officer etc. Technical and research support staff (166) consisting lab technicians, technical assistant, research assistant, demonstrator etc. constitute 17% of the sample.

**2.2.5: Student Respondent Category: Level of Study**



The sample of student respondents consists mostly of Ph.D. students (363 i.e.70%) as this is the level at which is break in education and research is likely to take place. Remaining 30% of the sample consists of 145 Master's students and a few students pursuing undergraduate studies.

### **2.3 Entry of Women into Higher Studies and Research in Science**

This section highlights some comparisons based on secondary data about the presence of women in science. Section 2.3.1 presents some official statistics at the all India level. Institute level data on female presence in institutes of science and technology covered by this study are presented in the section 2.3.2.

#### **2.3.1 Higher Education Statistics**

**Secondary data** has been primarily sourced from GOI reports, particularly MHRD studies and reports **All India Survey on Higher Education** and **Educational Statistics at a Glance** for the period 2011-12 to 2015-16.

**Table 2.B** shows annual percentage enrolments - female and total (male and female combined) - for 7 different disciplines out of aggregate enrolments across all disciplines, for the period 2011-12 to 2015-16, at Ph. D., M.Phil., Master's and Bachelor's degree programmes.

Comparison of female and overall enrolment percentages reflect differences between female and male enrolment percentages across different disciplines. Based on this the following observations are made.

Female enrolment percentages for "Engineering and Technology" and "IT and Computer Science" are lower than male enrolment percentages for these disciplines at the UG level, which is the point of entry into higher education for all years during 2011-16.

For "Science" and "Medical Science" the female enrolment percentages are slightly higher than male enrolment percentages.

For "arts" the difference between female and male enrolment percentages is marked reflecting the higher entry of women into the field of arts.

Table 2.B: Percentage of Female Enrollment in Select Disciplines as compared to Total Enrollment											
		2011-12		2012-13		2013-14		2014-15		2015-16	
UG		Female	Total	Female	Total	Female	Total	Female	Total	Female	Total
	Science	13.2	11.9	13.2	12.6	14.1	15.8	15.4	15.4	16.2	16.0
	Engineering & Technology	12.0	18.9	10.8	17.3	10.7	17.4	9.6	15.9	9.3	15.6
	Medical Science	3.7	2.8	3.9	3.0	4.0	3.0	4.0	3.1	4.3	3.3
	IT & Computer	4.7	5.1	2.7	3.0	2.6	2.7	2.4	2.6	2.3	2.5
	Agriculture	0.3	0.4	0.3	0.6	0.3	0.6	0.3	0.6	0.4	0.7
	Arts	38.0	33.8	46.2	40.8	46.1	40.4	45.9	40.2	41.1	36.2
	Commerce	14.3	14.5	13.9	14.4	13.5	13.9	13.7	14.0	14.0	14.1
PG		Female	Total	Female	Total	Female	Total	Female	Total	Female	Total
	Science	9.62	8.9	14.26	12.78	13.84	12.45	14.09	12.51	14.49	12.3
	Engineering & Technology	4.74	6.18	4.69	6.24	5.43	7.12	5.75	7.6	4.88	6.69
	Medical Science	4.86	4.39	2.77	2.92	2.86	2.97	3.02	3.06	3.22	3.33
	IT & Computer	9.13	10.3	8.76	9.93	7.61	8.32	6.99	7.48	5.74	6.22
	Agriculture	0.32	0.42	0.31	0.48	0.38	0.56	0.34	0.58	0.34	0.57
	Arts	...	...	18.13	17.11	18.08	16.83	18.41	17.35	...	...
	Commerce	8.11	7.27	8.8	7.75	10.3	9.22	10.68	9.61	11.79	10.75
M.Phil		Female	Total	Female	Total	Female	Total	Female	Total	Female	Total
	Science	17.58	17.5	28.39	27.01	27.22	25.66	27.9	26.69	27.62	25.37
	Engineering & Technology	0.28	0.27	0.38	0.37	0.29	0.24	0.43	0.3	0.19	0.15
	Medical Science	5.56	4.3	0.51	0.35	0.6	0.49	0.44	0.46	0.46	0.41
	IT & Computer	6.32	5.15	6.68	5.1	7.25	5.54	7.28	5.6	5.6	4.74
	Agriculture	0.05	0.04	0.08	0.14	0.02	0.05	0.02	0.17	0.05	0.15
	Arts	...	...	15.31	18.17	17.06	19.73	16.63	18.92	...	...
	Commerce	9.86	8.31	11.15	10.11	10.89	9.47	10.18	9.05	8.88	7.58
Ph.D		Female	Total	Female	Total	Female	Total	Female	Total	Female	Total
	Science	22.97	22.15	28.36	27.88	27.82	26.27	27.78	25.88	27.52	26.82
	Engineering & Technology	15.16	20.55	11.92	17.67	14.73	21.21	16.42	23.42	17.38	24.19
	Medical Science	6.22	5.59	3.38	3.77	4.47	4.66	3.83	3.99	4.18	4.14
	IT & Computer	1.81	1.35	2.02	1.71	1.68	1.54	1.87	1.69	2.53	2.19
	Agriculture	2.35	2.84	2.86	3.56	3.73	3.89	3.14	3.84	3.53	3.83
	Arts	...	...	15.32	14.6	14.65	13.27	13.49	12.13	...	...
	Commerce	3.89	3.65	3.46	3.12	2.93	2.85	3.75	3.09	3.17	2.74

Source: Compiled from MHRD Reports

The pattern continues at the Master's and Doctoral levels for "Engineering and Technology" and "IT and Computer Science" with female enrolment percentages for these disciplines being lower than male enrolment percentages.

Considering female and male enrolments for "Medical Science" at the Master's and Doctoral level the female enrolment percentages are lower than overall enrolment percentages for three out of five years which signifies a reversal from the pattern observed at the UG level.

This reflects that moving up from UG to higher degree and research programmes, the restricted presence of women in higher studies and research in science becomes evident for broader range of disciplines.

Considering percentage female enrolments in specific disciplines out of total female enrolments, across different years for the five year period 2011-16, it is observed that the female enrolment percentage has been increasing for most disciplines and for most years, indicating a change towards more women entering and continuing with higher studies in science.

### **2.3.2 Institutional Presence of Women in Science: Secondary Data**

Institute level data across different categories of institutes and states, regarding percentages of females in total working science professionals and students of science enrolled in higher studies and research show the dearth of female science professionals and students of science in the premier institutes of science and technology in India.

Figures for female presence among total working science professionals is less than 30% for most of the institutes of science and technology<sup>ii</sup>. Among these a large segment has female presence less than 20%. There are some instances where female presence among scientific staff is less than 5%. Correspondingly there are a few institutes with 40% to 50% female presence among working science professionals.

Overall for the sampled institutes female presence is around 20% considering scientific and administrative staff other than Post-doctoral fellows. Among Post-doctoral candidates less than 29% are female. The figure is higher among Ph.D. students with more than 33% being female.

<b>Table 2.C: Presence of Women in Science in Surveyed Institutes</b>	
<b>Category of Woman in Science</b>	<b>Female (%)</b>
Working (Scientific and Administrative Staff)	20.0
Post-Doctoral Fellows	28.7
Ph.D.	33.5
Students (UG and PG)	24.0

Among students enrolled in undergraduate or post-graduate programmes in science and technology female enrolment is around one-fourth (one-sixth at undergraduate level with the percentage rising to around one-fourth at the post-graduate level).

Considering institute level figures percentage of female candidates among Post-doctoral fellows ranges from two-thirds (67%) to less than one-fifth (18%); whereas the variation in female presence among Ph.D. enrolled students of science across institutes is much larger with female presence as high as 86% or as low as 15%.

The proportion of Post-doctoral enrolment out of Ph.D. enrolment is 18.03% overall (19.3% for male and 15.4% for female). Male Post-doctoral fellows are 2.5 times their female peer group whereas at the Ph. D. level male enrolment is less than twice the female enrolment. These figures clearly imply the loss of trained women scientists during the transition from Ph.D. to Post-doctoral research India.

<sup>i</sup>**End Note 1:** Initially, a three-stage stratified random sampling was proposed for the survey based on zone wise selection of states and then selection of reputed institutes of various categories from each state followed by a representative sample of respondents from each institute.

But, the procedure of random sampling could not be adopted in view of the following:

- (a) Lack of updated frame for sampling of respondents due to non-availability of updated staff list on Institute websites
- (b) Reluctance of potential respondents to participate in the study in many cases or to participate without approval from institutional head
- (c) Even for respondents who expressed interest to participate in the study, because of their multiple professional commitments the interviews had to be rescheduled several times and in many cases abandoned after several scheduling, while few respondents could not be reached at their contact details or declined to participate later
- (d) A large number of institutes did not show interest in the study and did not respond to request made.
- (e) Presence of a few female scientific staff members in case of many institutes made achievement of target sample size of 1500 from initially sampled institutes from 20 categories from 11 states and Delhi NCT, difficult.

With the random sampling procedure proving to be inapplicable, purposive sampling used to select respondents to ensure an adequate sample size of women in science, with appropriate representation across the zones and category of institutes. To get an adequate representation for each zone on the sample, almost all the institutes as available on official government websites were invited to participate in the study with a request to send a list of female respondents from the institute willing to participate in the study.

<sup>ii</sup>**End Note 2:** Other than DRDO, ISRO, DAE



# CHAPTER 3:

## Currently Working Women in Science: Career Aspirations, Attainment and Challenges

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### 3.1 Quantitative and Qualitative Variables of Interest

This chapter and the next present insights about the nature of field data from the survey for two types of respondent categories viz. currently working female science professionals and students of science.

Major variables of interest such as respondent profile in terms of age, marital status, number of children, highest degree held, nature of employment (job contract), nature of primary and additional work responsibilities, incidence and reasons for dropout or break in education, incidence and reasons for continuation and completion of education after break, incidence and reasons for break in employment, various achievement indicators with regard to professional recognition are all analysed along with respondent's perception regarding effect of dual role on career attainment and on fulfilment of family and household responsibilities and perceptions regarding work environment.

Observation from data on respondent's views regarding best practices for retaining women in science both among currently working science professionals and students of science is presented in Chapter 5.

The analysis is focused on all-India level. An exploratory analysis using simple descriptive statistics for the above variables along with their distributions are presented in section 3.2.

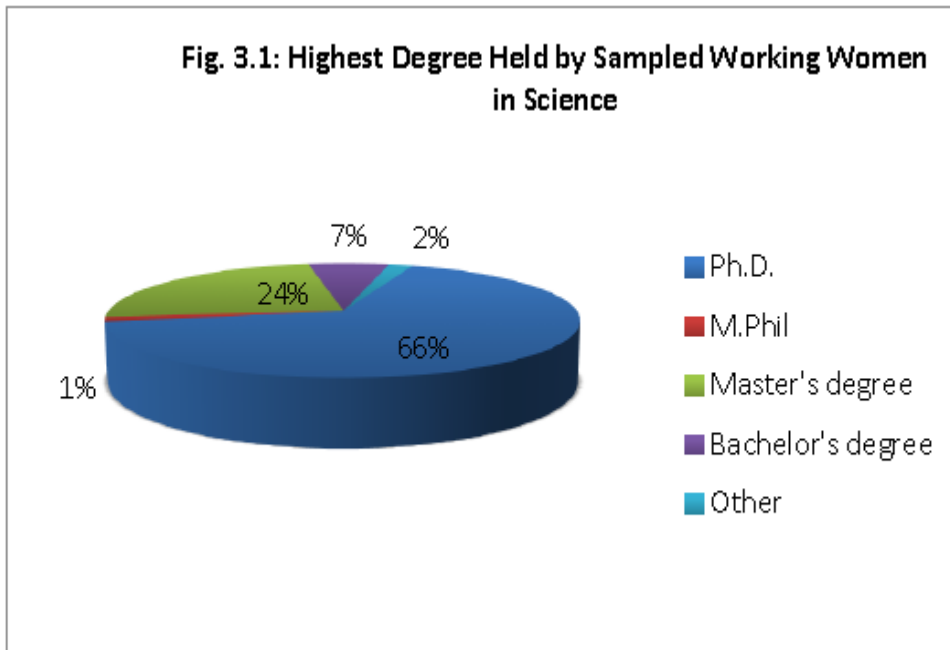
### 3.2 Data Description

#### 3.2.1 RESPONDENT PROFILE

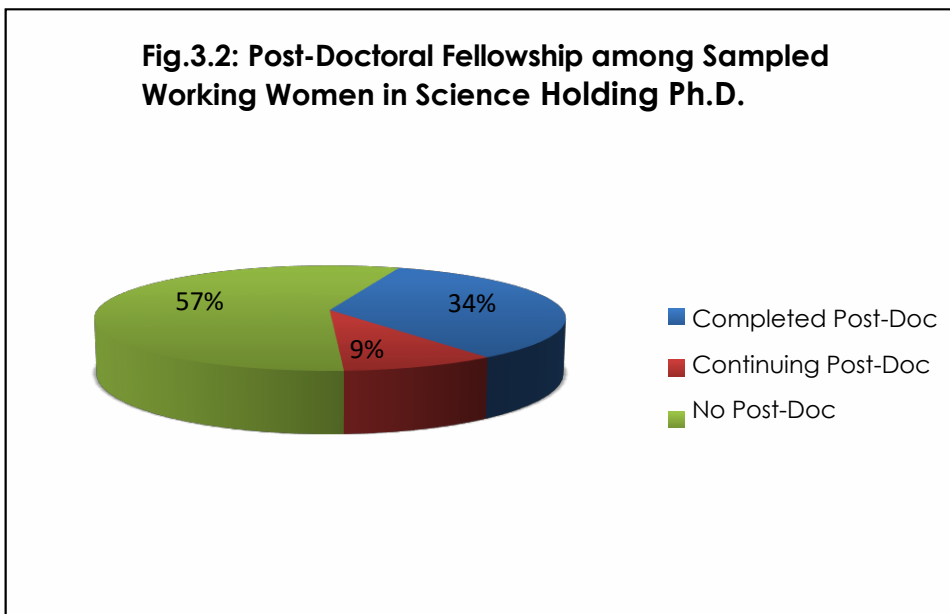
##### a: Highest Degree held:

**Figure 3.1** summarises the distribution of working women in science across different academic degrees. The respondents who have a diploma or certificate as their highest education (after completion of school, UG or PG degrees) have been considered under the "Other" category. It is observed that 66% of the surveyed working women in science have Ph.D. as their highest degree.

Another 25% has M. Phil or Master's degree as their highest degree and 7% has Bachelor's as their highest degree. Just about 2% of the currently working women in science reported as having done a diploma or certificate programme after completion of higher secondary education or a degree courses.



**b: Post-Doctoral Fellowship:**

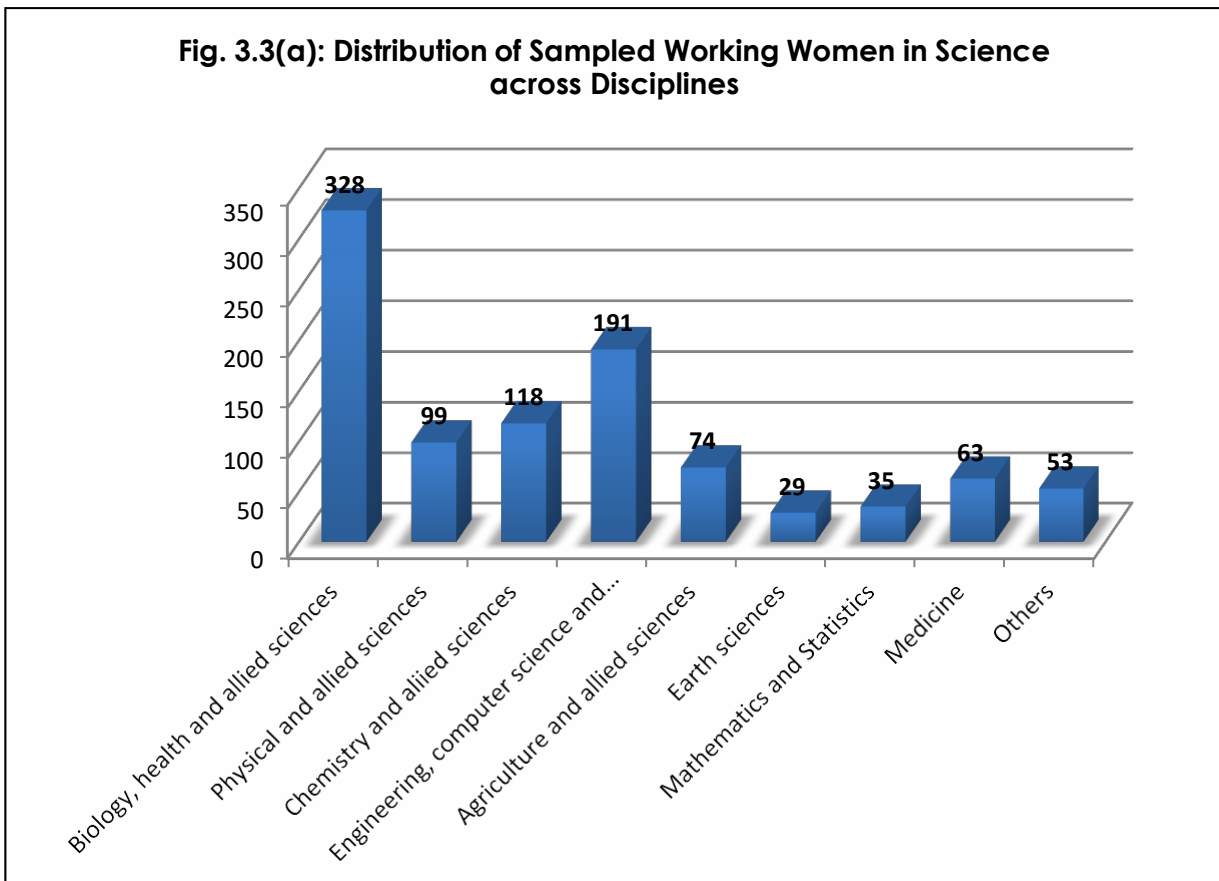


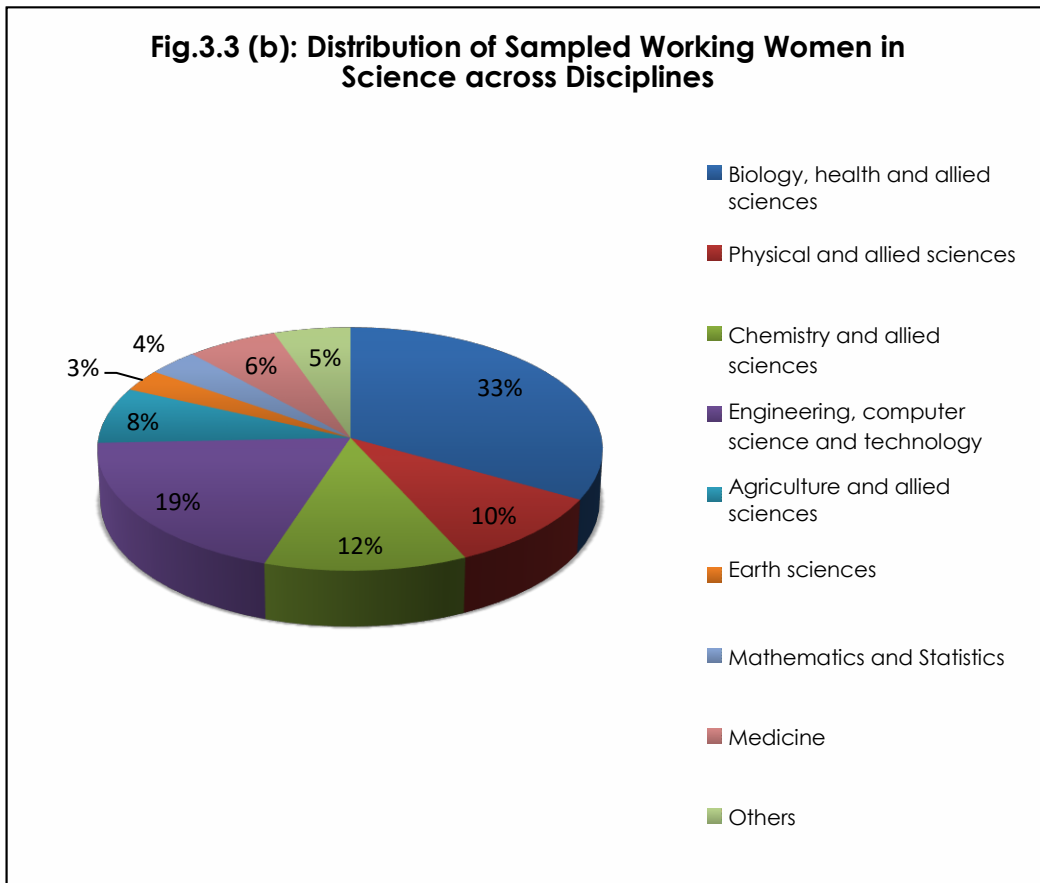
The transition of women in science from doctoral to post-doctoral phase is a critical one. **Figure 3.2** above summarises the findings in this regard. It shows the distribution of respondents from currently working women with a Ph.D. degree in science across different stages of post-doctoral work. Of the 658 working women who completed doctoral research 57% (371) reported not having post-doctoral research experience. “No Post-doc” includes respondents with Ph.D. degree who either “did not apply” or “applied but did not get” or “applied and got, but discontinued before completion”. Four among the 371 respondents without post-doctoral experience volunteered information that they got a post-doctoral fellowship and started work but discontinued before completion. The remaining 43%

doctorates are either currently pursuing post-doctoral research (9%) or reported as having completed post-doctoral work (34%). A few among the current post-doctoral researchers reported as this being their second round of post-doctoral engagement.

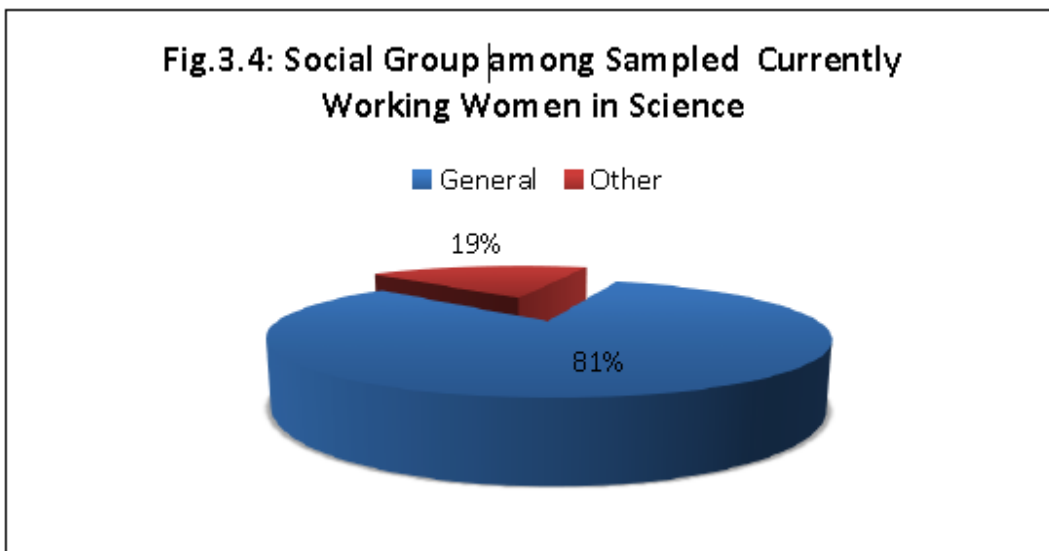
**c: Discipline:**

**Figure 3.3 (a) and (b)** show the distribution of sampled currently women in science across different disciplines. ‘Biology, health and allied science’ as the dominant discipline is evident in our sample. Of the 328 science professionals from the above discipline, which constitutes 33% of the sample, 96women science professional have an interdisciplinary background such as bio-chemistry, bio-physics, biotechnology etc. Engineering and Computer Science (19%) and Chemistry and allied sciences (12%) and Earth sciences (10%) are the other major disciplines that have 10% or more respondents from this group.



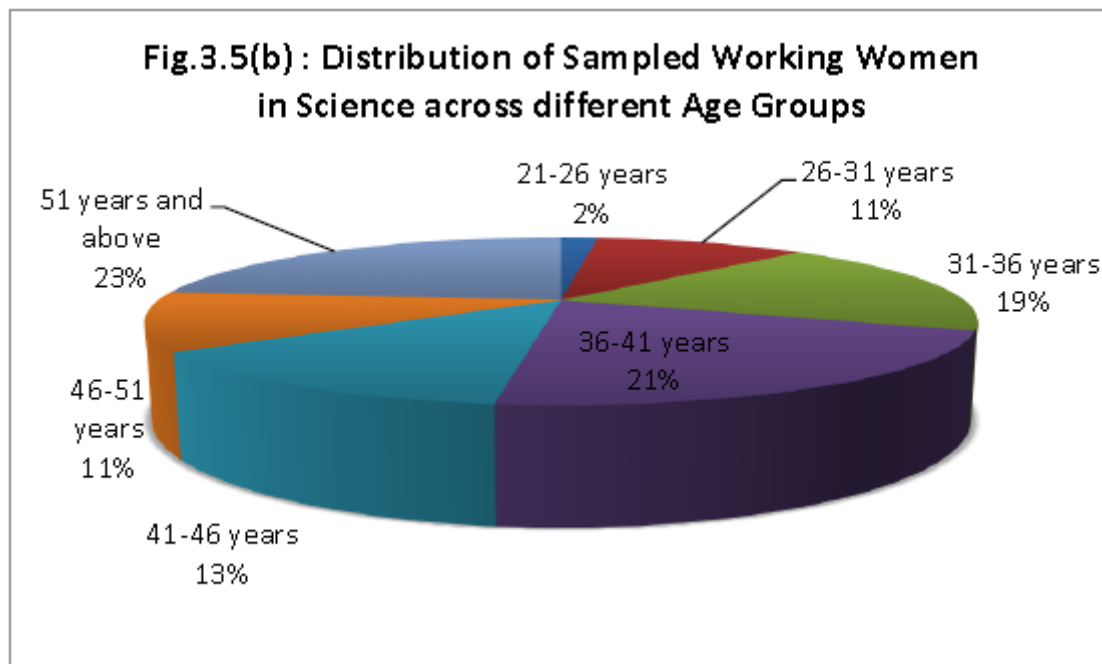
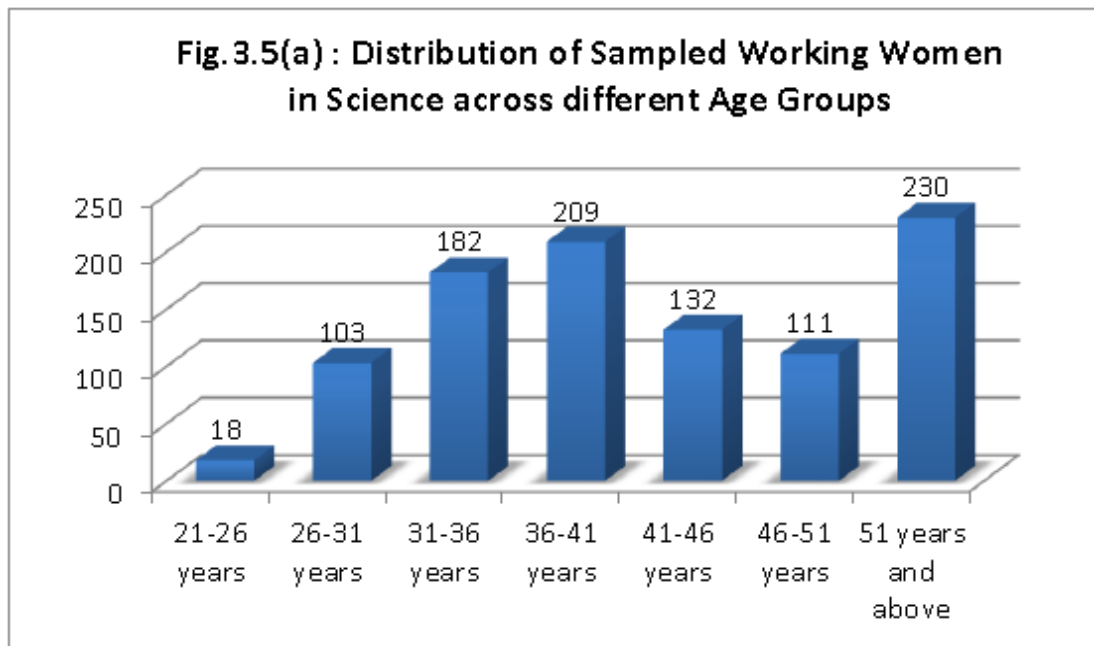


**d: Social Group:**



Graph in **figure 3.4** reveals that among the sampled currently working women in science 81.5% are from general category and 18.5% is from the “Other” category (including SC, ST, OBC).

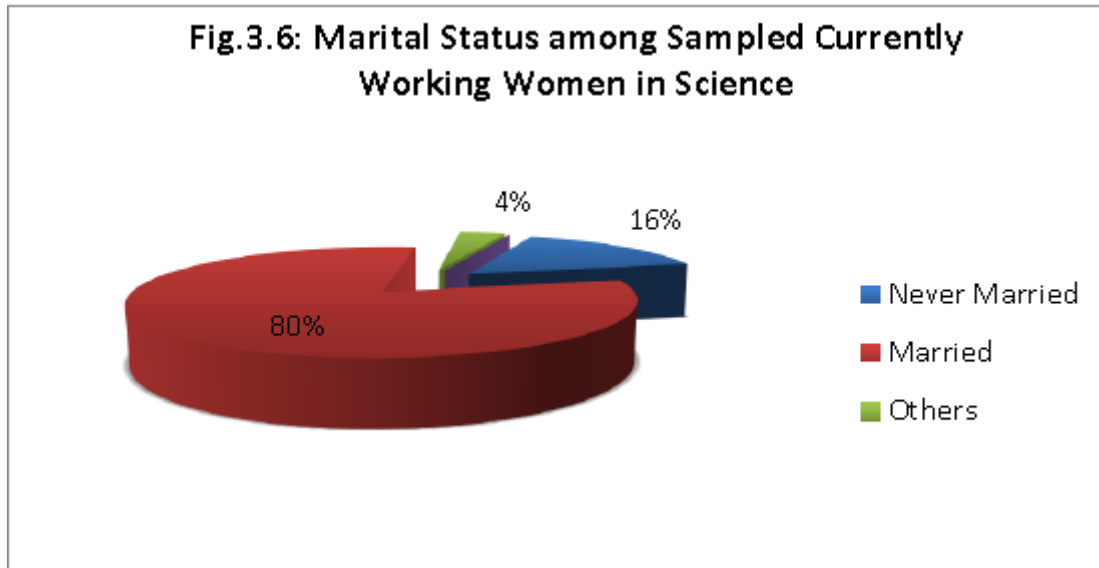
e: Age:



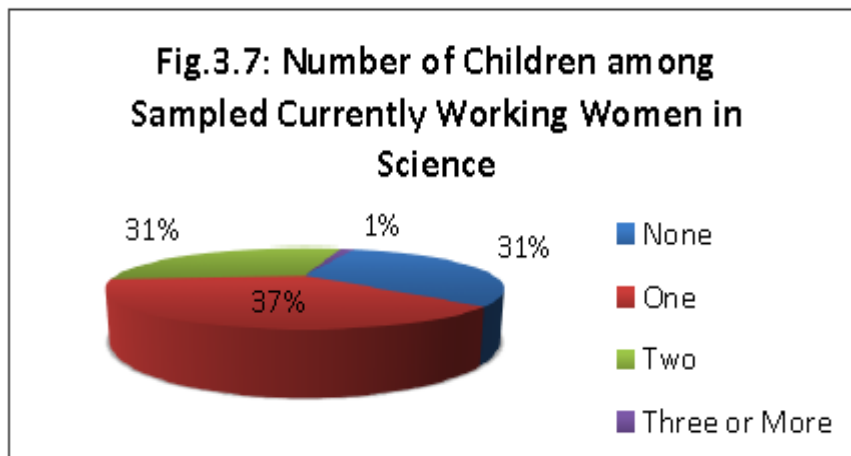
Graphs in **figure 3.5 (a) and (b)**, show the age-wise distribution of sampled working women in science. About a third (32%) of the sampled women in science is from the age group of 21-36 years whereas 34% are from the age group 36-41 years; another 34% is from the age group of 46 years and above.

**f: Marital Status:**

**Figure 3.6** illustrates the distribution of sampled working women in science according to their marital status. 80% of sampled respondents in this group have reported “married”; 16% are “never married”. The “Other” category includes divorced, separated or widowed respondents and constitutes 4% of the sample.



**g: Number of children:**



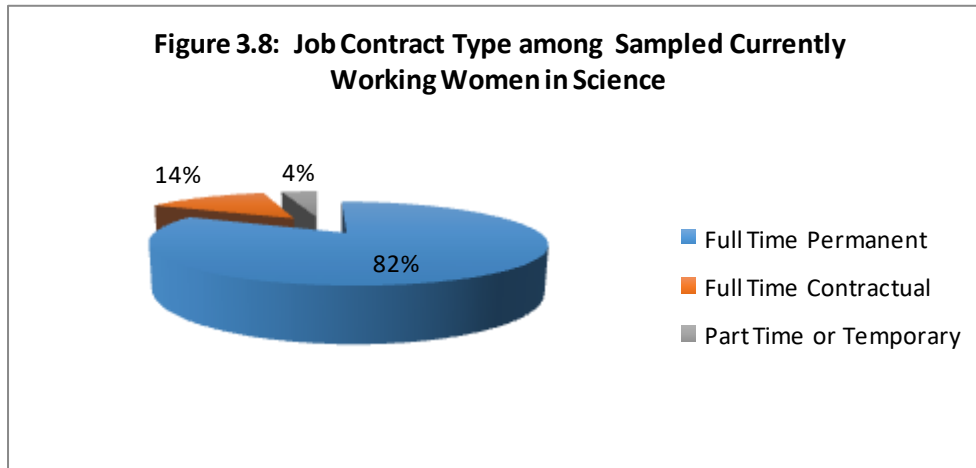
The status with regard to number of children for sampled working women respondents is illustrated in **Figure 3.7**. While about a third (31%) of the working women in science respondents have reported that they do not have a child, 37% have reported as having one child and another 31% have two children. Thus nearly 69% of the sampled working women in science constitute the segment subject to dual role commitments related to marriage and family care including care of children. This is indeed a lower bound as the remaining segment has other family commitments.

### 3.2.2 OCCUPATION AND CAREER TRACK

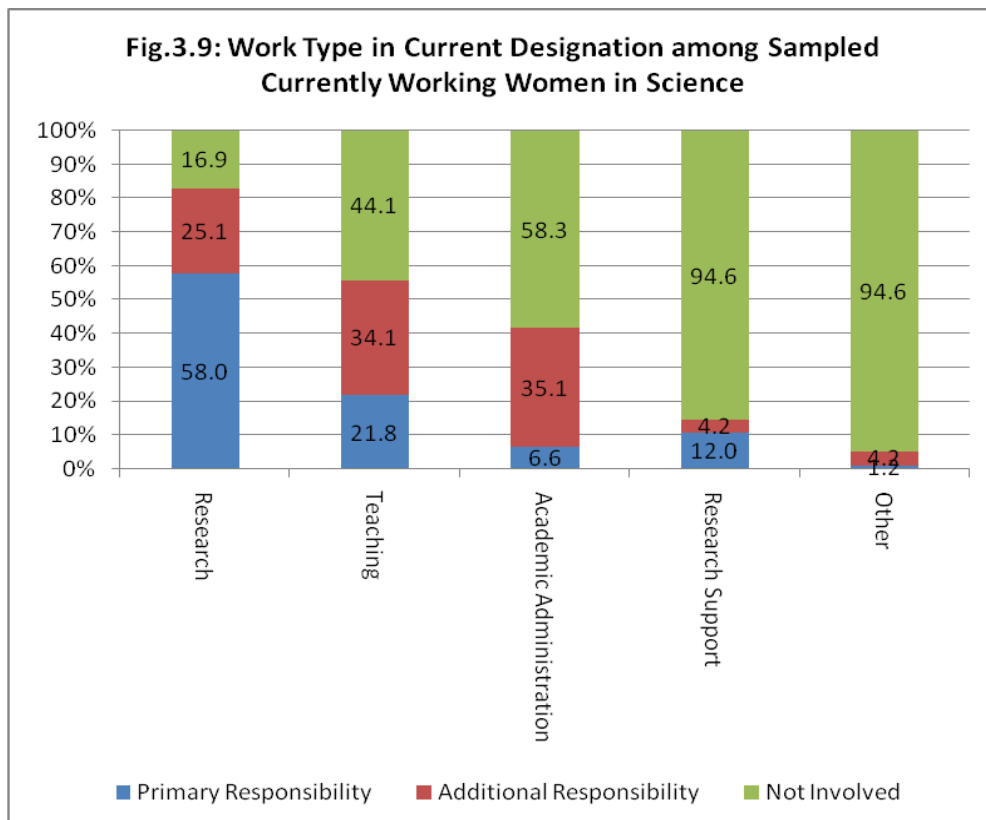
#### I. Current Employment

##### a: Nature of Employment in Current Designation:

**Pie-chart in 3.8** indicates that 82% of sampled respondent in this group have full-time permanent jobs; 14% have full time contractual jobs (consisting mostly of post-doctoral fellows). A small percentage (4%) has part-time or temporary jobs.

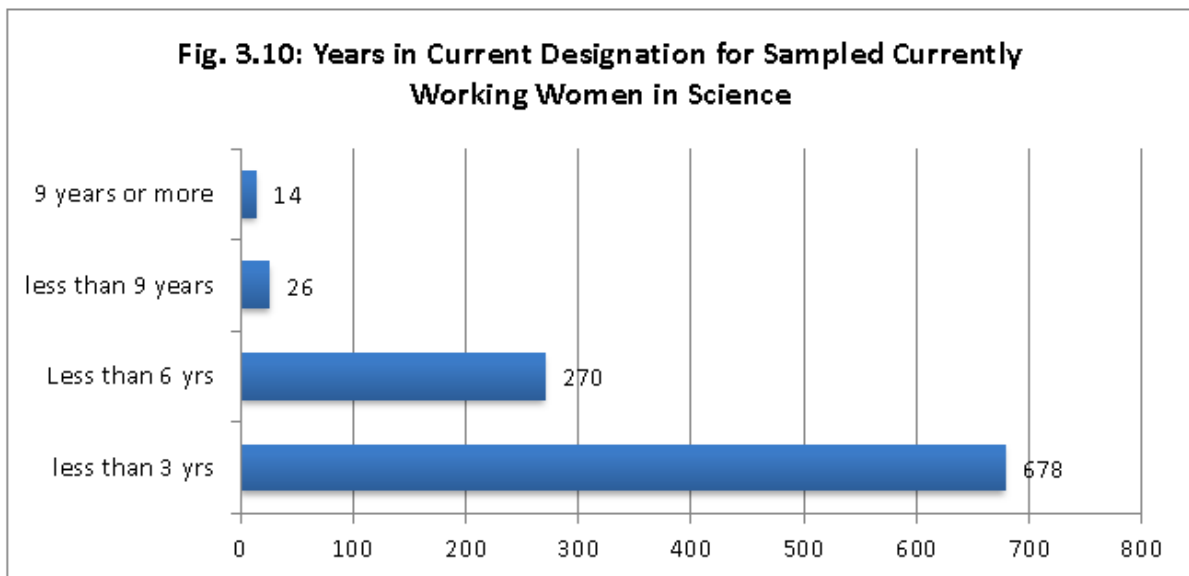


##### b: Work Type - Primary and Additional Responsibilities:



**Figure 3.9** illustrates the nature of work for major and additional responsibilities held by the sampled working women in science. Depending on time allocated to a particular type of work a responsibility is classified as belonging to “primary”, “additional” and “not involved” category. The divided bar charts show for each work type the percentage of sampled respondents for whom it is a primary responsibility or additional responsibility or no responsibility i.e. the percentage of respondents who are not involved in this particular activity. For the sampled working women in science, research is the primary activity for most respondents (58%). Over a quarter (25.1%) respondents reported that it is their additional responsibility, while 16.9% reported that they are not directly involved in research. Teaching and research support services are major responsibilities for 21.8%, 12.6% of working women respondents. Academic administration is major responsibility for 6.6% of sampled respondents. With regard to the nature of additional work responsibilities, 25.1% reported that research is their additional responsibility. The corresponding figures for teaching, academic administration and research support services are 34.1%, 35.1% and 4.2 %. So while research emerges as primary responsibility, teaching and academic administrations are mostly additional responsibilities.

