STATUS OF WOMEN SCIENTISTS IN S&T/R&D INSTITUTIONS IN DELHI

REPORT BY:

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1. EXECUTIVE SUMMARY

There are several dimensions to consider with regard to issues about Indian women in science, first, they are professionals in the academy, and as such their lives and work are affected by the overall environment, ethos, and policies in the Indian higher education system. Second, by virtue of the fact that they are women, they face situations that are quite distinctive and related to their role and status in the society. Again, since we are considering very male-dominated disciplines in particular, specific factors, such as the peculiar nature of the disciplines come into play.

The research study has tried to incorporate many of the basic factors, which initiates naturalistic inquiry. As stated earlier, some of the significance of such an inquiry is a natural setting, the human instrument for data gathering, qualitative methods, purposive sampling and emergent design. To elaborate: assuming that reality cannot be understood in isolation, the research has been carried out in the natural setting or context of the entity, data have been gathered primarily through personal interviews and observations, and through questionnaire methods both by direct interviews, by post and by E. mails.

It is now recognized by all modern societies that education and career is not only the right of women, but also a key factor that contributes to the economic and social development of country. Women scientists focusing upon their lives as university academics, as researchers in the hard sciences and as women. The overarching research question addressed here may be stated as follows: what patterns and difference emerge in the perceptions and attitudes of academic women scientists toward themselves as women in science; their career routes; their relationships with colleagues-male and female; their research interests, communication strategies and linkages: the manner in which their family life intersects with their careers; and the discipline of science and its value? What

emerge from this is a comprehensive description of the lives and careers of individual women who struggle in a male-dominated workplace that marginalizes them.

The following are salient observations:

- The number of women scientist coming in for this profession shows only negligent increase.
- A total of 28 R&D/S&T institutions are in the study. This includes a combination of Central Govt. Institutions, Universities, Deemed universities, corporate, NGO's. etc.
- The total samples are 280 women scientists working in various institutes.
- 68% of women scientists are in the age group of 30-50 years.
- Maximum number is in life sciences while minimum in genetics & agricultural economics.
- Out of total 280 women scientists 206 are married and most of them are married to similar profession. 127 out of 206 got married by arranged manner.
- Religion-wise out of 280 women scientists, 259 are Hindu, 3 Muslim and only 1 Christian.
- Caste-wise very poor representation of SC, ST and OBC category.
- 84% women scientists has done their schooling from city while only 1% from the villages.
- Majority has become scientist by default as out of 280 respondent, 65 never planned to become scientist while 128 planned at college/university level, only 79 has planned at school level.
- 59% of women scientist has not visited abroad.

As is readily appreciated the issue of family commitments, particularly child rearing is perceived as the foremost and major barrier and as such has received considerable attention. However, gradually an appreciation has evolved of the more subtle factors that influence the issue. Among these are certain preconceived notions and stereotyping that is instrumental in discouraging young women from taking up a career in science. Even for women in professional scientific careers, some attitudes and values of the traditional

male bastion retard progress. We would like to enumerate the mind-sets that unconsciously discriminate against women and are potential barriers to the entry and progress of women in the sciences.

First and most common is the assumption that one has to work long hours to demonstrate commitment. Women who cannot or do not spend as much time in their work places as their male colleagues are automatically regarded as less dedicated. This assumption however is not always true. It is now realized that women tend to give better 'quality time' to their work that compensates for their shorter working hours. Their time management in terms of output is believed to be better than men.

Secondly, very prevalent is the preconceived notion that family commitments are incompatible with scientific competence. Single mindedness, that is absorption in science to the exclusion of all else in life is perceived as an essential quality for a successful scientist. In our opinion it is not single mindedness but perseverance and dedication that are required in a good scientist.

Thirdly, in science as in other areas, men tend to regard assertiveness as a quality essential for leadership. Strong cultural biases tend to make women less assertive than men, which automatically excludes them from leadership positions. But is assertiveness really an essential quality for a leader. In our opinion it is not, at least in science. What is needed is not assertiveness, but thoughtfulness, tolerance and nurturing to realize fully the potential of ones team.

To many women professionals, this sounds horribly familiar. In some professions, women have a choice. They can leave and find other work. They can work independently, without joining an organisation. In science, this is difficult. And in India, it is even more difficult as most scientific research organisations are government-run. They provide security, but they also leave you with little space to negotiate, to fight for a change of culture, to innovate.

2. INTRODUCTION

WOMEN SCIENTIST THAN & NOW

How Long Have Women Been Active Scientists?

Actually, how long have people been active in science? The answer is the same for both women and men - as long as we have been human. One of the defining marks of humanity is our ability to affect and predict our environment. Science - the creation of structure for our world - technology - the use of structure in our world - and mathematics - the common language of structure - all have been part of our human progress, through every step of our path to the present. Women and men together have researched and solved each emerging need.

They contributed in all the ways there are to the technical advancement of humanity. They held the same burdens of scholarship as the men did, and they accomplished just as much. These women left a remarkable legacy. They were as resourceful and passionate about their work as any scientist today, and certainly as creative.

In the Indian context women have entered into all disciplines of science & technology. In 1975 we had only 800 woman engineers and in 1996 it reached 56,000. Kerala, Karnataka and Tamil Nadu are leading in most of the areas in terms of women engineering force. Similarly, the number of woman Ph.D. holders in science in 1950 was approximately 80 but this number swelled to 3312 in 1993 and today this number is more than 6000.

How do we define a scientist?

Today we define a scientist as someone who usually has a Ph.D. and works in a technical field. This person is a specialist in a narrow field of research, and often is well trained in only that field. Today's Ph.D. shows special aptitude and creativity in a particular discipline and rarely shows the same talent outside that discipline. Today's science has a large set of separate disciplines: astronomy, mathematics, physics, biology, chemistry, and the social sciences, all in various combinations.

WHY MORE WOMEN DO NOT PURSUE SCIENTIFIC FIELD AS A CARREAR

Although hard facts on the crucial stages of a women's career in science is unavailable or at best fragmentary, it would appear that there are serious leakages in the pipeline from college to university to scientific careers. These dropouts are a costly loss of talent especially when women leave science careers after substantial investments of time, funding and other resources have been dedicated for them and by them. This has prompted several studies world wide to gain insights into the obstacles to entry, retention and progress of women in science and factors contributing to the attrition that provoke women to abandon science careers midway. As is readily appreciated the issue of family commitments, particularly child rearing is perceived as the foremost and major barrier and as such has received considerable attention. Suggestions to resolve the problem have included more family friendly work environments, compulsory equal sharing of leave by both parents during child birth, training boys to make them more competent to look after their future families etc. However, gradually an appreciation has evolved of the more subtle factors that influence the issue. Among these are certain preconceived notions and stereotyping that is instrumental in discouraging young women from taking up a career in science. Even for women in professional scientific careers, some attitudes and values of the traditional male bastion retard progress. We would like to enumerate the mind-sets that unconsciously discriminate against women and are potential barriers to the entry and progress of women in the sciences.

First consider the entry level that is high school and college. The mismatch between cultural stereotypes of women and scientists make many bright young girls summarily reject the option of selecting a career in science. This happens even more frequently due to the dearth of female role models who can inspire girls and with whom girls can identify. It is thus important to actively demonstrate to young girls in schools and colleges that there is a cadre of excellent women scientists all over the world. The recent increase in young women aspiring to a career in biosciences can probably be attributed to an increase in successful women scientist in this particular field as opposed to the physical sciences. Fundamentally girls need to see that science can serve their interests in life and contribute fundamentally to wealth creation, quality of life and sustained development. Realization of this fundamental aspect may account for the increase of women in the engineering profession, breaking the potentially inhibitory image of engineering as a non-feminine male occupation.

In the professional world of science there are some preconceptions, assumptions and values that are disadvantageous to women. Certain qualities are selected for that are at best very indirectly related to being a good scientist and that clash with cultural pressures on women.

First and most common is the assumption that one has to work long hours to demonstrate commitment. Women who cannot or do not spend as much time in their work places as their male colleagues are automatically regarded as less dedicated. This assumption however is not always true. It is now realized that women tend to give better 'quality time' to their work that compensates for their shorter working hours. Their time management in terms of output is believed to be better than men.

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A per the report, Female graduate students at MIT, Cambridge, asked about their experience, replied that they had no problem in competing intellectually with their male counterparts, but found the experience uncomfortable. They wanted a co-operative environment where interactions were intended to be supportive rather than confrontational. The competitive culture was also commented on by another group of women chemists in a survey in the U.K. Women were more interested in exploring how to reach a solution and in learning from the process, rather than in arriving at a result and rushing to publish. Whereas men stresses the importance of gaining public recognition none of the women mentioned it. These surveys give useful insight into the attitudes and differences between men and women and may account for the fact that men outrace women, as publications and public recognition are a visible and quantifiable measure of productivity.

In India, as in many other countries, women have had to fight to be accepted as capable of being equal partners with men in science and technology. Within "science", there were areas that were considered suitable for women and others considered outside their realm of capability. Thus it has taken a struggle, for instance, for women to become scientist. In fact, as recently as five years ago, when a well-known all-women's college in the United States, Smith College, announced that it was offering a degree in engineering, an electronics magazine ran an article with the title, "Is Female Engineer an Oxymoron?" The author claimed that in his 32 years as an engineer in power electronics, he had never worked with a woman engineer. He concluded that women did not have a love or aptitude for "real" technical work.

This response, in many ways, is typical of what you hear when you raise the issue of women in science. Rather than looking at the reason why more women do not pursue careers in a particular branch of science and technology, men conclude that women have no aptitude for that stream. Each time a woman becomes an aeronautical engineer, or a nuclear physicist, or excels in some area previously considered a male preserve, she is applauded and celebrated, but strictly as an exception.

Even before they reach the point of choosing a career in science, women have to make difficult choices. Every year, girls do far better than boys, in science and arts, in the Class X and Class XII examinations. In some institutions, the majority of the toppers are girls. What happens to them after that? Do they drop out? Are they forced by their families to make choices which are not their own? Do they fail to get through the competitive entrance examinations? Are they forced to make pragmatic choices about the future because they are conditioned to believe that marriage and family come first? Is there no way for them to balance their commitments to family with their desire to follow a career?

The declining number of girls who follow through on their apparent aptitude for science at the school level is evident in the few women scientists at the top of the academic pyramid. Those women, who do manage to pursue a career in science, often have to strategies how to survive and to get ahead. In one study of women in science in an academic institution in the U.S., the researchers divided the women they interviewed into two categories: the "instrumentals" and the "balancers". The former were described as "women who follow the male model and expect other women to do so, too". The latter were "those who attempt to delineate an alternative model, allowing for a balance between work and private spheres". This probably holds good for women in any profession, including the media, but seems particularly apt for women in science.