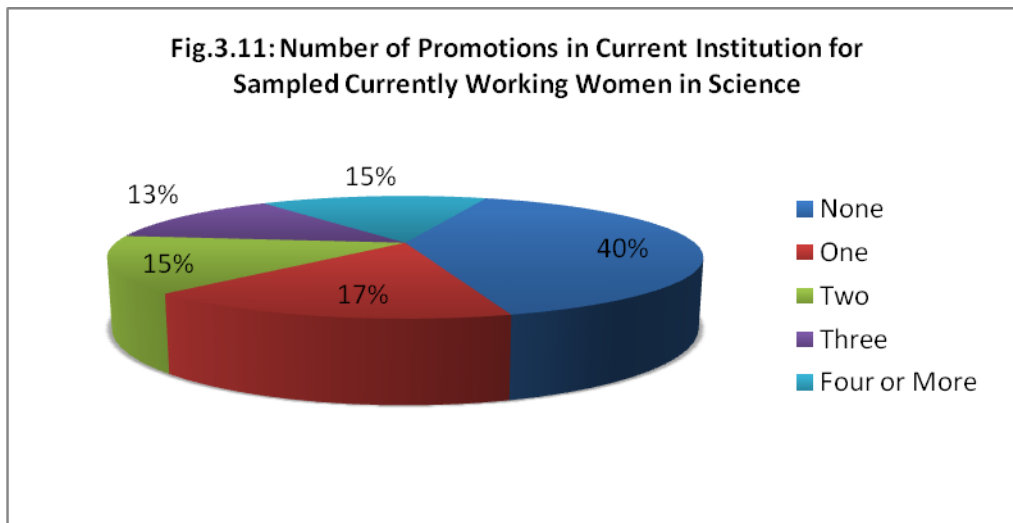
**c: Number of Years in Current Designation:**



**Figure 3.10** shows that 69% (678) of sampled working women in science have been working in their current designation for less than three years; another 27% (270) are working in their current designation for almost 6 years. 3% (26) working women respondents have reported working in their current position near about the last nine years while 1% (14) has reported working in their current designation for 9 years or more.



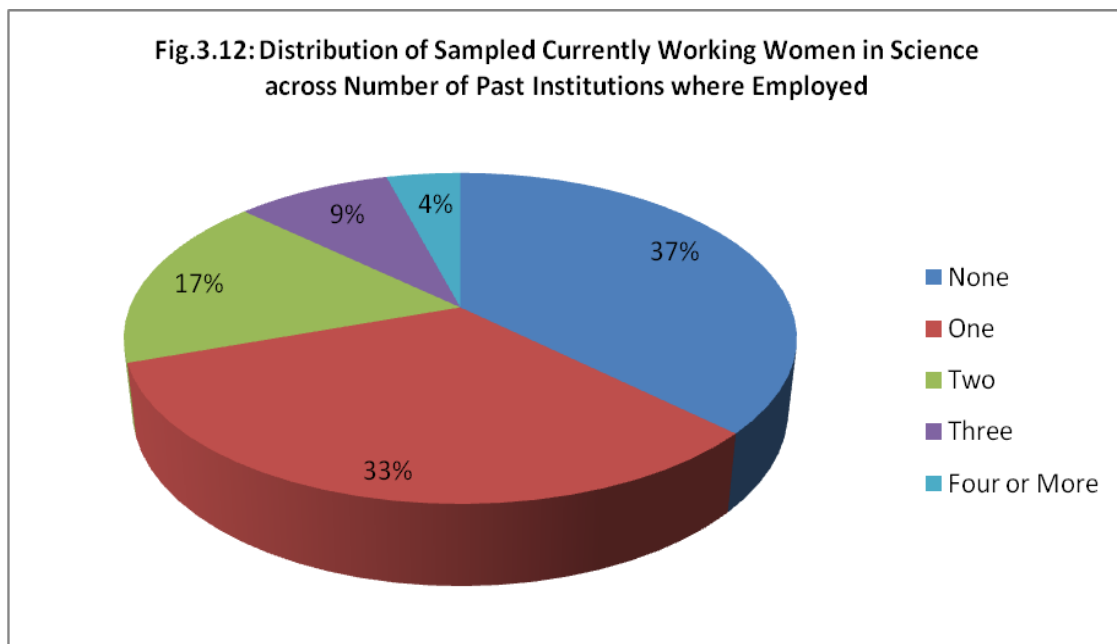
**d: Number of Promotions in Current Employment:**



Pie-chart in **figure 3.11** shows that 40% of sampled working women in science reported that they have not received any promotion in their current institution. 17% and 15% working respondents have stated that they have received one and two promotions respectively. 13% respondents from this group have stated that they have received three promotions in their current institution and 15% of our sample respondents have received 4 or more promotions in their current institution.

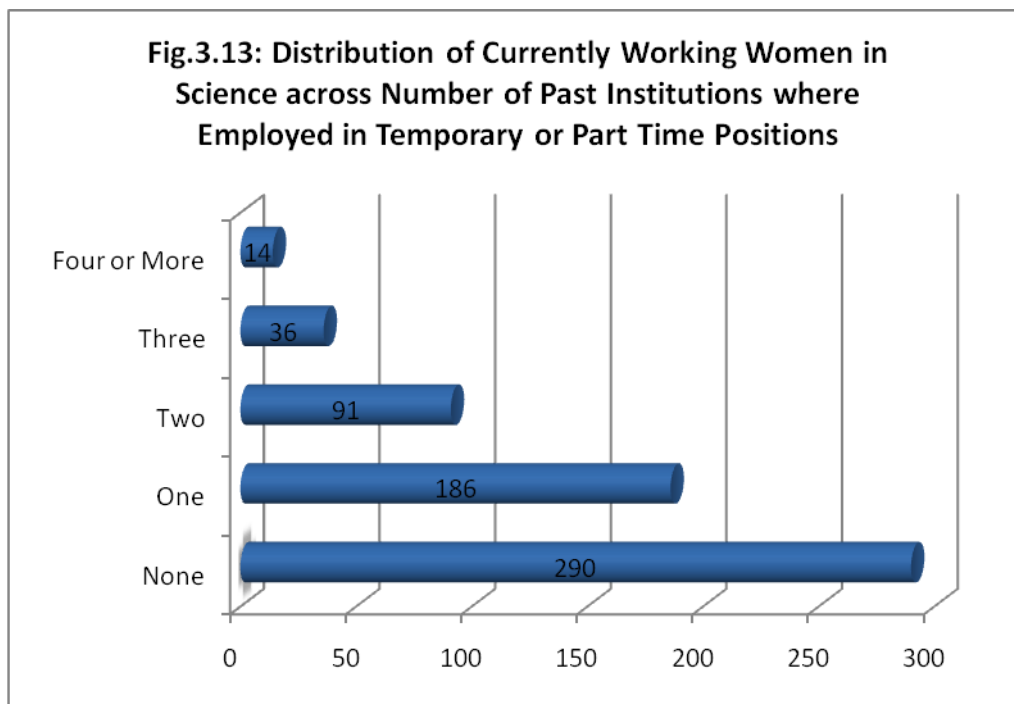
**II. Past Employment**

**a: Number of Past Organisations where Employed:**



**Fig 3.12** shows that 37% of sampled working women in science have reported that their present job is their first job. 33% of respondents from this group have reported that their present institution is the second institution where they have been employed. 17%, 9%, 4% sampled respondents have reported that number of past institutions where they have worked is 2, 3, 4 or more respectively. So among the sampled working women in science only 30% of respondents have worked in more than two institutions.

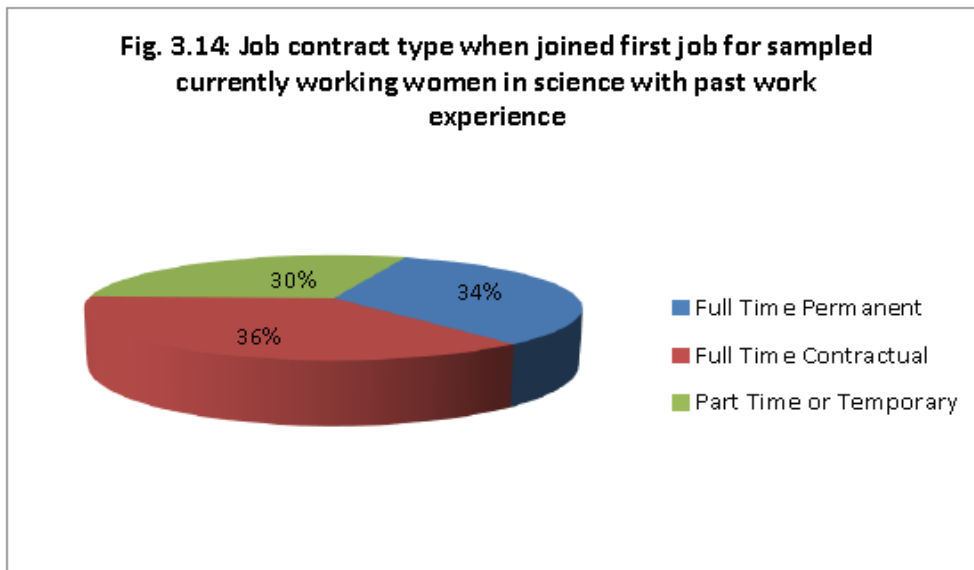
**b: Number of Past Organisations where only Part-time or Temporary Positions were held:**



**Fig 3.13** reveals that 290 respondents from the sampled working women in science were never employed in temporary or part-time positions. 186 female workers have reported that they were engaged in one organisation in a part-time position, whereas 91 have reported that they have worked in two organisations in part-time or temporary positions. 50 respondents from this group have reported that they have worked in three or more organisations in part-time positions.

### III. First Job

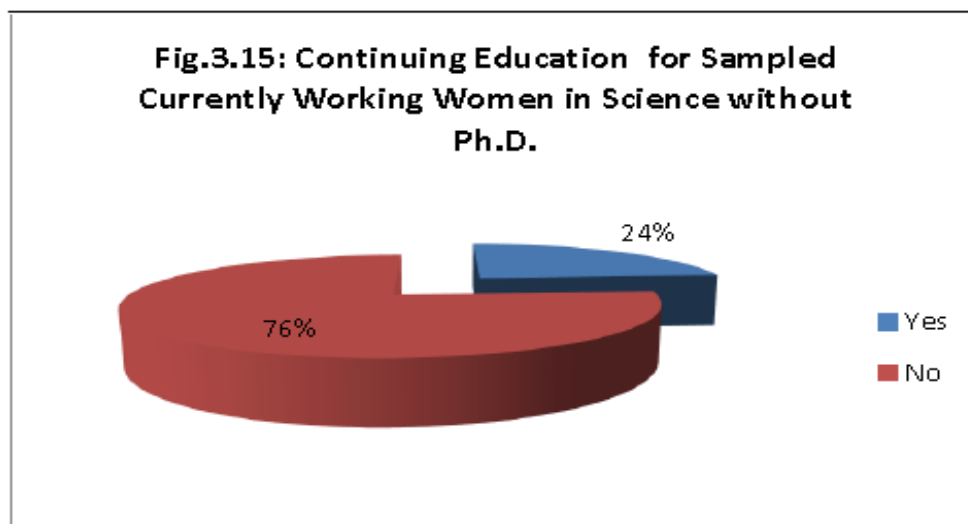
#### Nature of Employment at First Job:



**Figure 3.14** shows that only about 33.6% (208) of sampled respondents among currently working women in science with past work experience, started their career with a full time permanent job position; whereas 36.5% (226) started in full-time contractual position; another 29.9% (185) have reported of starting their career with part-time or temporary positions.

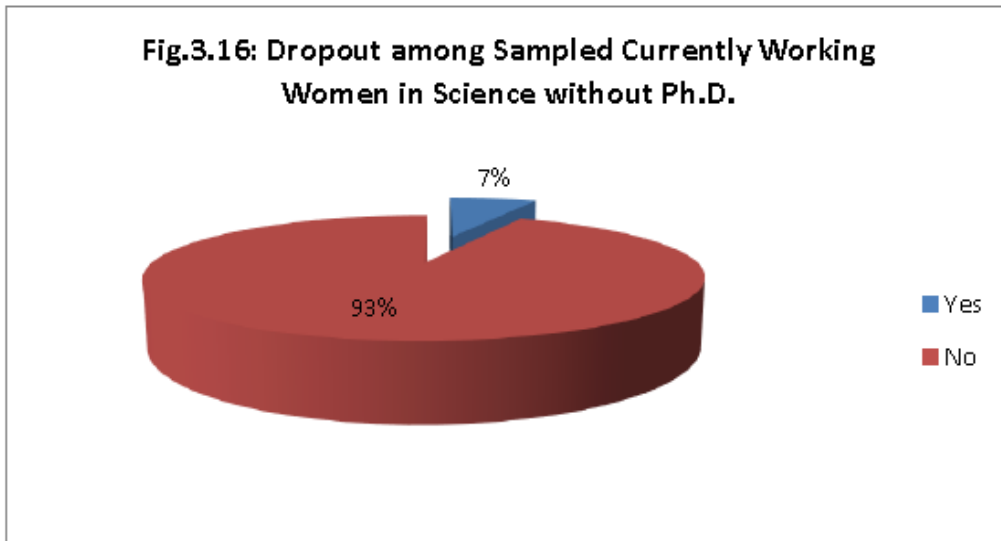
### IV. Breaks in Education and Employment

#### a: Continuing Education (Part-time or distance):



**Figure 3.15** summarises the incidence among 333 currently working women in science without Ph.D. degree, who are continuing their studies in part-time or distance learning mode. 24% (80) respondents from this group have reported that are continuing education whereas 76% (253) have reported that they are not.

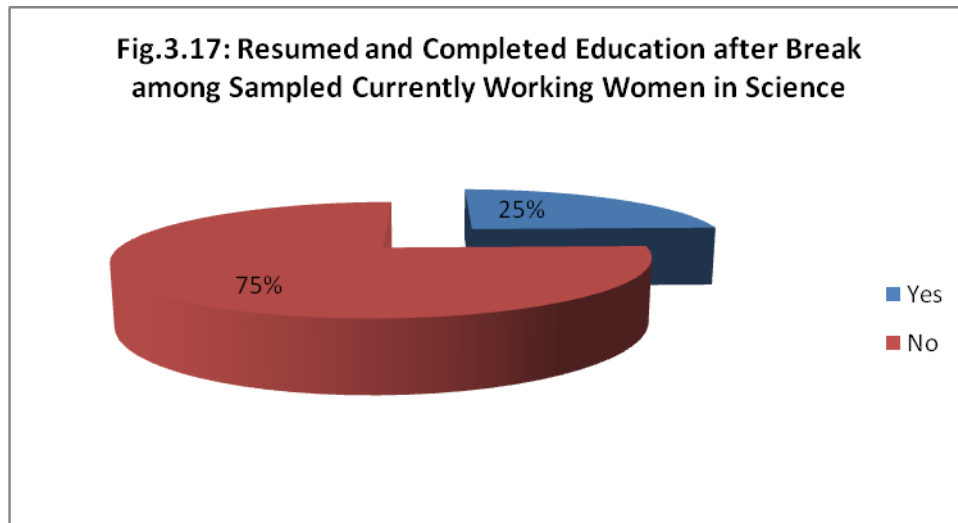
**b: Dropout from Higher Studies or Research in Science among Currently Working Women in Science:**



**Figure 3.16** shows that among the currently working women in science without Ph.D. degree 6.6% (22) have reported dropping out of a full-time course of study in the past; whereas 93.4% (311) have reported otherwise.

Among the 22 dropouts 5 respondents have cited “family care” and another 4 have cited “marriage related issues” as the reason for dropout. Remaining 14 respondents have cited “Other” reasons for dropping out of higher studies. 50% (11) working respondents who have dropped out of higher studies in the past have said “Yes” they would like to resume higher education, while remaining 11 have said “No”. Those respondents who have stated that they would like to resume higher education have cited “supportive family”, “love for science and career in research”, “need for personal identity” and “favourable government schemes for women” as factors favourable for recommencement of education. Factors unfavourable for recommencement of education are “marriage and related issues”, “family care”, “family objection” and “time commitment and work pressure involved in research in science”.

**c: Resumed and Completed Full-time Course of Study after Break:**

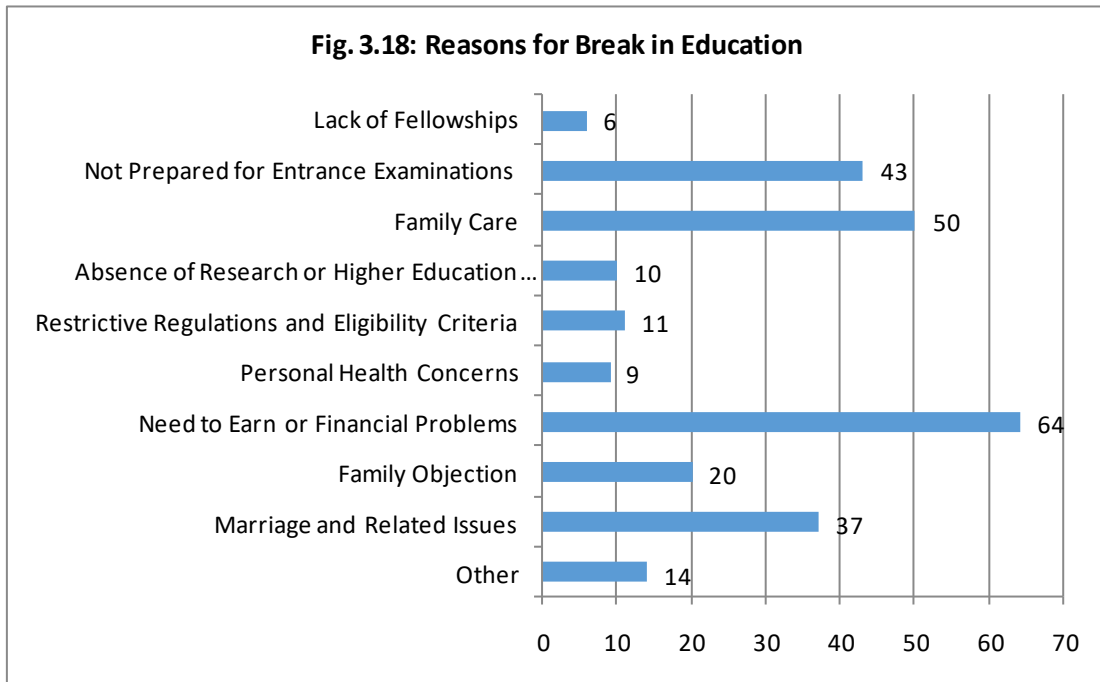


**Figure 3.17** above summarises data on incidence “resumed and completed education after break” among 991 currently working women in science. 25% (243) respondents from above category reported as having a break in their education and having recommenced and completed education after break; whereas 75% (747) reported of having no break in their education.

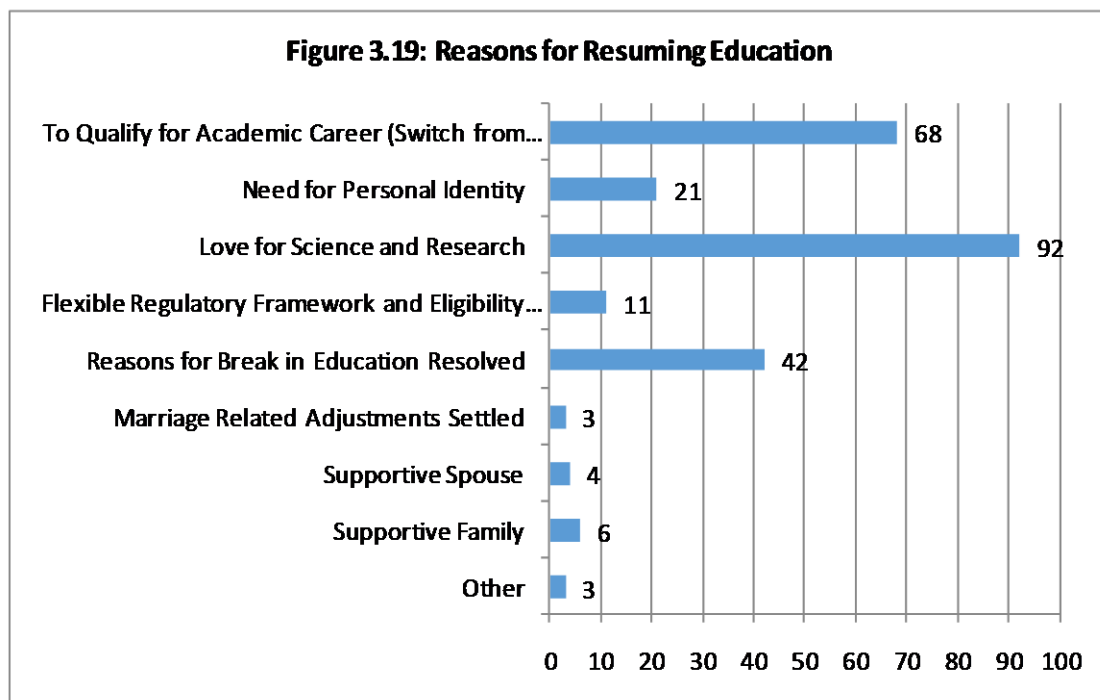
**d: Reason for Break in Education:**

**Figure 3.18** highlights the reasons for break cited by the 243 women in science who have undergone breaks in education. The question was an open ended free response question and the respondents cited more than one reason. Thus the sum of frequencies as is expected is more than 243.

“Need to earn and financial problems” is among the most frequently cited reasons by 64 respondents from this group. Dual role related factors such as “family care” and “marriage and related issues” are also cited by 50 and 37 respondents respectively out of 243. Some respondents have taken a gap year between enrolments in two consecutive degrees; they have cited “not prepared for entrance examination” as the reason for the break. 20 respondents reported “family objection” to be the cause of break. Few (27) respondents have cited features related to higher education system and policies such as “lack of fellowships”, “absence of research or higher education institutions” and “restrictive regulations and eligibility criteria” as the reason for break.

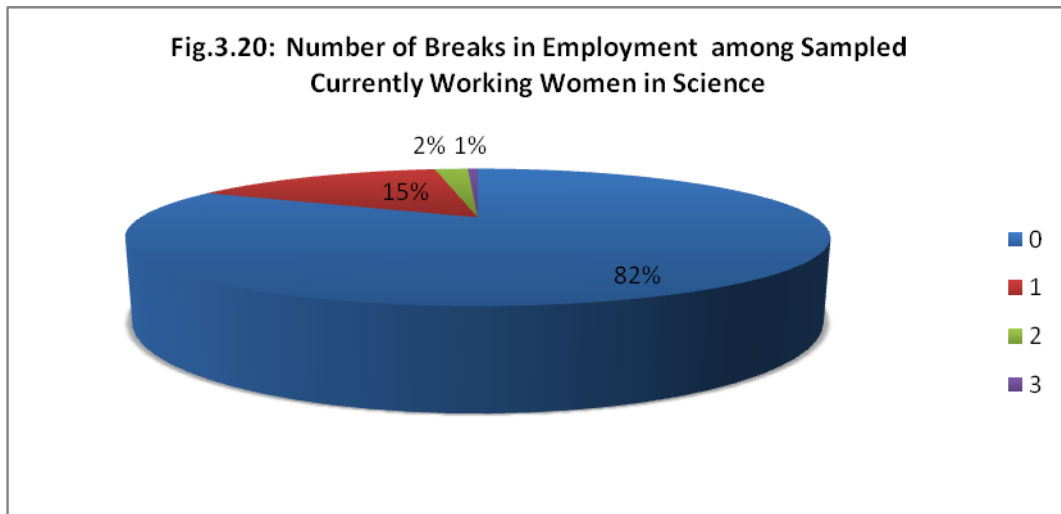


**e: Reason for Resuming Education after Break:**



As **figure 3.19** shows, the four most commonly cited factors for resuming education by those who resumed and completed education are “love for science and research career” (92), “to qualify for an academic career” (68), “reason for break resolved” (42) and “need for personal identity”(21).The reasons are mostly reflect the attitude and preference of the respondents. A few have cited “supportive spouse” (4) or “supportive family” (6) as the reason for resuming education.

**f: Incidence of Breaks in Career or Employment:**



The incidence of breaks in employment among the currently working women in science is presented in **Figure 3.20**. A clear majority (82%) of respondent have reported that they do not have a break in career. A total of 177 respondents have reported one or more break in career. Specifically 15% (151), 2% (20) and 1% (6) of 991 sampled working women have reported that they have had one or two or three breaks in their career.

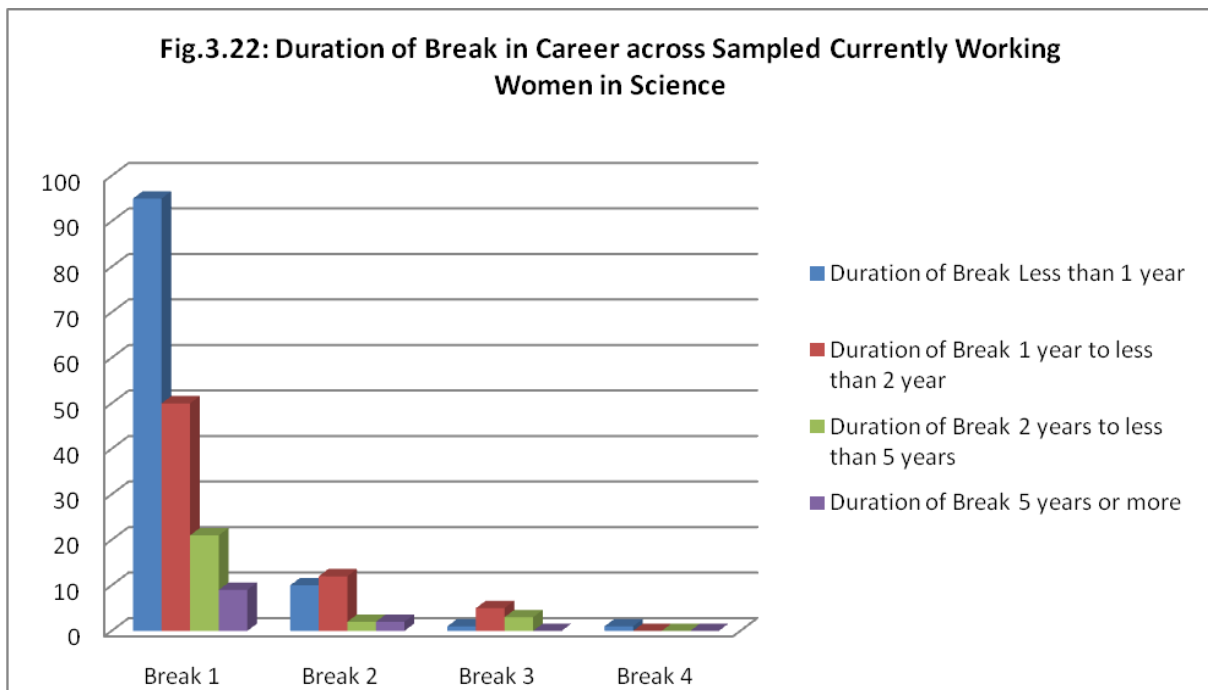
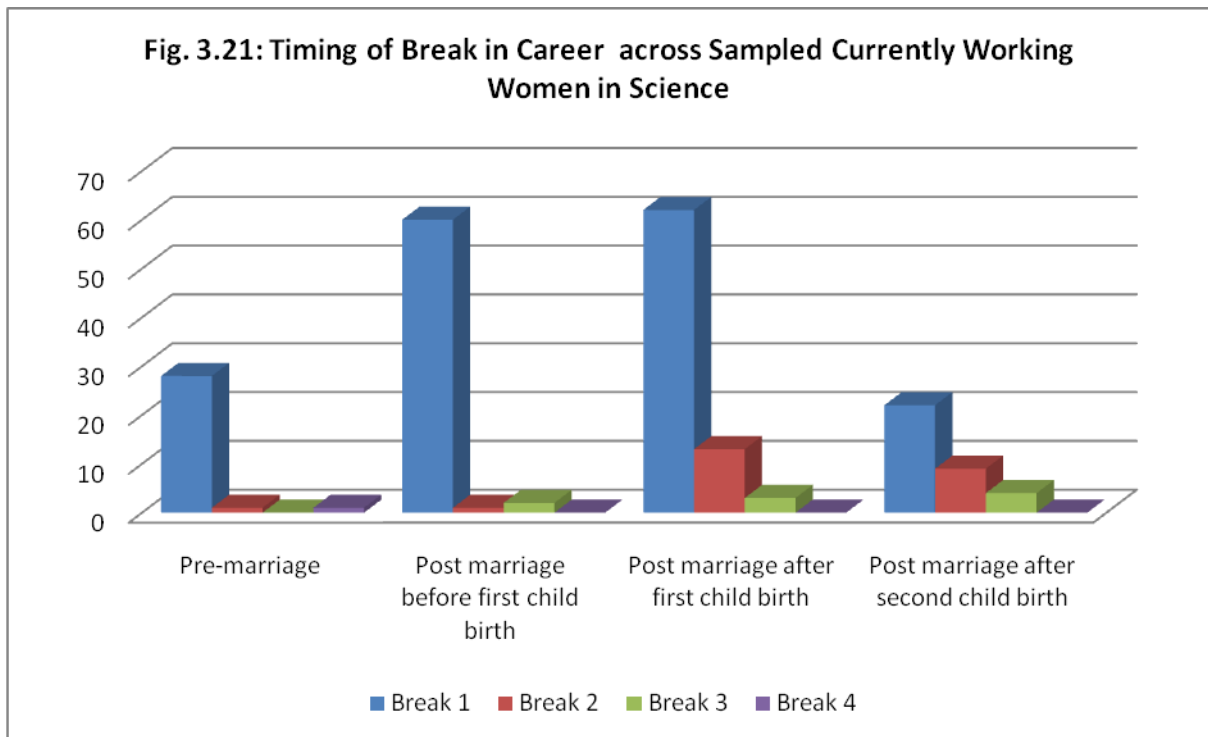
**g: Timing, Duration and Type of Break in Career**

Data was collected on the timing (with respect to marital and child birth status), duration and type of break for each break in employment for those working women who reported having a break in their career. For those with multiple breaks the details were collected separately for each break.

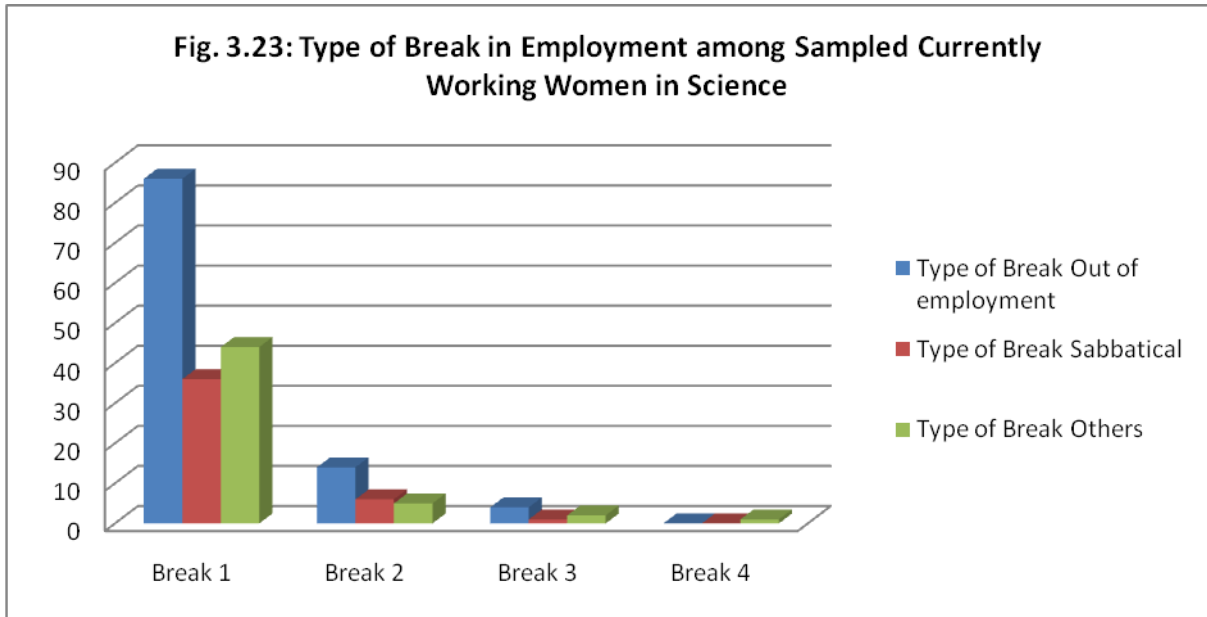
From **Figure 3.21** it is evident that among the reported first-breaks in the highest numbers occur post-marriage before and after first child birth. There are also reported instances of first-breaks pre-marriage and post-marriage after second child birth. Second or third breaks in career occur mostly post-marriage after first or second child birth. The incidence of second or third breaks pre-marriage or post-marriage before first child birth is very low.

**Figure 3.22** illustrates that for the first break the incidence of break less than one year is the highest. Incidence of first break decreases, as duration of break increases. This is markedly different from the pattern for second or third breaks. For second-breaks incidence of longer duration breaks of 1 year to less than two years is higher than incidence of shorter duration breaks of less than one year. For third-breaks the pattern is similar with duration of breaks of one year to less than two years being most

common. Also it is evident for third or fourth break in their career the incidence of less than a year break is very low.

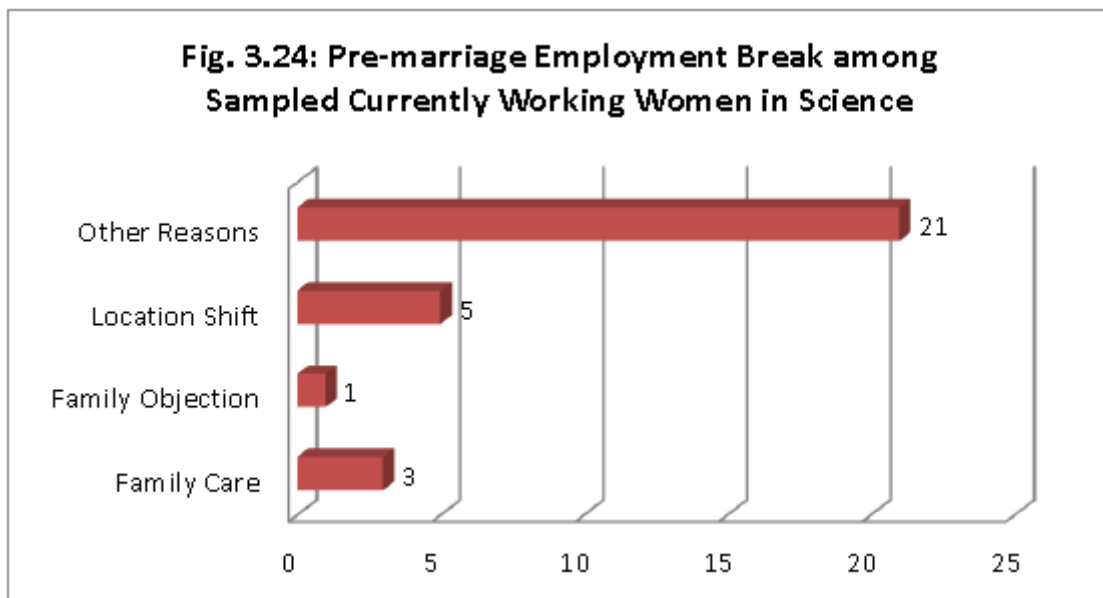






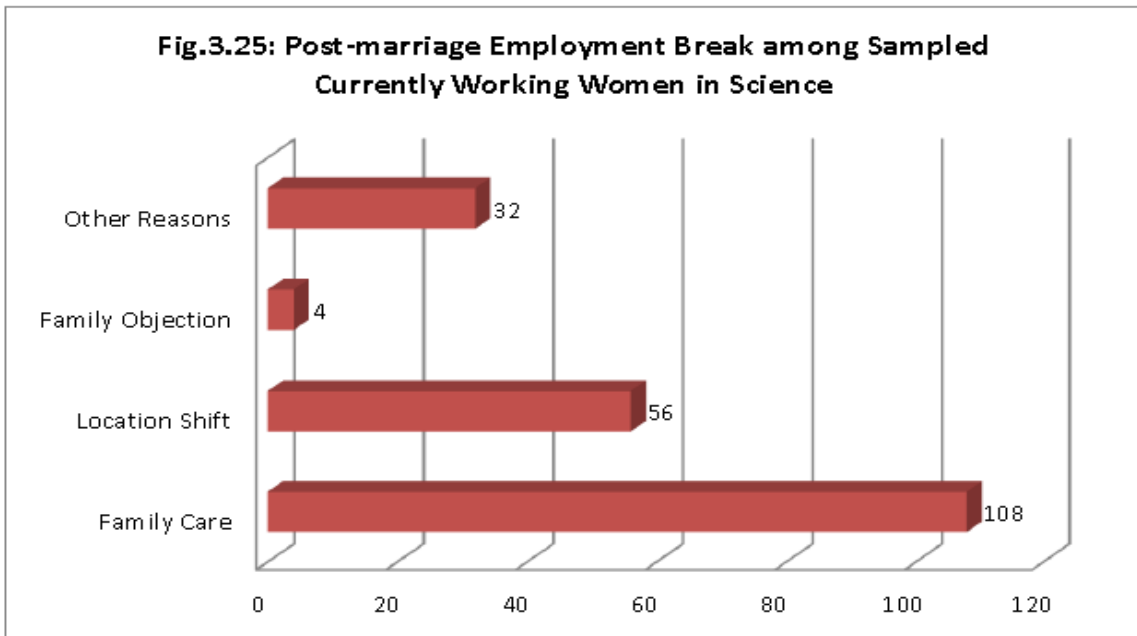
**Figure 3.23** shows the distribution of breaks by type of break. Irrespective of the number of break, the most common type of break reported by working women respondents is “out of employment” followed by “sabbatical”.

**h: Nature of Reasons for Pre-marriage Break in Career:**



**Figure 3.24** summarises reported reasons for pre-marriage break in career in response to open ended question in this regard to women in science who mentioned having undergone a break in career. 5 respondents in this group cited shift of location of family, 3 reported family cares, 1 reported family objection and 21 respondents cited other reasons.

**i: Nature of Reasons for Post-marriage Break in Career:**

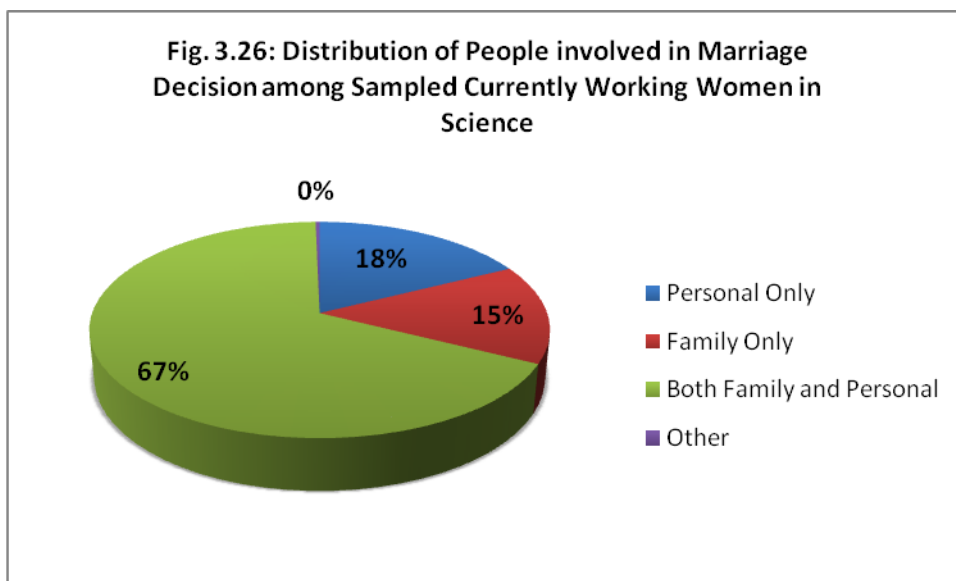


From **figure 3.25** it is evident that for post-marriage break in career family care (108) is the most frequently cited reason for break by currently working women who have had a career break in the past. Location shift is the other major reason cited by 56 respondents from this category. 4 respondents have reported family objection as the reason for break in their career.

**3.2.3 MARRIAGE, FAMILY AND CAREER**

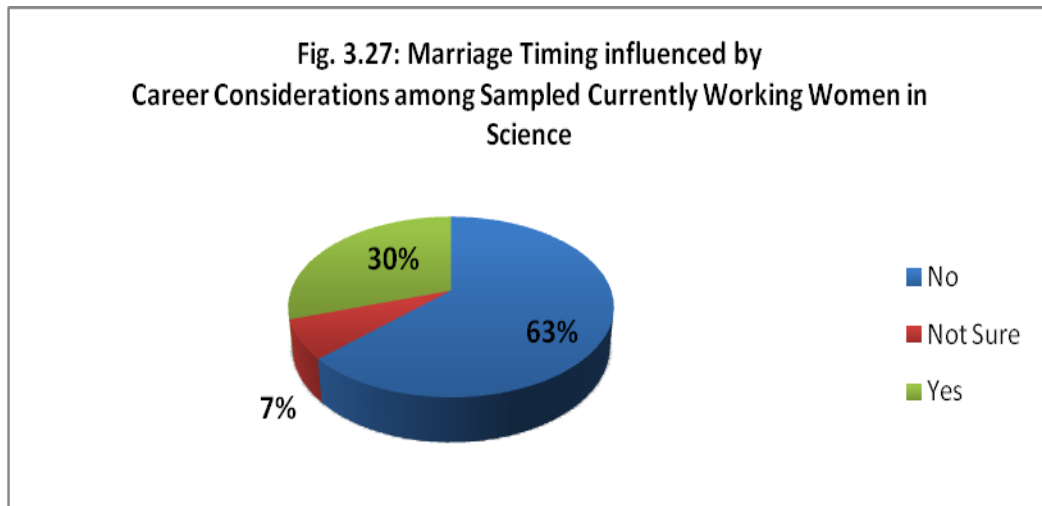
**I. Career and Marriage Decision**

**a. Marriage Decision:**



**Fig 3.26** shows that 67% of the sampled working women in science reported that the decision for their marriage was or would be both personal and family decision. 18% have said that the decision regarding marriage was or would be a personal decision. 15% reported that the decision was would be a family decision only.

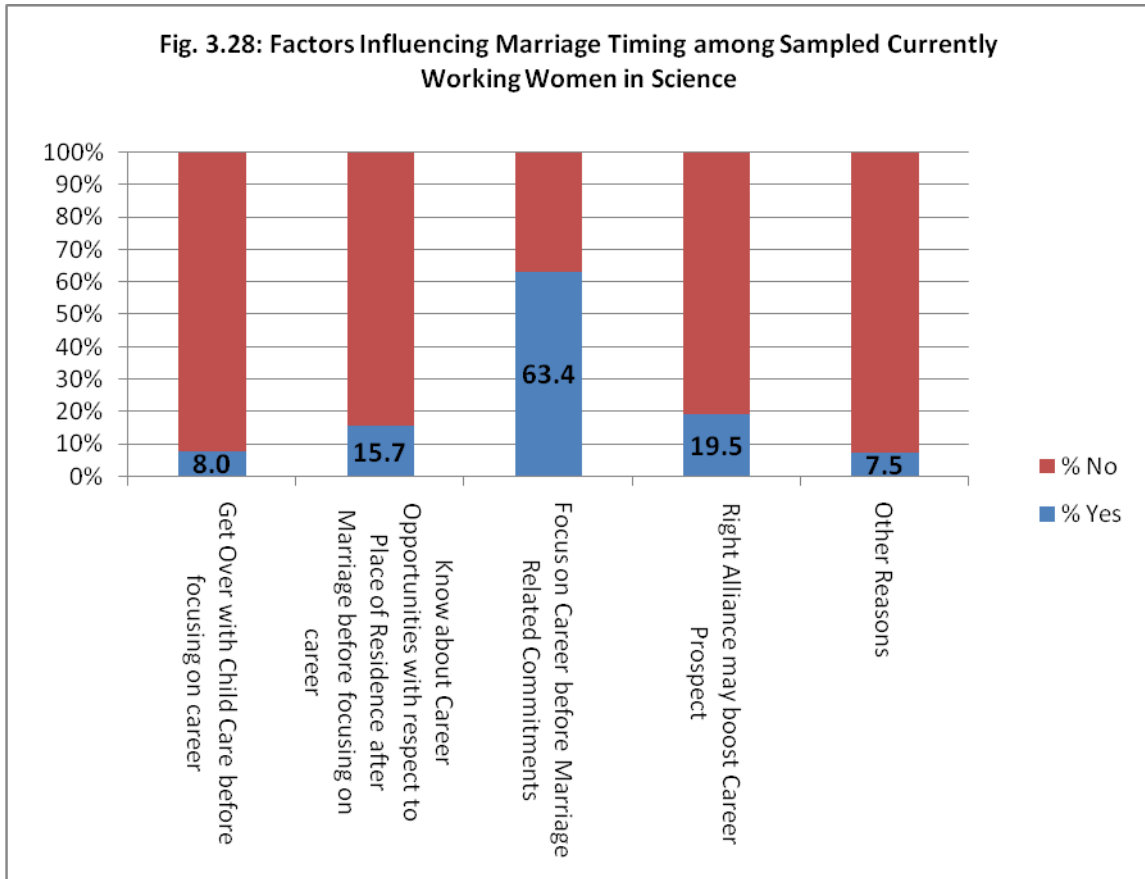
**b: Interdependence of Marriage and Career Plans:**



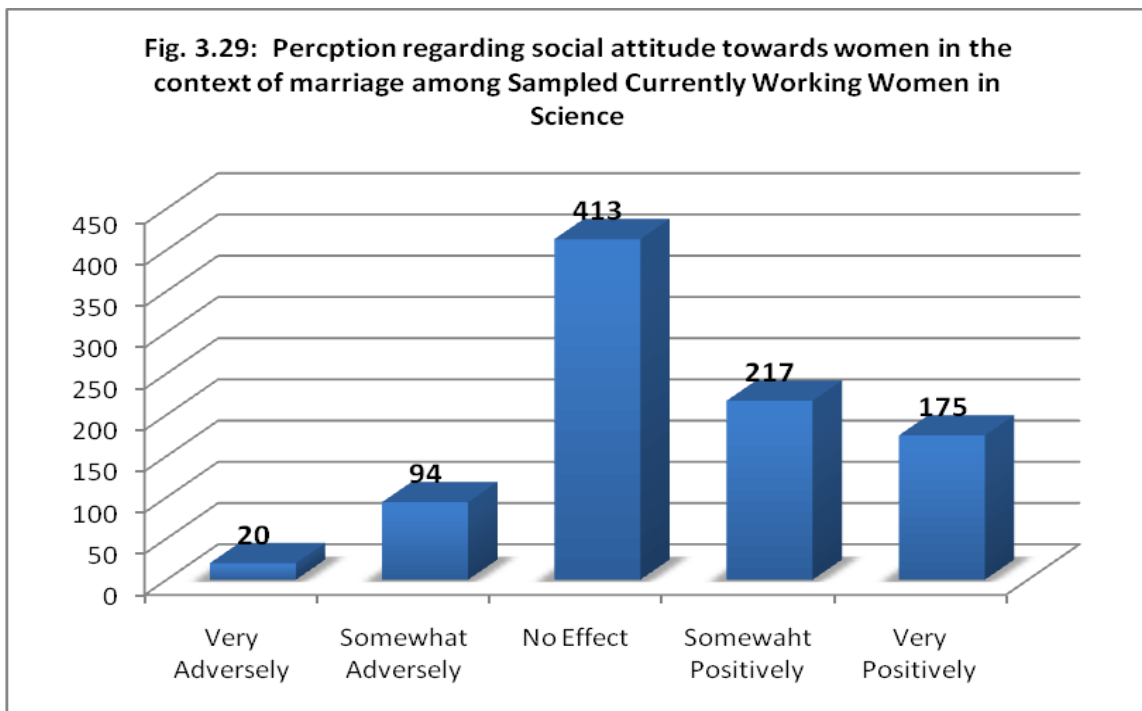
**Fig 3.27** shows that 30% of sampled working women in science said that their decision regarding timing of marriage was influenced by career consideration; 7% responded that they were not sure while 63% of the respondents from this group said that their marriage timing was or would be a decision independent of career considerations.

**c: Reasons for Early or Delayed Marriage:**

**Fig 3.28** shows that 63.4% of the sampled working women in science have said that “focus on career before marriage related commitments” influenced their marriage timing. 19.5% have said that “right alliance may boost career prospect” influenced their marriage timing. 15.7% have said that “know about career opportunities with respect to place of residence after marriage before focusing on career” influenced their marriage timing while 8% of the respondents from this group have said that ‘get over with child care before focusing on career’ influenced their marriage timing. Since each respondent’s answer could include more than one reason the percentages across reasons may not add up to 100%.



**d: Social Attitude to Women in Science in the Context of Marriage:**

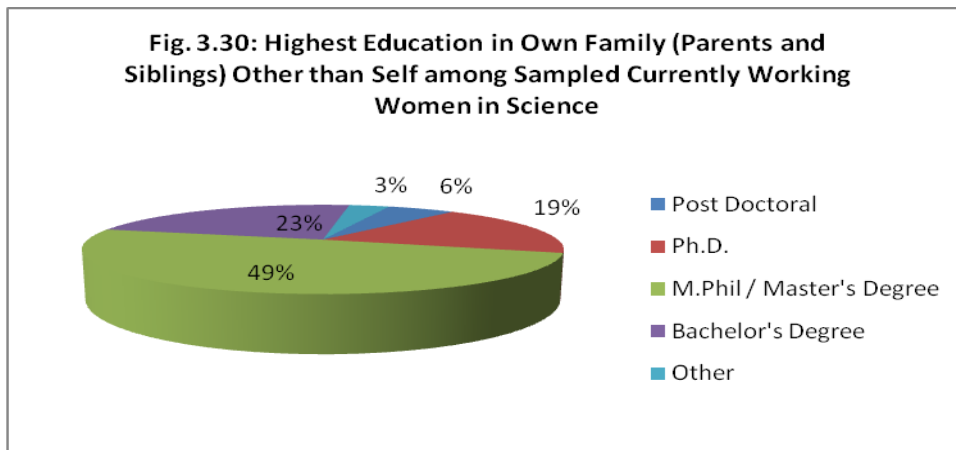


**Fig 3.29** it is evident that overall perception among sampled working women regarding social attitude to women in science in the context of marriage and dual role is positive. A large number, 413 have reported that their being a science professional did not affect the marriage proposals received, 392 respondents from this group said positive or very positive effect. 94 working women have however reported that their being a science professional had an adverse effect while 20 said it had a very adverse effect.

**II. Family Profile, Family Commitments and Career:**

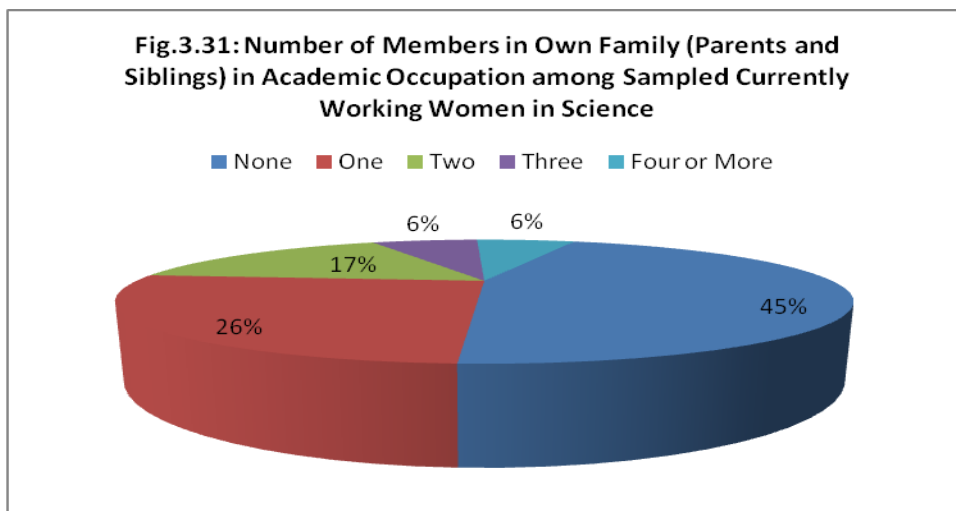
**a: Highest Education among Own Parents and Siblings:**

**Figure 3.30** shows that for 49% sampled working women in science the highest education among parents and siblings of these respondent is an M. Phil or Masters degree. 19% and 6% have reported Ph.D. and Post-doctoral as the highest degree while 23% have reported Bachelor’s degree as highest degree and 3% have reported “other”.

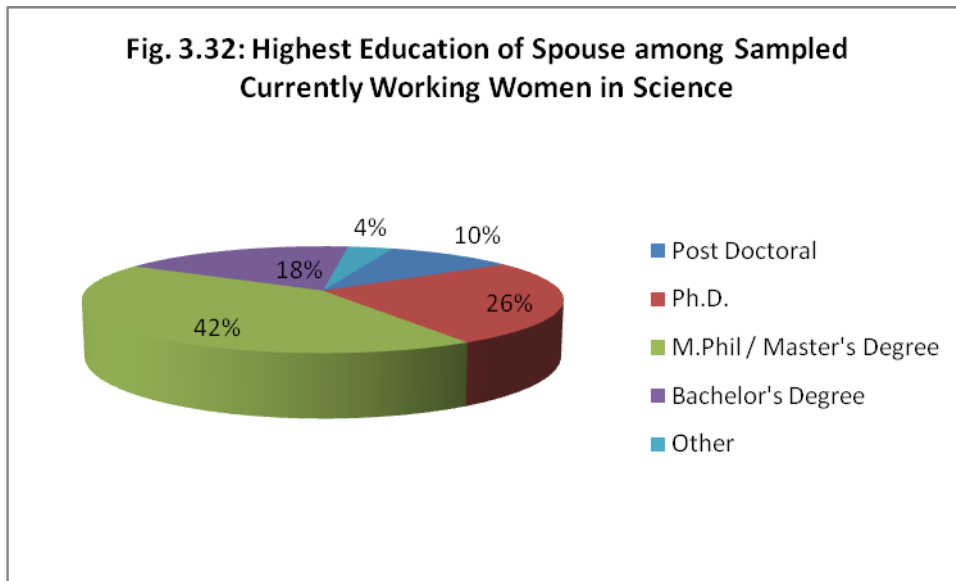


**b: Number of Members in Academic Occupation among Own Parents and Siblings:**

**Figure 3.31** shows the presence of members from academic profession among parents and siblings of working women in science. While 45% of respondents from this category have reported that there are no members linked with academics in their family (parents and siblings), another 55% have reported as having at least one member from academic profession among their parents and siblings. 12% have reported having three or more members from among their parents and siblings in academics.

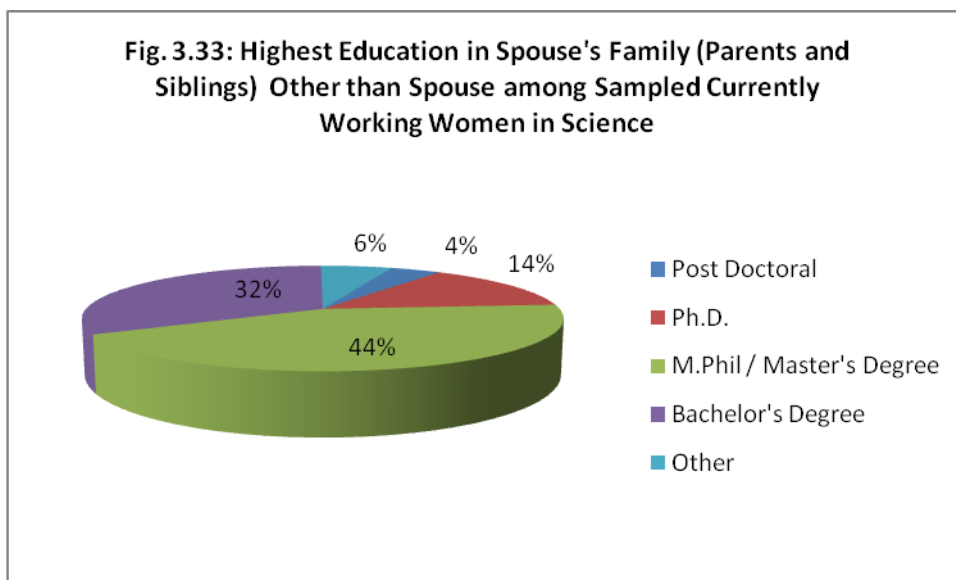


**c: Highest Education of Spouse:**



**Figure 3.32** shows the distribution of sampled working women in science by the highest education of spouse. A large percentage (42%) of currently working women have reported M Phil. or Master`s degree is the highest educational qualification of their spouse. 26% of currently working women have responded Ph.D. as the highest education for their spouse; while 10% have reported their spouses having Post-doctoral research experience. 18% of respondents in this group reported their spouse`s to be Bachelor`s degree holders, while 4% have reported “other”.

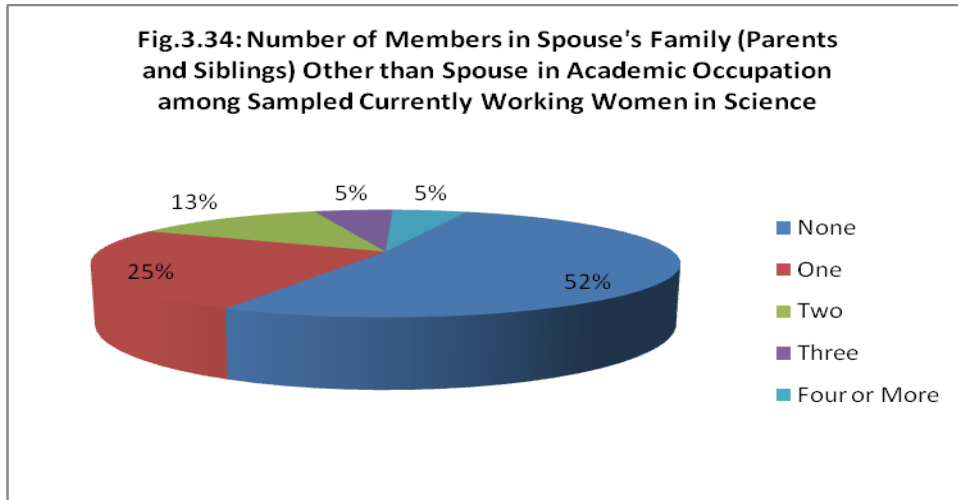
**d: Highest Education among Spouse`s Parents and Siblings:**



Above pie chart in **Figure 3.32** shows the distribution of sampled currently working women in science by the highest education in spouse`s family (parents and siblings) other than spouse. 44% currently working women have reported that M. Phil. or Master`s Degree is the highest degree for

their spouse`s family. Another 32% has said that Bachelor`s Degree is the highest qualification in their spouse`s family. 14% currently working women have reported Ph.D. as the higher degree for their spouse`s` family while 6% have selected post-doctoral option and only 4% have selected other option.

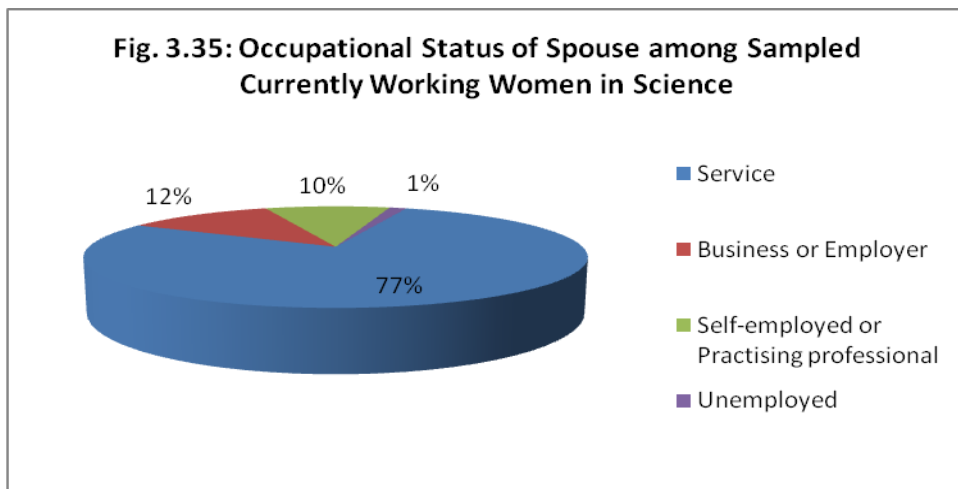
**e: Number of Members in Academic Occupation among Spouse`s Parents and Siblings:**



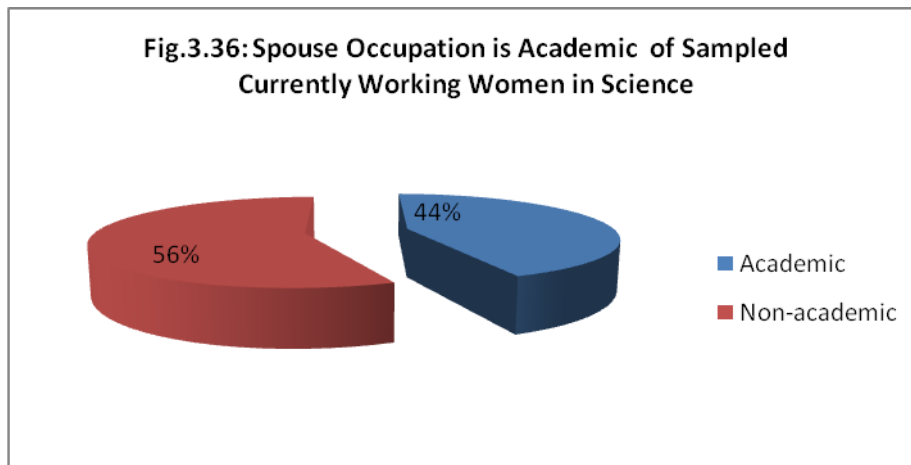
**Figure 3.34** shows a large percentage (52%) of working female respondents has responded that none of the member in their spouse`s family other than spouse is engaged with academic occupation. 25% have responded that among their spouse`s parents and siblings, one member is associated with academic profession. Another 23% have responded that two, three or more members among spouse`s parents and siblings are from academic profession.

**f: Status of Employment of Spouse**

**Figure 3.35** shows distribution of sampled currently working women in science by the occupational status of spouse. 77% respondents from this group have reported that spouse is in service. 12% have reported that their spouse is in business; 10% have reported that their spouse is a self-employed or practising professional, whereas 1% has reported that they are currently unemployed or retired.



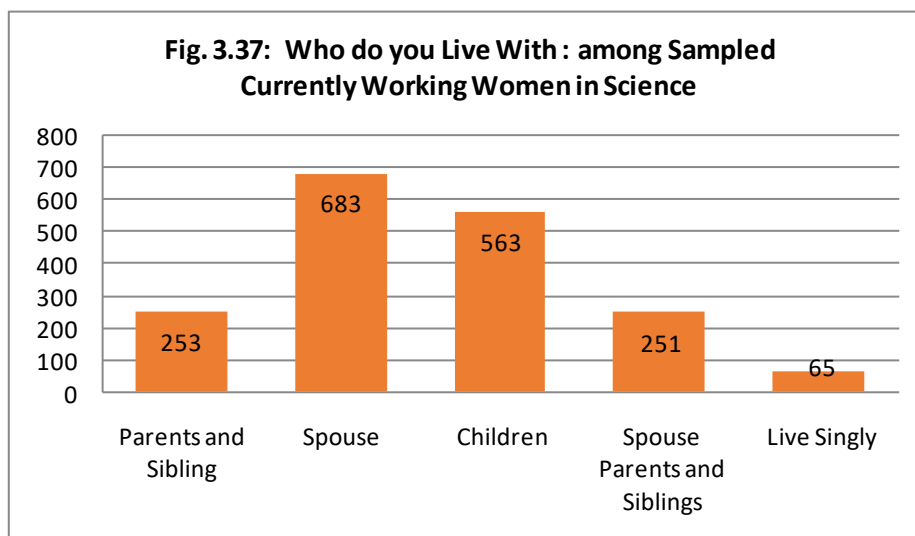
**g: Nature of Job of Spouse:**



**Figure 3.36** reveals that for sampled married women in science 44% have reported that their spouse is in academic profession, while 56% have reported that their spouse is from non-academics.

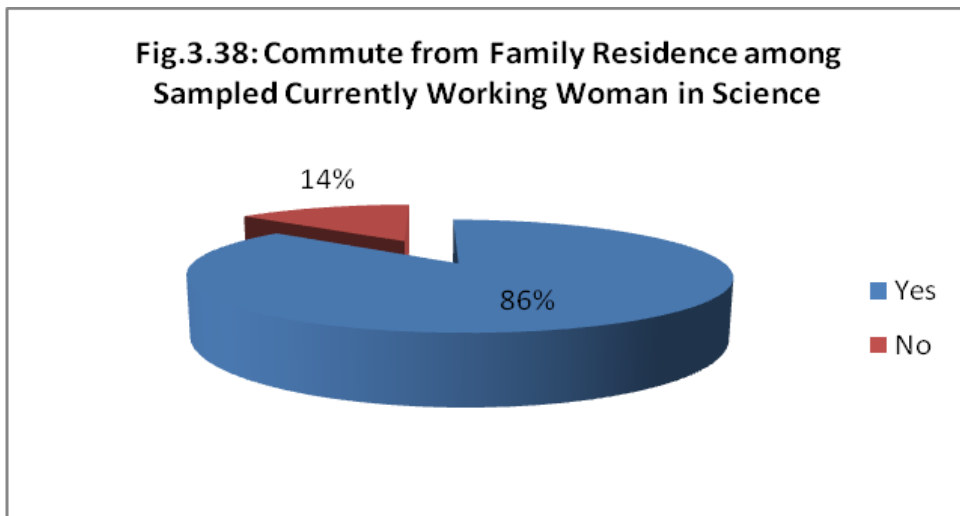
**h: Who Do you Live With (Direct Family)**

Figure above summarises the feedback of sampled working women in science regarding the direct family members with whom they live with most of the time. Each respondent was asked to select all options which are applicable, with each option corresponding to particular categories of direct family members of a respondent. A large number (683) of sampled currently working women has responded that they live with their spouse; the number of respondents (563) from this group who have said they live with their children is also very large. 253 and 251 respondents have said they live with their own parents or spouse’s parents and siblings respectively. 65 respondents have said that live singly.



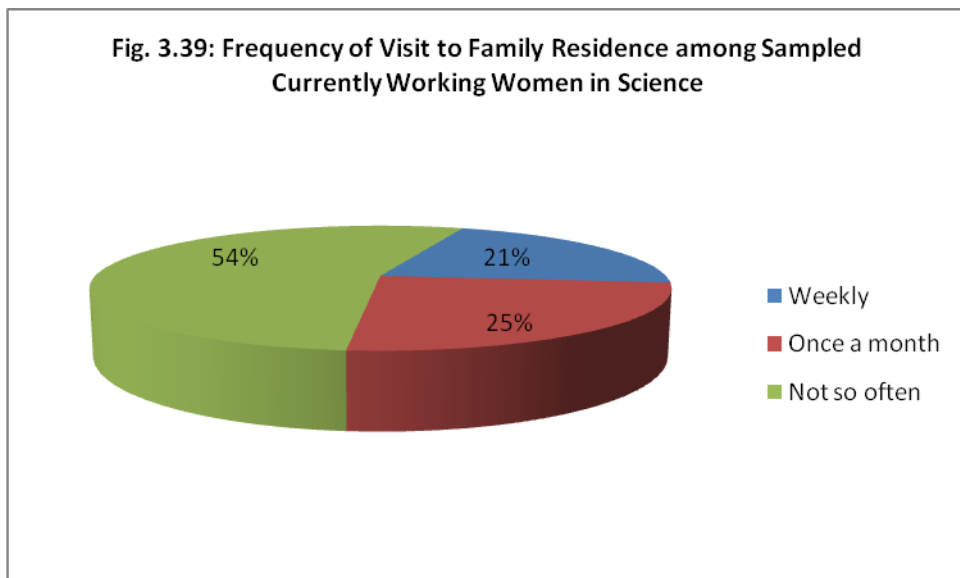


**i: Commute to Place of Work from Family Residence:**



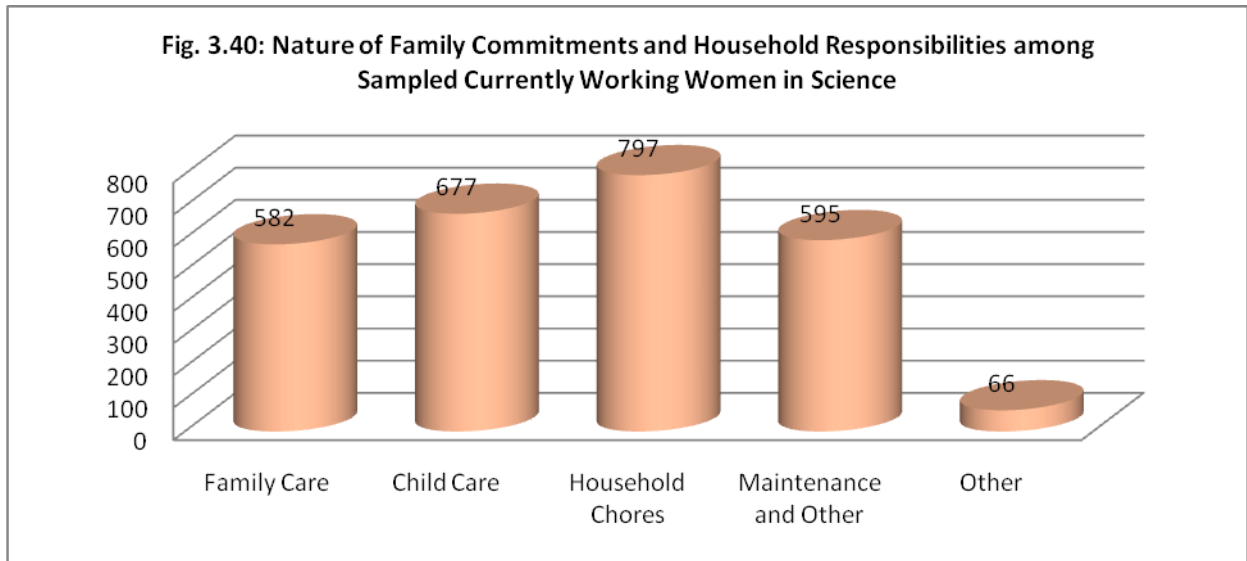
Pie-chart in **Figure 3.38** explains whether respondents are travelling daily to place of work from their family residence or not. Family residence means spouse, parents or any other member of direct family whom the respondent lives with as mentioned by the respondent.

**j: Frequency of Visit to Family Residence:**



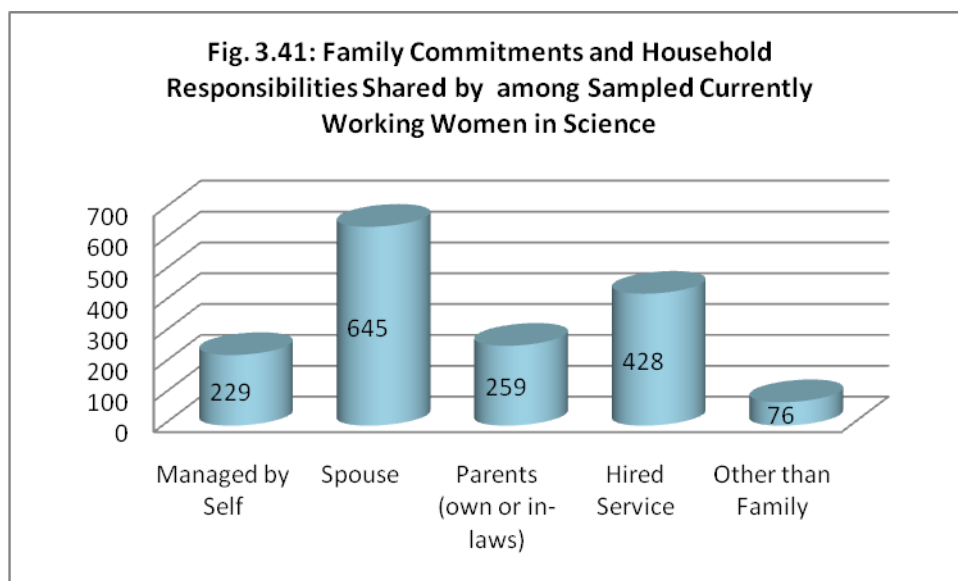
Pie-chart in **Figure 3.39** summarises the feedback of sampled working women in science not travelling daily to place of work from their family residence regarding the frequency of their visit to family residence. 54% have said not so often; 25% have said once in a month. Rest of the 21% have said weekly.

**k: Nature of Family Commitments and Household Responsibilities:**



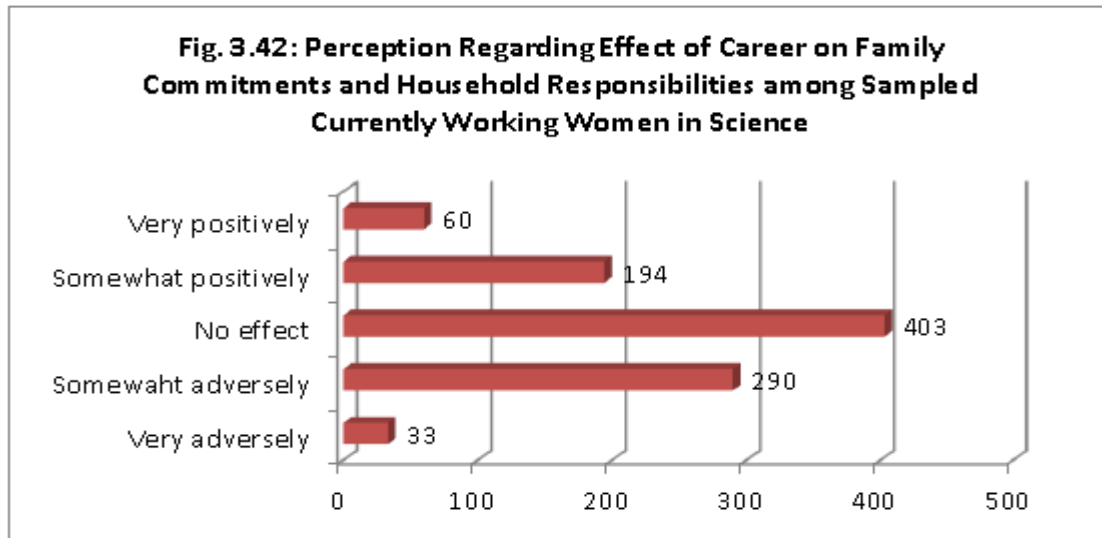
**Figure 3.40** above shows the nature of family commitments and household responsibilities by the sampled currently working women in science. Each respondent was asked to choose all relevant options from given options regarding responsibility type. Thus sum of frequencies do not add up to the total number of respondents. Figure shows that the most frequently cited responsibility is household chores (797); child care (677), maintenance and other related work (595) and family care (582) are the other frequently cited categories of responsibilities related to household work and family commitments.

**l: Support and Sharing of Responsibility with respect to Family Commitments and Household Responsibilities:**



**Figure 3.41** summarises respondent feedback of sampled currently working women in science regarding whether anyone shares family commitments and household responsibilities with them. They were asked to select all options applicable. The most commonly cited options are spouse (645), hired service (428), parents (own or in-laws) (259) and other than family (76). 229 respondents from this group have reported “managed by self”.

**m: Effect of Career and work on Family Commitments and Household Responsibilities:**



**Figure 3.42** summarises the feedback of sampled working women in science regarding their perception about the effect of career on family commitments and household responsibilities. While a large number 41% (403) said that it had “no effect”, (30%) 290 and (3%) 33 expressed that it affected the family commitments “somewhat adversely” or “very adversely”. A relatively smaller number (26%) 254 said it affected their family commitments “somewhat positively” or “very positively”.

**n: Refused Challenging Opportunity in Career with Enhanced Compensation, Prestige and Responsibilities:**

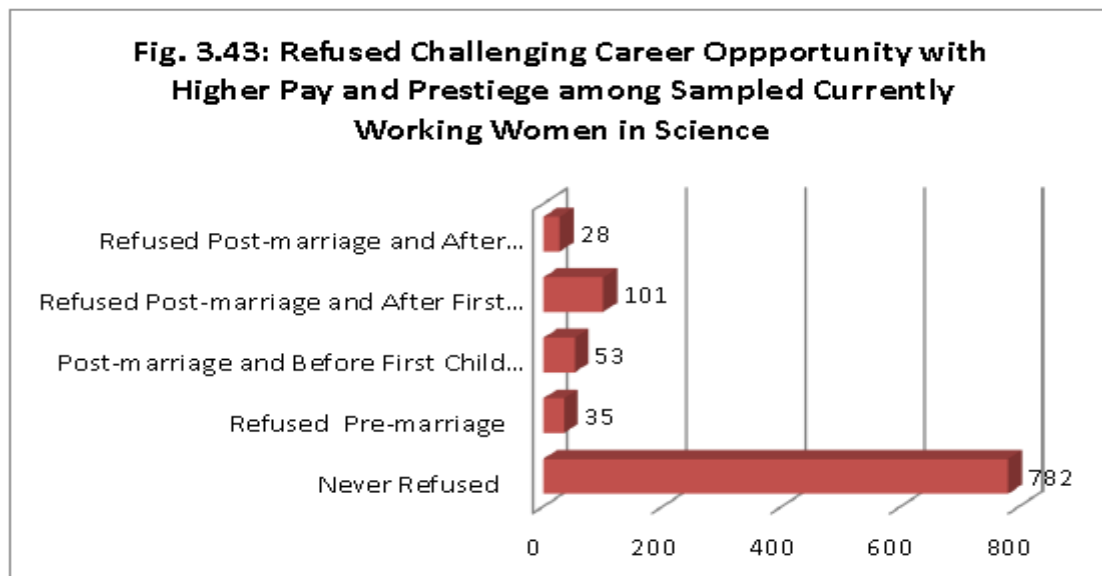
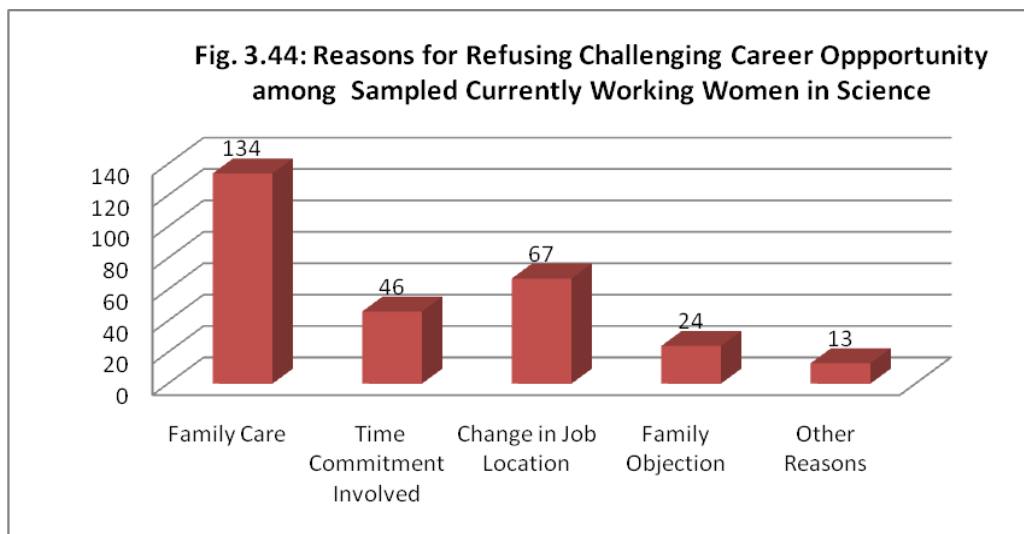


Figure 3.43 shows that overall there have been 217 reported instances of refusing a challenging career opportunity among sampled currently working women in science. In some cases there has been more than one refusal. Refused post- marriage after first child birth is most common (101), whereas there are 86 instances of pre-marriage or post-marriage before first child birth refusals.