Career Opportunities for Women having Science

Every year a new group of science graduates come into job market. Students are choosing science for two reasons: The main one is its appeal to young graduates due to new technological opportunities. The other is attractive remuneration. On account of the

improved prospects, science departments begin attracting more number of students. Because of the time lag between when students enter college and when they graduate, the job market could undergo a change radically. Hence when young graduates are in the job market they are forced to compete with each other for a decent placement. Advanced materials and environmental protection are growth areas; Cross-disciplinary research and work teams in, for example, biology, physics or environmental sciences are to be pursued. When a woman scientist starts her career, she often finds that much of what she learned in college cannot be applied to the particular job at hand at once. Therefore many scientists get the feeling that they have been over-trained. Whether, in fact, this is so, quite a few discover that their skills and knowledge can be put to use in places other than on the job. One of the most satisfying types of secondary career is that which is based on applying one's unused professional capabilities.

- Women have been technologists and natural resource managers for centuries. They are fully aware of the various species and ecosystems. Hence they can contribute a lot in the environmental protection and conservation of natural resources to achieve cleaner and still cleaner environment.

- They can develop model projects for Governmental agencies to enable them to implement policies.

- They can conduct research in pollution abatement practices.

- Risk analysis and Environmental Impact Analysis studies can be undertaken.

- Women are most suited to take up teaching profession in science and technology and be guides for undertaking research in various fields like, environment, chemistry, material science, engineering & technology, safety etc.

Today, many scientists have become very familiar with solving waste-disposal problem or pollution abatement practices. At the same time, many small industries are confounded by these same problems. Officials of local governments usually do not have the technical skills to be able to properly evaluate the various options open to them. Failure can be most costly, as when statutory agencies force a new small-scale industry be closed for expensive modifications. They can play a vital role here not only in the identification of problems but also in providing solutions to them.

There are hundreds of professional and semi-professional publications that a scientist can contribute to, either as a writer, editor, or both. Here again, the income is not attractive, but the opportunities for recognition are good and the benefits of keeping abreast of the latest developments in her field of interest are significant.

Most of us are forced to write many reports during the course of our daily jobs. Our writing skills may not be great (at least not initially) but we have had experience in summarising the importance of what we have done. Writing for a magazine or journal is not too different. One has to learn the requirements of content, style, length and so on, but once these are learned, and one has gained some experience, the task of writing or editing can become pleasurable. The possibilities in this field are almost endless for those who have enough interest to learn the fundamentals.

She would have left college on a technical high. Her goals, shaped by her professors, are to become an authority, to publish, to add something to the technical knowledge of her field. This is fine for the brilliant scientist or engineer who is mainly interested in research and who may eventually go into teaching. But her grades are average and nonetheless, she takes a job in R & D. For five years, she settles into becoming an expert in the role of a specific field of research in Chemistry or Chemical Engineering.

Then, she decides to get an M.B.A. through part-time. Now her goals are influenced by what the professors say at M.B.A School. She decides to change jobs, so she sends out resumes detailing her scientific expertise, also specifying that she is seeking a position "with profit and loss responsibility in general management." This is what is called the

career menopause: that is, a radical change in career objectives (usually too late in life to be achieved).

These young, academically brilliant science background holders start knocking at the doors of industries and institutions. But when rejection letters are received, which is very common, they wonder what went wrong. They are probably not effectively communicating their abilities via their resume and/or during interviews.

WORKING CONDITIONS OF WOMEN SCIENTIST

There are immediate issues of the working conditions of Woman scientists. There are also larger issues of "gendered" science, the need to evolve a system of knowledge that integrates a gender perspective in its approach and direction. The latter is somewhat more difficult to comprehend and to implement. The former, too, is not all that easy.

The Results of Science have no Gender

When we, as scientists, wear blinders, about anything, we fail. We have never seen science succeed by using only one view, by using only one tool, by using only one person's thoughts, by looking at something only one way. We cannot back out of some invention, some theory and some solution whether or not the originator was female or male. We need to celebrate these women and raise them to be heroes. Understanding of science and technology will only strengthen our life, our work and our world. Solutions to problems come from research, thought and technology. By the end of the 20th century we have women by the thousands achieving advanced degrees in all the technical fields. It took 188 years for American women to get the vote; in the last 15 years American women earned over 15,000 Ph.D.s in technical fields. Graduate schools in medicine and dentistry are routinely 50% female. Astronomy has over 30% of its graduate's students who are women. Perhaps it is time to put our women of the past into our stories of the present and our hope for the future.

The reality of the workplace for women is quite different. The woman scientist who we approached describes the situation where she works, a leading government-funded research institute: "This is one Institute where cheap `gendered' jokes are in order at every meeting organised officially. There is the added disadvantage of some male colleagues who openly insult/abuse the women scientists. The few who speak up against them have to face difficult work conditions - a work place that is an impending threat all the time, regular disruption at work, and of course direct punishment by manipulating our performance report and granting low grades or denying assessment opportunities."

To many women professionals, this sounds horribly familiar. In some professions, women have a choice. They can leave and find other work. They can work independently, without joining an organisation. In science, this is difficult. And in India, it is even more difficult as most scientific research organisations are government-run. They provide security, but they also leave you with little space to negotiate, to fight for a change of culture, to innovate.

What an irony that in the very profession where people should innovate, should try out new things, should experiment, the work atmosphere is ossified, hierarchical and resistant to any new thinking or to any change in the rules of engagement. Perhaps this is why "government" science is so dead, so devoid of energy.

3. METHODOLOGY

The research study has tried to incorporate many of the basic factors, which initiates naturalistic inquiry. As stated earlier, some of the significance of such an inquiry is a natural setting, the human instrument for data gathering, qualitative methods, purposive sampling and emergent design. To elaborate: assuming that reality cannot be understood in isolation, the research has been carried out in the natural setting or context of the entity, data have been gathered primarily through personal interviews and observations, and through questionnaire methods both by direct interviews, by post and by e. mails.

The research design has developed in some ways as function of the interaction between the surveyor and the respondent, and the analysis or findings are not pre-determined or pre -hypothesized, but the result of themes are just emerging from the data. The selection of the sample was on the basis of sampling method. It was emphasized to take the sample proportionately to the total scientist in each institute.

This is an exclusive study of various institutions and a sample survey of women scientists working in various institutes. The emphasis was to include the women scientists working in different institutions, depending upon which area of specialisation, area of working, nature of duties, timings, challenges etc. Although the main objective of the study to highlight the low representation of women scientist in R&D institute and to find out the reasons for this factor, the study was able to touch the sensuality of the relation between relativity of science & women.

REVIEW OF LITERATURE

Before designing the questionnaire, extensive efforts are made to search literature on women scientists not only in India but also all over the world. This was done through visiting various libraries, meeting prominent persons and through Internet. All the collected information was compiled and used in the present study.

DATA COLLECTION

Two sets of questionnaire were prepared to collect data. One is for collection of basic information about the R&D/S&T institutes and second for collection of data from women scientists.

Basic information about Institutes

The basic information was collected from various institutes to find out proportionately the representation of women scientist in each organization. The basic information was collected by meeting the head of the institution**.** The team obtained the background data by collecting the primary information from the institute and verified with secondary data such as annual reports and the data available at the websites of the Institute.

Data collection from Scientists

The questionnaire consist of more than 20 questions covering Personal background, Academic background, Personal achievements: Job status and current work, Career expectations and values, family background, socio-economic and educational status, type of work doing, information about the atrocities, impact on the family other related aspects. One questionnaire will take around 15-20 minutes to fill and daily 8-10 questionnaires will be filled. 280 questionnaires were filled by interviewing persons from various institutes.

The pre test of the questionnaire was conducted at selected institutes to understand whether the questions are clearly understood by the scientists, any more questions to be added, any thing to be omitted and whether there is a continuity of questions. This enabled us to determine if the types of questions which are asked were clearly understood by the interviewees such that their responses would give us the kind of data we were seeking. After pre-testing, necessary modification was made to make the questionnaire more effective.

The data consist of completely answered questionnaire from all the persons interviewed. The preliminary interview, which lasted half an hour to one hour in which we basically 'broke the ice' and provided a starting point for a later more detailed interview. At the first interview, the biographical details such as age, marital status, number of children, educational and career experience as well details of their socio economic background, such as place of birth and education, parents and spouse's education were collected.

A list of details sought in the interviews was designed to get a basic information of the respondents. These interactions helped to uncover the women's perceptions of themselves as scientists and also to probe into their experiences during their careers and research. These interviews lasted typically an hour and a half, sometimes longer. They were conducted at a time convenient to the scientist. Broad open-ended questions were asked and depending upon the responses, which probed with further questions such as can you explain further or could you give me an example. A list of probe questions is included in the appendix. We kept substantial field notes to capture the characteristics of the participants and whole atmosphere of the interview, such as facial expression of the and other non-verbal clues. Casual conversations with the participants during the visits to the institution other than the formal interviews were noted in detail and without affecting the spontaneity.

The questionnaires, publication lists from each of the respondents, the basic information about the institute, following was determined. Details of the personal, educational and professional experience. Details of publications- number of publications, books and journal articles, Kind of issues researched, theoretical, fundamental or applied, Other career information such as conferences attended, memberships in scientific or other organizations, national and international awards received and number of Ph. D's produced.

ORGANISATION AND ANALYSIS OF DATA

As stated earlier, the fundamental information for this research came primarily from open-ended interview, questionnaires, publication lists and observation notes. Each set of data was organized in a manner guided mainly by Bogdan and Biklens (1982) suggested for qualitative research.

All the sets of personal interviews-preliminary and in depth interviews with heads of departments were recorded carefully. And in depth interviews with scientists and interviews with head of the departments were also noted and transcribed verbally. All comments were also analyzed and inferences were taken. The data from questionnaire, the data on the socio-economic status of the scientists, along with the data of publications were tabulated in order to construct a profile of the scientists in general and to study the various parameters.

During the period of the research, extensive field notes on every possible aspect of interaction with everyone at the institute was recorded from scientists, faculty, students, administrators, other staff both males and females. Detailed notes were also made on the conditions of all the labs and institutes. The data was organized by day, date and time of observation.

The next stage was analysis. As stated earlier, the biographical and publication data were tabulated in varied ways for analysis. The interview data and the field notes were carefully coded. Each piece of information, comment or observation was coded in as many codes as possible. Some codes related to problems of women faced in different areas of their work. Examples of such codes are: Problems in entry- influence required to get appointment; frustration in career- I have not been able to do either research or teaching properly-problems in career-University and government policies and the quota system. Other codes were concerned exclusively with the institutes. Within each major code there were subcategories in the code assigned to them because they covered more than one theme. For instance, a statement coded as problems in doing research. The

coded data were collated and organized by code. This enabled us to identify number of themes and select the ones that recurred most often. It is these recurrent and strong themes that recurred most often. It is these recurrent and strong themes that form the basis for each of the chapters that follow.

Finally in writing up of the study, strict confidentiality has been maintained and all the names and their comments are generalized and interpreted only as a data and no level of personalization. The participant's comments are very minimally edited in order to preserve the style and flavor of their language.

CONCLUSIONS

After organizing and analyzing data, conclusions were derived with inference to the collected literature. The findings of the study are the outcome of this study, which can be used widely by the policy makers, researchers, social institutions and other interested groups.