**o: Reasons for Refusing Challenging Opportunity in Career:**

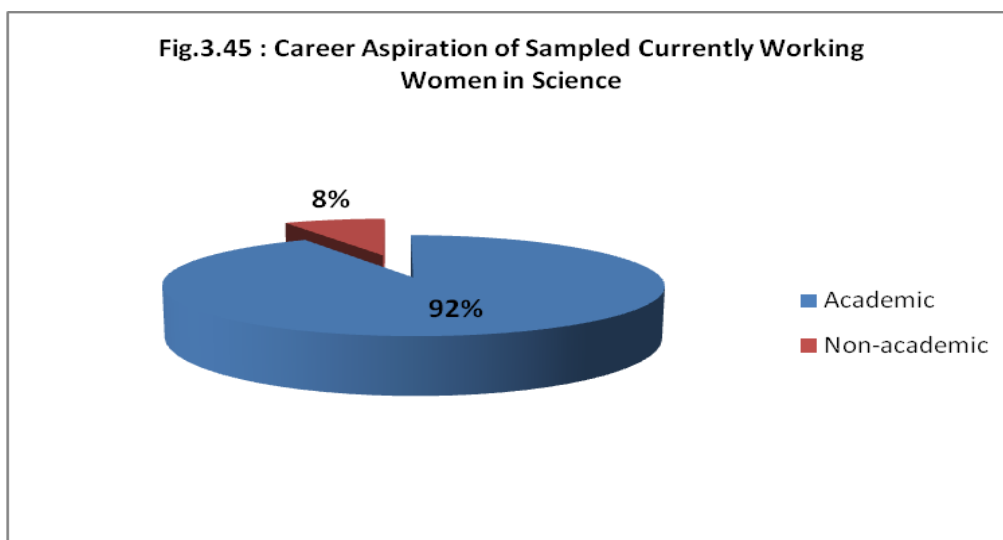
Figure 3.44 summarise reasons for refusing challenging career opportunity among sampled currently working women in science. The most commonly cited reason being family care (134), followed by change in job location (67), time commitment involved in job (46) and family objection (24).



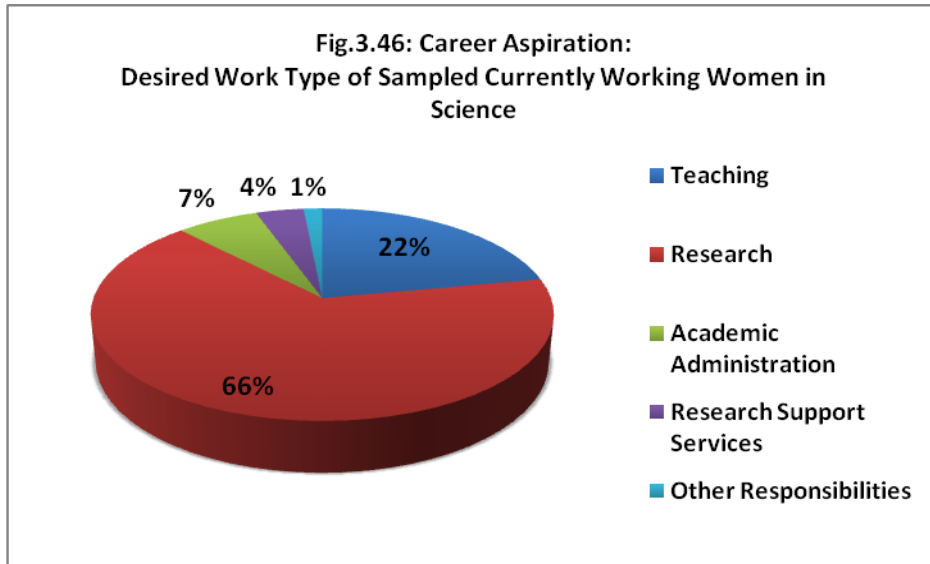
**3.2.4 CAREER ASPIRATION, ACHIEVEMENTS AND PRIORITIES**

**a: Highest Career Aspiration:**

Figures 3.45 and 3.46 summarise reported data on nature of occupation and type of work for highest career aspiration of the sampled working women in science.



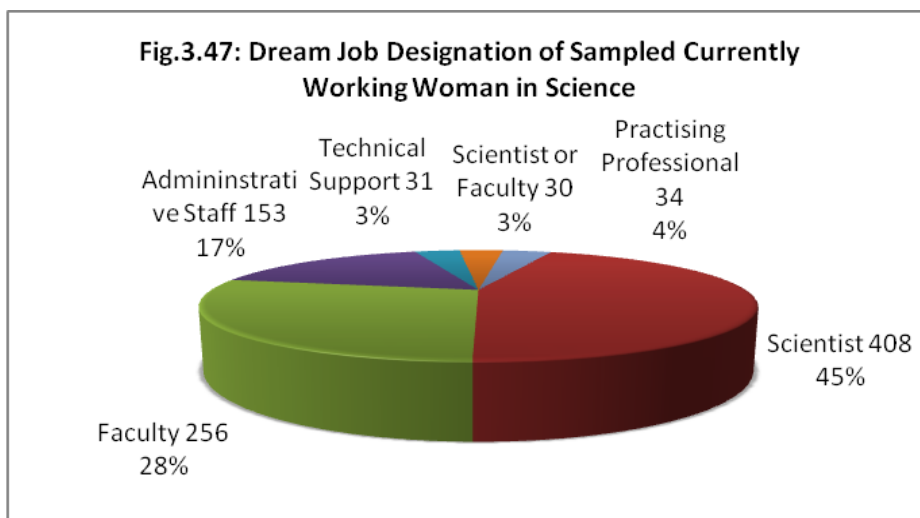
A significantly large percentage of respondents (91.4%) in this group have reported “academic”, as their highest career aspiration. Only a small percentage (8.1%) has cited non-academic profession as career aspiration.



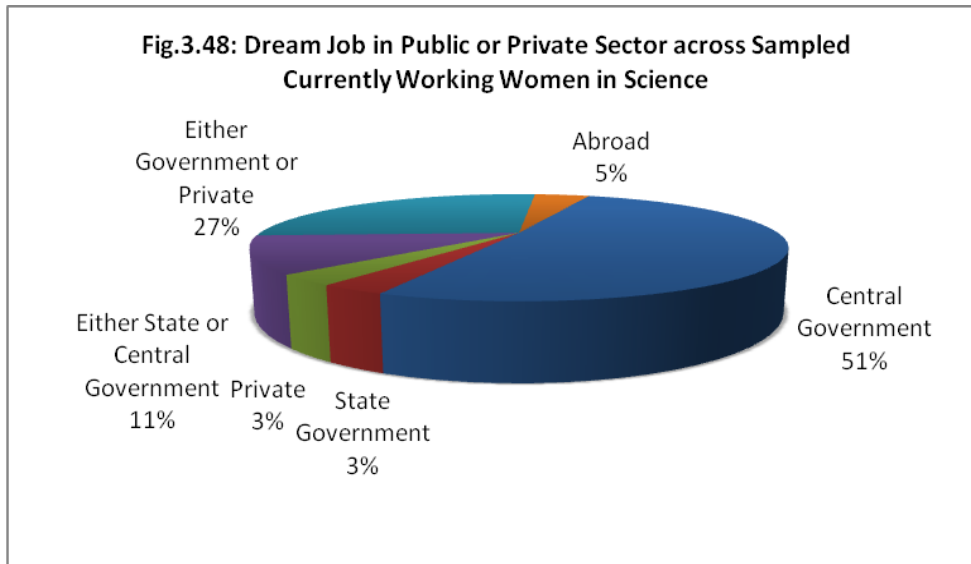
**Figure 3.46** shows the distribution of working women in science across their desired type of work. 66% of respondents in this group have chosen “research” as their career aspiration. On the other hand 22% have responded that they would like to go for “teaching”. 7% have expressed interest in “academic administration”. Only 4% respondents aspired to be in “research support services” and 1% reported “other responsibilities”.

**b: Designation and Organisation Type for Your Dream Job:**

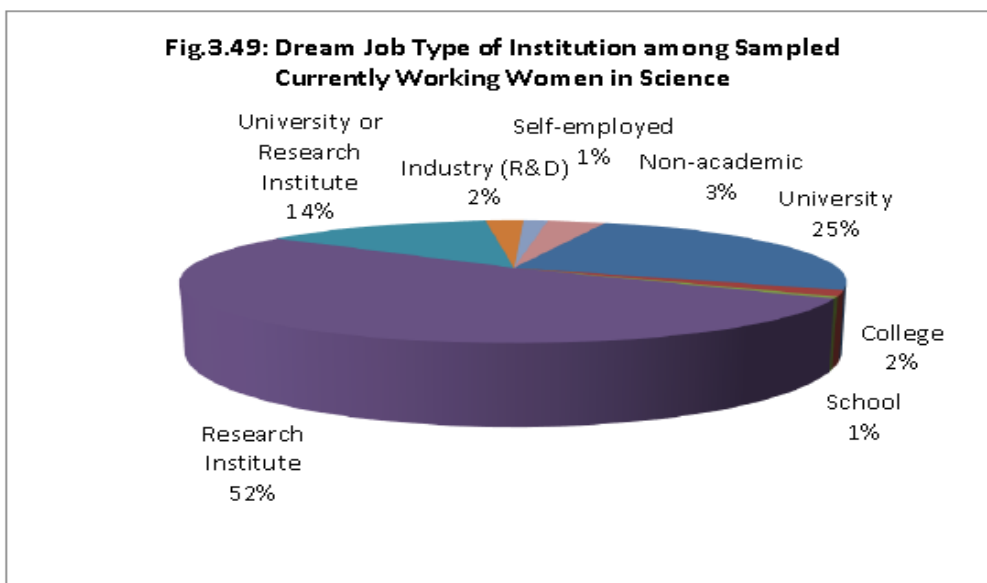
This question regarding “designation and organisation type for dream job” is an open ended free response question. The responses have been summarised under three heads based on actual responses received: designation type, sector type and organisation type.



This pie-chart in **figure 3.47** highlights dream job designation type of the sampled working women in science respondents. 45% respondents has expressed that they want to be a scientist; 28% expressed interest in faculty positions, i.e., teaching departments; 17% expressed interest in administrative staff position; 4% said they preferred being a practicing professional and another 3% said they were indifferent between a scientist or faculty position. Finally 3% pointed out technical support as dream designation.



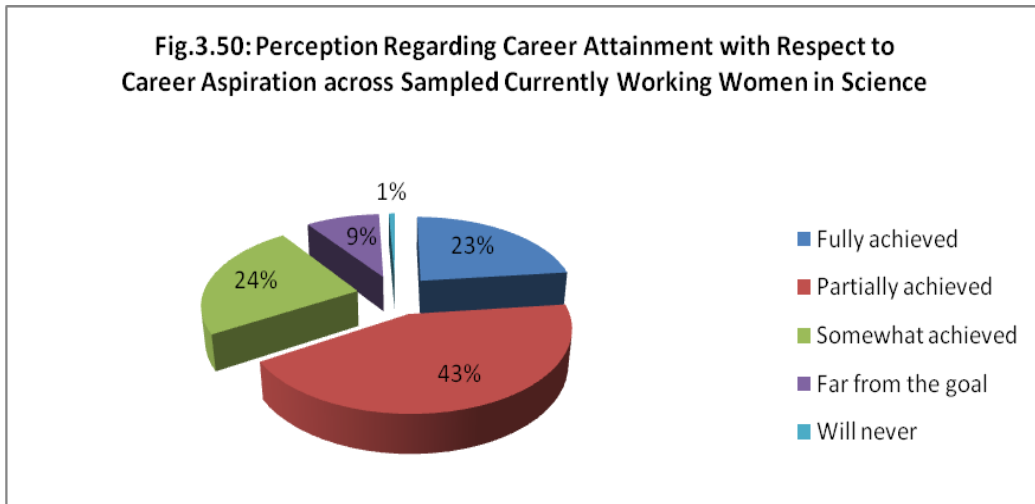
This pie chart in **figure 3.48** illustrates the scenario for dream job sector. 51% of the sampled female science professional respondents would like to get “central government job”; 27% from this group want get “any job - either a private or government job”; 11% student respondents stated they would like to get “either state or central government job”; 3% would like to work in private sector and another 3% expressed interest in “state government job”; only 5% out of the total sample aspired for “international jobs”.



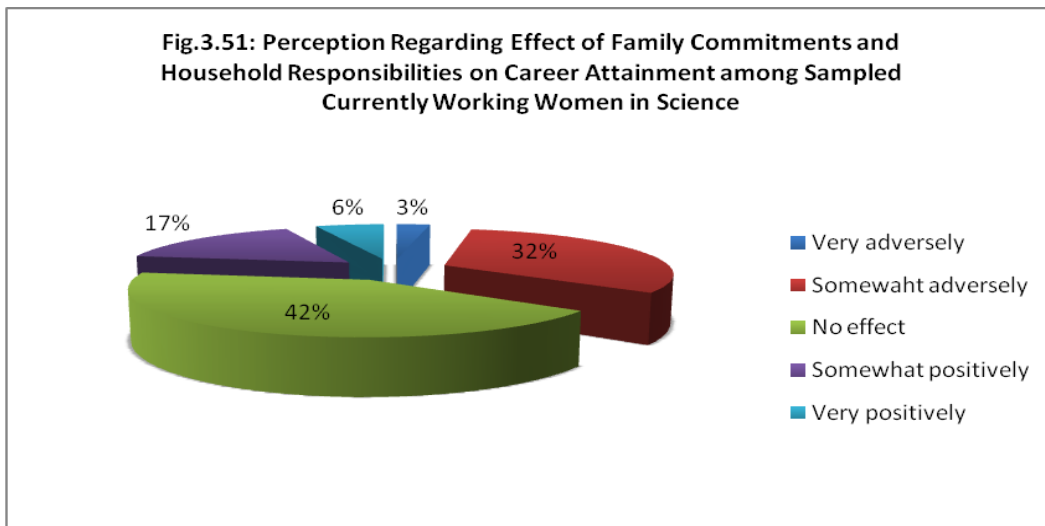
In terms of institution type for dream job in **figure 3.49**, 52% sampled working women professional mostly preferred jobs in research institute; 25% of respondents in this group said they are interested in getting a job in university; 14% remained indifferent between university and research institute jobs. 3% expressed interest in non- academic sector; 2% preferred R & D industry job while 1% said they would opt for self-employment.

**c: Perception Regarding Career Achievement with respect to Aspiration:**

The pie-chart in **figure 3.50** illustrates the perception of sampled women in science professionals regarding career attainment with respect to career aspiration. The responses varied from fully achieved to will never achieve on an ordinal scale to the question “How far have you been able to achieve your highest career aspiration commensurate with your age?”. Of the sampled working women 43.1% responded partially achieved; 24% responded somewhat achieved; 23.1% of the respondents said they have fully achieved their goal; 9.1% responded far from the goal and lastly 0.7% responded that they will never achieve their aspiration.



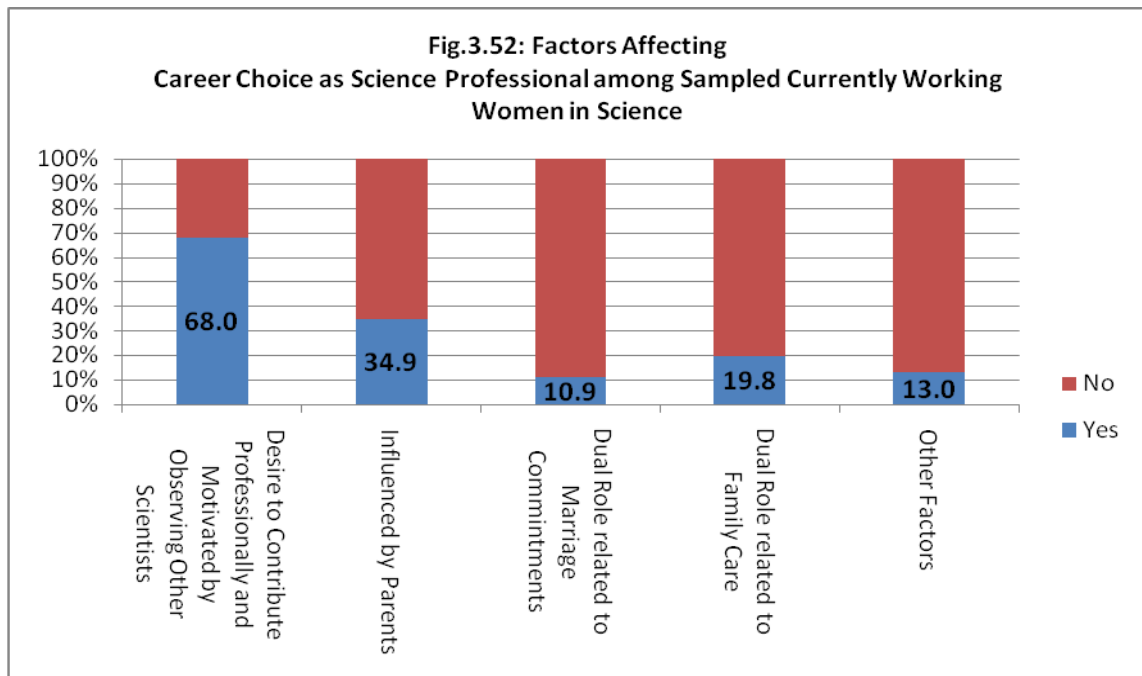
**d: Effect of Family Commitments and Household Responsibilities on Performance and Achievement in Career**



**Figure 3.51** illustrates the perceptive question regarding effect of family commitments and household responsibilities on career attainment. Among the sampled women science professionals 42.5% responded that family responsibilities have no effect on career attainment as they can balance both; 32.1 % of them said they were somewhat adversely affected; 16.7% of them responded that due to household support the effect is somewhat positive for them. At the extreme cases 5.8% have opted for very positive effect and 2.8% have opted for very adverse effect.

**e: Factors that have influenced Choice of Occupation:**

Bar-graph in **figure 3.52** summarises the feedback of sampled working women in science respondents regarding factors that have influenced them in their choice of science as a stream of education. 68% have responded “observing successful professionals and/or desire to contribute professionally” or “love for the subject” as the reason for their choice. Whereas another 34.9% respondents from this group have said that they have been “influenced by parents”; this is encouraging in terms of societal attitude to entry of women into science; 19.8% responded dual role related to family care; 10.9% respondents from this group have cited dual role factors related to marriage commitments; but 13% have picked “Other” reasons for their choice of the subject as their stream of study. Since each respondent have the option to choice multiple responses so their choices may include more than one option therefore the sum of frequencies reported in the bar graph need not add up to 991.

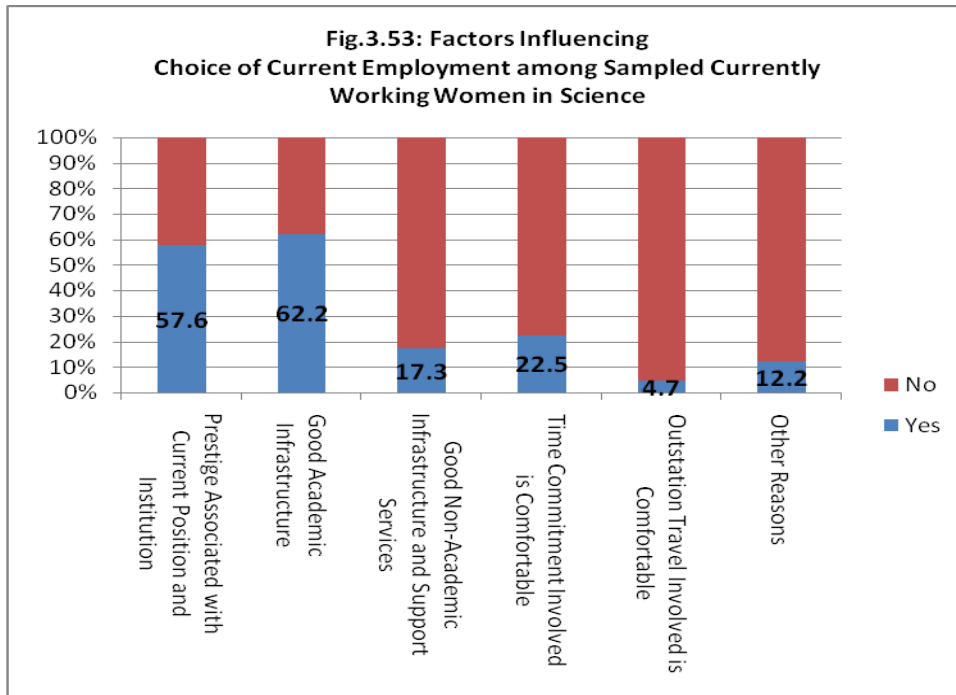


**f: Reasons for Taking Up Current Job:**

**Figure 3.53** illustrates data on feedback regarding factors influencing choice of current employment of sampled currently working respondents. 62.2% respondent selected “Good workplace academic

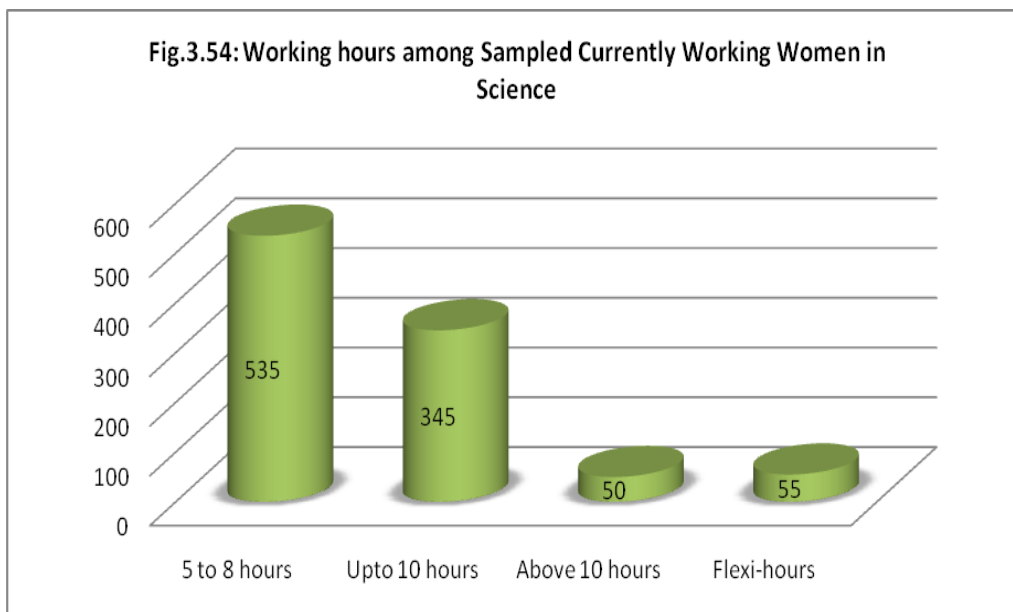


infrastructure and support services” thus making it the dominant factor in selecting current employment; 57.6 % selected “Prestige associated with the position and institution”; next 22.5% cited “Time commitment involved in job including travel time” as their reason to pursue current job; 17.3% preferred the “Workplace non-academic infrastructure and support services” of present job; and 4.7% responded “Outstation Travel Involved” as their reason. Lastly 12.2% provided some “Other” reason behind choice of present employment.



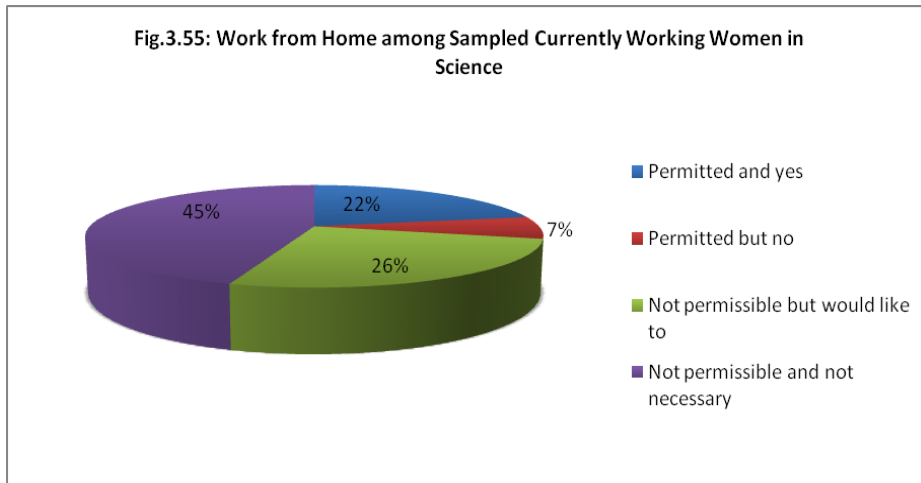
**3.2.5 WORK ENVIRONMENT: FEATURES AND EXPERIENCE (Current Employment)**

**a: Work Timings:**



**Figure 3.54** captures the work hours of sampled working women in science. The bar chart shows that out of a sample of 991 respondents in this group 535 of them work for a fixed hour of 5-8; 345 of them work for up to 10 hours; 55 of the respondents get to have flexible working hours and lastly 50 of them work for above 10 hours.

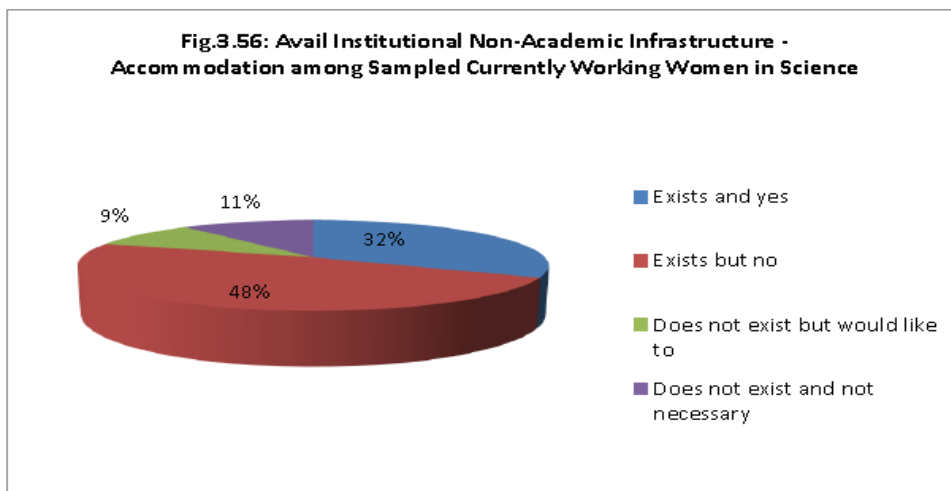
**b: Work from Home:**



**Figure 3.55** captures the accessibility of work from home option for the sampled working women science professionals. The above pie chart shows that among sampled respondents in this group, 45% of the female respondents reported that it is not permissible to do work from home and it is also not necessary. 26.1% said it is not permissible to work from home but they would like to do so. 21.9% reported it is permitted and they do work from home. Only 7% reported that it is permissible to do work from home but they don’t work from home.

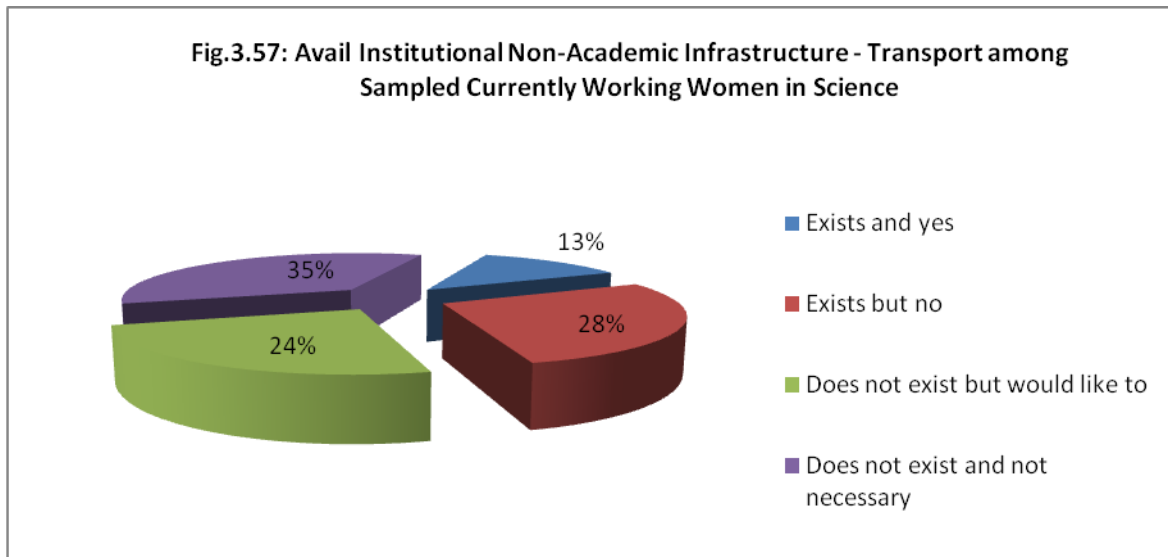
**c: Use of Institutional Housing Facility:**

This pie chart in **figure 3.56** shows the availability and use of institutional housing or hostel facility at current place of work among sampled currently working women in science. A large percentage 48.2% have responded “exists but no”, i.e., the facility exists in the institute but they opt out of it. Whereas 32% respondents have said that such facilities do exists and they use it, i.e., the response “exists and yes”; 10.8% respondents have selected the option “does not exist and not necessary”. Lastly only 9% have expressed the facility “does not exist but would like to”.

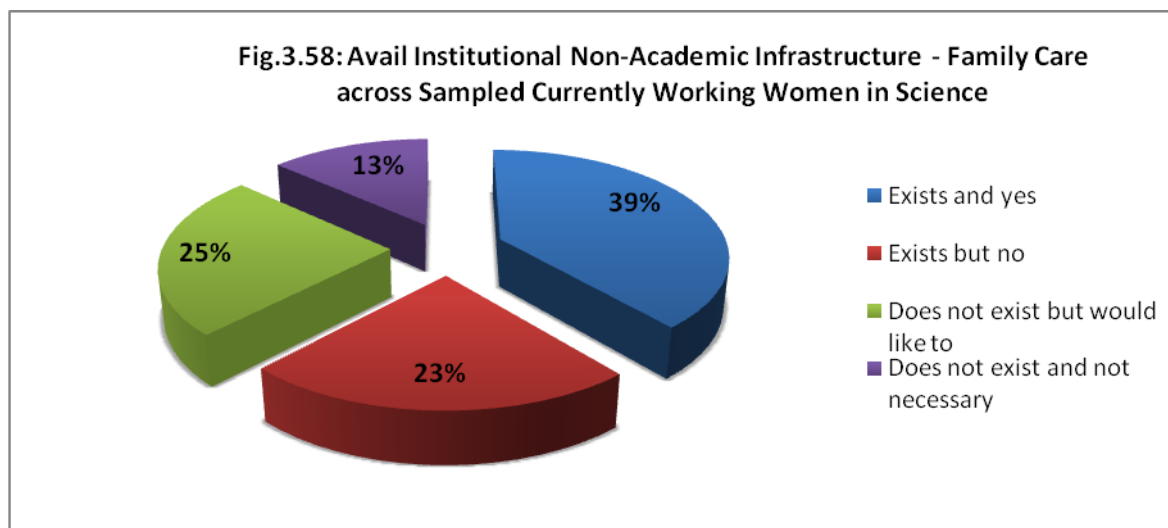


**d: Use of Institutional Transport Services:**

**Figure 3.57** explains the availability and use of institutional transportation facility at current place of work by sampled currently working women in science. This pie-chart illustrates the responses to the question “Do you avail of the institutional transport services at your current place of study?”. Out of a total sample of 976 respondents, 35.2% have said “Does not exist and not necessary”; 27.8% have said “exists but no”; 24.5% women have selected “does not exist but would like to”. Lastly 12% respondents in this group have said the facility exists and they use it.



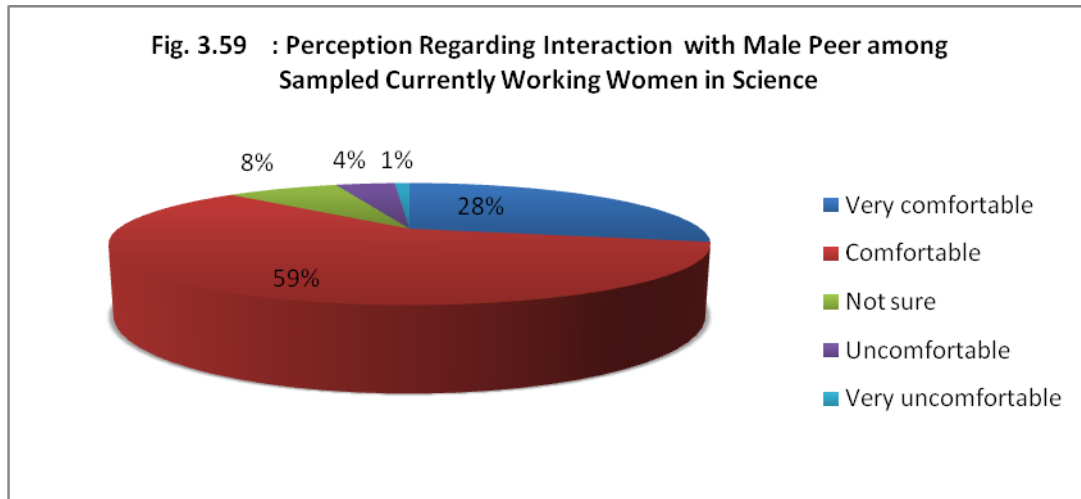
**e: Use of Institutional Family Care Related Support Services:**



**Figure 3.58** shows out of sampled currently working female science professionals, 39% of the sample workers have reported that family care facility is available and they use them, 25% female worker would like to have family care facility but this facility doesn’t exist in their institution, 23%

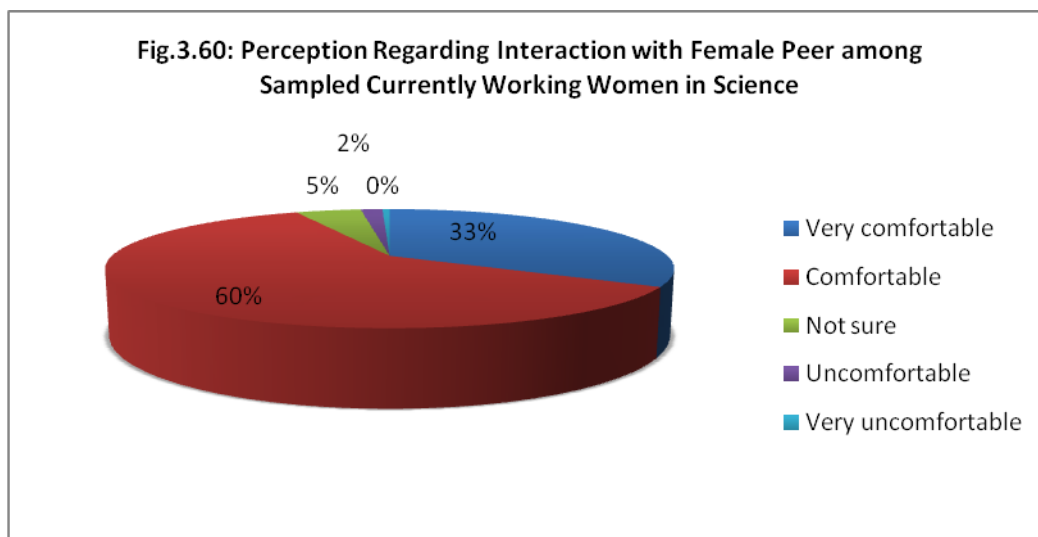
female worker said ‘no’ to the family care facility even if this facility is available in their institution and 13% of the female respondents have said that this facility not necessary and not available as well.

**f: Attitude of Male Colleagues as Professional Peers:**



**Figure 3.59** shows the perception among the sampled female currently working respondents regarding attitude of male working professionals as academic peers. 59% respondents from this group have reported “comfortable”; 28% selected “very comfortable” option; 8% respondents are “not sure” about attitude of male peers.4% has selected “uncomfortable” option. Lastly 1% has reported that attitude of the male peers are “very uncomfortable”.

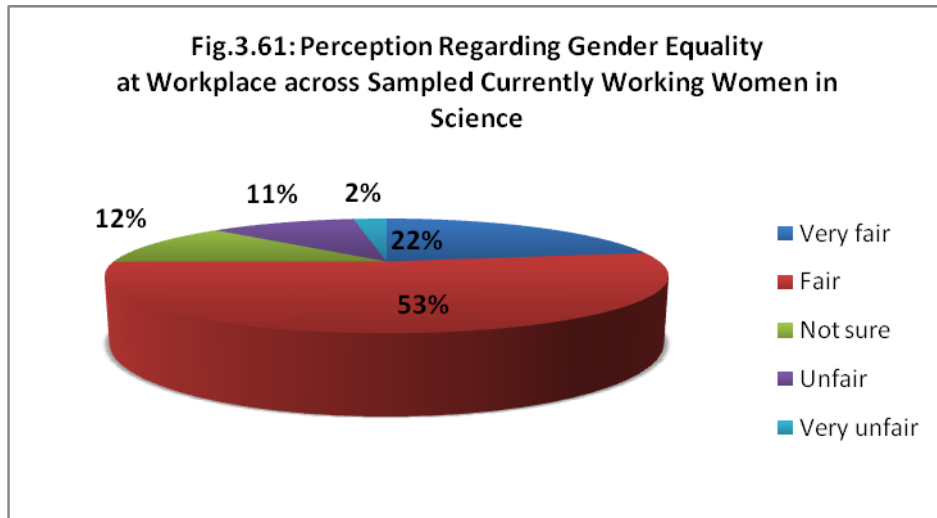
**g: Attitude of Female Colleagues as Professional Peers:**



This chart is showing the perception regarding attitude of female colleagues as academic peers towards the sampled currently working female professionals. In response to the question “Are the female colleagues comfortable interacting with you academically?” 60% students have said yes their

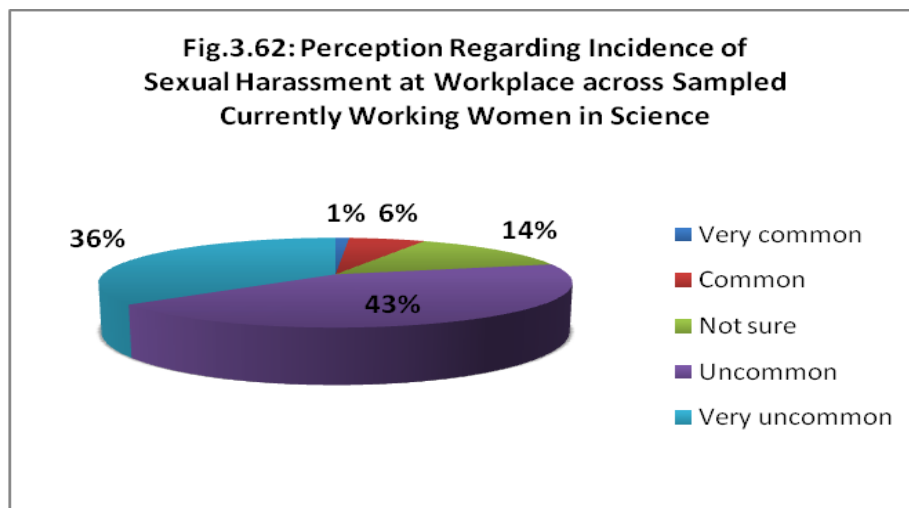
attitude is “comfortable”, 33% have responded very comfortable option. 5% respondents have responded “not sure” about the attitude of female peers. 1% has selected “uncomfortable option”. Only 2% has said attitude of the female peers is uncomfortable.