4. REVIEW OF THE LITERATURE

The Context

The education of women especially those from the lower castes have lagged behind that of men at almost every period of history. This has been the overall pattern. There have been however, some variations, particularly in the case of a few individuals. For instance, in the early Vedic period (2000-1500 BC), women from the elite classes were privileged enough to gain acess to learning along with men. Leelavati, the mathematician, Gargi, the philosopher, and Khana, the astronomer, are some famous name of the period. Later, because of the rising patriarchy and increased rigidity of the caste structure, women no longer enjoyed this privilege. And from the time until British colonization, very few names of women appear in the historical accounts of education in the Indian subcontinent.

In the eighteenth century, the British rulers decided, with great reluctance, that they needed to impart some minimum English education to Indians, mostly males, so that they could then perform the required clerical and secretarial services. Of course there were no lofty ideals of the colonized sharing the benefits of enhanced learning with the colonial rulers. However, not all British held the same narrow opinion about the ideals of education and, by western education in India progressed into higher levels, albeit at the cost of indigenous forms such as temple schools and trade apprenticeships, which eventually disintegrated and disappeared.

In the late 19th century, western education for women developed mainly through the efforts of the elite as a "tag – on" to men's education. For a century or so, Christian missionaries had been providing schooling to girls from families that had converted to Christianity. The western – educated Indian elite, who wanted to socialize with the

Europeans, engaged these missionaries to teach English to their wives and daughters. This led to the establishment of the schools in some parts of the country (Borthwick, 1984). Further, the attack at that time on Hindus customs like child marriage and female infanticide forced the Hindu elite to reconsider their views on the status of women, The resultant social reform movements proved to be powerful catalysts for the spread of education among women (Chitnis, 1989: Raman, 1996).

In the early twentieth century, Indian nationalists, especially Gandhi, realized that if the movement for political independence was to succeed, the support of women who constituted half the population must be enlisted. At this time Gandhi not only encouraged them to join the struggle for freedom, but also declared that women's education was vital for the advancement of the nation.

It was then that the entry of women into higher education that had hitherto been sporadic became endorsed by the leadership. Thus it is around this time, the late 19^{th} and early 20^{th} centuries, that was begin to hear the extraordinary tales of women such as Dr. Haimavati Sen (Forbes, 1994) who faced serious struggles, but were resilient and courageous enough to complete degrees in medicine and other fields. Even so, for most women, perform the role of housewife and mother more efficiently, not help them attain equality with men.

Contemporary Issues of Access

The commitment of women's education that had been earlier established has been reiterated over and over again in several reports of government commissions especially appointed for education after Independence (Government of India, 1959,1961,1964-66). Largely as a result of these efforts, the enrollment of girls in educational institutions has actually been (Chitnis 1989) higher than that of boys (5.5 % for girls as compared to 3.9% for boys). Most spectacular is the growth of higher education for women, which has been more rapid than any other sector: a lopsided phenomenon, since female literacy has not improved at the same rate as higher education. But in spite of increase in the

enrollment of women in higher education, it is still lower than that of men. The enrollment of women in higher education was about 1.5 % of the age cohort 17-23 years in 1981, and there were 38 women for every 100 men enrolled (Desai & Krishnaraj, 1987).

Given all of the above contradictions, it is no surprise that there have been several problems with the quality of the advance. First, the pre-Independence emphasis of educating girls in order to make them better housewives continued for at least the next 25years (Government of India, 1947). Second the growth has been restricted mainly to the middle and upper classes. Owing to a quota system in most states, caste no longer forms the primary criterion for access to higher education, but class certainly continues to be an important factor. Enrollment of men and women also varies a great deal by region, with urban women being more likely to gain access to higher education than rural women. Another problem, similar to that in western countries, relates to the disciplines in which women are enrolled. Women in higher education in India, like those in many western countries, tend to be found in large numbers in the liberal arts faculties. Women in professional courses and in science and engineering are still a painfully small minority; this tendency is increasing as we proceed from the undergraduate to the doctoral level (Chanana, 1993). This is mainly because marriage, and not a career, is the primary goal for the middle – class women. A degree is perceived as enhancing her prospects of finding a good husband, and a career is to be pursued only in the event of untimely death of the husband or in case of divorce. Even women students themselves tend to see college as away of biding time between school and marriage (Jhabvala & Sinha, 1975). Moreover, many parents consider it less important or find it financially more taxing to support their daughters through professional education than heir sons (Desai, 1977; Mukhopadhyay & Seymour, 1994).

Recent studies such as those by Isranеy (1989 b) have begun to expose institutional barriers to the education of women outside the family. Some of these are the paucity of financial aid given to women as compared to men students, the lack of campus services like child care, and a very male –oriented curriculum.

Women and the Work Force

One aspect of the 'modernization' and the 'women and the development' debate has been a human - capital based belief that women who have received education are somehow obliged to pay back their share by contributing to the economic development of the country. Higher education is considered important merely because it provides a means of entry for women in to the labor force. A number of studies of employment pattern of university educated women lament the extent of unemployment and underemployment among these women, as well as the problems women face in getting a job of their choice. Thus, even after having obtained a higher education, societal and family factors adversely affect women's chances of using their education (Krishnaraj, 1977). Yet the entry of women in higher education is important not only because it prepares them for jobs. It is important that women have the opportunity to benefit equally from the intellectual and cultural experience of higher education, regardless of their future roles in life (Ahmad, 1979). A well known longitudinal survey of professional women's attitudes towards education, employment and family situations reveals that most of the women retain traditional values despite their education (Blumberg & Dwaraki, 1980). All traditional values are not restrictive, but it does seem disconcerting that education mainly provides a measure of economic independence and does not necessarily translate into independence in any other sphere.

According to Krishnaraj (1991), debates on women in profession have progressed a great deal from the earlier educated women as deviant reconciling dual conflicting roles' model to the 'women seeking equality at work and at home' framework. In the 1970's, the onus of proving herself capable of managing her 'double role in the family and in the workplace was placed on the woman herself. According to Kala Rani's (1975) study of job satisfaction among workingwomen, women were said to have low job commitment because they were ready to give it up in the event of a family crisis. Blumberg's students looked at employment as something that could be easily given up depending upon who they married or what the family decision about their marriage turned out to be. Misra

(1977) was quite certain that the role- person- system conflict would be resolved with time as the women anchored her to a different, more stable set of values.

From the late 1980s, scholars have begun to recognize that it is important that the emphasis on the individual women must shift to discussions about institutions, structure and systems. The responsibility for progress or the lack of it need not be placed upon the women herself; there may be other barrier in the workplace or at home that have not been studied. For instance, Chanana (1988) found that the women's ambitions are low because the cultural process of socialization fosters a low self- image. This lack of confidence is perhaps one reason why they do not progress well. Women evolve adequate coping styles, although these tend to be conflict- avoidance rather than action oriented. Israney (1989b), who points out the structural barriers to women's entry into education, also discusses social obstacles to the transition of women's careers in higher education from the post-graduate level to that of faculty and administrators.

Women in Science in India

There are several dimensions to consider with regard to issues about Indian women in science, first, they are professionals in the academy, and as such their lives and work are affected by the overall environment, ethos, and policies in the Indian higher education system. Second, by virtue of the fact that they are women, they face situations that are quite distinctive and related to their role and status in the society. Again, since we are considering very male-dominated disciplines in particular, specific factors, such as the peculiar nature of the disciplines come into play.

The question of women in science in India stands out because of the almost complete lack of empirical research specifically on women scientists. This is understandable because while India has had women doctors for a very long time, the phenomenon of the women scientist and researcher as someone unique, perhaps different from the male scientist, is fairly new. Probably the first data on women scientists were collected in 1975 when the Indian Women Scientists Association was formed, and a small exploratory

study was conducted on the employment status, job satisfaction and obstacles to the career of members of the association, a study which, despite its limitations, was an important beginning (Krishnaraj, 1991). Begum and Balaraman (1975) surveyed women scientists in the largest research establishment in India, the Bhabha Atomic Research Centre (BARC). They concluded that women had to work harder than men to progress in their careers and that this was both due to the socialization of the women and the lack of child care facilities.

From these simple beginnings, however, perspectives have changed and research on women scientists has looked at access to science, position and status and, more recently, at progress. As noted before, women in higher education tend to be concentrated in the faculties of humanities and the social sciences. Despite the increasing numbers, they form a peripheral group in the natural and physical sciences and in engineering. There are, however, differences within the different fields. Medicine is the only subject that leads Indian women to a highly prestigious profession and where they have come to be represented in substantial proportions. Women in medicine have been studied fairly extensively. Bhargava (1983) has shown that women choose areas such as radiology and pediatrics that do not conflict with their familial and other roles.

Institutional barriers to the progress of women in science and research are beginning to attract the attention of scholars, but such studies have not yet been designed to capture the ethos of the institutions or the nature of science in these institutions. Interviews with researchers in the sciences at the University of Delhi have revealed that despite family support, the manner in which research in the sciences is conducted has proved to be a barrier to their advancement (Rani & Saxena, 1987). Jaiswal (1981) seeks to portray the status of women in relation to men in the work hierarchy. Chakravarty and others examine the work performance of a group of men and women scientists (1986). Their work is the only study that focuses exclusively on research scientists and thus constitutes very important contribution. They find that women tend to be engaged in 'pure' research rather than in administration. The authors point out that this means that they are less involved in the decision-making processes in an institution. Again, the pure research that

they do belongs less to the analytical and creative category; they do more compilation, collection and review work. There is very little difference between the productivity of men and women in terms of books or research papers, but there is a sizable difference in the numbers of patents and innovative experimental devices that men and women produce.

In a large scale survey of the status of science degree holders in Delhi, the career status and support systems available to science degree holders and how their education in the sciences has affected them. It includes quantitative data on the career status of the women, as well as in depth case studies of women's perceptions of discrimination, career satisfaction, of their roles at home and at work, their assessment of the value of science and of behavioral outcomes of being scientists.

The lives and careers of women in science in the Third world reflect a curious intermingling of all those societies' contradictions. While the rhetoric of development and modernization in these countries has been instrumental in ensuring women's entry into higher education and in to science, the extent of their position and progress has been determined mainly by social and cultural consideration governed by a long standing patriarchy. Interwoven with these complexities is their peripheral position in the influences their careers, but also their perceptions of science.

First and foremost, it is a **research study on the status of women scientists in different R&D and S&T institutes of Delhi**. "As on 1st April, 1998 nearly 3.08 lakhs personnel were employed in the R&D establishment in our country including in house R&D units of public and private sector. 31% were in R&D activities, 32.6% were performing auxiliary activities and rest 36.4% were providing non technical support. There were only 9701 women directly engaged in R&D activities, which is only 9% of the total scientists. Women participation in R&D activities is extremely low compared to their male counterparts.