**h: Perception Regarding Equality of Opportunity (for Career Advancement for Male and Female Scientists with Similar Qualifications and Experience):**



Above figure explains the perception among sampled female working science professionals about equality of opportunity for career advancement for male and female scientists with similar qualifications and experience. The respondents were questioned whether with same qualification and experience do female scientists or faculty of science get same opportunity for promotion, award of projects, fellowships etc. Very large percentage (53%) respondents from this category have selected “fair” option. 22% respondents opted “yes it is very fair”. 12% respondents expressed that they were “not sure” about that. 11% selected “unfair” option. Only 2% respondents have said it is “very unfair”.

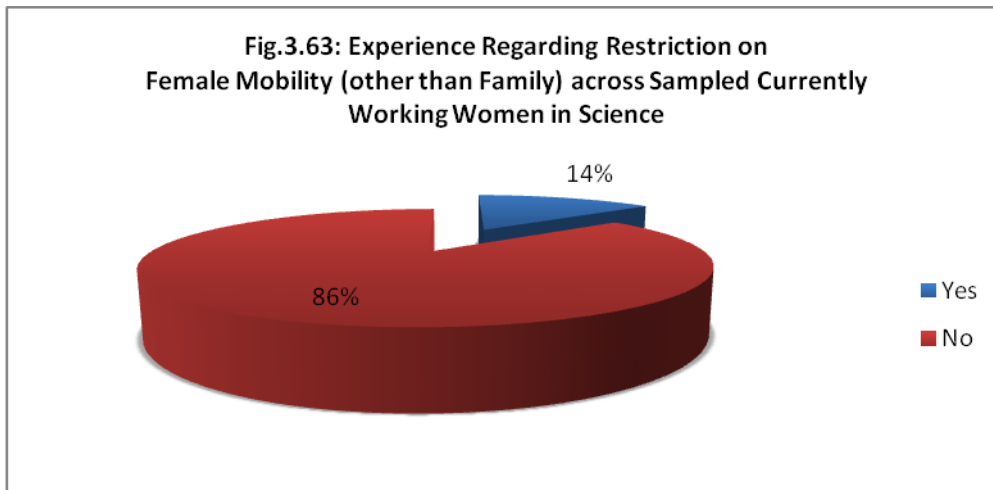
**i: Perception Regarding Incidence of Sexual Harassment in Work Place:**



**Figure 3.62** graphically points out the perception of female working respondents regarding incidence of sexual harassment in place of study. While the majority of respondents from this group have reported “uncommon” or “very uncommon”, i.e., 43% and 36% respectively, 14% have said they are “not sure”. 6% of respondents in this category perceive it to be “common”; 1% has said it is “very uncommon”.

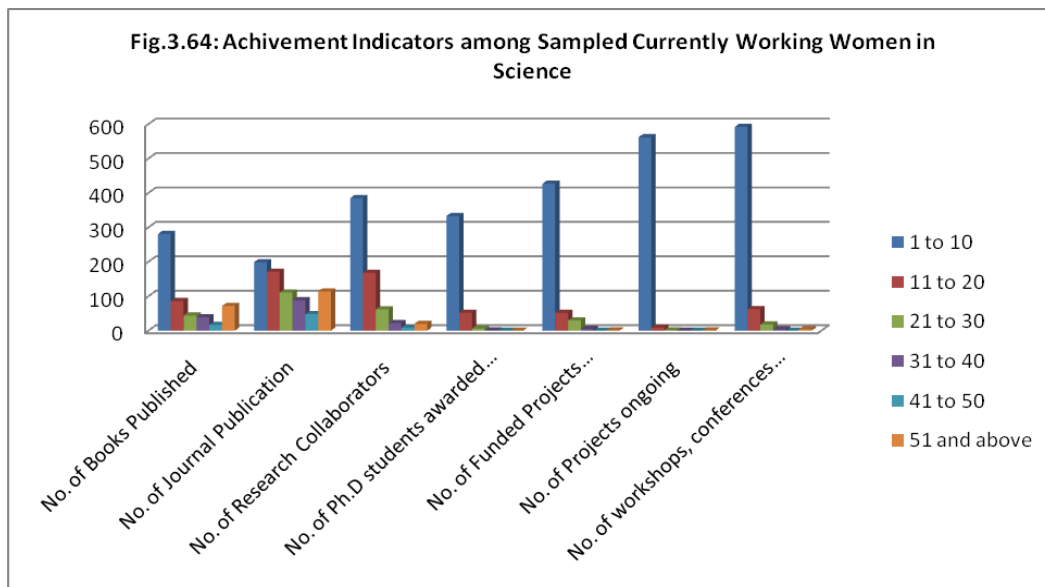
**j: Social Restrictions on Female Mobility Other than Family:**

**Figure 3.63** shows the present scenario regarding perception about social restrictions on female mobility. Here a large percentage of sampled working women in science respondents i.e. 839 out of 977 have reported that they didn't face any kind of social restriction till now. Remaining 138 respondents have said “yes”.



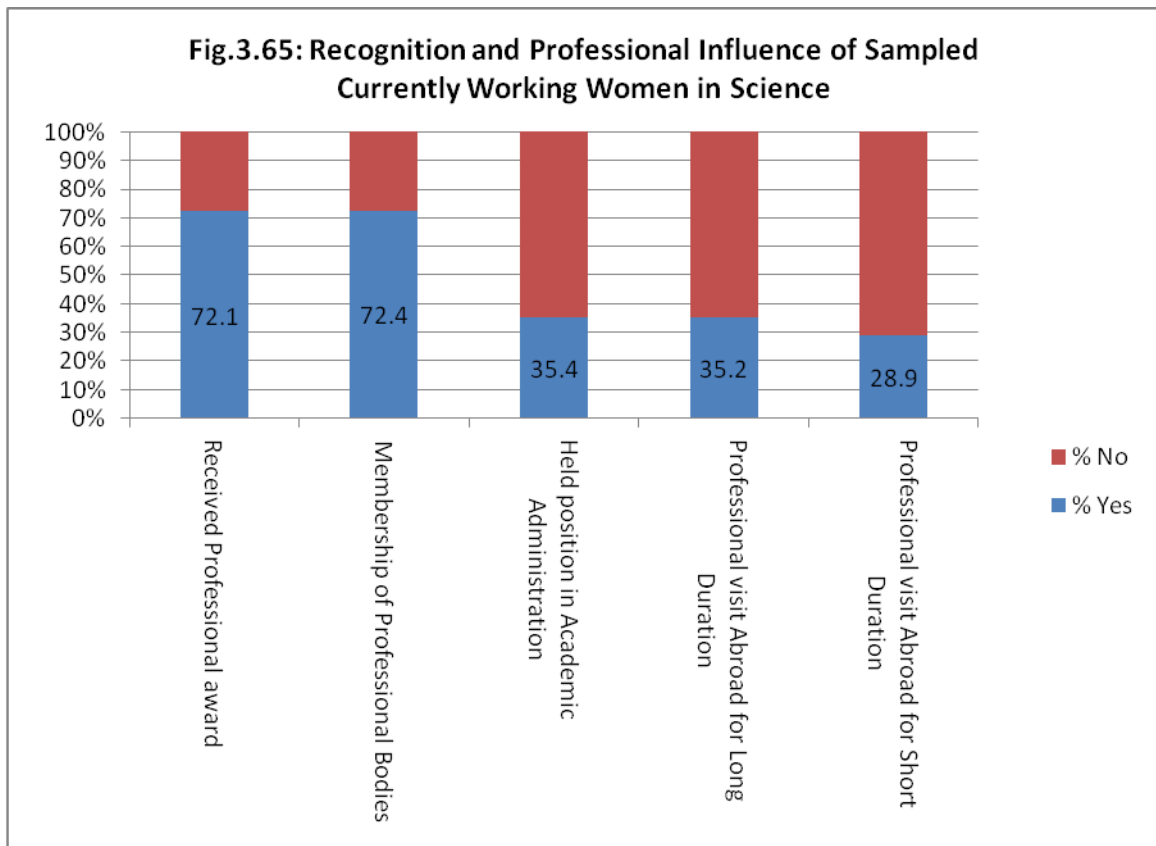
**3.2.6 ACHIEVEMENT INDICATORS**

**a: Research Publications, Collaborations, Projects, Dissemination and Workshops:**



**Figure 3.64** highlights the distribution of certain achievement indicators of sampled female science professionals across classes of width 10. The achievement indicators are: Number of Books published, Number of Journal publication, Number of Research Collaborators, Number of Ph.D. students awarded and on-going, Number of funded projects completed, Number of on-going projects and finally Number of workshops, conferences attended in the last two years.

**b: Recognition and Professional Influence:**



**Fig 3.65** provides a detail account of recognition and professional influence of the sampled currently working women science professionals. The blue area comprises of the percentage of respondents who opted ‘yes’ for the following recognition criteria - 72.4% of the sampled working women received the membership of professional bodies and 72.1% of the sample respondents have received professional award. 35.4% female respondents held position in academic administration. 35.2% and 28.9% female respondents professionally visited abroad for long duration and short duration (only for last two years) respectively.

# CHAPTER 4:

## Students of Science: Aspirations, Achievements and Enabling Factors

### 4.1 Aspirations, Achievements and Enabling Factors

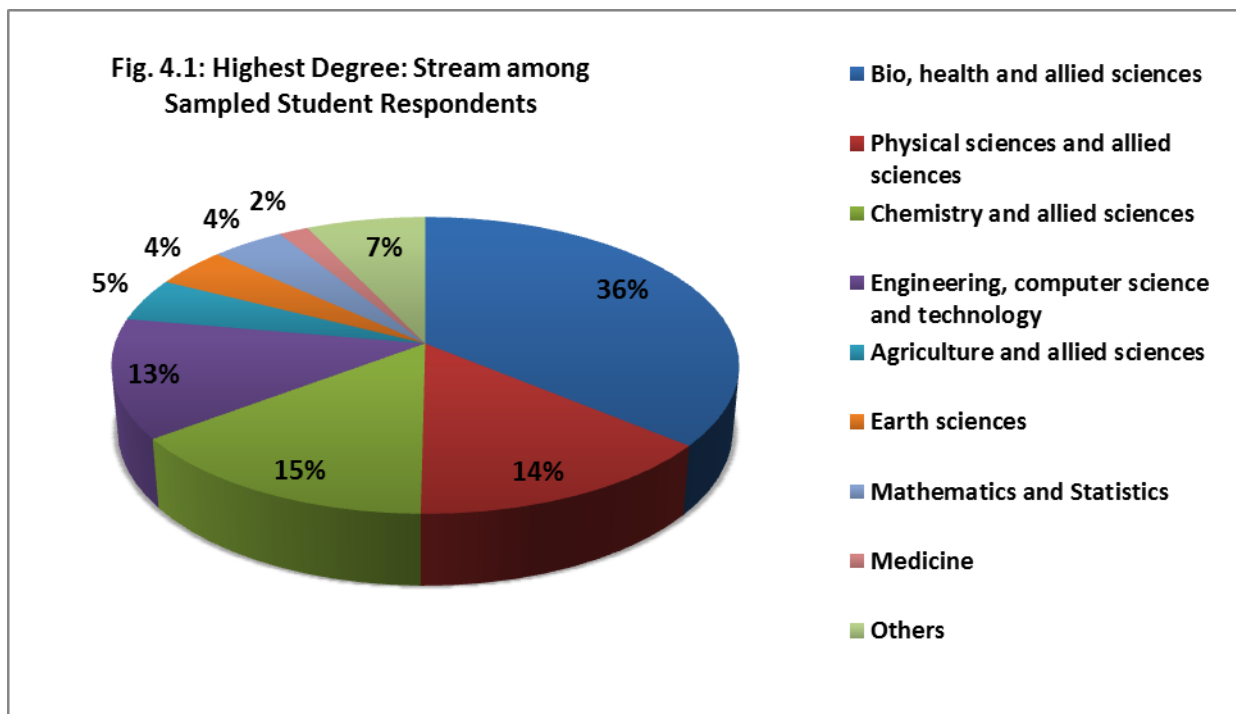
This chapter deals with career aspirations, achievements and breaks in education of students pursuing doctoral research and higher studies in science. It also looks into their family profile and commitments and the study environment and how it impacts the fulfillment of their career aspirations. A total of 518 students were covered by the survey.

The major findings and observations are presented in section 4.2.

### 4.2 Respondent Profile: Student of Science

#### a: Discipline

**Figure 4.1** below shows the discipline-wise distribution of the sampled students of science based on the stream of education for highest degree held. Biology, health and allied sciences is the dominant discipline with more than one-third (36%) of the female students of science being from this discipline. The other three common disciplines are Chemistry and allied sciences (15%), Physical sciences (14%) followed by Engineering and Computer Science (13%).





Figures 4.2 to 4.5 illustrate the profile of students of science covered by the survey with regard to their social group, age, marital status and number of children.

**b: Social Group**

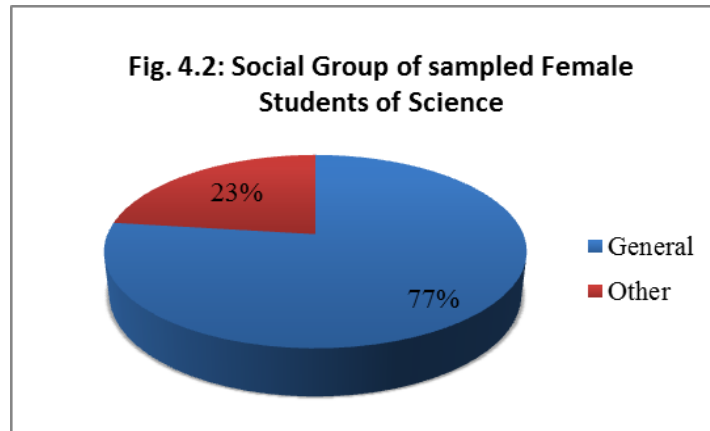
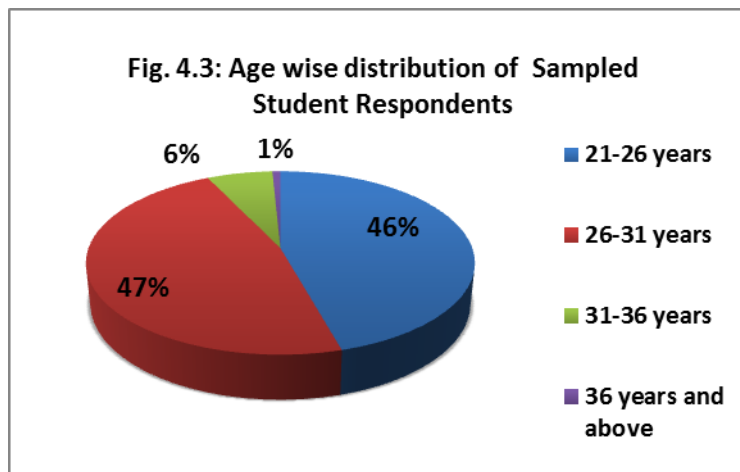


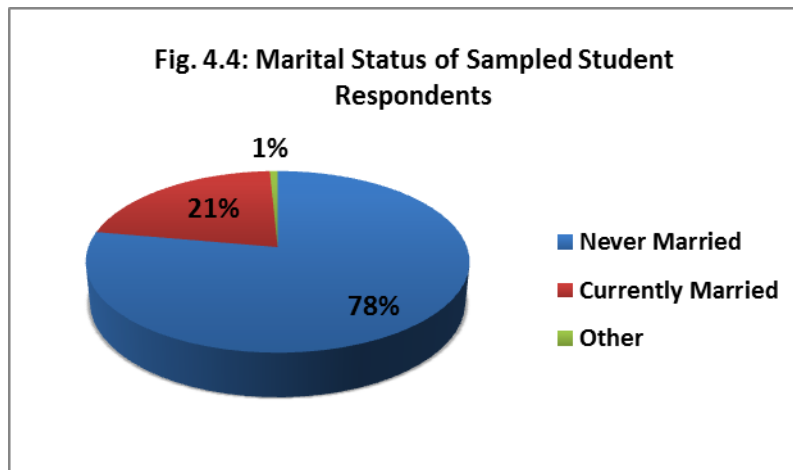
Figure 4.2 shows that 77% of students interviewed have reported as belonging to the General category, while 23% are from “Other” category (including SC, ST and OBC).

**c: Age**



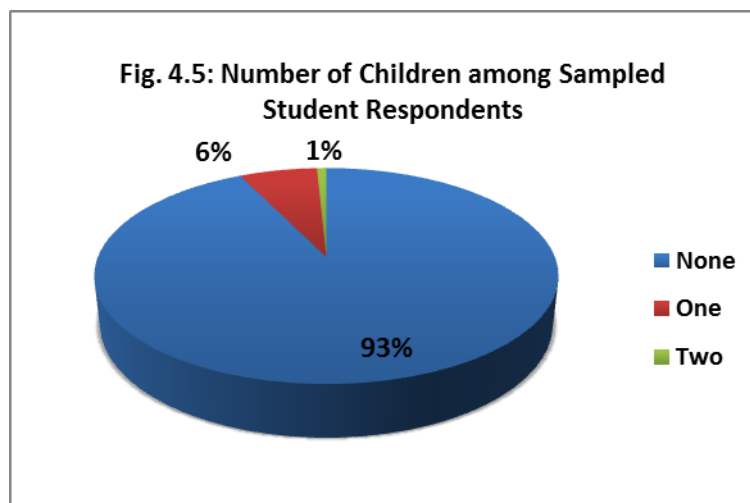
The age-wise distribution of sample students of science is illustrated in figure 4.3. The two dominant age groups are “21-26 years” and “26-31 years” and constitute 46% and 47% of the sample respectively. The latter category comprises mostly of doctoral research fellows which is the segment of interest for their proneness to dropout.

**d: Marital Status**



**Figure 4.4** illustrates the distribution of sampled student respondents according to their marital status. 78% of sampled female student respondents have reported “never married”; 21% are “currently married”. The “Other” category includes divorced, separated or widowed respondents and consists of 1% of the sample.

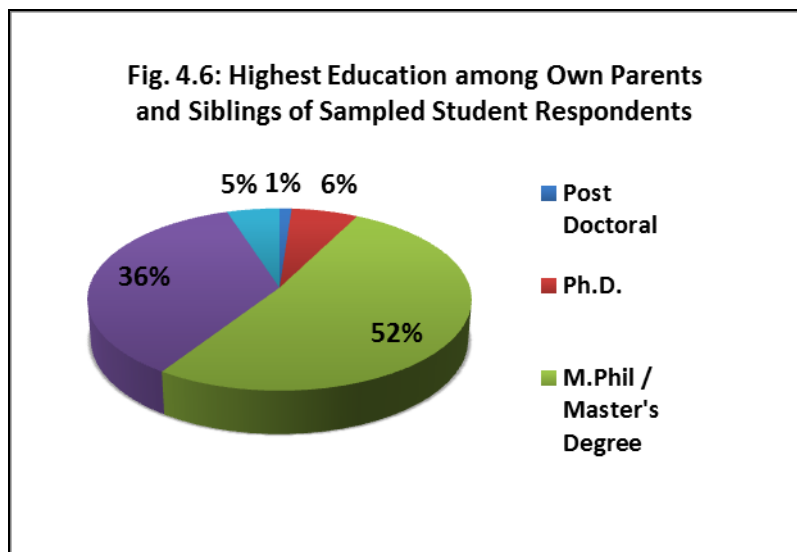
**e: Number of Children**



The status with regard to number of children for sampled student respondents is illustrated in **Figure 4.5**. While most (93%) of the student respondents have reported that they do not have a child, 6% have reported as having one child and 1% have two children. This 7% constitutes the segment subject to dual role commitments related to marriage and family care.

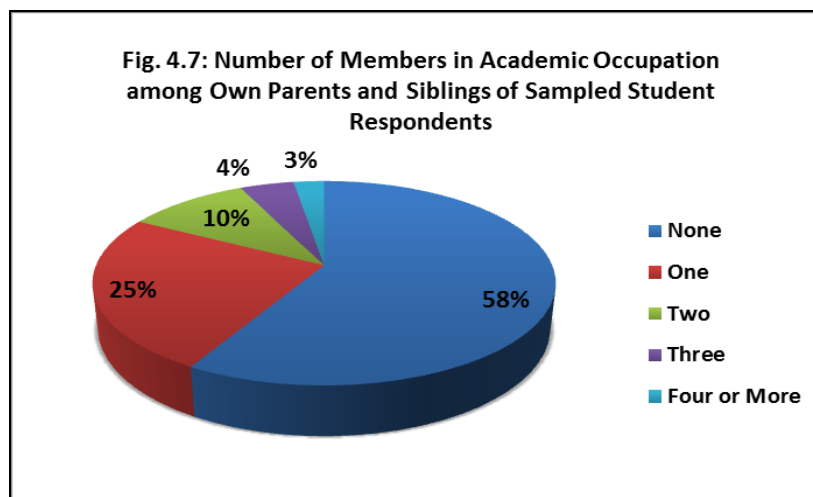
### 4.3 Family Profile and Family Commitments

#### a. Highest Education among Own Parents and Siblings



Above diagram illustrates the scenario regarding the highest education among own parents and siblings of sampled student respondents. 52% have said that M. Phil. or Master`s degree is the highest education in their family. On the other hand 36% have responded that Bachelor`s degree is the highest degree held in their family. Few student respondents (6%) have a family member with a Doctoral degree and 5% have stated having family members among their parents and siblings with Post - Doctoral research experience.

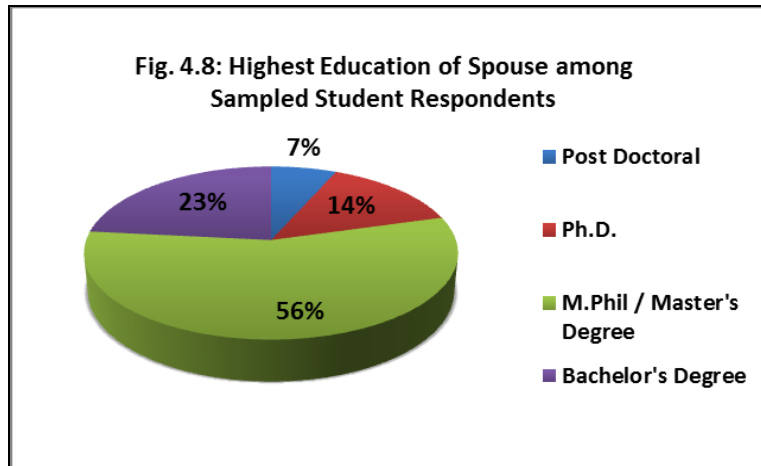
#### b: Number of Members in Academic Occupation among Own Parents and Siblings



**Figure 4.7**, represents the number of members in academic occupation among own parents and siblings of sampled student respondents. A majority of students (58%) have reported that none of their family members are connected with the academic profession. Whereas 25% of this group have chosen option one i.e. only one member of their family is connected with academic profession. A small

percentage of students (10%) have responded that two members of their family are in academic occupation. Lastly, 4% have said three members and 3% have reported four or more members of their family to be connected with this profession.

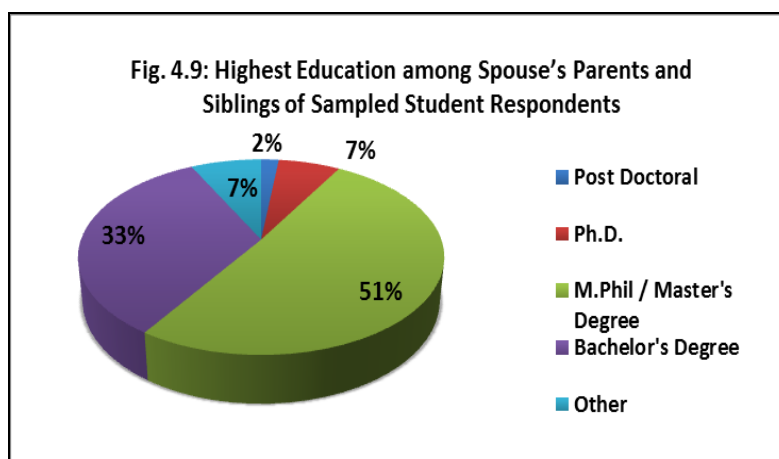
**c: Highest Education of Spouse**



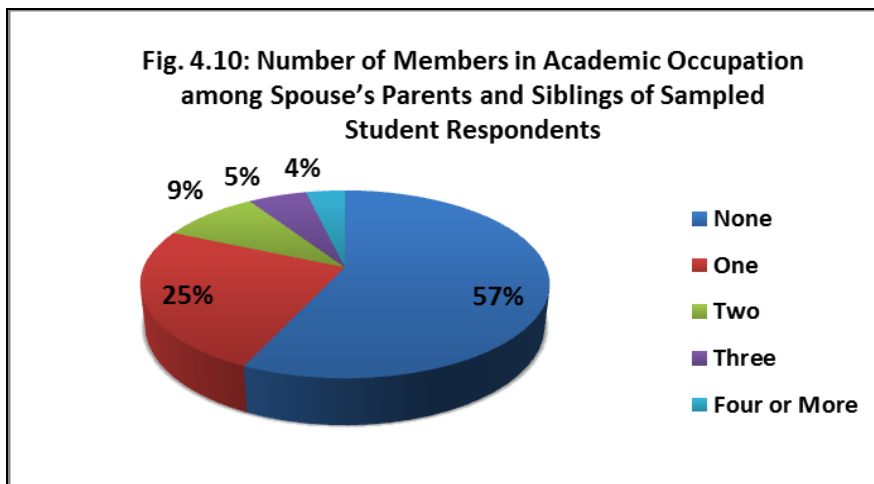
**Figure 4.8** shows a significantly higher proportion of respondents (i.e. 56%) in this group have responded that M. Phil. or Master`s degree is the highest academic degree of their spouse. Whereas 23% students in the group reported their spouses` qualification to be Bachelor`s degree, 14% have responded Ph.D. is the highest qualification degree for their spouse. Only 7% have selected Post-Doctoral option.

**d: Highest Education among Spouse`s Parents and Siblings**

The highest degree held in respondent`s spouse`s family among the sampled student respondents is illustrated in **figure 4.9**. 51% students respondents have reported that M.Phil. or Master`s as the highest qualification degree in their spouse`s family. The second highest proportion of the group (33%) have responded Bachelor`s degree is the highest degree of their spouse`s family. 7% students have selected Ph.D. and another 7% have selected “Other” for highest degree held in spouse`s family. A very small percentage (2%) of women has selected Post-Doctoral option.



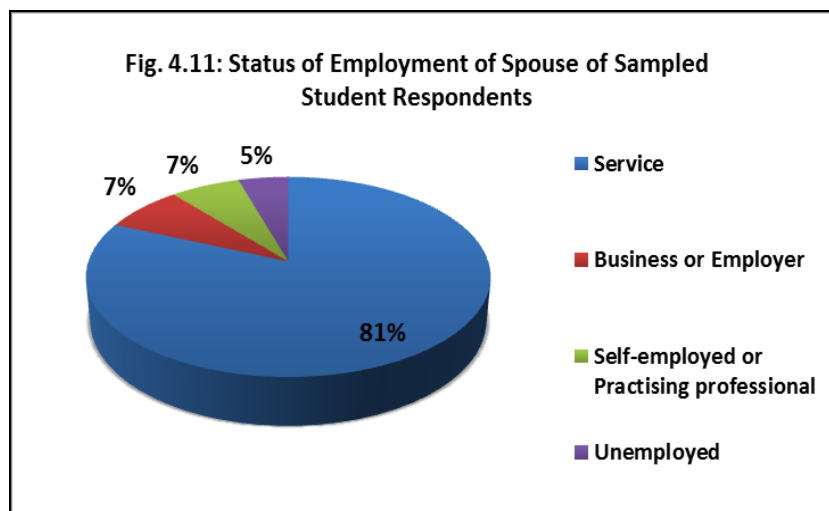
**e: Number of Members in Academic Occupation among Spouse’s Parents and Siblings**



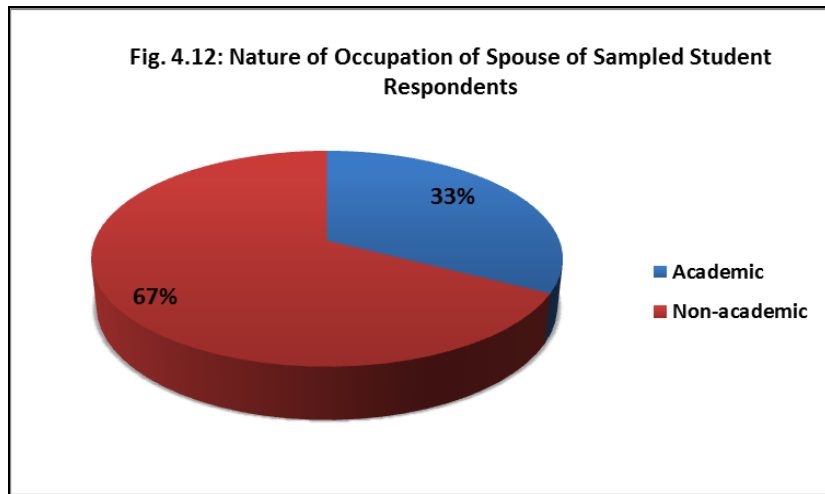
**Figure 4.10** above illustrates the incidence of number of members in academic occupation among spouse’s parents and siblings. A large proportion of student respondents i.e. 57% have significantly reported that none of their spouse’s family members are connected with the academic occupation. Whereas second highest proportion (25%) of this group has responded one of the members of their spouse’s family is from academic profession. 9% student respondents have selected two members and 5% have selected three members of their spouse’s family to be connected with this occupation. Lastly 4% have selected four or more members of their spouse’s family are engaged in academics.

**f: Status of Employment of Spouse**

A significantly higher proportion of student respondents (81%) have reported that their spouses are in “Service”, as is illustrated in **Figure 4.11** below. This proportion is really large compared to other three sub categories. 7% student respondents have selected “Business or Employer” and another 7% have selected “Self-employed or Practising” option for the employment status of their spouse. Only 5% have reported their spouses are currently “unemployed”.

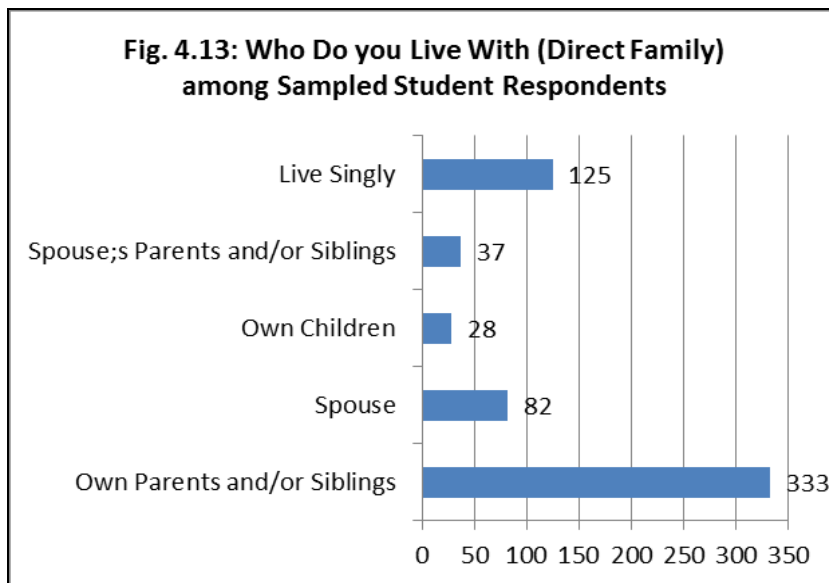


**g: Nature of Occupation of Spouse**



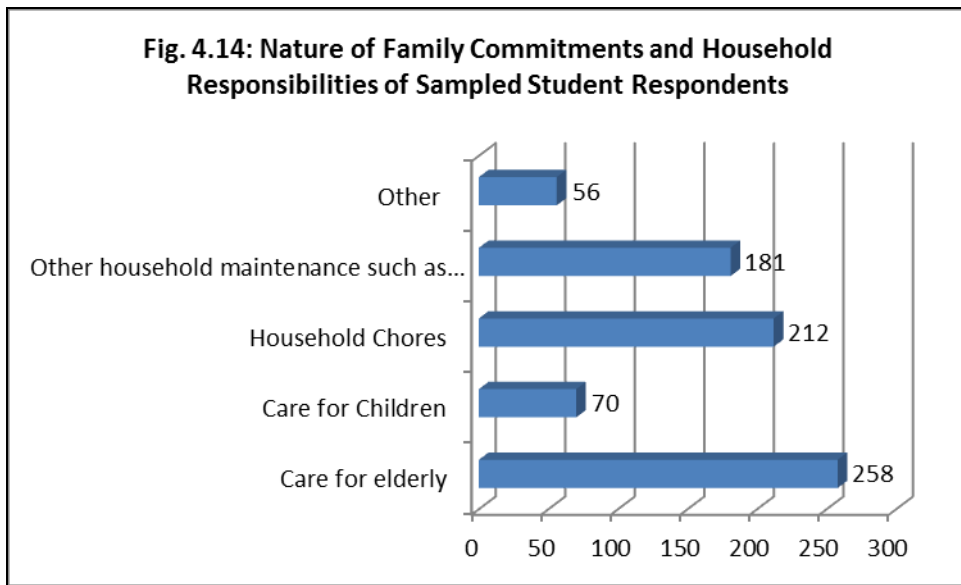
This particular pie-chart in **Figure 4.12** explains the nature of occupation of spouse. Major proportion of student respondents (67%) has reported that their spouses are engaged with the non-academic profession whereas 33% women have said that their spouses are from academic occupation.

**h: Who Do you Live With**



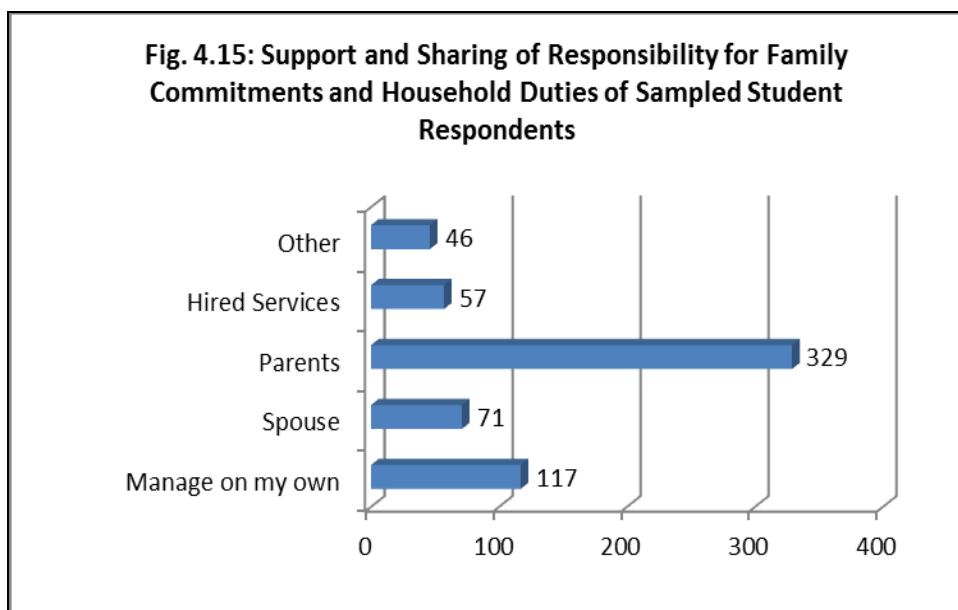
This particular pie-chart in **figure 4.13** illustrates captured data based on response to the question: “Who do you live with most of the time?” or more specifically “Who from among the given options (1. own parents/siblings 2. spouse 3. own children 4. spouse parents/siblings 5. live singly), do you live with most of the time?” The respondents were allowed to select one or more options. While 125 student respondents have reported that they “live singly”, others have selected one or more options from among the remaining four categories. Since each student respondent’s choices may include more than one option therefore the sum of frequencies reported in the bar graph need not add up to 518.

**i: Nature of Family Commitments and Household Responsibilities**



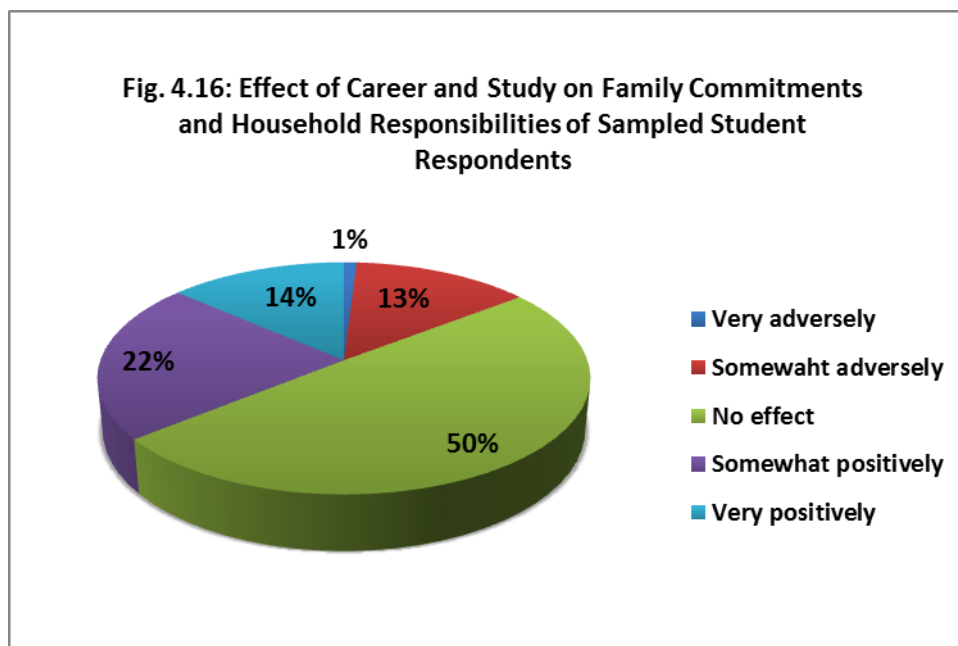
Above bar-graph in **Figure 4.14** summarises captured data on the nature of family commitments and household responsibilities for sampled student respondents. Highest number of respondents in this group 258 out of 518, have selected option one i.e. “care for the elderly”. Whereas second highest number of student respondents has selected option three which is basically “household chores”. Third highest number of student respondents has selected “household maintenance”. A small proportion 70 out of 518 has said that they “care for children” and 56 students have chosen “Other” option. Since each student respondent’s choices may include more than one category of responsibility therefore the sum of frequencies reported in the bar graph need not add up to 518.

**j: Support and Sharing of Responsibility for Family and Household Duties**



Above bar-graph in **Figure 4.15** summarises captured data on “whether anyone shares family commitments and household responsibilities” for sampled student respondents. Highest number of respondents in this group 329 out of 518 has mentioned that “parents” share responsibilities with the respondents. A large number 117 has mentioned that they “manage on their own”. Among the married students “spouse” is a common option selected by 71 student respondents. Since each student respondent’s choices may include more than one option therefore the sum of frequencies reported in the bar graph need not add up to 518.