It is now recognized by all modern societies that education and career is not only the right of women, but also a key factor that contributes to the economic and social development of country. Women scientists focusing upon their lives as university academics, as researchers in the hard sciences, and as women. The overarching research question addressed here may be stated as follows: what patterns and difference emerge in the perceptions and attitudes of academic women scientists toward themselves as women in science; their career routes; their relationships with colleagues-male and female; their research interests, communication strategies and linkages: the manner in which their family life intersects with their careers; and the discipline of science and its value? What emerge from this is a comprehensive description of the lives and careers of individual women who struggle in a male –dominated workplace that marginalizes them.

5. INTRODUCING WOMEN SCIENTIST IN DELHI

The chapter deals with the personal as well the professional details of women scientists working in various R&D/S&T departments. The study examined their family and socio-economic background, reporting on educational status of their parents, husbands and siblings and describing briefly how this background has contributed to their education and career.

The study in this chapter refers to the total number of women scientists whose data are collected who are working in various R&D institutes. As such, the trends exhibited by the total sample can certainly be considered representative of the total scientist in Delhi.

The following are salient observations:

- The number of women scientist coming in for this profession shows only negligent increase.
- A total of 28 R&D/S&T institutions are in the study. This includes a combination of Central Govt. Institutions, Universities, Deemed universities, corporate, NGO's. etc.
- The total samples are 280 women scientists working in various institutes.
- The sample refers to all women scientists who responded. The method of collecting data was
    1. Directly filling the questionnaire
    2. By E. mailing the questionnaire.
    3. Questionnaire by post
- The data collected is analyzed for the overall features and trends.

The study is particularly focused on the low representation of women scientist in various R&D and S&T institutes. Participation of women in science and technology is an important aspect in the social and economic development. All over the world the low

participation of women in scientific profession has been a matter of concern. And the need for correction of the situation is their contribution to the field of Research & Development is the preamble to formulation of appropriate measures. There are many research studies conducted regarding women and their employment status. But studies with specific focus on women scientists working in R & D sector has not been done so far.

The selection of this particular group of respondents for two primary reasons. First as women scientists in R&D sector, they are among the most peripheral of scientists in India. Second, because the emphasis of the study is on the low representation of women scientists in various departments.

The R & D institutes in Delhi were selected, because Delhi shows a fair representation of India as whole with the cosmopolitan culture and representation from all the states. And finally and most importantly, because there is not even a single study carried out till to find out the status of women scientist in various R&D sectors in Delhi.

In the study, though the entire female scientists are not included, the study has ample representation from all the disciplines and areas of specialization into which scientists are working. As in most other countries, Indian women are peripheral to the field of science. Most of the go in for liberal arts and humanities. Within the sciences too, different disciplines have different degrees of femaleness that is some have more women in them as a portion of the total number of qualified persons. According to the Chanana's 1992 figures (1993), the proportion of women enrolled in university education in 1988-89 was 43.2 percent in arts, 32.6 percent in the sciences, but only 6.2 percent in the Engineering and Technology. Within the sciences as per Gandhi and Nigams statistics (1975) show that there are several variations. At the top are Home science and Psychology, in which there are respectively 95 and 46 percent women as a proportion of the total number of qualified persons. Zoology, Botany, Geography, Chemistry and Mathematics has between 10 and 30 percent. The Disciplines in which women are less includes Physics (6.6 percent) Statistics (7.6 percent) and Agricultural (3.6 percent).

The institutes covered are as follows:

S.No.	INSTITUTES COVERED
1.	National Institute of Communicable Diseases, 22, Sham Nath Marg
2.	Malaria Research Center, Shamnath Marg
3.	National Vector Borne & Communicable Disease
4.	CSIR (HRD group), CSIR complex, PUSA
5.	National Centre for Agricultural Economics & Policy Research (NCAP) PUSA
6.	Indian Agricultural Statistics Research Institute
7.	National Institute of Scientific Technology & Development Studies (NISTADS)
8.	National Institute of Science Communication (NISCAIR)
9.	National Physical Laboratory
10.	Central Pollution Control Board, Parivesh Bhavan
11.	Centre for Environmental Management, University of Delhi
12.	Department of Botany, University of Delhi
13.	Institute of Genomics and Integrative Biology, Env. Biotechnology Division
14.	National Centre for Integrated Pest Management
15.	National Bureau of Plant Genetic Resources
16.	Soil Sciences Department, ICAR, PUSA
17.	National Institute of Post Harvest Technology
18.	Maulana Azad Medical College
19.	Indian Meteorological Department, Mausam Bhawan
20.	Safdarjung Hospital
21.	All India Institute of Medical Sciences (AIIMS)
22.	Indian Institute of Technology
23.	Indian Social Institute
24.	National Productivity Council
25.	Indian Renewable Energy Development Agency
26.	Bio-resources and Biotechnology, Tata Energy Research Institute
27.	Pan American Business Solutions Pvt. Limited
28.	Engineers India Ltd.

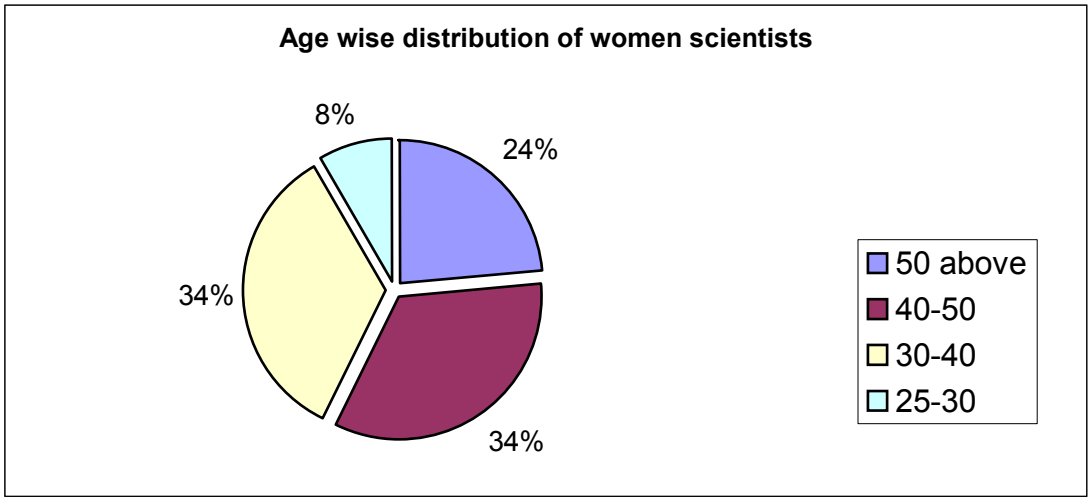
The group of women scientists studied here consists of all women scientist working in various scientific institutes who are post graduates in science, that is Physical Science, Natural Sciences, Mathematics/ Engineering degree or a degree in Medicine. The study generally took whom the institute has given the grade of a scientist.

All the respondents are working and enjoying the cadre of the scientist/ faculty at various institutions. All of them are full time working as scientist at least for last one year. During the period of data collection, due to some reasons we could not meet all the scientists and it was not a problem being the study is a sample survey study.

PERSONAL BACKGROUND

AGE

The average age of the group of the 280 women scientists in this study is 40 years.



The overwhelming majority is the age group 38-43. The Diagram shows the percentage of distribution. An examination of the table shows that there is no significant correlation between their age and position. The 68% of the respondents of the survey are in age-group 30-50. Only 8% of the respondents are in the age groups of 25-30. 24% of the respondents are above the age of 50 holding very senior positions. The only relevance of age was the age has direct correlation with the position or seniority being the majority respondents who belong the Govt. Sector.

SUBJECT

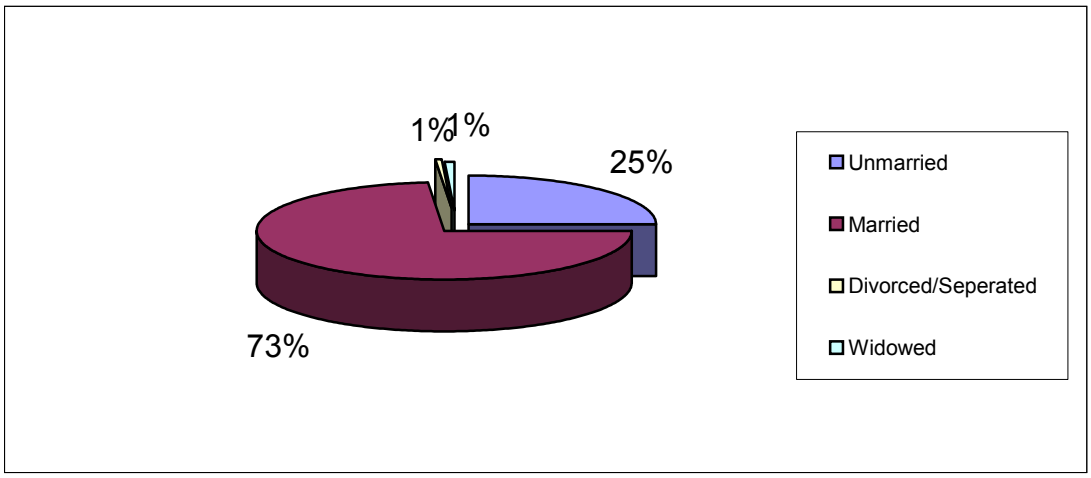
Women began to enter the sciences in large numbers only in the 1960's. Therefore, one reason for the fewer numbers of women in higher positions could be the late entry of women into sciences. Traditionally, however there have always been many women in medicine and medicine related professions, although there are several variations within the specialties in medicine. The head of the department, many women are choosing pathology as a specialty than when she joined profession. Biochemistry has also traditionally attracted many women students, the head of the department of the physical chemistry is proud to note that there is such an excellent gender balance of faculty in his department. Given the all-India data on this, it may be noted that many more women choose subjects like Chemistry and biology rather than physics and mathematics. Research on the access of women to mathematics in India shows that, In general, the percentage of women in mathematics is just as low as in the other sciences.

Subject	**Number of women scientist**
Mathematics	17
Zoology	29
Chemistry	28
Botany	31
Biotechnology	13
Physics	9
Policy research	7
Life Science	14
Environmental Science	12
Computer Science	8
Microbiology	15
Agricultural Economics	7
Physiology	17
Biochemistry	16
Food science & Technology	9
M. Tech Environmental Engg.	8
Pharmacology	8
Anatomy	12
Pathology	16
Genetics	4
	280

MARITAL STATUS

The near universality of marriage among the women is clearly reflected in the group in the study. The overwhelming majority of women participants are married and almost all of them have one or two children.

The marital status of the respondents is presented in table below. It is seen that 73% of the total scientists are married and 25% are unmarried. The data shows an interesting relevance of single status the professionals.



To authenticate the relevance of the single status, another question was included whether them being a scientist affected there marriage proposal the opinion is reflected in the table.

Very adversely	Somewhat adversely	No effect	Somewhat positively	Very positively
11	46	71	46	106

The table reflects that their higher educational qualification has however affected 11 of them very badly and 46 of them in a somewhat adverse manner. The majority of the scientist is of the opinion that them being a scientist has helped them to get a match either by arranged marriage or by their own choice.