**k: Effect of Career and Study on Family Commitments and Household Responsibilities**



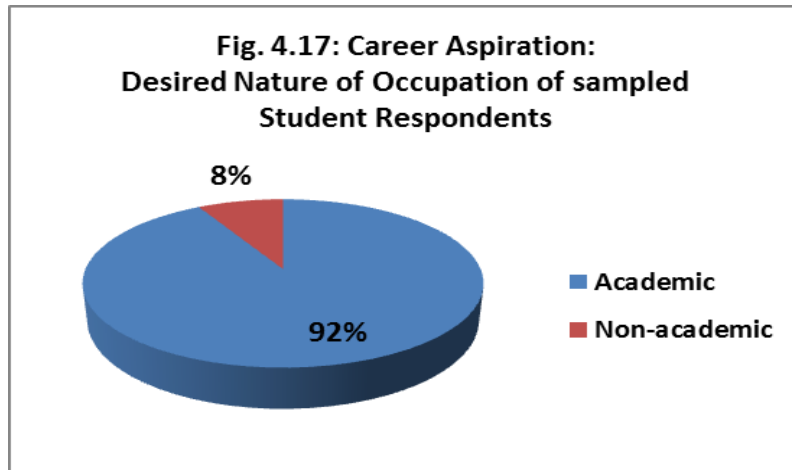
**Figure 4.16** indicates that 50% of students reported that their career and study commitments did not have any effect on their family commitments and household responsibilities. For these respondents dual role has not had any adverse effect on their family life. Significantly larger proportions 22% and 14% respectively have responded that their career and study commitments have had a somewhat positive and very positive effect on their family commitments and household responsibilities. Many of the respondents volunteered information that the positive effect was associated with financial support for family. Overall the proportion of respondents reporting adverse or very adverse effect of study and career on family commitments is small compared to those reporting an adverse effect.



### 4.3 Career Aspiration, Achievements and Breaks in Education

#### a: Highest Career Aspiration

Figures 4.17 and 4.18 summarise reported data on nature of occupation and type of work for highest career aspiration of the sampled student respondents.



A significantly large percentage of respondents (92%) in this group have reported “academics”, as their highest career aspiration. Only a small percentage (9%) has cited non-academic profession as career aspiration.

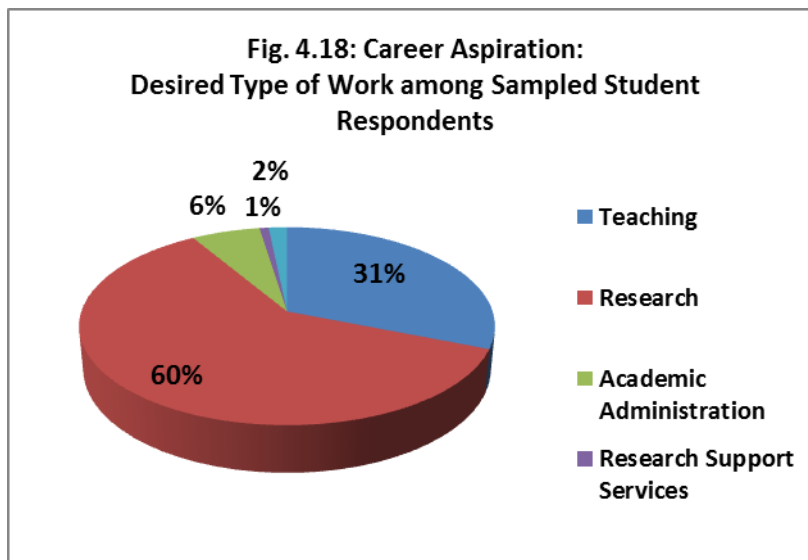
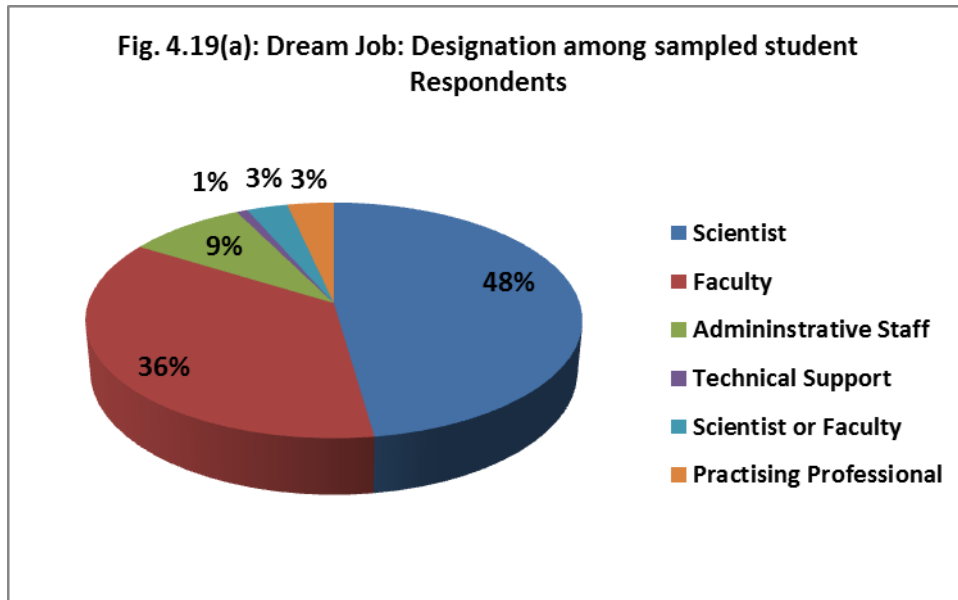


Figure 4.18 shows the distribution of student respondents across their desired type of work. 60% of respondents in this group have chosen “research” as their career aspiration. On the other hand 31% have responded that they would like to go for “teaching”. 6% have expressed interest in academic administration”. Only 1% student respondents have said that they would like to stay with “research support services”.

**b: Designation and Organisation Type for Your Dream Job**

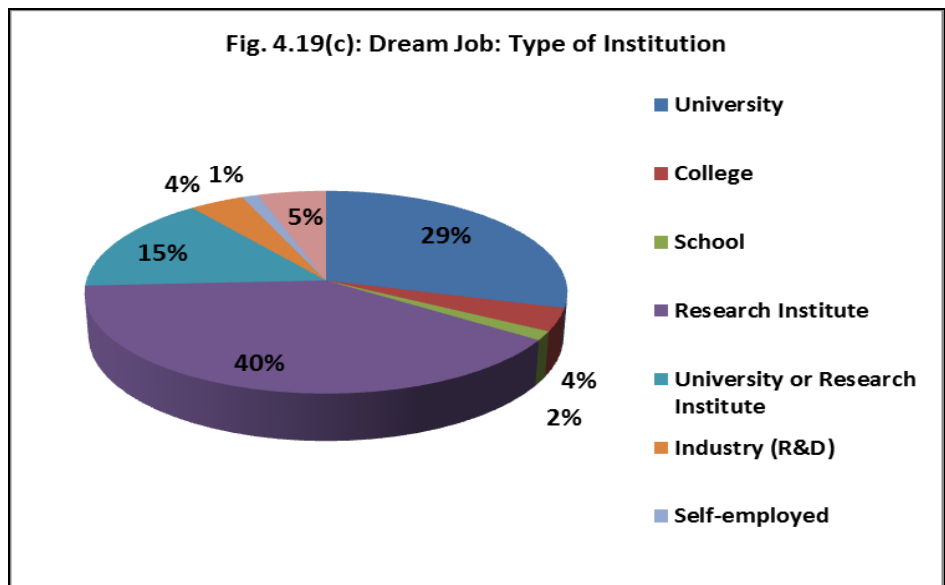
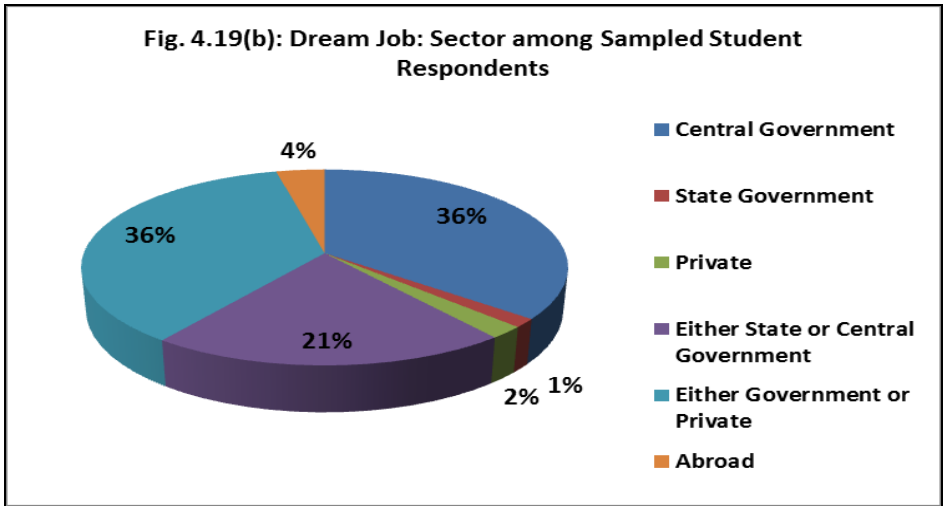
This question regarding “designation and organisation type for dream job” is an open ended free response question. The responses have been summarised under three heads based on actual responses received: designation type, sector type and organisation type.



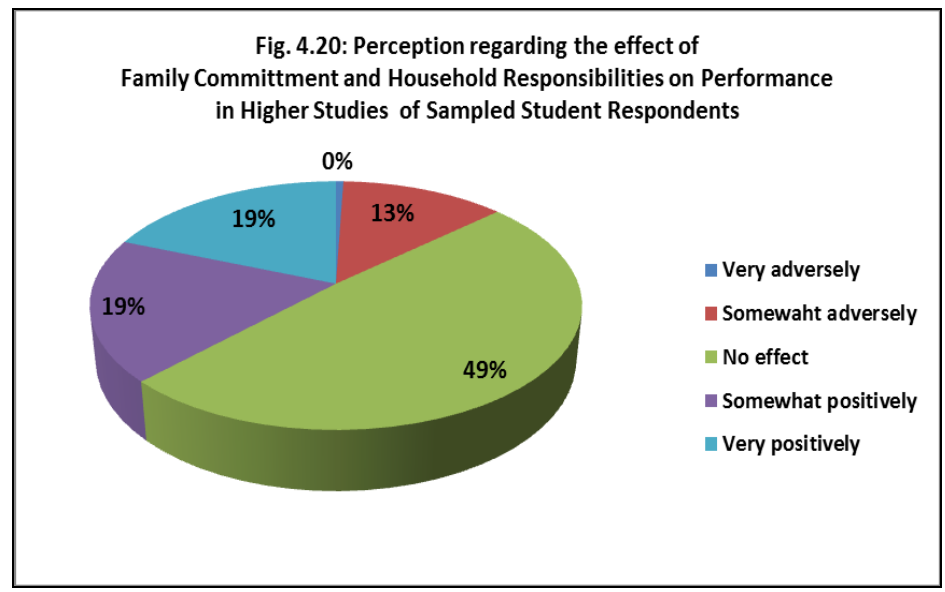
**Figure 4.19(a)** explains dream job designation type of the surveyed student respondents. 48% student respondents has expressed that they want to be a scientist; 36% expressed interest in faculty positions in teaching departments; 9% expressed interest in administrative staff position; 3% said they preferred being a practicing professional and another 3% said they were indifferent between a scientist or faculty position. Only 1% opted for technical support as dream designation.

**Figure 4.19(b)** illustrates the scenario for dream job sector. 36% student respondents would like to get “central government job”. 21% student respondents stated they would like to get “either state or central government job”. 36% from this group want get “any job - either a private or government job”. 45% expressed interest in going “abroad”. 35% would like to work in private sector and only 1% explicitly expressed interest in “state government job”.

In terms of institution type for dream job in **Figure 4.19 (c)**, 40% student respondents would like to get job in research institute; 29% of respondents in this group said they are interested in getting a job in university. 15% were indifferent between university and research institute jobs. 4% expressed interest in industry job while 1% said they preferred self-employment.



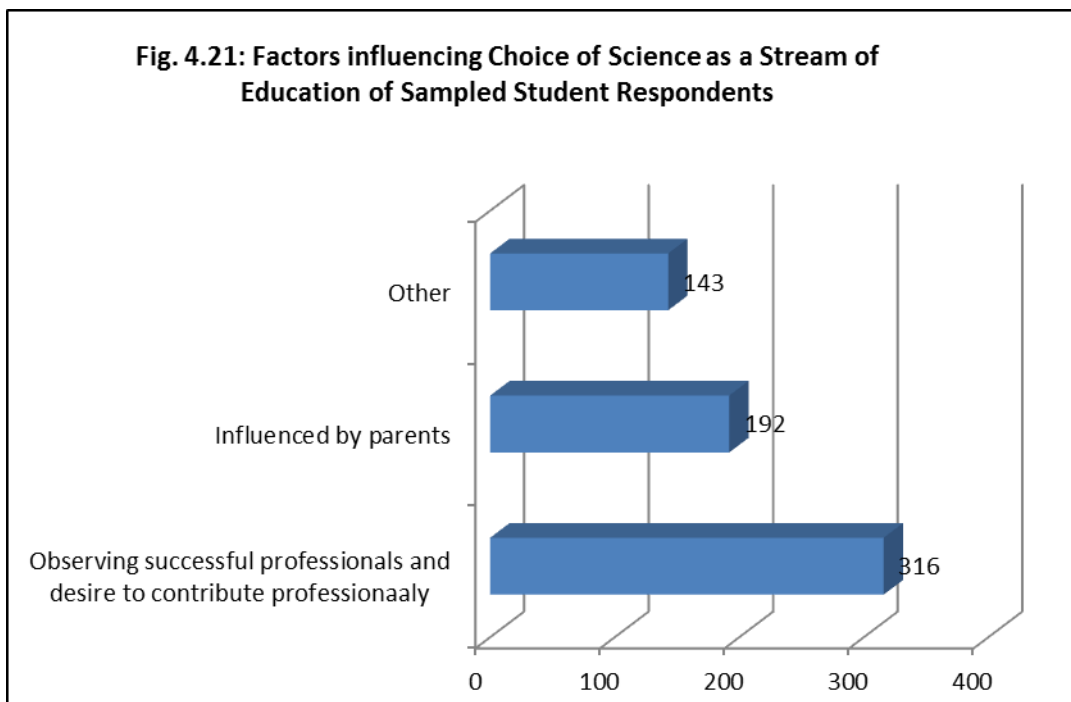
**c: Perception Regarding Effect of Family Commitments and Household Responsibilities on Performance and Achievement in Studies**



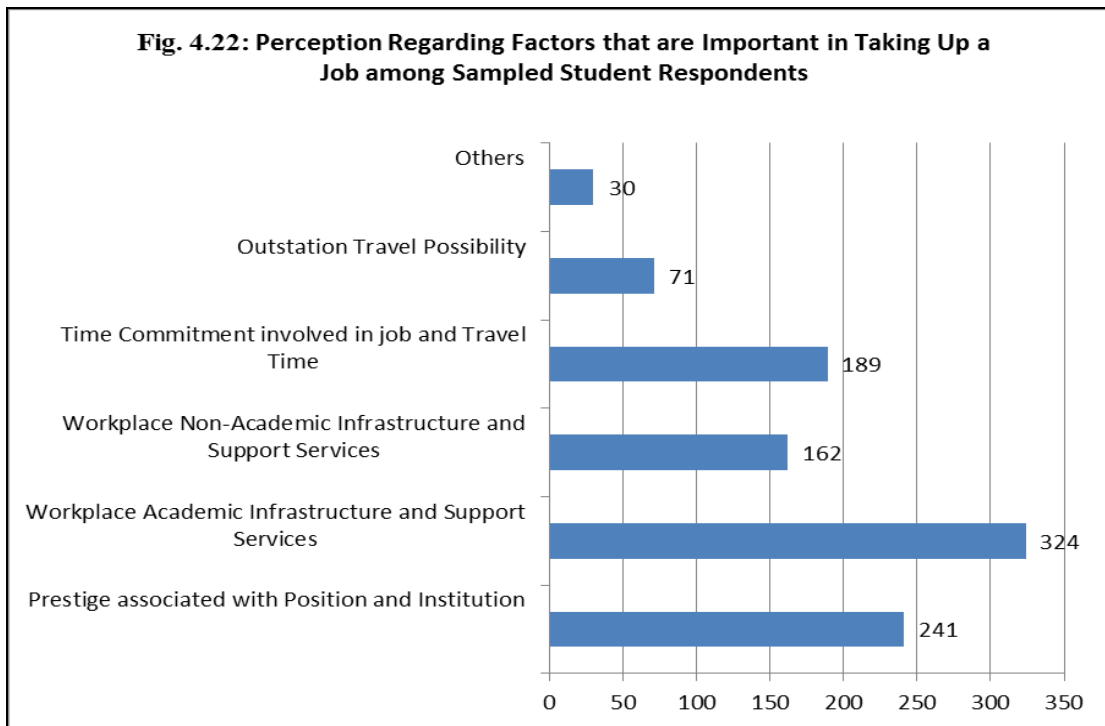
**Figure 4.20** shows that as in case of the question regarding effect of career and study commitments, the effect of family commitments and household responsibilities on performance in career and higher studies is perceived to be nil by near about half (49%) of the respondents. Whereas 194 (38%) student respondents have claimed that the family commitments have had a positive effect on their performance in higher studies. Of the 69 students (13%) who have reported that the effect has been adverse only 3 student respondents have said that the effect has been very adverse.

**d: Factors that Have Influenced Choice of Science as a Stream of Education**

Bar-graph in **Figure 4.21** summarises the feedback of student respondents regarding factors that have influenced them in their choice of science as a stream of education. Most (316) have responded “observing successful professionals and/or desire to contribute professionally” or “love for the subject” as the reason for their choice. Whereas another 192 (37%) respondents from this group have said that they have been “influenced by parents”; this is encouraging in terms of societal attitude to entry of women into science. 143 respondents from this group have cited “Other” reasons for their choice of the subject as their stream of study. Since each student respondent’s choices may include more than one option therefore the sum of frequencies reported in the bar graph need not add up to 518.

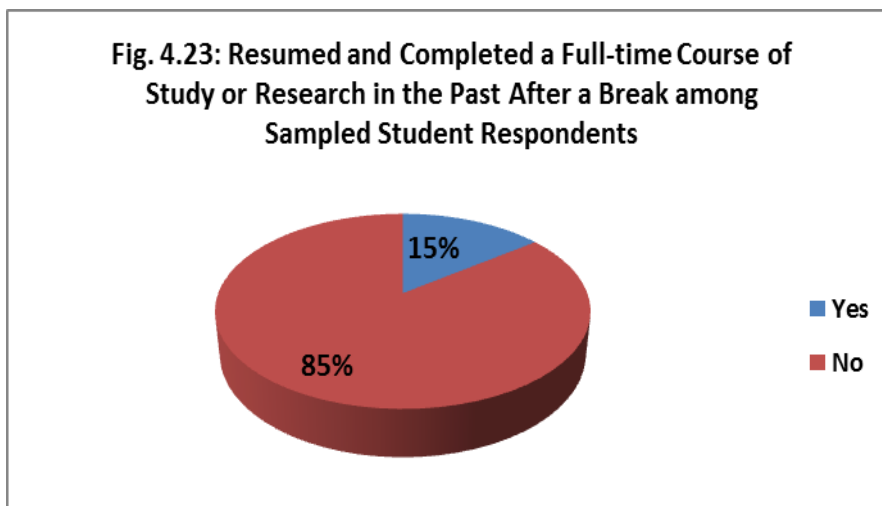


**e: Perception Regarding Factors that are Important in Taking Up a Job**



**Figure 4.22** presents data on feedback regarding factors influencing choice of future employment of sampled student respondents. “Workplace academic infrastructure and support services” emerge as the most important factor cited by 324 student respondents. “Prestige associated with the position and institution” is considered an important factor in choice of employment by 241 respondents in this category. “Time commitment involved in job including travel time” and “workplace non-academic infrastructure and support services” are the two other commonly cited criteria by 189 and 162 student respondents respectively. “Out station travel” is the other criteria that have been reported as important for employment decision by 71 students.

**f: Resumed and Completed a Full-time Course of Study or Research in the Past after a Break**

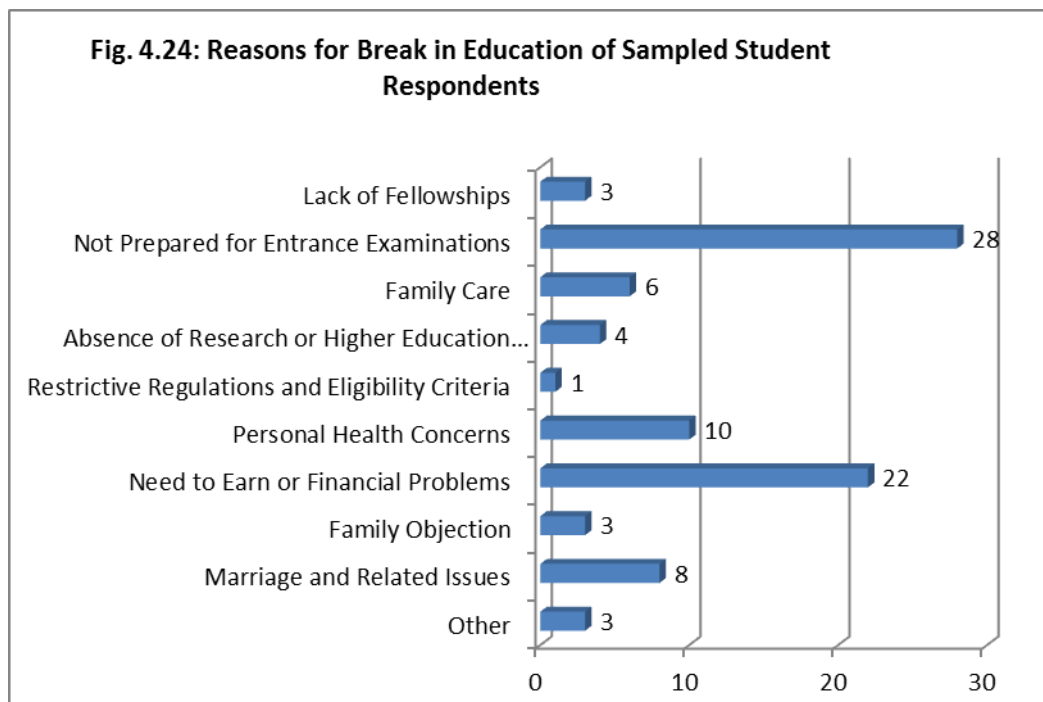


**Figure 4.23** illustrates the incidence of break in education among current students of science. 15% of sampled student respondents have reported that they have resumed and completed a course of study after a break in education. 85% have reported that there has been no break in their education.

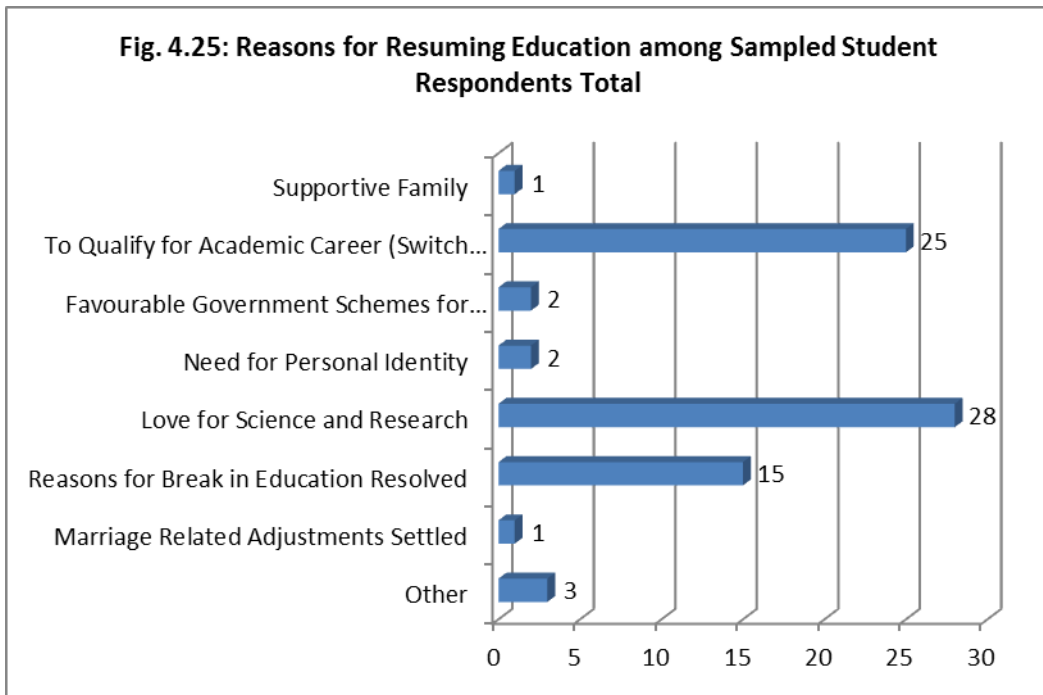
**Figures 4.23(a) and (b)** below summarise the feedback regarding “reasons for break” and” reasons for resuming” higher studies obtained from the 76 student respondents who have had a break in their education and have resumed and completed the course of study thereafter. Both questions were posed as open ended free response questions and each student respondent cited one or more reasons.

**g: Reasons for Break in Education**

The commonly cited factors for break are “not prepared for entrance examination” (28) and “need to earn or financial problems” (22). The students who have cited the former reason basically have a gap year between two consecutive degrees. “Marriage and related issues” is the reason for break in education has been cited by 8 respondents in this group. “Family care” and “family objection” has been reported by another 9 (6 and 3) respondents.



**h: Reasons for Resuming Education**



**Figure 4.24** shows that “Love for science and research” and acquiring additional qualifications to prepare for “switch to academic career” have been cited by 28 and 25 student respondents respectively as the reasons for resuming education after break. 15 respondents from this group have said that they resumed education when the reason for break was resolved.

**4.4 Study Environment: Infrastructure and Experience (in current place of study)**

**a: Avail Institutional Housing or Hostel Facility at Current Place of Study**

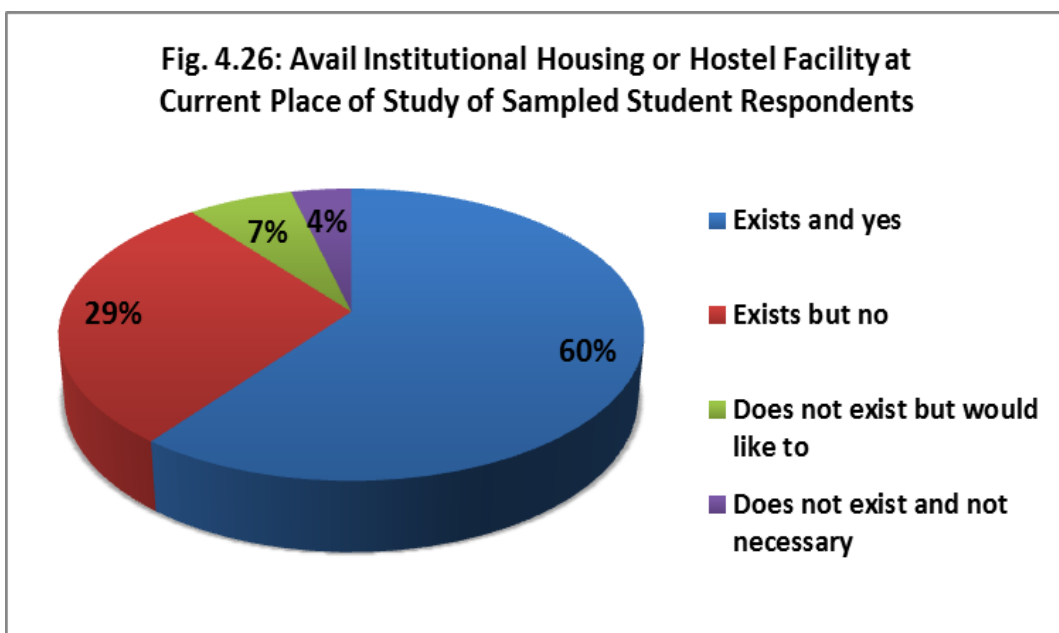


Figure 4.26 shows the availability and use of institutional housing or hostel facility at current place of study among sampled student respondents. A large proportion of respondents (60%) have responded exists and yes. Whereas 29% respondents have said such facilities but they do not use i.e. chosen “exists but no”, 7% respondents have expressed the facility “does not exist but would like to”. Lastly only 4% have selected the facility “does not exist and not necessary” option.

**b: Avail Institutional Transportation Facility at Current Place of Study**

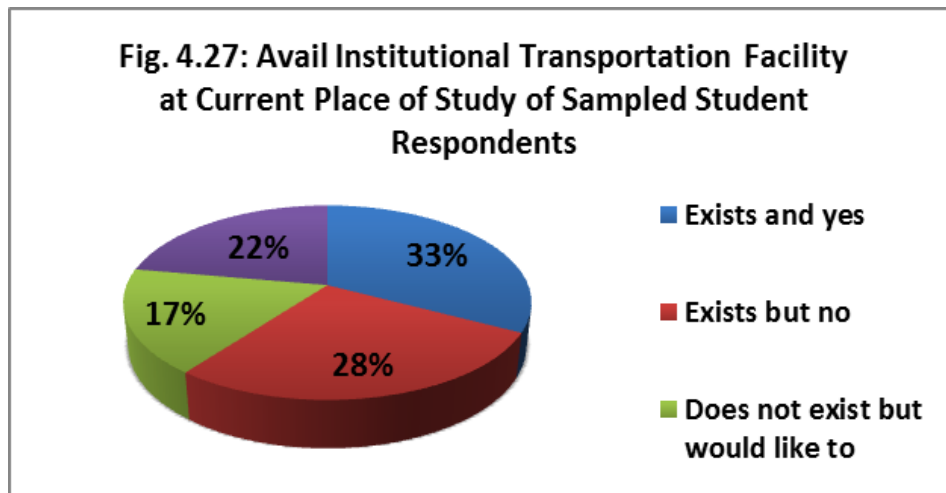
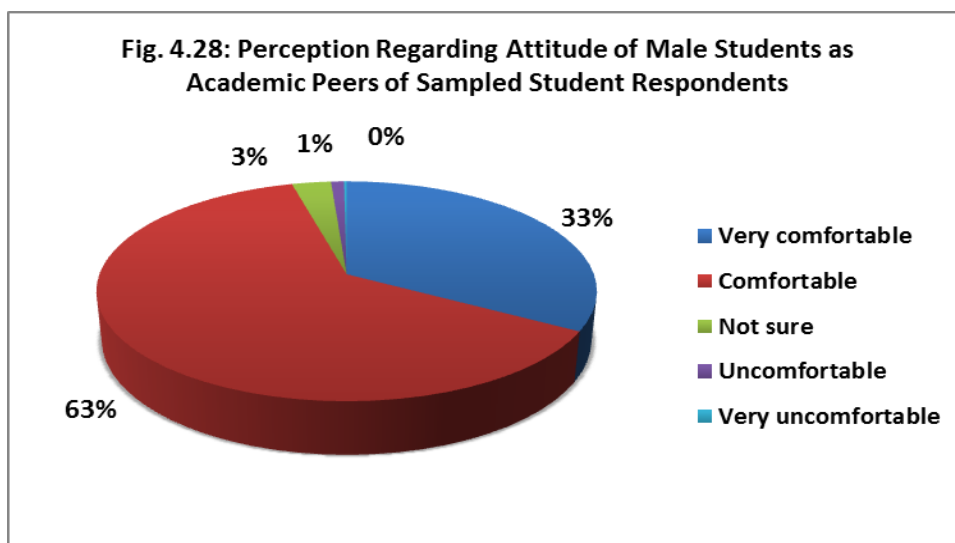


Figure 4.27 shows the availability and use of institutional transportation facility at current place of study by sampled student respondents. More specifically this diagram illustrates the answer to the question “Do you avail of the institutional transport services at your current place of study?” 33% have said “exists and yes”; 28% have said “exists but no”; 22% women have selected “does not exist and not necessary”. Lastly 17% respondents in this group have said the facility “does not exist but would like to” use such facility if it existed.

**c: Perception Regarding Attitude of Male Students as Academic Peers**

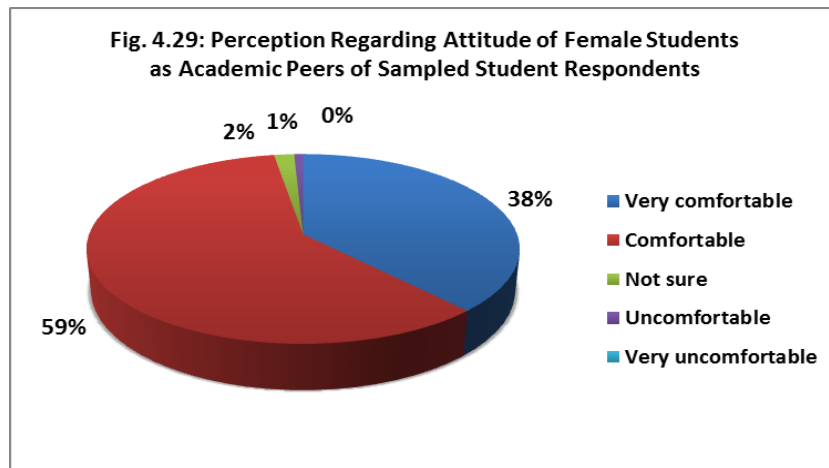




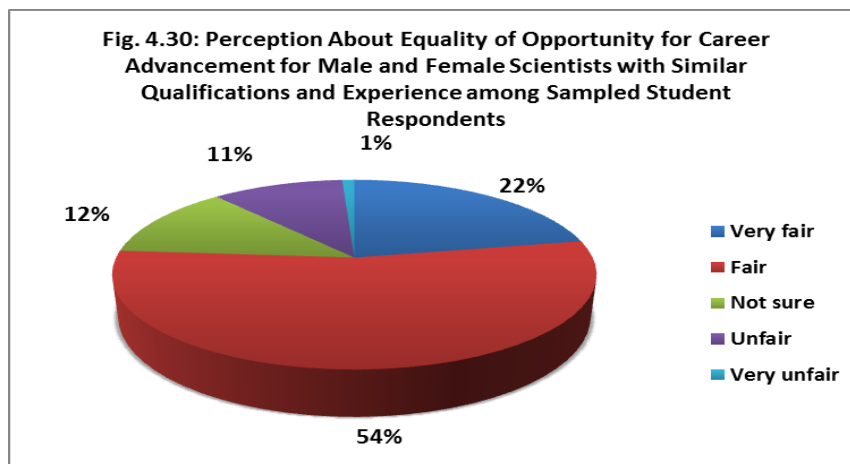
**Figure 4.28** above shows the perception among the sampled female student respondents regarding attitude of male students as academic peers. 63% respondents from this group have reported “comfortable”; 33% selected “very comfortable” option. 3% respondents are “not sure” about attitude of male peers. 1% has selected “uncomfortable” option. Lastly no one has said that attitude of the male students are “very uncomfortable”.

**d: Perception Regarding Attitude of Female Students as Academic Peers**

This pie chart is showing the perception regarding attitude of female students as academic peers. In response to the question “Are the female students comfortable interacting with you academically?” 59% students have said yes their attitude is “comfortable”, 38% have responded very comfortable option. 2% student respondents have responded “not sure” about the regarding attitude of female students. 1% has selected “uncomfortable option”. No one has said attitude of the female peers in class is “very uncomfortable”.



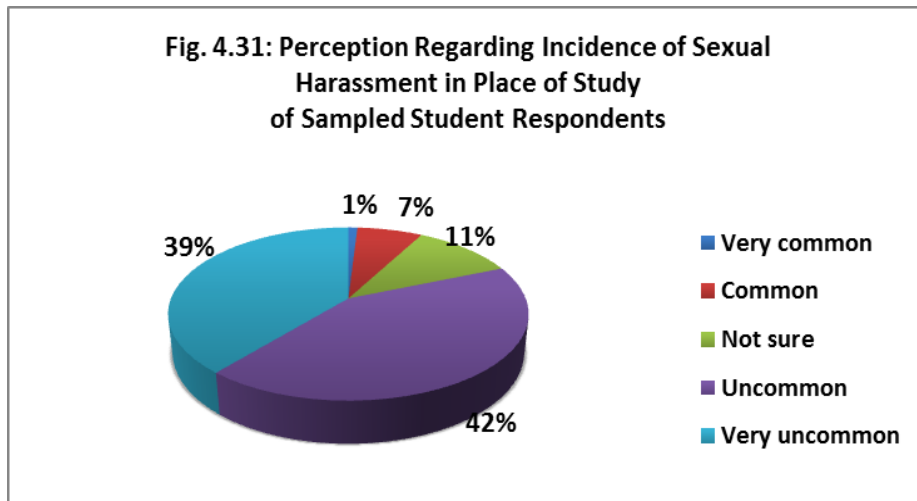
**e: Perception About Equality of Opportunity for Career Advancement for Male and Female Scientists with Similar Qualifications and Experience**



**Figure 4.30** explains the perception among sampled student respondents about equality of opportunity for career advancement for male and female scientists with similar qualifications and experience. The

respondents were questioned whether with same qualification and experience do female scientists or students of science get same opportunity for promotion, award of projects, fellowships etc. Very large percentage (54%) respondents from this category have selected “fair” option. Second highest percentage of respondents opined “yes it is very fair”. 12% respondents expressed that they were “not sure” about that. 11% selected “unfair” option. Only 1% respondents have said it is “very unfair”.

**f: Perception Regarding Incidence of Sexual Harassment in Place of Study**



**Figure 4.31** summarizes the perception of student respondents regarding incidence of sexual harassment in place of study. While the majority of respondents from this group have reported “uncommon” or “very uncommon”, 11% have said they are “not sure”. 7% of respondents in this category perceive it to be “common”; 1% has said it is “very uncommon”.

**g: Social Restrictions on Female Mobility**

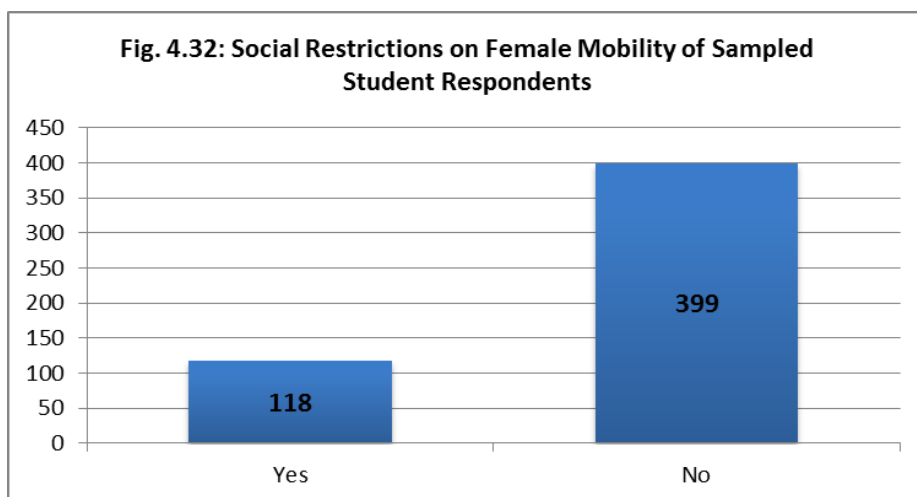


Figure above shows the present scenario regarding perception about social restrictions on female mobility. Here a large percentage of student respondents i.e. 399 out of 518 have reported that they didn't face any kind of social restriction till now. Remaining 118 respondents have said “yes”.

# CHAPTER 5:

## Currently Unemployed and Dropouts: A Few Case Studies

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This chapter presents some case studies where a few women scientists have provided us with a detailed picture of the reasons for the problem of higher dropout and unemployment among women in science than other streams of education. A synopsis of the in-depth interviews is provided in sections 5.1 to 5.2. A few case studies delving into the career choice decision of school teachers is also presented in section 5.3.

### 5.1 Currently Unemployed

**Case U1:** *Education and past work experience:* This respondent is a scientist with Post-Doctoral work experience, a Ph.D. in Molecular Biology and lacks a permanent job. In her forties and single (never married), past work experience includes working as a Principal Investigator in a SERB Funded Young Scientist Project for two years and two more temporary projects. The respondent cited lack of funded projects as the reason for recurrent job shifts and frequent breaks in career since her first job in 2004.

*Educational and occupational profile of family:* Highest degree held by respondent's parents and siblings is Master's degree. Highest education among respondent's family and siblings is Ph.D. with one member from academic profession and among spouse's parents and siblings there is at least one member with Post-Doctoral experience. Respondent's spouse has Post-Doctoral work experience and is working in academic sector at present.

*Views on work environment and policy:* The respondent talks about how the co-operation of peer and also excellent lab facility and Wi-Fi campus has helped in her career advancement.

*Present status:* Respondent has no family responsibility and talks about lack of opportunities and project funding as primary reason for current break in career.

**Case U2:** *Education and past work experience:* The respondent is a scientist with Post-Doctoral work experience, Ph.D. in nuclear physics and currently undergoing a career break. In her forties and married, awardee of two esteemed fellowships – CNRS and DAE – her past work experience includes working as a Senior Research Associate under CSIR Scientist's Pool Scheme for three years. The respondent cited family care as reason for career break and unemployment for the last 10 years.

*Educational and occupational profile of family:* Highest degree held by respondent's parents and siblings is Master's degree; among spouse's parents and siblings there is at least one member with Post-Doctoral experience. Respondent's spouse is a Post Doc working in the academic sector.

*Views on work environment and policy:* Respondent's view on management policies when employed is mostly positive. The availability of flexible timing, co-operation of seniors and institute being near place of residence acted as enabling factors for continuing with job despite the pressure of child care in the past when employed.

*Present status:* Respondent lives with her parents and a child; spouse is working abroad. According to the respondent, family commitments and household responsibilities has adversely affected her performance and achievement in career.

**Case U3:** *Education and past work experience:* This respondent is a scientist with Post-Doctoral work experience, Ph.D. in experimental nuclear physics and is currently obliged to take a break in between projects. In her forties and unmarried, the respondent aspires to work in a Central government institute as an administrative officer and to serve the society with past work experience as a trainee in a CSIR laboratory of four months. The respondent cited lack of opportunities and full time positions for women in science as the reason for working only in temporary positions.

*Educational and occupational profile of family:* Highest degree held by respondent's parents and siblings is Master's degree; and one among them is in academic occupation namely research and teaching. A career figure more importantly than family and the respondent prefers focusing on career before making any family commitments.

*Views on work environment and policy:* Respondent points out that flexibility of time and exposure to new skills and ideas (nationally as well as internationally) as well as well state-of-the-art research facilities and resources have been the enabling factors for her career continuity in the past.

*Present status:* Respondent shoulders a lot of the household responsibilities which is having adverse effects on career attainment and progression.

**Case U4:** *Education and past work experience:* The respondent is an esteemed female scientist who holds a Ph.D. degree in Chemistry and has Post-Doctoral work experience abroad but who never held a permanent job position. In her forties and married, winner of two awards- Young Scientist and S.R. Palit -she has been constantly moving from one temporary position to another across different projects, even with a past work experience of 3.5 years as a Principal Investigator. The respondent cited lack of project opportunities and funding, especially women specific ones, relocation after marriage, and non-flexible office hours, lack of support from institute and family as reasons for remaining unemployed for last two years.

*Educational and occupational profile of family:* Highest degree held by respondent's parents and siblings is Master's degree and among them at least one member is working in academic sector. Among respondent's in-laws highest degree held is Master's degree, with all members involved in non-academic occupations. The respondent's spouse is a Post Doc working in academics.

*Views on work environment and policy:* Lack of projects, gender discrimination and irregularity in availability of job positions, lack of transparency are areas of concern for the respondent. While alongside the respondent also points out how flexible working hours and work from home opportunities have been helpful in balancing family and career to some extent.

*Present status:* Lack of recognition of efforts and promotions has resulted in setback in respondent's career. Moreover family commitments have also adversely impacted career continuity.

The two most common reasons for unemployment that emerges from the case studies of six currently unemployed women in science with widely varied backgrounds are:

- Lack of opportunities and project funding
- Family commitments, mostly resulting from the social norms of giving higher priority to career aspirations of the male members of the families.

## **5.2 Dropout from Higher Studies and Research in Science** (*without any academic work experience*)

Dropout from Higher Studies and Research in science refers to respondents who have discontinued higher studies or research in science before completion. Conceptually, such dropouts may be divided into four categories.

- (i) Dropout among current students of any stream of study other than science who switched discipline (left science but are pursuing arts or commerce or other streams of study).
- (ii) Dropout among currently working women in science in public sector.
- (iii) Dropout among currently working women holding a science degree and working in private sector in administrative or R&D job, who discontinued studies and took up employment,
- (iv) Dropout among homemakers who did not pursue further studies since dropout and never took up employment.

Of these the incidence of dropout in category (ii) has been analysed in Chapter 3 on Currently Working Women in Science. Since the current survey is institution based and covers respondents from premier institutes of science in public sector, only a few dropouts could be covered from the other categories depending on whatever references could be obtained from other respondents.

Brief accounts of detailed interviews with two dropout respondents of types (iii) and (iv) respectively.

**Case D1:** The respondent is a female science professional with a Master's in Medical Biotechnology. In her mid-twenties, the respondent stopped pursuing Doctoral research and shifted her goal from academic to non-academic sector citing poor condition of research funds and non-availability of opportunity for scientists as reason for the switch. At present the respondent is working as a Scientific Analyst in a private Pharmaceutical firm.

**Case D2:** This respondent holds a Master's degree, has completed B.Ed. and has no work experience. In her mid -twenties and unmarried, the respondent has discontinued research after enrolment due to family obligations even after qualifying for NET. Family pressure being the cause of respondent's backing out of becoming a "Professor" in an institute of higher education or a "Teacher" in a school.

The case studies of two different kinds again reveal the same two most important factors responsible for dropping out from science studies as that for current unemployment:

- First, the lack of research funds and opportunities.
- Second, more importantly, the commonly-held societal ideals preventing women from pursuing higher education.

### **5.3 School Teaching and Occupational Choice**

**Case S1:** *Education and past work experience:* This respondent holds a Master's degree in Physics and is an Assistant teacher of Physics in a school. In her late fifties, the respondent is married with one child. With a full time permanent job experience of thirty-one years since joining her current employment in 1985, she never had any desire to enrol for doctoral research. There is one break in education when she took up employment and there are no breaks in career.

*Educational and occupational profile of family:* Highest degree held by parents and siblings is Master's Degree. Respondent's spouse holds a bachelor's degree and is employed in non-academic job position. Highest degree held by respondent's in-laws (spouse's parents and siblings) is Ph.D.

*Views on work-environment and policy:* Respondent is happy with policies and considers management support, library and laboratory facilities to be very beneficial for career advancement.

**Case S2:** *Education and past work experience:* This respondent with a Master's degree in Chemistry is an Assistant teacher of science in a school and is married with one kid. With a full time permanent job experience of twenty-eight years since joining her current job (also her first job) in 1988, the respondent has no desire to continue further education and has no breaks in career.

*Educational and occupational profile of family:* Highest degree held by parents and siblings is Master's Degree. Respondent's spouse is a post-graduate and works in non-academic sector. Highest degree held by respondent's in-laws (spouse's parents and siblings) is a Bachelor's degree.

*Views on work-environment and policy:* Respondent is not happy with policies and refuses to disclose details; but she points out that the library facility is a crucial feature for academic advancement. Office hours are fixed and work from home permitted which are positive factors which have helped the respondent to continue with career despite family responsibilities.

**Case S3:** *Education and past work experience:* The respondent has a Master's degree in Chemistry, is an Assistant teacher in a school and in her mid-thirties she is married with one child. With a full time permanent job experience of eleven years since joining her current employment in 2005, the respondent has no desire to continue further education. There is one break in education when the respondent took up employment and there have been no breaks in career.

*Educational and occupational profile of family:* Highest degree held by parents and siblings is Master's Degree. Respondent's spouse is a post-graduate and works in non-academic sector. Highest degree held by respondent's in-laws (spouse's parents and siblings) is a Bachelor's degree.

*Views on work-environment and policy:* Respondent not happy with policies and refuses to disclose details; but stresses that the laboratory facility of the school is very good. Office hours are fixed and work from home not permitted.

**Case S4:** *Education and past work experience:* The respondent has a Master's degree in Physics, is an Assistant teacher in a school and in her mid-thirties she is married with one child. With a full time permanent job experience of nine years since joining her current employment in 2007, the respondent is a dropout from Ph.D., as she has been unable to resume her doctoral research since her break in education when she took up employment. The respondent has no desire to continue further education, and there have been no breaks in career.

*Educational and occupational profile of family:* Highest degree held by parents and siblings is Bachelor's degree. Respondent's spouse a post-graduate and is in non-academic employment. Highest degree held by respondent's in-laws (spouse's parents and siblings) is a Master's degree.

*Views on work-environment and policy:* Respondent is not happy with policies and refuses to disclose details; but she points out that the quality of students in her institution is very good. Office hours are fixed and work from home not permitted.

**Case S5:** *Education and past work experience:* The respondent is a post-graduate in Mathematics, is an Assistant teacher in a school and in her early thirties she is married with one child. With a full time permanent job experience of six years since joining her current institution in 2010, the

respondent has no desire to continue further with higher studies and research and has no break in employment.

*Educational and occupational profile of family:* Highest degree held by parents and siblings is a Master's degree. Respondent's spouse is a post-graduate and is in non-academic employment. Highest education held by respondent's in-laws (spouse's parents and siblings) is a Master's degree.

*Views on work-environment and policy:* Respondent finds the policies to be really helpful for career advancement. She points out that the library facility; laboratory facility and the attitude of co-workers and Head Mistress have all conducive for enhancing her academic productivity.

**Case S6:** *Education and past work experience:* The respondent has a Master's degree in Chemistry, is an Assistant teacher in a school and in her late twenties she is married with one child. With a full time permanent job experience of 3 years since joining her current institution in 2013, the respondent is a dropout from Ph.D., as she has been unable to resume her doctoral research since her break in education when she took up her current employment. At present the respondent has "given up her plans" of pursuing her research work and there have been no breaks in employment.

*Educational and occupational profile of family:* Highest degree held by parents and siblings is Ph.D. and one among them has Post-Doctoral research work experience. Respondent's spouse is an academic with Post-Doctoral experience. Highest degree held by respondent's in-laws (spouse's parents and siblings) is a Master's degree.

*Views on work-environment and policy:* Respondent considers the existing policies to be really helpful for career advancement. She points out that academic infrastructure such as library and laboratory facility and the attitude of co-workers have all been conducive for enhancing her academic productivity. She feels that the policies for career advancement do not provide equal opportunities to male and female scientists with equal qualification and experience.

The case studies of six married female school teachers of Science and Mathematics with work experience of varying duration (ranging from thirty-one years to three years) and with varied educational and occupational family profile lead to the following observations regarding occupational choice among school teachers:

- First, school teaching is preferred vocation for these respondents
- Second, full time employment in a permanent position is preferred option even if it results in break in education



# CHAPTER 6: Best Practices and Concluding Remarks

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## 6.1 Best Practices for Entry and Retention of Women in Science

This chapter presents a summary of the feedback of women in science, both working professionals and students of science, regarding the management practices and features of place of work or study that have helped them in achieving professional excellence and also balance their career commitments with their family and household responsibilities.

The questions have been put as open ended free response questions and drew very detailed suggestions. These have been classified thematically under five broad heads given below. More detailed descriptions under the five major heads are presented in sections 6.2 to 6.6.

- a. Overall Quality of Academic Infrastructure and Support Services
- b. Over Quality of Non-Academic Infrastructure and Support Services
- c. Policy Framework, Regulatory and Management Practices
- d. Work Environment, Time Commitment and Professional Interaction
- e. Academic Independence, Research Funding, Collaborations

## 6.2 Enabling Regulatory and Management Practices and Career Continuity of Working Women in Science

Of the 991 currently working women in science surveyed, feedback could be obtained from 982 respondents. Each respondent was asked the two following questions:

1. Overall have the regulatory and management practices been conducive for your career continuity and advancement.
2. State Reasons

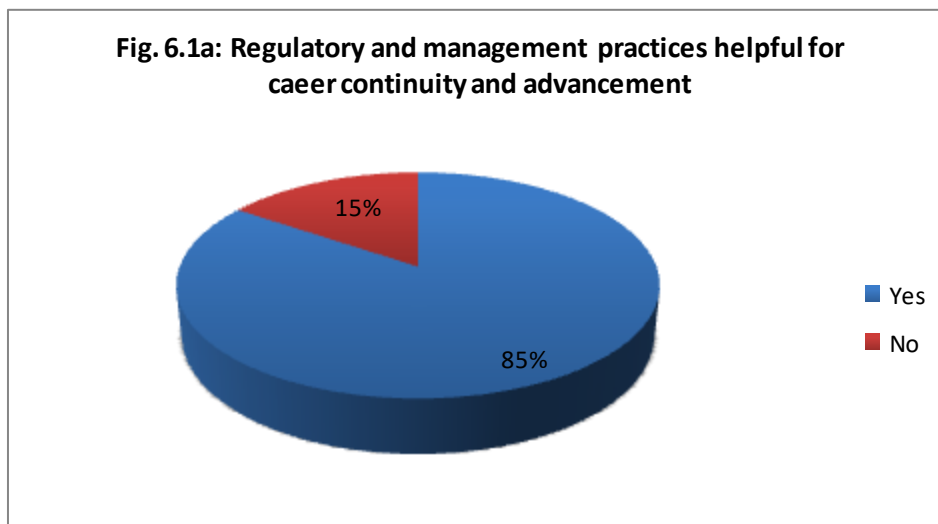
The feedback for question 1 above is summarised in Table 6.1a in Appendix; while the features and practices mentioned in each respondent's answer have been enumerated to produce the Tables 6.1b and 6.1c in the Appendix.

The second question being open-ended, respondent feedback had to be first grouped thematically. Based on that, the policies and practices that have been identified as being enabling in career continuity and advancement by working women science professionals are mostly related to the following specific areas:

- *Policy Framework, Regulatory and Management Practices*

- Adequacy and comprehensiveness of career advancement or promotion norms and due recognition to effort
- Fellowship features including contingency
- Fellowship tenure and grants
- Job security
- Maternity and childcare leave rules
- Provision for sabbatical
- Service continuity and leave rules and other terms of service
- Transparency and time taken in administrative procedure
- Women specific academic schemes and fellowships

**Figures 6.1a, 6.1b and 6.1c** below (refer **Tables 6.1a to 6.1c** in appendix) illustrate the respondent feedback in this context. **Figure 6.1a** shows that 85% of sampled currently working science professionals have said that overall they found the practices helpful; 152 i.e. 15% have responded otherwise.



**Figures 6.1b and 6.1c** highlight respectively, the percentage of respondents by the frequently cited policy features which the currently working female science professionals believe to have acted as enabling factors in career continuity and advancement during their entire career; and those enabling features for which they believe there is scope for further development and enhancement.

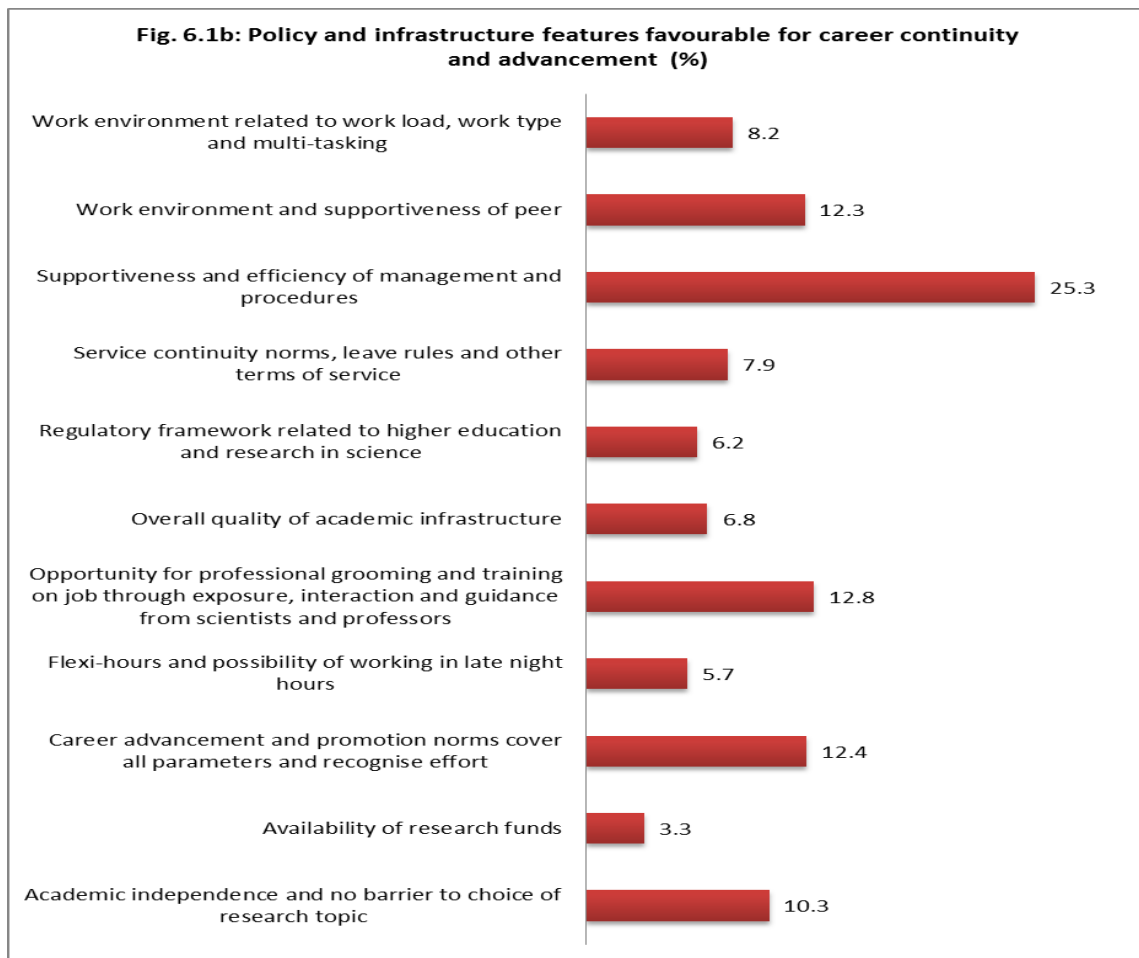
Some of the responses stress more on infrastructure and work environment related features rather than regulatory and management practice features and a clear demarcation is not there. A complete enumeration of actual observations made in response to these questions is given in **Tables 6.1b and 6.1c** in Appendix.

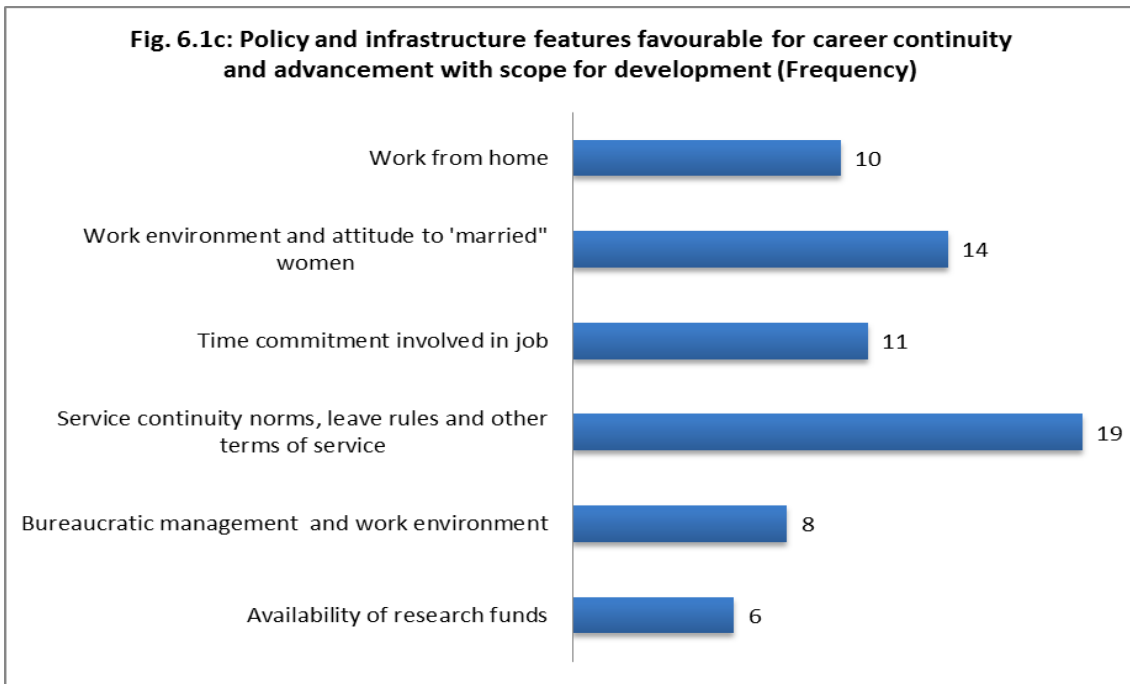
Of these **Figure 6.1b** highlights only those features listed in **Table 6.1b**, which have been mentioned by 3% (30) or more of 982 currently working female science professionals who have responded to this question. Since each respondent's feedback includes more than one feature therefore the sum of

percentages of respondents across all features suggested add up to more than 100% or total feedback count exceeds the total number of respondents. **Figure 6.1c**, based on **Table 6.1c**, shows only the top five to six features commonly cited by the female science professionals as enabling features with scope for further development and enhancement.

It is observed from **Figures 6.1b** that work environment related features such as (a) supportiveness and efficiency of management and procedures, (b) supportiveness of peer, (c) opportunities for professional grooming and training on job through academic exposure, interaction and guidance from senior scientists and faculty career advancement along with regulatory features such as (d) promotion norms and (e) service continuity norms are all considered crucial factors for career continuity by working women science professionals. Other features such as flexi-hours and timings, work load and type, academic infrastructure and resources and academic independence are also thought to be important factors in career continuity.

Service continuity norms leave rules, work environment and peer group interaction, time commitment involved in job, possibility of working from home and availability of research funds and project opportunities are cited as areas where flexibility, extension of provisions and further development would be beneficial for retention of women in science as is illustrated in **Figure 6.1c**.





### 6.3 Enabling Features of Place of Work, Academic Productivity and Dual Role for Working Women in Science

With regard to features of workplace each respondent was asked to express their views on the following two areas of concern:

1. Features (infrastructure, facilities, systems and processes) of your place of work that has helped in enhancing your academic productivity.
2. Features (infrastructure, facilities, systems and processes) of your place of work that have been conducive (supportive or helpful) for maintaining both career and family commitments.

The views expressed by respondents regarding work place features which have been empowering and conducive for professional excellence and also for balancing family and career are outlined under the following broad thematic heads.

➤ *Overall Quality of Academic Resources, Infrastructure and Support Services*

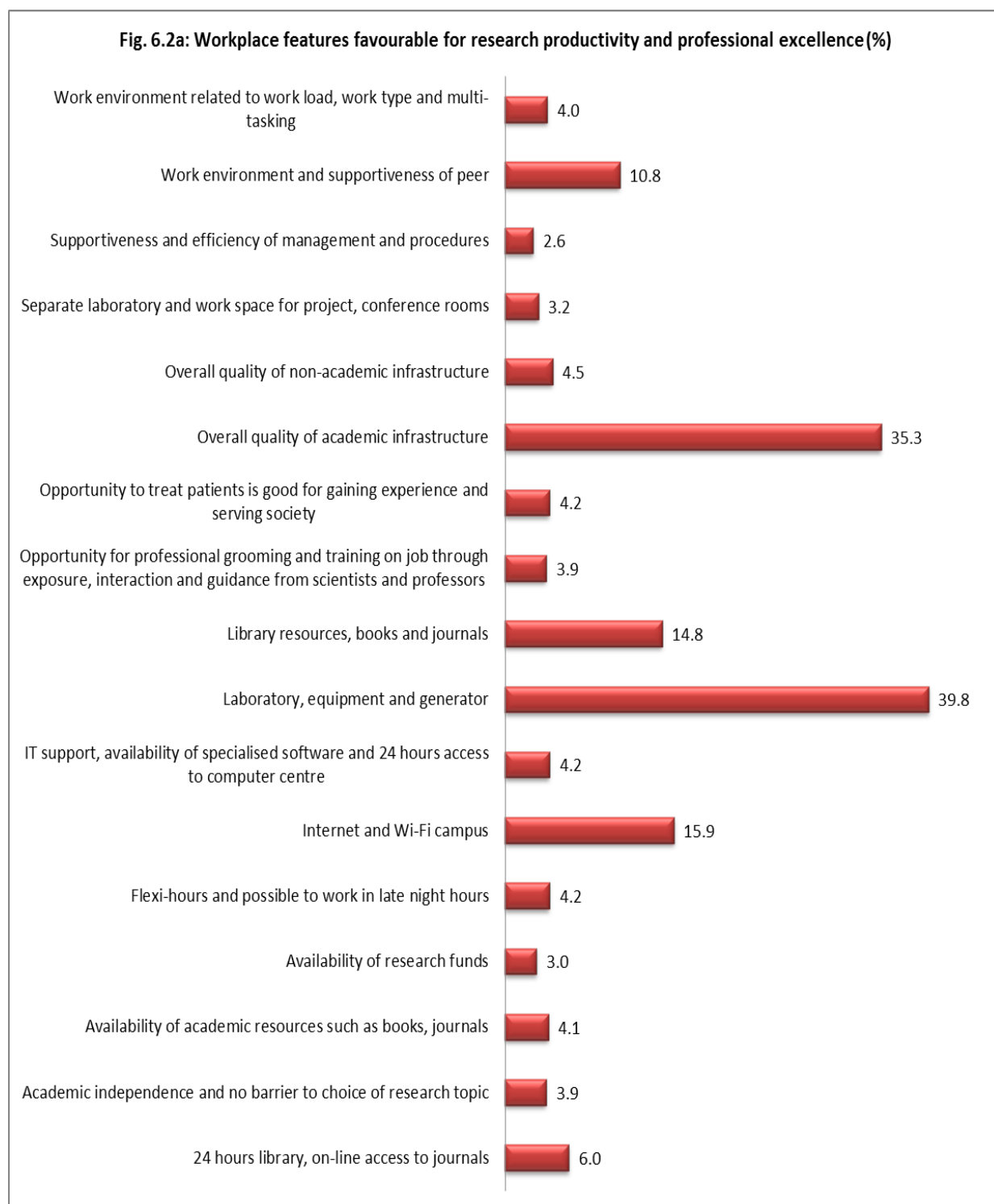
- Academic resources (24 hours library and online access to journals, books, specialised software etc.)
- Access to laboratory and computer centre outside office hours
- Efficient IT and technical support personnel
- Internet and Wi-Fi
- Laboratory, latest equipment and generator
- Project specific separate laboratory, conference room and work space
- Workshops for customised equipment
- Availability of research funds
- Field work support services and infrastructure.

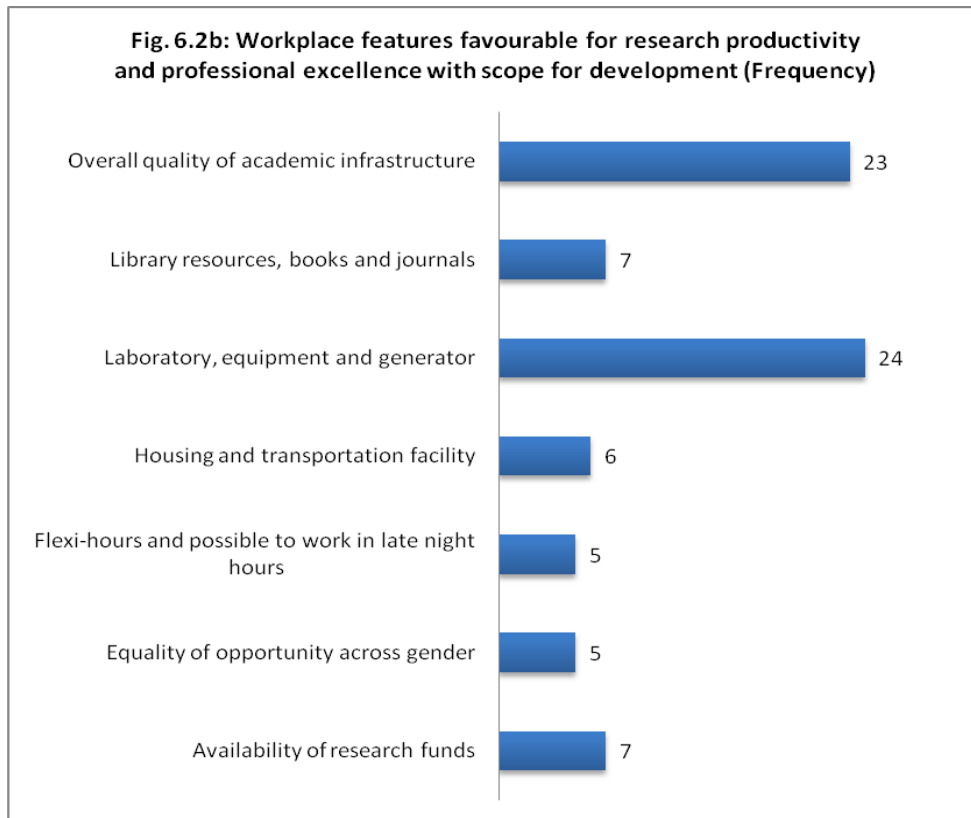
- *Over Quality of Non-Academic Infrastructure and Support Services*
  - Family care and health care support service (elderly)
  - Family care and health care support service (child),
  - Housing and transportation facility
  - Medical benefit and health care support service for self
  - Workplace non-academic infrastructure with respect to comfort & convenience e.g. women's lounge, recreation facilities, canteen, housing, transportation, health care, crèche, schools, departmental store
  - Workplace non-academic infrastructure with respect to safety and personal security including women complaint cell
- *Work Environment, Time Commitment and Professional Interaction*
  - Five working day per week
  - Fixed working hours and no overtime
  - Flexi hours and / or work timings
  - Professional grooming and on job training through exposure and opportunity for interaction or guidance from scientists and professor, on job training.
  - Organisational support for women scientist
  - Professional profile of peer
  - Quality of students
  - Sexual Harassment
  - Supportiveness and efficiency of management and procedures
  - Time commitment involved in job including travel time to place of work
  - Work environment and supportiveness of peer
  - Work environment, peer group interaction and attitude to “married” women
  - Work environment, work load and type
  - Work from home
- *Academic Independence, Research Funding, Collaborations*
  - Academic independence with respect to choice of research topic
  - Organisational support for international collaboration
  - Presence of think tank and multi-disciplinary departments and opportunities for research collaborations

As in case of enabling regulatory and management practices for career continuity, the enabling factors suggested in this case are related not only to workplace infrastructure and environment but include some policy features as well. **Tables 6.2a** and **6.2b** in Appendix summarise the data based on actual responses. They enumerate the number and percentage of respondents for the frequently cited work place and policy features which the sampled working female scientists believe to have been helpful; and

those features for which they believe there is scope for further development and enhancement for achieving professional excellence in research.

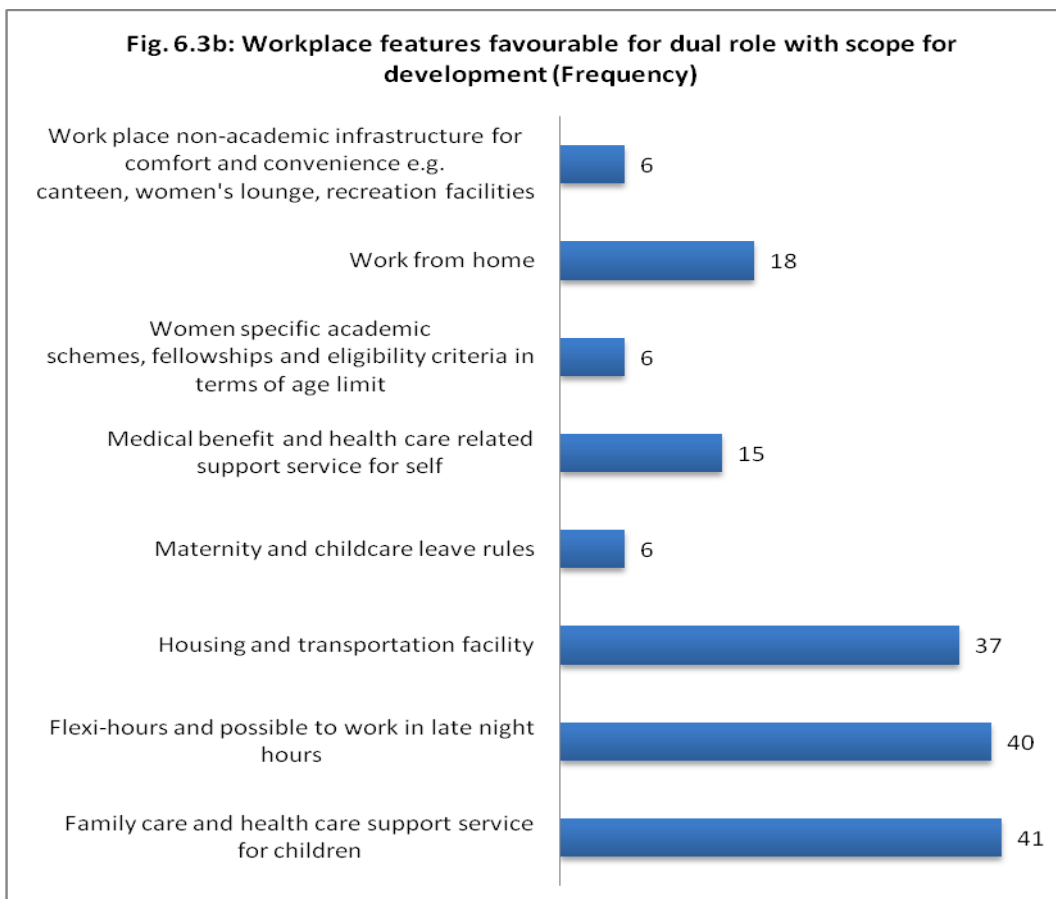
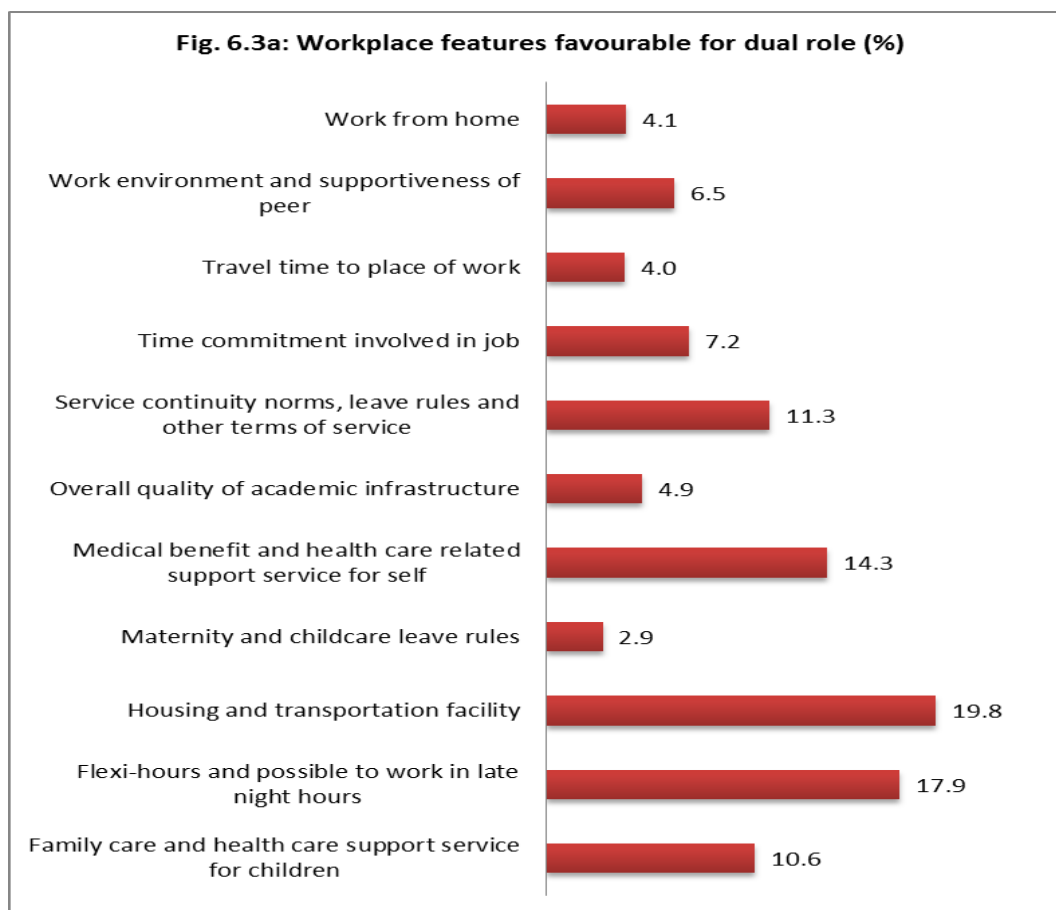
Among the features itemised in **Table 6.2a**, the frequently cited features by 3% (30) or more of the working respondents are illustrated in **Figure 6.2a**. **Figure 6.2b** shows the top five commonly cited enabling features from among those listed in **Table 6.2b**, for which the respondents feel that there is scope for further development and enhancement.





From **Figures 6.2a** and **6.2b** it is observed that overall quality of academic infrastructure, specifically state of the art laboratory and generator for uninterrupted power supply for running of experiments is considered to be the most critical factor for ensuring academic productivity and professional excellence by the currently working women in science. Other academic resources like library, books and journals, internet and Wi-Fi campus and work environment related features such as supportiveness of peer are also cited as important features that help to enhance academic productivity. These are also cited as features where extension of provision would be helpful. A few respondents have mentioned flexi-hours and work timings, housing and transportation facility as factors that would enhance academic productivity.

**Figures 6.3a** and **6.3b** (refer **Tables 6.3a** and **6.3b** in Appendix) illustrate the percentage of currently working female respondents for the frequently cited work place and policy features which they believe to have been enabling and conducive; and those features for which they believe there is scope for further development and enhancement for dual role. Only those features which have been suggested by 3% (30) or more of the working respondents are illustrated in **Figure 6.3a**. **Figure 6.3b** shows the top six commonly cited enabling features cited in **Table 6.3b**.





It is observed that non-academic infrastructure; particularly institutional provision of housing and transportation facilities is considered the most crucial enabling factor for balancing career and family commitments by currently working women science professionals. It is also suggested that extension of provision in this area would be helpful.

The other two broad features which have been cited frequently both as crucial enabling factors already in place and also as factors where enhancement or extension of provision would be helpful are (a) flexi-hours and timings, facility of working in laboratory in late hours or outside office hours, work from home and (b) medical and health care related services for self, children and family. Supportiveness of peer and flexibility in service continuity norms and leave rules are also considered significant factors conducive for dual role.