TYPE OF MARRIAGE

It is interesting to note that majority of the married women scientist belongs to the arranged marriage category. A year wise analysis also does not show that this percentage is slowly decreasing.

Total Number	Arranged	By own choice	No response
206	127	71	8

34% of the respondents married their person of choice. This percentage is higher than the corresponding national average in this regard. However no comparison can be made since national data about this aspect is not available.

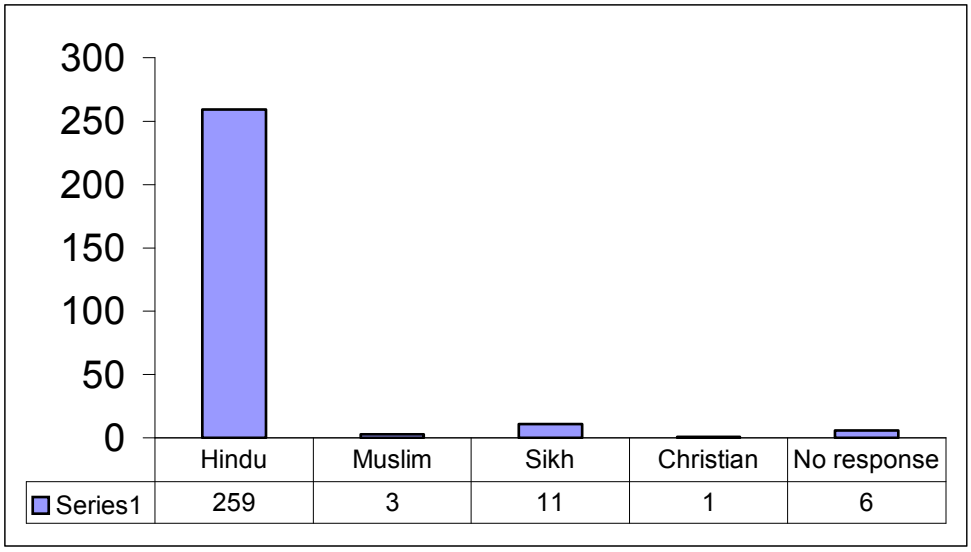
HUSBANDS PROFESSIONS OF THE RESPONDENTS

The professions of husbands are a combination of scientist, professional & service. Only 9 scientists are married to Businessman. It is interesting to note 74 of them are married to scientist.

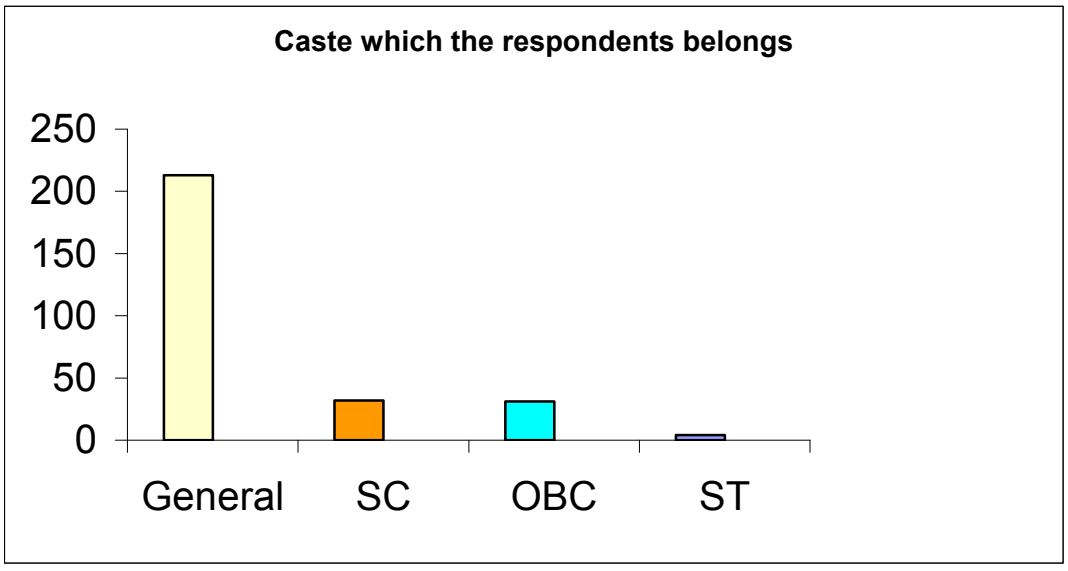
Scientist	Service	Doctor	Engineer	Businessman	Other profession
74	86	19	31	9	61

RELIGION

In terms of religion, the group is fairly representative of Indian society. The overwhelming majority of women are Hindu. This is yet an other illustration of the complexity of the issue of caste and how it interviews with class and economic issues, the survey could not include very representation of Muslims & Christians in the study. This does not authenticate that there is only one or two Muslim or Christian Scientist, but proportionately the representation is very poor.



The graph reflects the vast variation in the representation of various religions. The significant majority of the respondents belonged to Hindus. This graph is entirely different from what is expected in a survey of women scientists in metropolis city. This data reveals that the Sikhs have a lower population than Muslims, their representation is comparatively higher than them.

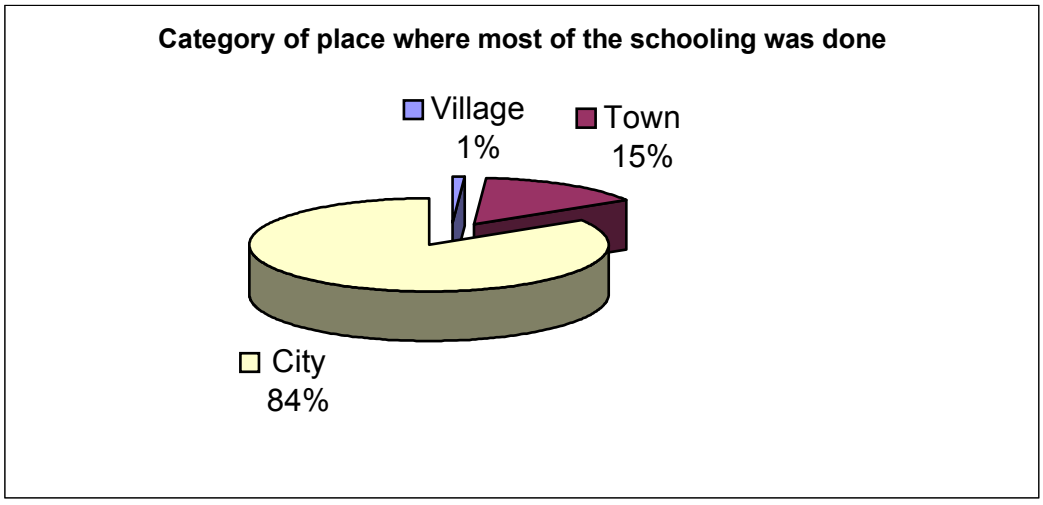


It is evident from the graph that there is no significant representation of backward class or scheduled caste.

QUALIFICATION OF THE WOMEN SCIENTISTS

Academic Background

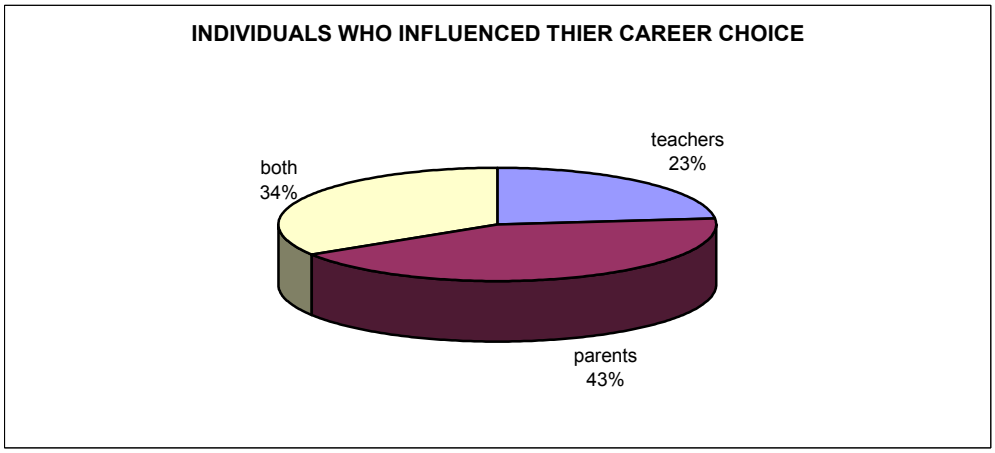
The influence of the school background, location type medium of instruction and attitudes of the parents on the decision of the respondents in choosing a career as a scientist was studied. This also plays an important role in the decision along with certain other relevant face of academic career.

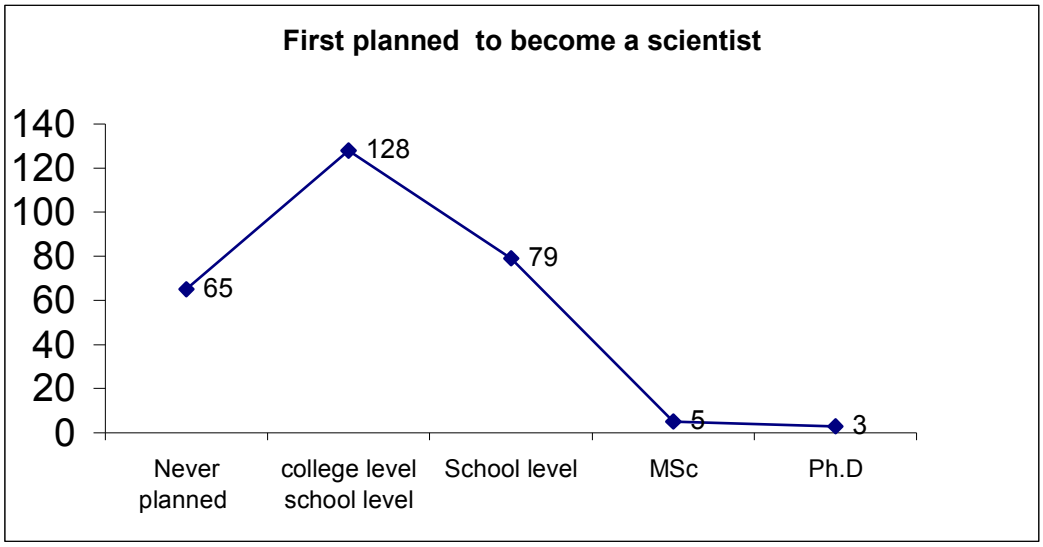


The distribution of respondents has been presented as a function of location of the school. The largest number of respondents comes from cities followed by town and then villages. This comes as an important revelation. This indicates that a desirable change in the attitudes of the parents & teachers makes an influence in the academic decisions of the children. Though the students have a caliber, timely motivation and grooming make much difference.