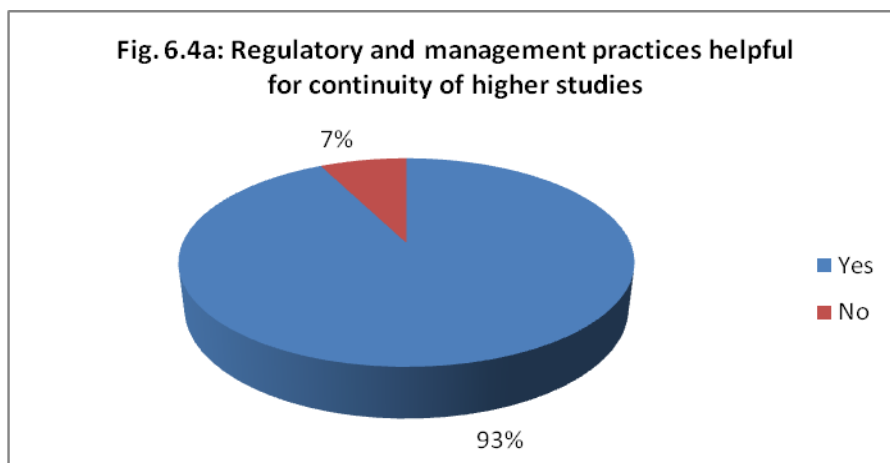
There have been some suggestions that overall quality of academic infrastructure has been helpful for balancing family and career. In this context it is suggested extension of provisions of non-academic infrastructure for comfort and convenience (canteen, women's lounge, crèche etc.) and women specific academic schemes are factors that are conducive to dual role.

#### **6.4 Regulatory and Management Practices for Continuity of Higher Studies and Research in Science**

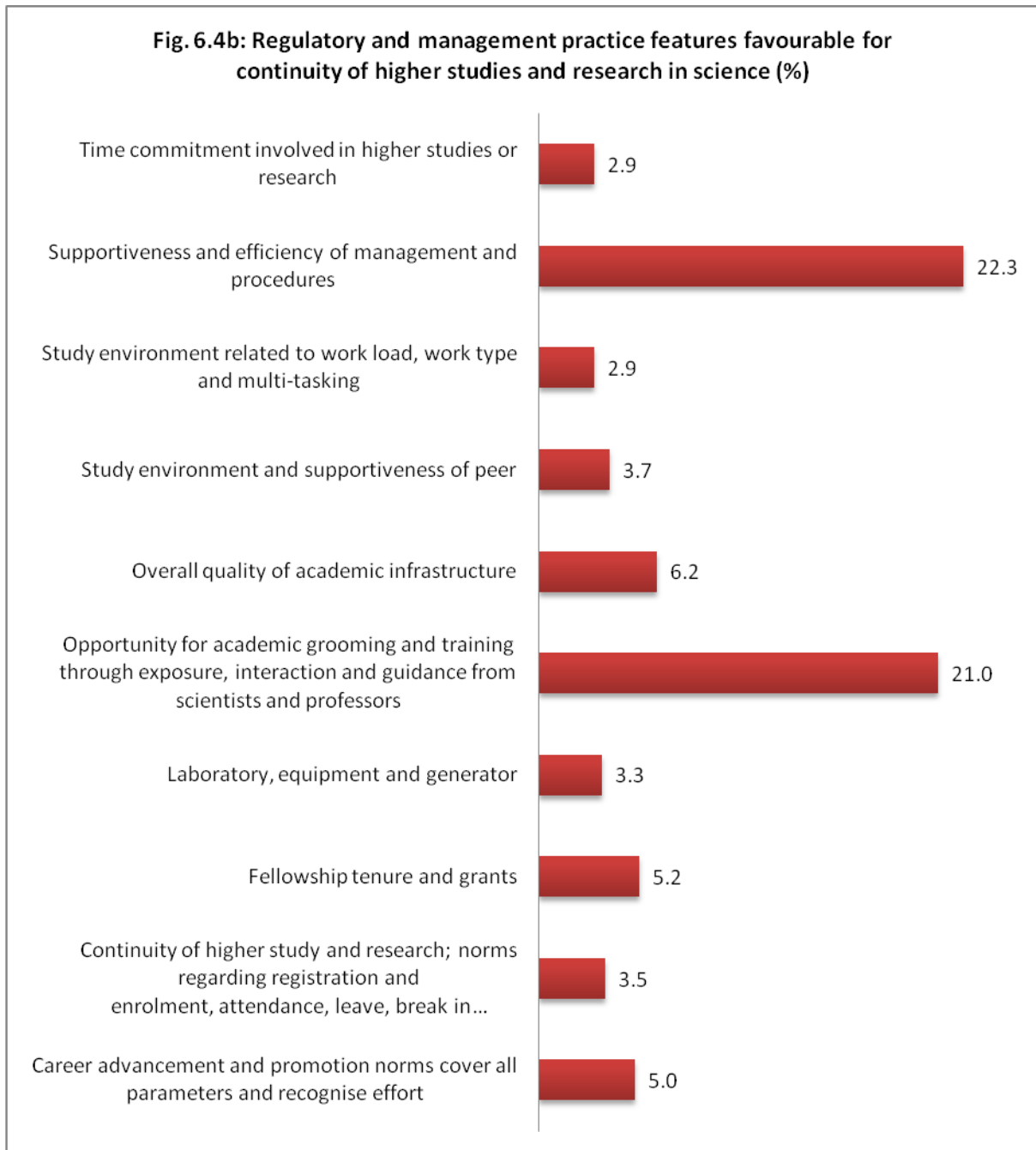
Section 6.4 presents the views of student respondents regarding policy features which they find have been conducive and enabling for ensuring continuity in higher studies and research. Each student was asked the following two questions:

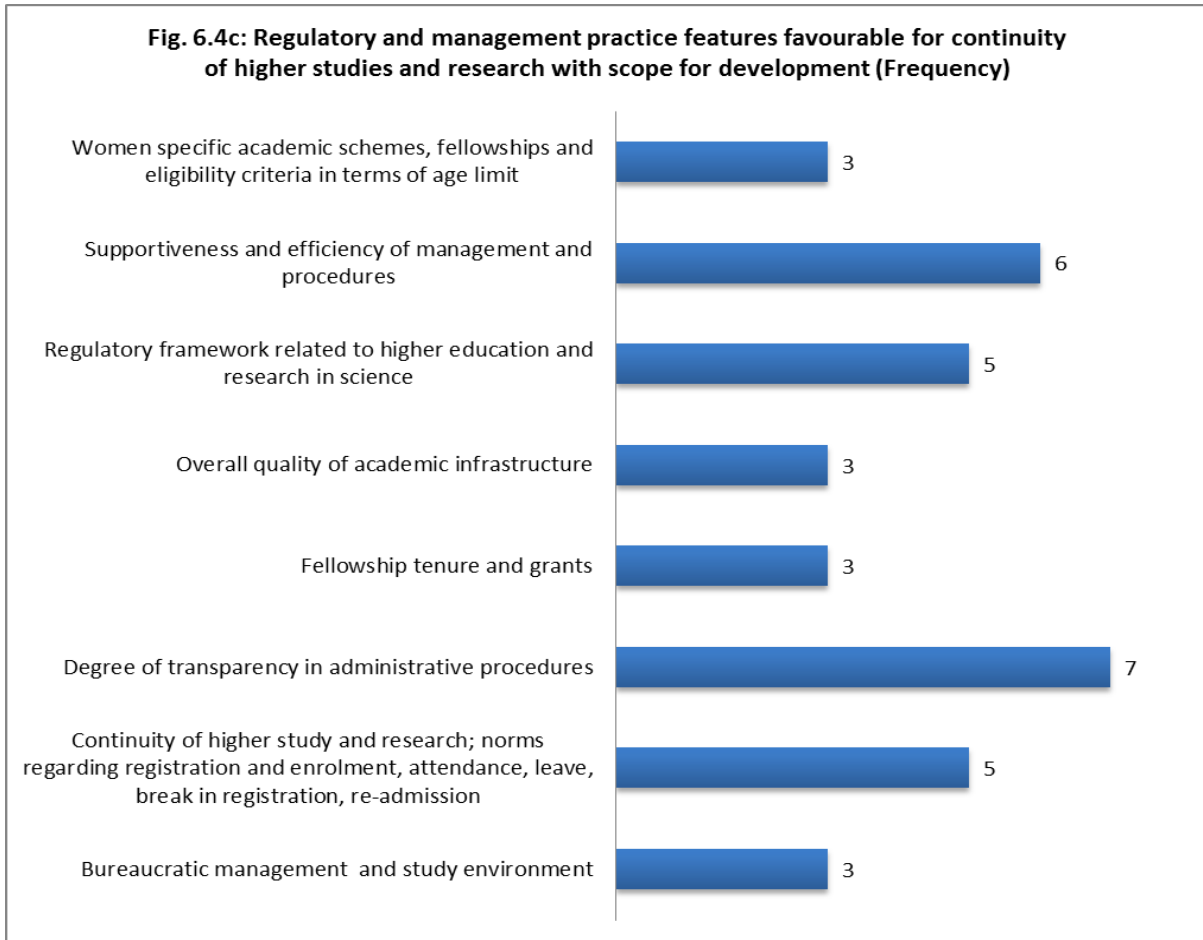
1. Overall have the regulatory and management practices been conducive for continuity of higher studies and research in science.
2. State Reasons

Table 6.4a summarises the feedback for question 1 above; while the features mentioned in each respondent's answer have been enumerated to produce the Tables 6.4b and 6.4c in Appendix. Figures 6.4a to 6.4c illustrate the feedback of the sampled students of science in this regard.



**Figure 6.4a** above shows that 93% of student respondents have mentioned that overall the regulatory and management practices have been helpful for continuity of higher studies and research in science. The most commonly cited policy features i.e. cited by 3% (15) or more out of 515 student respondents from whom feedback has been obtained and who believe that these have been enabling in avoiding breaks in education and research, are illustrated in **Figure 6.4b** below. **Figure 6.4c** illustrates the top five commonly cited features among those listed in **Tables 6.4c** in Appendix which the students of science believe have scope for further development and enhancement.





From **Figures 6.4b** and **6.4c**, it is evident that opportunity for academic exposure through interaction and guidance from senior faculty and scientists along with supportiveness and efficiency of management and procedures are considered to be crucial for continuity of higher studies and research in science. The latter and related factors has also been cited by a few students of science as areas where further development would be helpful for ascertaining continuity of women in higher studies and research in science.

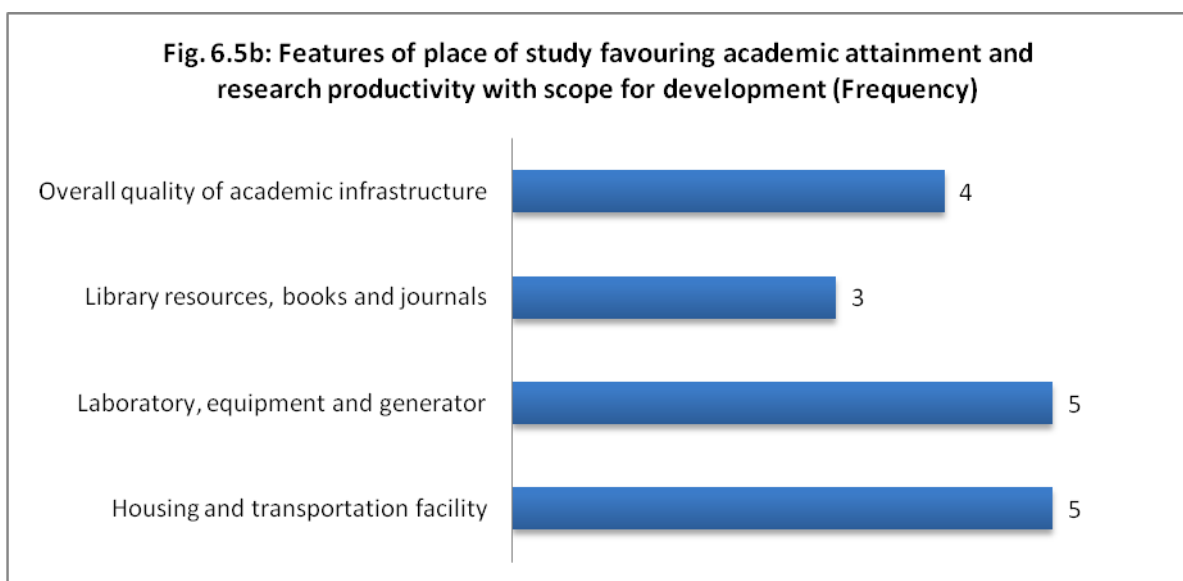
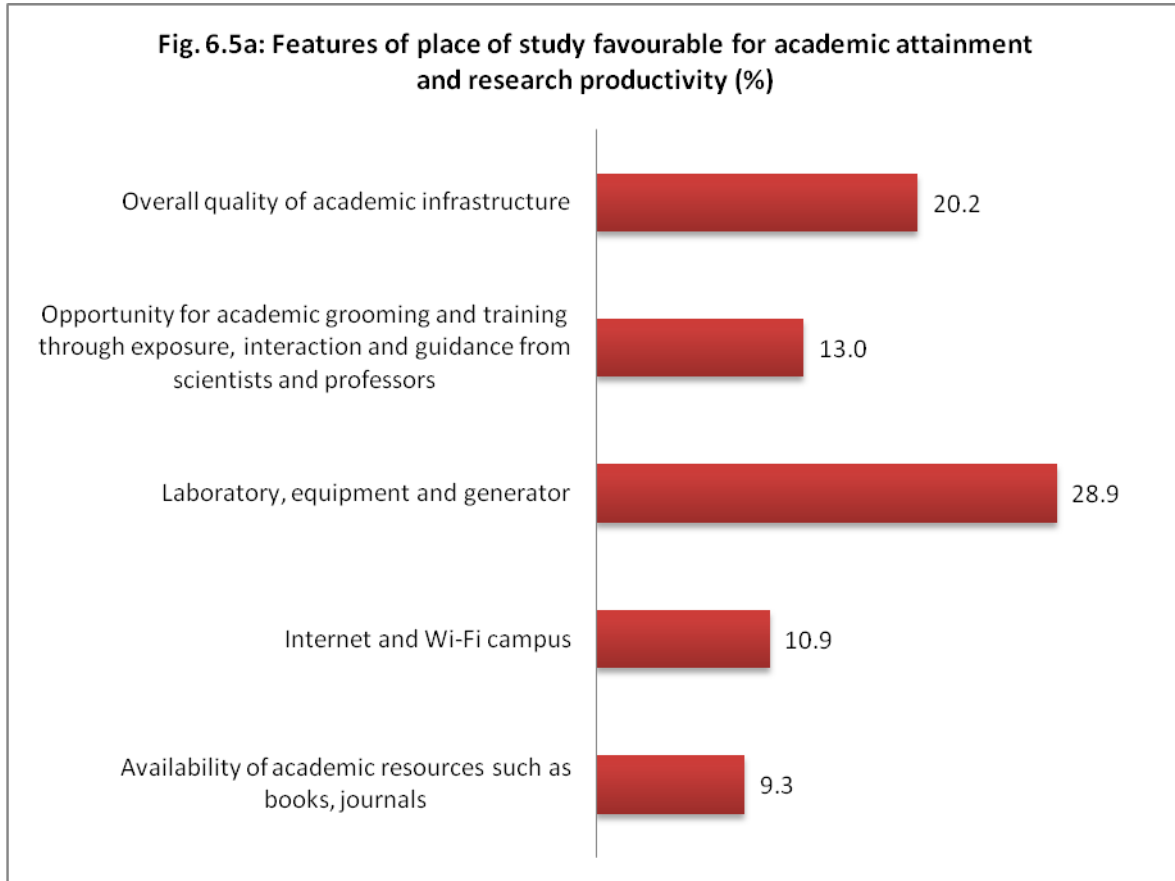
### **6.5 Enabling Features of Place of Study for Academic Productivity and for Dual Role**

This section highlights the views of student respondents regarding study-place features, infrastructure, systems and processes which they find have been conducive and enabling in achieving excellence and for continuing with higher studies and research in science despite their family and household commitments.

Each student was asked to express their views regarding the following

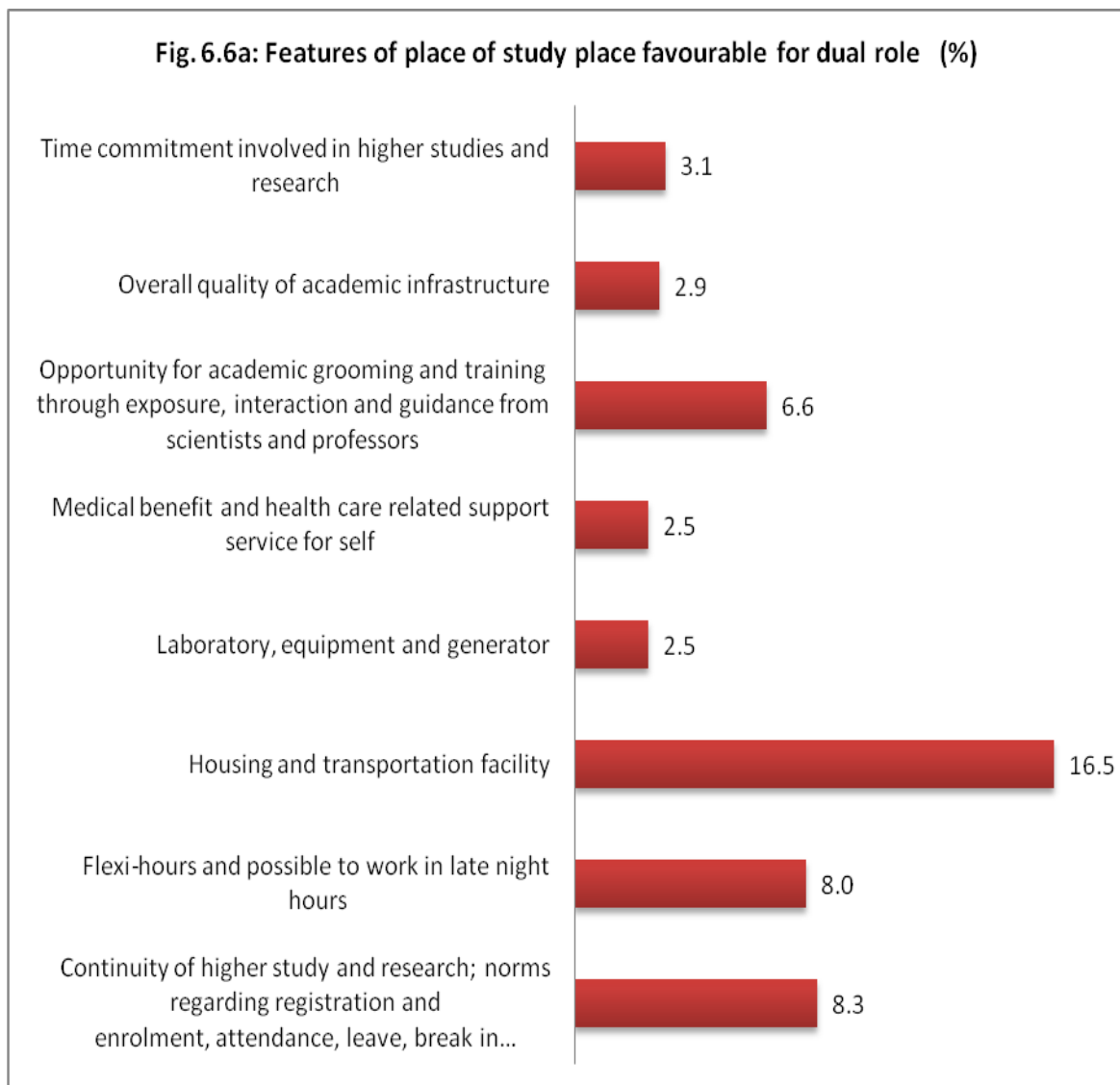
1. Features (infrastructure, facilities, systems and processes) of you place of study that has helped in enhancing your academic productivity.
2. Features (infrastructure, facilities, systems and processes) of you place of study that have been conducive (supportive or helpful) for maintaining both career (i.e. higher studies and research) and family commitments.

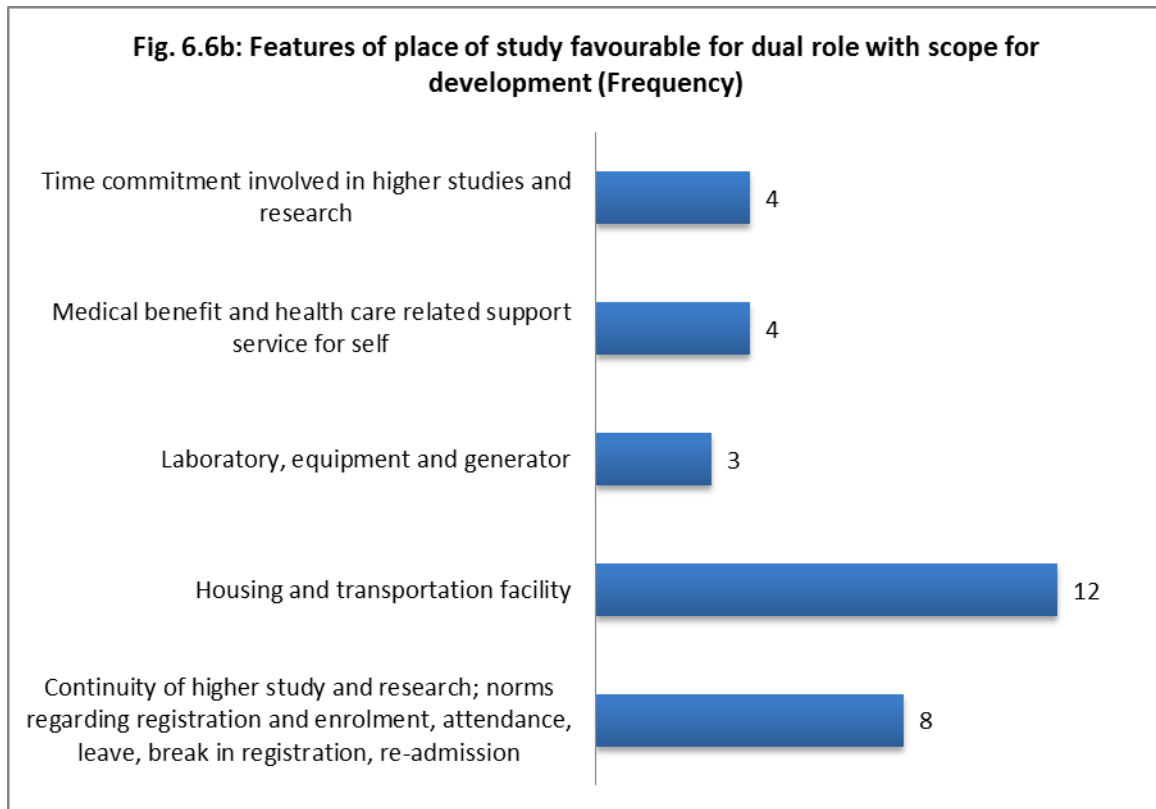
**Figures 6.5a** and **6.6a** highlighted the feedback of the sampled students of science with respect to features conducive to academic attainment and dual role respectively, based on the most commonly suggested features mentioned by at least 3% (15) student respondents out of 515 students from whom feedback has been obtained. **Figures 6.5b** and **6.6b** highlight the top four commonly cited features conducive to academic attainment and dual role but with scope for extension and further development.



It is observed from **Figures 6.5a** and **6.5b** above, that overall quality of academic infrastructure, specifically laboratory with latest equipment and generator for uninterrupted power supply is considered to be the most important factor for academic productivity among female students of science. Opportunity for professional exposure and guidance from scientists and teachers is also cited as enabling factors for performance in higher education. A few student respondents have mentioned institutional provision of non-academic infrastructure, particularly housing and transportation as enabling features where there is scope for extension.

### **6.6 Enabling Features of Place of Study favourable for Dual Role**





It is observed from **Figures 6.6a** and **6.6b** that non-academic infrastructural support particularly housing and transportation facility is the most commonly cited feature that has been both helpful and has room for further enhancement, for continuity of higher studies and research in science in view of the dual role. The second most commonly cited feature relates to norms regarding continuity of higher studies and research. It has been suggested that greater flexibility in rules governing registration and enrolment, attendance, leave, re-admission will be enabling factors in balancing higher studies and family commitments.

## 6.7 Concluding Remarks

### 6.7.1 Factors in entry and retention of women in science

The entry and retention of women in science and technology has been a matter of concern for the government and the scientific academia who is a stake holder in the process. The study is designed to understand the reasons for the low entry and loss of trained female scientists based on responses collected from women in science. It aims thereby to delineate the best practices and also make new policy recommendations based on the findings from the newly generated data set.

Exploratory and descriptive analysis techniques used in conjunction with case study method and content analysis of the data collected through a nationwide survey of (a) currently working women science professionals working in premier research institutes, laboratories, universities and schools (b)

students of science, (c) currently unemployed science professionals who are undergoing a career break and a (d) few dropouts without any work experience throw up the following major observations.

*Working female science professionals –*

### **Post-doctoral Research and Discipline**

- Among working women holding Ph.D. degrees, 34% have completed Post-Doctoral research and 9% are continuing post-doctoral research. As a standalone figure the rate of transition from doctoral to post-doctoral research is around 43%, which indicates the need for policies that would result in higher rates of conversion since career in science often begins with post-doctoral research engagements. An increase in the number of post-doctoral fellowships along with ensuring regularity in the availability of the same is a possible way to improve the rate of transition.
- Biology, health and allied sciences is the dominant discipline (33%) followed by Engineering and Computer Science (19%), Chemistry and allied Sciences (12%), Physical and allied Sciences (10%). The problem of entry of women in science is not uniform across disciplines. Interventions geared to popularising subjects such as Engineering or the Physical sciences or Chemistry among female students at the school level in both urban and rural areas might be helpful in changing mind-set.

### **Nature of Employment and Promotions**

- 82% have full-time permanent jobs; 14 % have full-time contractual jobs; 4% are in part-time or temporary positions. The incidence of lack of job security is not much evident in the given sample. However the figure 18%, that is nearly one-fifth of working women in contractual or temporary positions in national level institutes leaves room for intervention.
- 69% and 27% are working in their current designation for less than 3 years and less than 6 years respectively. Based on the given sample stagnation in career advancement does not seem a significant problem.
- 33% and 30% of respondents have reported that they have worked in one and in two or more institutions in the past, respectively. Among those with past work experience with other organisations 36.5% started in full-time contractual position; another 29.9% have reported of starting their career with part-time or temporary positions. For those commencing their career in full time contractual or part time positions, multiple organisations where the respondent has worked is not surprising. However evidence suggests that even those with full-time permanent first job positions, have switched jobs for reasons often related to shift of location of family.

### **Breaks in Education and Employment**

- 24% are continuing education in part-time mode; 7% reported of dropout from full-time course of study in the past; 50% of dropouts would like to resume education; 25% have a resumed and completed education after a break in the past. Data pertaining to break in education is not encouraging but data pertaining to percentage of scientists who have (a) recommenced and completed education after break or (b) are continuing education along with performing their job responsibilities or (c) would like to recommence education, is indeed encouraging. These points toward policy interventions geared to introduction of flexible norms regarding registration and readmission which make recommencement of education easier and smoother process.
- 18% have had one or more breaks in career mostly due to being out of employment; breaks of less than one year is most common and duration of break increases with number of breaks; Family care and change of location being the primary cause of break for post-marriage breaks in career. Feedback with regard to breaks in career reflects that lack of opportunity for smooth transitions from one contractual engagement to another, two-body problem and dual role factors are at the root of such career breaks. Policy intervention in this context involves introducing flexibility in service continuity norms.

### **Dual Role: Effect on Career Attainment and Fulfilment of Family and Household Responsibilities**

- With regard to effect of career commitment on fulfilment of family responsibilities the overall perception is neutral or slightly skewed towards adverse though some have stated that the impact has been positive.
- Perception about effect of family responsibilities on career attainment: Over two-fifth working women believe that it does not have any effect. A little over one fifth have reported that it has a positive or very positive effect primarily because of family support. More than one-third currently working women perceive dual role related to family commitments as having an adverse effect on their career attainment. For those who find dual role to have an adverse effect suggested enabling factors relate mostly to institutional provision of non-academic infrastructure and support services; specifically those related to housing, transportation, family care and health care (for elderly, children and self). Flexible working hours and work from home, 24 hours access to library and laboratory have also been suggested.
- There are 217 reported instances of refusal of a challenging career opportunity among sampled currently working women in science. In some cases there has been more than one refusal. Refused 'post-marriage after first child birth' is most common, whereas there are 86



instances of 'pre-marriage' refusal and 'post-marriage before first child birth' refusals. The most commonly cited reason being family care (134), followed by change in job location (67), time commitment involved in job (46) and family objection (24).

### **Career Aspiration and Attainment**

- Desired type of work: 66% of respondents in this group have chosen 'research' as their career aspiration. On the other hand 22% have responded that they would like to opt for 'teaching'. 7% have expressed interest in 'academic administration'. Only 4% respondents aspired to be in 'research support services' and 1% reported 'other responsibilities'. Policy intervention popularising research support services will help to better absorb women who have had career breaks and are planning re-entry into career.
- 68% have responded 'observing successful professionals and/or desire to contribute professionally' or 'love for the subject' as the reason for their choice of science as a stream of education. 34.9% respondents from this group have said that they have been 'influenced by parents'. Respondent feedback on the reasons for entry into a science career is encouraging in terms of both of individual attitude and societal attitude to women pursuing higher studies and research in science. In view of this the awareness programmes mentioned earlier could also involve interaction with parents of working science professionals.
- Good academic infrastructure and support services and prestige are the critical factors in choice of current employment, though dual role factors such as time commitment and non-academic infrastructure also matter. Flexibility in employment contracts allowing for choice regarding time commitment is desirable.
- 72.4% of the sampled working women received the membership of professional bodies and 72.1% of the sample respondents have received professional award. 35.4% female respondents held position in academic administration. 35.2% and 28.9% female respondents professionally visited abroad for long duration and short duration (only for last two years) respectively. Among the sampled working women in science the incidence of academic administration is less common with just over one-third holding position of responsibility. This is less encouraging than the evidence regarding incidence of membership of professional bodies or receipt of award and recognition. Travel abroad is still less common among women which may be a reflection of issues related to dual role and family care. While lower presence of women in academic administration may be a reflection of lack of interest in academic administration among women (7% have expressed interest) as compared with research and teaching it may also be a reflection of systemic lags.

*Students of Science –*

### **Discipline**

- The inclination towards certain disciplines is prevalent among current female students of science, as among current working female science professionals. This reiterates the need for policy initiatives for popularising other disciplines.

### **Educational and Occupational Profile of Family**

- The incidence of family members with research degree is not very common among current students of science, although more than 40% have reported of having family members in academic profession. In case of married students less than 15% have spouse with research degrees and almost 67% are engaged in non-academic profession. So, parental education is not very important for entry of women into science; parental profession is relatively more important. This is in view of the fact that ‘influenced by parents’ is a commonly cited factor for entry into science.

### **Breaks in Education**

- Reported incidence of 15% students having a break in education and recommencing education is mostly due to need to earn or financial problem which may be linked with family care and support. This is relatively more common than breaks due to marriage and related issues or family objection which again is a reflection of societal attitude. Thus policy interventions involving possibilities of transfer across institutes and of and re-entry in to education will help resolve both issues.

### **Dual Role: Effect on Academic Performance and on Family Commitments**

- Overall the proportion of respondents reporting adverse or very adverse effect of study and career on family commitments is small compared to those reporting a positive effect while half the respondents have mentioned “no effect”.
- The overall feedback is that impact of family commitments on career attainment and performance in higher studies is either neutral or positive. A little over one-tenth of the student respondents have mentioned the effect has been adverse or very adverse.

### **Career Aspiration**

- As in case of currently working women in science research support service is not a desired vocation among current female students of science.
- Among factors that have influenced students in choice of science as a stream of study – commonly cited factors are observing successful professionals and/or desire to contribute professionally or love for the subject as the reason for their choice. More than one-third has said that they have been influenced by parents. This is encouraging in terms of societal attitude to entry of women into science.
- With regard to factors influencing choice of future employment, workplace academic infrastructure and support services emerge as the most important factor followed by prestige associated with the position and institution. Time commitment involved in job including travel time and workplace non-academic infrastructure and support services are the two other commonly cited criteria along with outstation travel which indicate the influence of dual role factors in choice of employment.
- Among the current female students of science, university or research institute jobs in faculty or scientist position is a far more preferred vocation rather than research jobs in industry. Interestingly 1% has said they would prefer self-employment.

#### **6.7.2 Best practices**

The design of policy geared to create an enabling environment for any specific group in society has two alternative foundations or approaches. First, design of strategies based on data collected on objective parameters influencing the environment of the target group; second, design of schemes based on direct feedback of the stake holders who are the primary beneficiaries of the policy. This section augments and complements the policy suggestions summarised in section 6.7.1 based on the first approach. The direct feedback of women in science regarding ways and means of making the higher education and research environment more conducive towards female science professionals and students has been analysed in detail in sections 6.1 to 6.6 of this chapter. This section summarises the major observation regarding suggested best practices.

Of the sampled 991 women science professionals and sampled 518 students of science 85% and 93% respectively, mentioned that the overall regulatory and management practices have been helpful for continuity of career and higher studies.

**Table 6.A** presents an aggregated view of the responses by the sampled women in science – working and student - regarding enabling factors in respect of three dimensions: (a) career continuity /

continuity of higher studies and research (b) professional excellence and research productivity / academic performance and research productivity (c) dual role balancing family commitments and career / higher studies.

The specific features or measures suggested are placed under broad categories. Figures in each cell represent the total count of feedbacks received in each category, where a respondent may have suggested multiple features from different categories or from the same category. Major observations based on **Table 6.A** are summarised below.

*Best Practices for Working Women in Science:*

- **Work environment, time commitment and peer group interaction** is the most commonly or the second most commonly cited group of factors that are considered enabling with regard to **all the three dimensions** mentioned above.
- Specifically conducive **work environment** is most crucial for **continuity and retention** of women in science.
- **Overall quality of academic resources, infrastructure and support services** are most crucial for **research productivity and professional excellence**.
- **Overall quality of non-academic resources, infrastructure and support services** are most crucial for **dual role**.
- **Policy and management practices** constitute the second most significant group of factors for **retention and continuity** of women in science.

*Best Practices for Female Students of Science:*

- **Study environment, time commitment and peer group interaction** is the most significant group of factors in facilitating **dual role** and balancing of higher studies and family commitments. It is the second most important factor for both **continuity of higher studies and academic attainment**.
- **Non-academic infrastructure and support services** are significant enabling factors **dual role**.
- **Academic resources, infrastructure and support services** are critical enabling factors in **academic attainment**.
- **Policy and management practices** is expected to have the maximum influence on continuity of higher studies, by students of science, unlike working women in science.

Largely while academic resources and support services are critical for ensuring professional or academic excellence and research productivity, work or study environment, non-academic

infrastructure and support services along with regulatory and management practice features are critical for entry and retention of women in science and facilitating their dual role.

Some suggest that quality and availability of non-academic infrastructure help to improve academic productivity and adequate provision of academic infrastructure is conducive for dual role.

Interventions for recommencement of education, focused on reforms in regulatory framework and management practice, is likely to yield better results. While interventions for recommencement of career based on work environment related reforms, is likely to be more effective.

The Best Practices identified by the sampled women in science corroborate much of the policy interventions following from the observations summarised in section 6.7.1.

### **Implementation Strategies**

*The fundamental choice is between ensuring service continuity and allowing flexibility in employment contracts, as the means for promoting entry and retention of women in science.*

In this context the following measures may help to prevent permanent loss of skilled scientific woman power and going a step further ascertain continuity in higher studies or career in science among women. **The following points outline the ways in which Best Practices could be strengthened, continued and spread across the country:**

- An increase in the number of post-doctoral fellowships along with ensuring regularity in the availability of the same is a possible way to improve the rate of transition from doctoral to post-doctoral research. Provision could be made for transferable post-doctoral fellowships of relatively shorter or one-year duration which may be availed of within two to three years of completion of Ph.D. by female doctoral degree holders. Special awards, monetary and non-monetary, linked with successful and timely completion of projects may be introduced as added incentives.
- Interventions geared to popularising subjects such as Engineering or the Physical sciences or Chemistry among female students at the school level in both urban and rural areas might be helpful in changing mind-set. Awareness programmes generating exposure to the work and life of successful female Physicists and Scientists, both among students and their parents, might help in creating a pathway for progress by creating a critical mass of students in these less popular disciplines.
- Such programmes may be organised by schools and colleges by arranging visits from science professionals for sharing their views not only with aspiring candidates but also their parents, in seminar or workshop mode. Group discussion involving participation and exchange of

ideas and experience between parents of current students of science or science professionals and parents of future aspirants may be arranged. The involvement of direct and indirect stakeholders, particularly with diverse background in terms of experience may help in changing mind sets more simply and across a broader segment of society. Moreover visits to science laboratories and institutes could be arranged (similar to study tours for social sciences or industry visits in management programmes). Mass media and social networking sites could also be effectively used for this purpose.

- Women science professionals who are already established should regularly visit research institutes, universities and colleges and inspire the women students/scholars (already in the pipeline) to join higher education in science in these less popular disciplines etc. Institutions may form a peer group setup where experts should come and visit the aspiring candidates.
- Interventions geared to introduction of greater flexibility in norms regarding registration, re-admission into higher studies and research will make recommencement of education easier and smoother. Breaks in education need to be accommodated to avoid losing potential talent. This will also allow for greater room for dual role.
- Introducing flexibility in service continuity norms is desirable. Career breaks needs to be accommodated as women scientists have dual commitments. Seniority based on total number of years of work experience or service rather than ‘continuous’ service may help to retain talent and experience by allowing for re-entry of women scientists which would otherwise be lost permanently.
- Flexibility in employment contracts allowing for choice regarding time commitment may be helpful. Fixed term contracts and split (part-time) contracts could be designed to make them as attractive as full time or permanent contracts.
- The current relaxation in eligibility criteria in terms of age limit for women may be replaced with eligibility assessment in terms of experience or other performance indicators.
- Policy intervention popularising research support services will help to better absorb women who have had career breaks and are planning re-entry into career.
- Extension of institutional provision of non-academic infrastructure – particularly housing, transportation, family care and health care related support services will help to ease the dual role problem faced by women in science and also address safety and security concerns. Childcare facilities at work place need to be broadened to accommodate children up to age fourteen to make it more effective.

- Even if direct provision is not there the institution may outsource the infrastructure and services. Institutional involvement is considered to be very convenient. Provision of extended non-academic infrastructure for meeting daily needs or for comfort and convenience in work place is also desirable.
- Introduction of work from home (where feasible) provisions, flexi-hours and timings for full time job contracts is desirable for making dual role commitments less taxing.
- Among other work environment related interventions, opportunities for professional development across all categories and ranks in employment may help to motivate and retain women in science.

**Table 6.A: Best Practices: Broad Characterization of Features Favorable for Entry and Retention of Women in Science**

Sl. No.	Broad Categories of Features Favorable for Entry and Retention of Women in Science	Policy Framework, Regulatory and Management Practices	Overall Quality of Academic Resources, Infrastructure and Support Services	Overall Quality of Non- Academic Infrastructure and Support Services	Work Environment, Time Commitment and Professional Interaction	Academic Independence, Research Funding, Collaborations
<b>1.0</b>	<b>Working female science professionals</b>					
1.1	Features favourable for career continuity and advancement	373	111	50	725	153
1.2	Features favourable for career continuity and advancement with scope for development	48	12	10	60	19
1.3	Features favourable for research productivity and professional excellence	97	1253	92	323	74
1.4	Features favourable for research productivity and professional excellence with scope for development	12	67	16	25	10
1.5	Features favourable for dual role	189	125	518	474	11
1.6	Features favourable for dual role with scope for development	25	4	105	82	2
<b>2.0</b>	<b>Students of science</b>					
2.1	Features favourable for continuity of higher studies	211	62	8	173	25
2.2	Features favourable for continuity of higher studies with scope for development	30	6	1	10	3
2.3	Features favourable for academic attainment and research productivity	15	369	13	95	9
2.4	Features favourable for academic attainment and research productivity with scope for development	6	20	8	3	2
2.5	Features favourable for dual role	74	49	116	133	7
2.6	Features favourable for dual role with scope for development	11	9	18	13	1

**Colour legend:**

	Most commonly cited
	Second most commonly cited

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