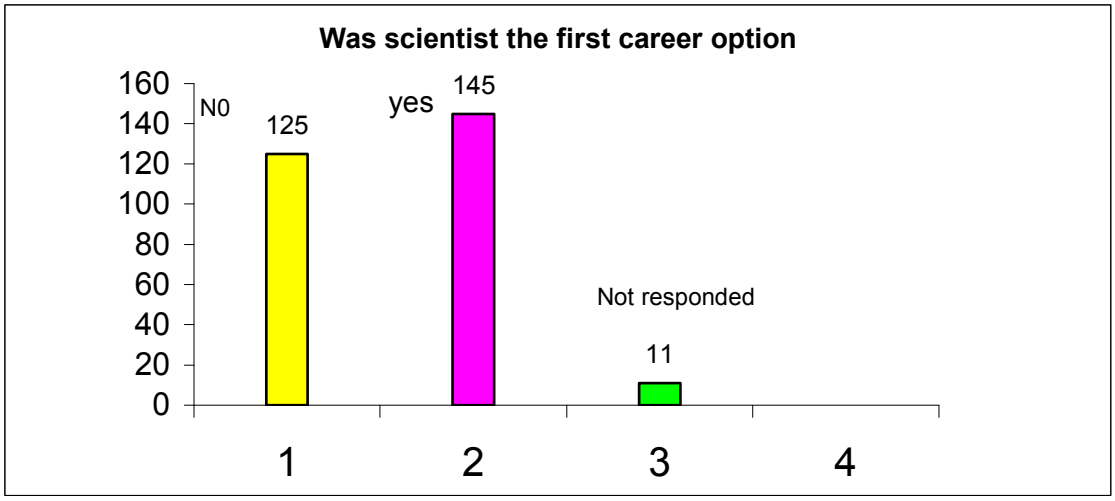
The attitudes of parents, other family members, teacher's etc. play an important role in the girls decisions regarding their career options. Information regarding this aspect was sought from the respondents through the questionnaire. It should be noted that this

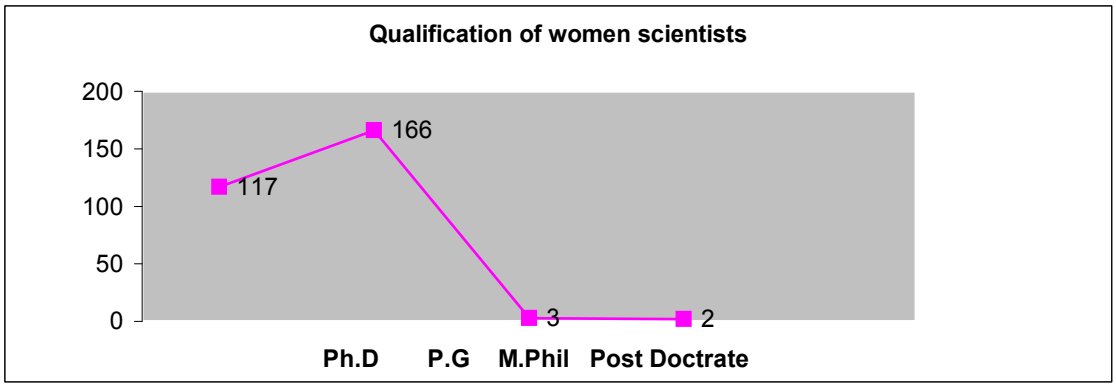
questions were worded for cross checking. The data shows that parents had the maximum influence encouraging their girls to opt for the scientist profession





Most of them planned the career as a scientist at the college level. At least 65 of them told that they never planned anything in life. 79 of the respondents told that they had determination and focus in their life to become scientists because of some or other role models at their school level.

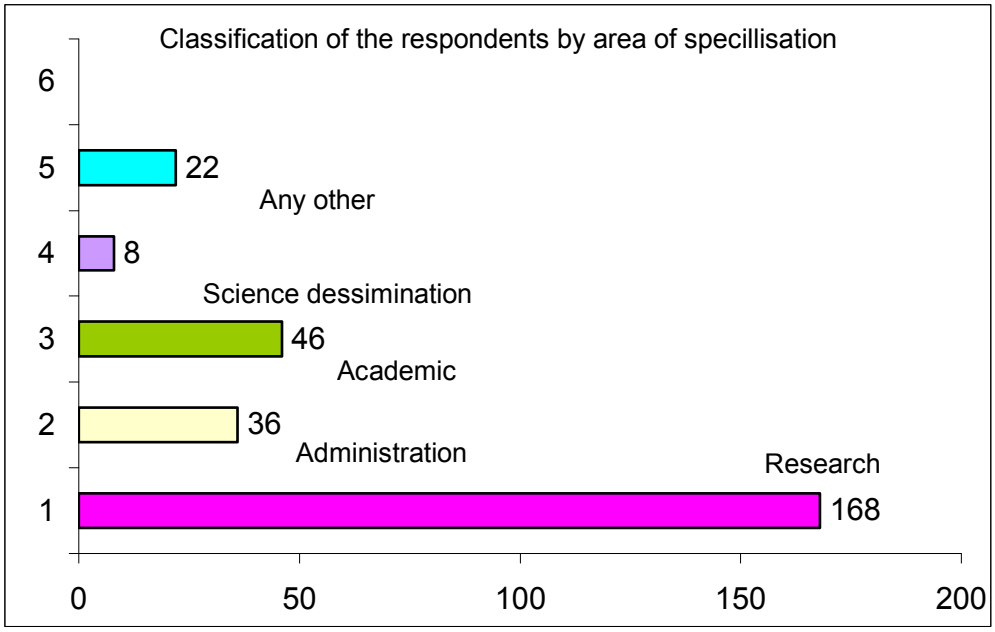




The scientist selected for the study was Postgraduate in Science/Graduation in Engineering & Medicine the data obtained indicates that majority of them are either post graduates/ graduates in Engineering or Medicine. 117 of them have their Ph.D. Only two of them have their post doctorate degree and 3 scientists have their M. Phil. Many of the scientists revealed that though they were interested in higher studies, when they got their jobs they could not do it because it was not permissible that way.

WOMEN SCIENTISTS & THEIR CURRENT PROFESSIONAL STATUS

Moreover research done in each of the disciplines serves different purposes. While some research is more fundamental nature, production of research literature often serves multiple functions as it advances knowledge, as well as consolidates, interprets and derives applications. This gives rise to a division of labour among scientists and institutes that are primarily concerned with training, research and the dissemination of information's. Research also fosters the vertical integration of communication structures, which link producers to intermediaries and users. This emerging division of labor may be indicative of the development of a hierarchy among and within institutions.



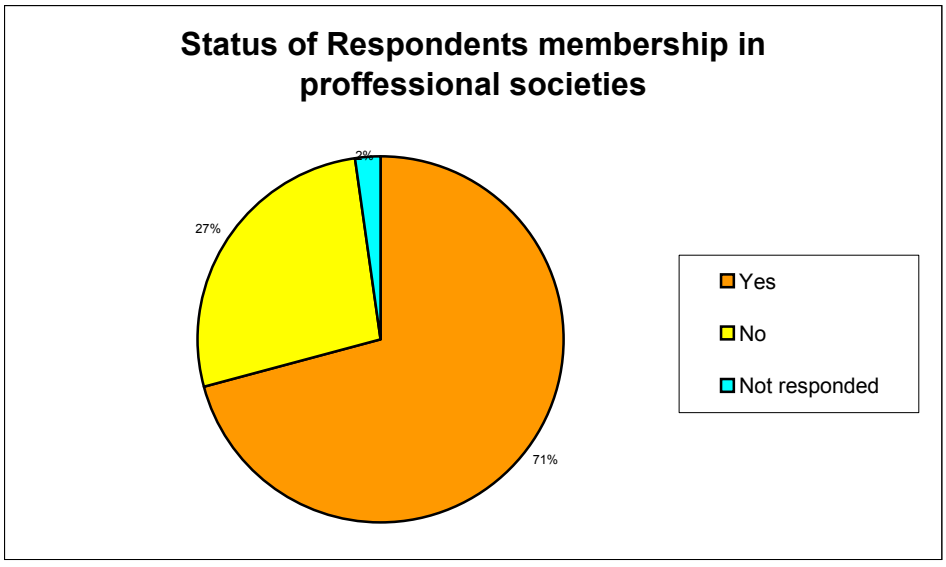
As seen in table, the group studied here consists of 280 women. Of the 280 women scientists, 168 scientists are actively involved in R&D. 36 of them are in administration. 46 scientists were in the academic sector, 8 were in the science dissemination and 22 of them included doing multifaceted job in the institutes.

RESEARCH TIMINGS

Management and administrative responsibilities are generally related to the status in the hierarchical ladder of the organization. The higher the position the more and more the responsibilities.

5-8 hours	Up to 10 hours	Above 10 hours	No fixed timings	Not responded
177	47	13	37	7

In R&D sector the timings spent in the lab is very important. 37 respondents told that there is no time limit for the lab hours or research. 47 of them told that they work upto 10 hours and not more than that. The majority of them told they have the routine working hours like any other office from 5-8 hours.

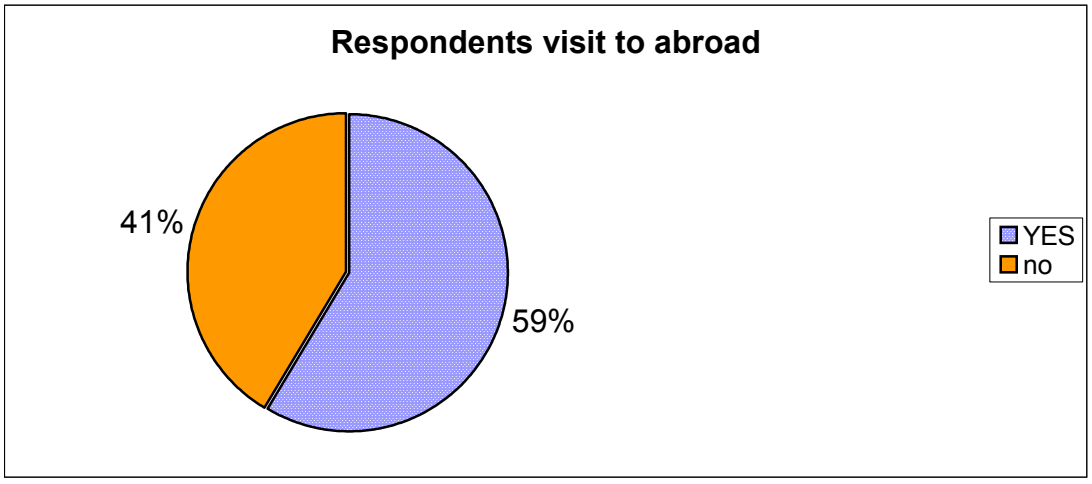


It is difficult to compare the status of this group with other groups in the literature owing to the lack of a satisfactory definition of family status. A gender gap can be seen when we compare the education of this group of women with their siblings. Many women reported

that their sisters were much less educated than they were. Many also said that that their brothers had less education, but these were fewer in number. The problem that the men in the family face is interesting. Some of them were compelled not to go for further degrees since they needed to take up jobs and establish themselves in order to be able to support their families, a constraint that the women did not have.

Women scientists in this study are mainly urban based who have had their early education in private schools where the medium of instruction is English. Their family educational status shows a wide gap between the educational level of their mothers compared to their fathers. An overwhelming majority of the women are married, mostly to men with a comparable level of education and occupation.

Both class and caste have played role in their entry into science. Most of the women have been encouraged to pursue their education by both the parents. Their main obstacles have been social or financial.



6. FAMILY & WORKPLACE

The inevitable double bind for women

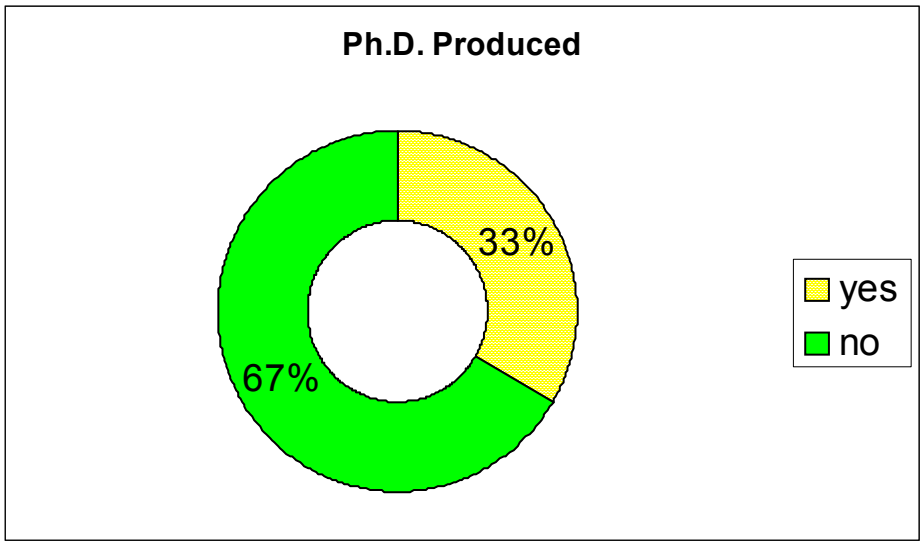
Studies of the workforce and of professionals are now beginning to examine not only how family commitments affect work, but also the reverse, namely, how work stresses affect family life and structure. The professional problems of women scientists are not unique to India alone. Similar problems exist in developed nations as well.

With regards to personal and family life, Presence of small children at home seems to be the principal factor-affecting career adversely. Women, have always taken the responsibility of the household in regard to domestic chores such as cooking, cleaning and childcare. Educated women today seek employment outside the home find themselves shouldering the additional burden of the household, sometimes quite unwillingly. Women's employment is accepted but expectations linger that they should primarily be in charge of the family especially children. Women's household responsibilities impinge upon her career in different ways depending upon the nature of the profession as well as the stage of her career in it. This chapter concentrates on problems women scientists at various R&D institutes face as a result of their dual responsibilities of household and work, and how they perceive their effects on their careers.

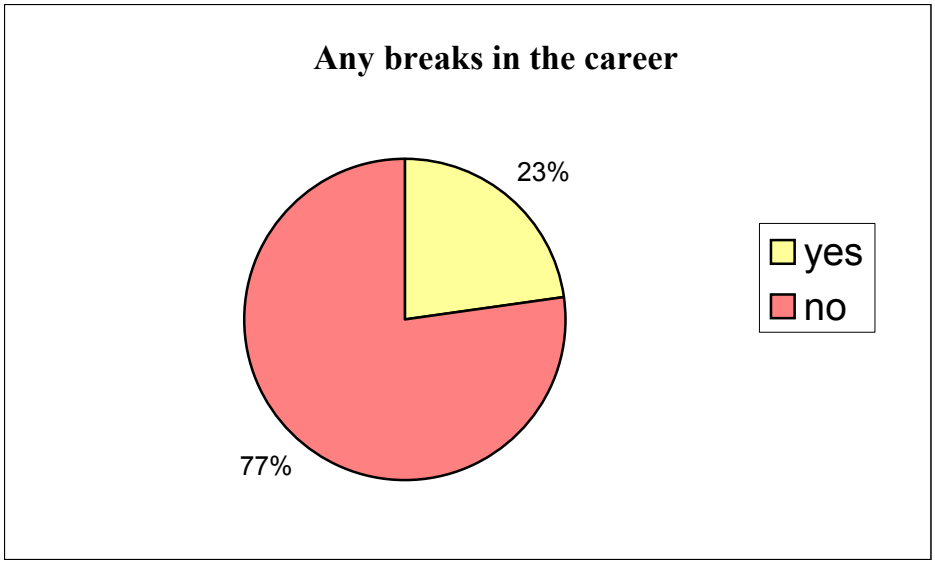
The reactions of the scientist the study included were highly illustrative of how such concerns are uppermost in women's minds. Women are mainly concerned about two family responsibilities that have significant bearing upon their careers, household chores and child-care. As a result they feel that they loose a number of opportunities. Such as they are unable to travel, except to a very limited extent, for purposes of work and are therefore unable to meet other scientists, establish and maintain research contacts, attend conferences or gain specialized training. Some of them also feel that they cannot work as

much as they would like to since they have to spend so much time with their family. In fact, studies on Indian women scientist show that the productivity of married women is not less than that of other women (Krishnaraj, 1991). Thus the matter is more complex. Lie's (1990) data from two samples of Norwegian academics suggest that while sex differences in scholarly productivity may not be due to family responsibilities alone, they are important inhibiting factors during critical stages of women's life courses. This is true not only during critical stages, but more critical in some disciplines and professional than others.

Out of the 280 respondents, only 117 are having the Ph.D., When the question of taking up research scholars were asked, 67% of them have not taken up any research students under them and do not have guideship. Only 33% of the respondents told that they undertake research mostly belong to.



Literature on women's studies often mention breaks in the career during the child bearing and rearing age as the reasons for slower career growth of women professionals. The outstanding feature of the data is that only 23% of the women scientist told that they had breaks in their career.



Another important point to be noted is that a majority of women who happened to have a break in their career try to return back to work for professional reasons. Most of them told they cannot afford to make a break in their career because of the difficulty of re-entry to the profession is difficult because of age-based restrictions. In the study though they had many difficulties and tremendous pressures, when their children were small, but decided to get along and they succeeded. And those who broke their career, small number has stated financial need as the reason for returning to work. Data concerning the difficulties associated with returning to work after a break is given. The two main reasons, which stand out, are the difficulties in finding a job and the attention required by the children. Family attitude also does not seem to be a major difficulty in getting back to the job.

Given the average age group is 45 years, and the median age of marriage 26-35 years, Most of the women have children.

Number of Children

It is important to note from the data that all the scientists surveyed had family planning. Not a single scientist has more than two children. This shows that small family is directly related with the education of women.

Distribution of children among married women

No. of Women	No. of Children
112	2 children
78	1 child
18	No children

Problem of Child-Care

Considering that the majority of women participants in this study have children, it is to be expected that child-care be the single most important problem faced by them. Studies of women academics in other countries show that there are a variety of attitudes toward and choices of child-care arrangements among women who are employed as well as a number of problems they face. Patrifocality is characterized by an underlying assumption that women are primarily responsible for child-care and have to cope with these problems in addition to the criticism they often face. Open and subtle- on how they are neglecting this important duty. Krishnasraj also comments on how the sexual division of labour within the family persists despite women's greater entry into paid employment outside the home and how, as a result, women feel deep anxiety and responsibility for family and children. Some women feel that they cannot perform their work related tasks in a satisfactory manner. Reconciling the two tasks however seems to be relatively easier for middle class women. There are two reasons for this. First families even those that are nuclear, are generally closely knit and women can get help from relatives in the extended household for child-care. Second, household servants are often available, although this is becoming increasingly difficult in Delhi. Not many institutions provide day care and private day-care centers are not common, although those numbers are now growing. However, not many studies exist about the cost and reliability of these arrangements.

The nature of child-care required varies depending upon the age of the child. When children are young, they need constant care and attention. Children also need emotional

and intellectual stimulation, and this differs considerably depending upon whether the caregiver is a grandparent, a day care teacher or a domestic servant. The responsibility for children does not end when they become old enough to attend to their physical needs. As stated earlier, Indian children generally live with the parents unless they get married. Indian families tend to be over protective of their children compared to western families and since dating is not permitted, parents are required to get the marriages of the children arranged. Therefore older children, especially girls, are considered just as serious a responsibility as very young children. As in Gill's (1990) article, many of the scientists interviewed have not had serious problems with the care of young children.

Primary source of satisfaction in personal life

The data shows that of the 206 married respondents 112 respondents are of the opinion that primary source of satisfaction in their life is growth & development of children. This data emphasize on the fact by some reason or other the women representation is directly linked to basic instinct of family commitment by women.

Your own career development	Being a help mate of your husband	Happy family life	Growth &development of your children
36	56	76	112

This chapter investigates the specific problems women scientists face because of family commitments. The details of the problems women scientist have had or are having with the care of young and older children and how it has affected careers. Subsequently, the study deals with, how to tackle this dual responsibility and in what way rules and regulations affect their efforts. A very interesting difference that the study observes was between younger and older scientists in their attitudes towards their family responsibilities. Women scientists are not given certain duties that would enhance their career experience. Women's chances of obtaining senior and more influential administrative positions are effected by social restrictions placed upon them. For instance many women do not travel around on theirs own. And they especially do not travel or socialize with male, colleagues or others. This is due to an inherent difference caused by

their gendered socialization, as well as due to societal restrictions. This retards their ability to communicate informally and network with other scientists. This also leaves an impression among the seniors that women scientists are less effective in accomplishing objectives simply because they are women.

The nature of family commitments

In general, a number of factors impinge upon the nature and extent of family responsibilities that women scientists shoulder, whether they are married or single, whether they have children, whether live in joint or nuclear families, whether parents and/or in-laws live with them and need to be looked after, and duties they have, if any, toward other family members. The overwhelming majority of women in this study have family commitments.

Has your career and work affected your married life

Sutherland (1985) points out that among the women academics in European countries that she studied, the proportion of unmarried women is higher than the rest of the population, but that this percentage is changing because more married women are now entering the academy than before. Although the two groups of participants, are not comparable, it is interesting that even this study shows a similar trend.

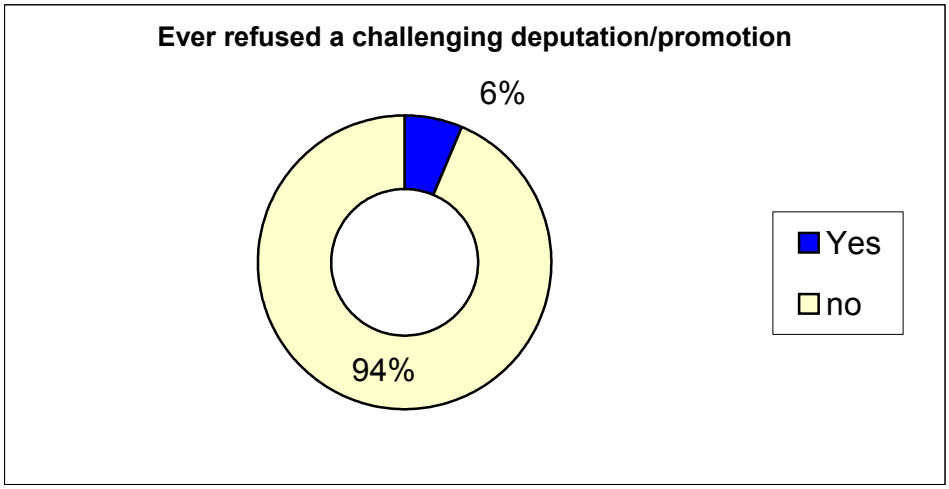
Very adversely	Somewhat adversely	No effect	Somewhat positively	Very positively
14	46	106	46	68

One of the family structures that existed in the past can be found even today, is what is commonly referred to "joint family". None of the participants in the study said that she lives in a typical joint family.

As per Gill's (1990) article, many of the scientists interviewed have not had serious problems with the care of young children. Some of them state this expressly; others do not mention childcare at all. Parents and parents-in-law have either looked after the

children or supervised the servants providing care. Some women said that they had succeeded in getting reliable servants to look after children, but according to them, getting a good domestic servant was a matter of luck and was becoming increasingly difficult. The women who said that they had good servants referred to the time when their children were young which were about 15 to 20 years ago. Most of the younger women who now rely on servants are having difficulty in getting a reliable person to whom they can entrust their children.

On the whole, solutions that women have sought for the problem of childcare have been individual ones. Some scientists, whose children are not grown up, mentioned some unconventional solutions. She feels that people should not depend upon the government to provide every facility. Child-care should be the responsibility of the community. The concept of institutional day-care has not caught on in India in spite of the problem having been identified as far back as the seventies. The underlying assumption is obvious. Women are not really supposed to out of the home and work; they should be taking care of the children.



Some women's careers have been affected in other ways by their family commitments. When they were asked whether they have refused any challenging offer, 94% of the respondents told that they have not, because may be they were not offered because of the

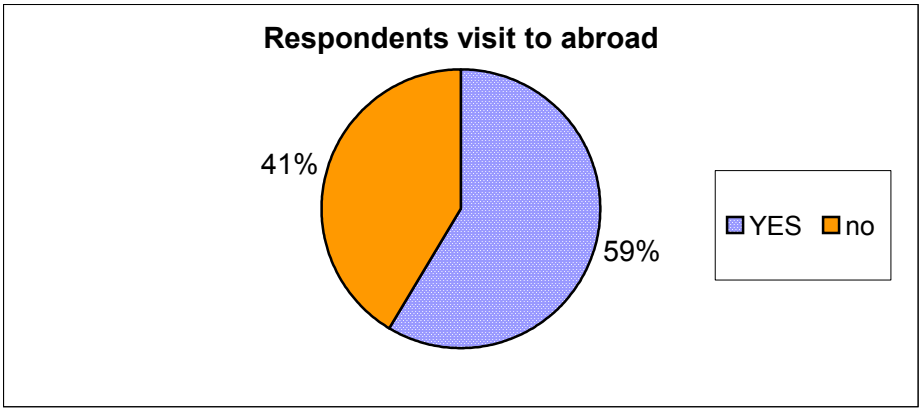
biased attitudes that already exists. 6% of the respondents told that they had to because of some personal & family commitments.

Reasons for refusing challenging deputation

Children too young	Health problems	Could not leave family residence	Not allowed by husband/parents
8	2	6	1

Adjustments

Do the women alone have to adjust their lives and schedules to accommodate these various obligations? Some problems are chronic, and others are acute at certain stages of their careers, but resolve themselves over time. Yes, but it seems to be the women's duty to cope with these problems. Two factors limit their ability to do so. The rules, policies and work conditions can make things difficult for women scientists. Other scholars are of the opinion that an academic career is popular because it allows women comparatively more time to perform their roles in the family because of short workdays and long summer vacations. When discussing the issue of the responsibility of older children, many women state that they cannot easily move out of the city leaving their children, even older ones behind. Thus they are unable to go for conferences, for training programs or even interviews for grant proposals. A number of women talked about how they had imposed certain restrictions upon themselves for the sake of family.



When a comparative data was sought to find out that the frequency of visits made by a male scientists & female scientists in an organization, it was found that the ratio of visit made by a male scientist is 4 times greater than the women scientist. When the team enquired about the difference between these, the chief told there is nothing biased about this figures, it is only a matter of choice or priority by the scientists themselves.

In most cases, women hire either part-time or full time domestic servants to help with household chores with children. Typically, women with young children have full-time servants, those who have grown up sons and daughters manage with part-time help. These servants, the majority of whom are females take care of chores such as dish washing, laundry and house cleaning.

Older children are not asked to share household tasks, and some women expressly stated they do not wish to disturb their children who have a heavy burden of school and college course work. Husbands help with child-care, rarely do they share the task of cooking, a chore of which most women said they are in charge. According to research, women are socialized to be more nurturing, more caring, and more supporting of relationships than men. This is true in most patriarchal societies and has been the case for centuries in India as well. It also means that personality, a result of socialization affects women's attitudes towards family responsibility and commitments.

In a group of women we studied, there is a slight but definitely perceptible difference in the opinions of younger women about their roles in the family in relation to their husbands, children and other relatives.

The perceptions of older women-40 plus age group- who are the majority, is traditional. These women has little or no career expectations for future, they say they have never been very ambitious, they are happy to have their careers take a back seat in relation to that of their husbands, and they take primary responsibility for their children. The younger women-below 40 years of age- few as they are, look at their roles differently. They are ambitious, have plans for the future in their careers and expect their husbands to play an important role in bringing up their children. Most importantly even if they do take

a major share of the responsibility of looking after the children, it is because they have to, they are certainly not happy doing so. There are few exceptions, the trend is quite clear. Many scientists told they had no great ambitions in her career and has felt a greater commitment towards her family. Women scientists emphasized the fact that women are capable of performing dual task. Young scientists are not easily satisfied, they find difficulty in transition from an independent working single woman to the role of a working wife and daughter in law.

Many were neither as blunt, nor as radical in their views about marriage and children. But they agree that is a burden. Women are generally overworked due to family responsibilities. In summary, patrifocal ideology affects women in science not only in terms of access to the discipline, but also later on their careers as scientists and researchers. The entry of Indian women to the public sphere came during the early part of the twentieth century as a result of liberal western influences on political leaders such as Gandhi. Women are therefore in the public service, but receive little support through institutional regulation. In addition, changes in attitudes of colleagues and superiors are slow. Two related aspects of patrifocality- that women are traditionally not a part of the public workplace and women are primarily responsible for family-affects the careers of the women closely. The influence of this ideology is exacerbated in the case of women in science because of the way scientific research is conducted in India.

The situation exists in most countries in the world and therefore should not be surprising. However in this case study, we must remember that we are looking at third world country, which has very few resources in laboratories and at a system of funding that is highly political. Every participant who has been abroad made this point. They could not believe how abundant the resources in laboratories abroad were and how much easier it was for them to work. Women, who cannot travel, attend conferences, training programs and thus meet with other scientists and be visible in the community of scientists. They are not necessarily less productive than men, but they feel that the effort they have to put in is quite disproportionate.

To conclude these findings have serious implications for the position of women in science. For one thing they show that these are both a question of ideology and of organization and the problem needs to be addressed from both ends - the family and the workplace. The study also shows that these are tricky issues that can be effectively unraveled only through in-depth studies such as this one.

7. OBSTACLES BEING A WOMEN SCIENTIST

The factors that affect the career of women scientists, as academics and as women in different R& D and S & T institutes of Delhi. In the context of the traditional family structure ' gives precedence to men over women- son over daughters, fathers over mothers, husbands over wives, and so on', creates several problems for women scientists in the day to day execution of their duties and results in their exclusion from some vital aspects of scientific research and practice, thus affecting their careers adversely.

Exclusion

There are several ways in which women can be excluded from the scientific community that range from overt discrimination in promotions and other appointments or more serious sexual harassment, to more subtle ways of ensuring that they play only a rather limited role as dictated by a patriarchal society.

We saw that there were several discrepancies in the practice of promotions, and the women scientists had been both positively and negatively affected by the policies for various reasons. Still, none of the women scientist in our case study complained that she had ever faced overt *gender* discrimination in the matter of promotions. In fact, 26 out of 280 women interviewed stated quite categorically that there is such discrimination. This is possible to some extent since most participants tended to see promotions as being fairly routine with the policy and procedures.

One of the women scientist interviewed, who preferred to work in a pharmaceutical firm but later she join at university. Because in pharmaceutical firm they prefer mostly men for that. It's more hard work, she went for an interview also. There they said, 'Usually we don't prefer women because they get married and go. Lot of problems is there for girls. So we prefer men who stick on to that job forever….'

Discrimination in Women Scientist

Women scientists tend to be discriminated against more often than man scientists. This discrimination takes place quite openly; there is nothing secret or subtle about it. They are for instance is discouraged from seeking admission in certain specializations. A professor in physical chemistry said that she was discouraged by the HOD when she attempted to enroll in the doctoral program in organic chemistry. Another HOD, in one of the other departments at the same school of chemistry, stated quit frankly in this interview that he does not encourage women students to join his department because he feels that they will not complete the program, and even if they do, they will not get a job, so the degree will be wasted. He is however unable to refuse admission to those women students who apply and who meet the requirements because that would be illegal. So there are female students in his department and almost all of them so far have completed their degrees, a fact that he admits quit reluctantly. Still, his is the only department among all the science departments studied where the number of women post-graduate students is abysmally low.

While interviewing the women scientists, we also interact with the senior officials (female/male). One of the HOD in a department said that, *I am not very favorable to admitting girls in my course. I am telling you frankly. I have been telling this to everybody. They (the women students) are well-behaved, hardworking, their performance is also very good. But then, you are never sure of them. Because it may so happen, in the middle of their studies they may suddenly discontinue because they are going to get married. In our department no one has discontinued because of marriage, fortunately….*
At the end of the second year they used to get married. One girl got married in the first year and continued. (…) But what do they do after this degree? They get first class, they get distinction. Do most of them after marriage practise their profession? They do not. (…) Because there is a practical barrier. What is the scope for them in industries?
And he continued relating a lengthy tale of how chemical industries do not recruit women at the level of managers: women are mainly secretaries or telephone operators. He also explained that the nature of the industry demands continuous work without any

interruption, even at night, and women cannot be therefore employed as managers or supervisors for security reasons.

Industrial laws for women employees in India tend to be protectionist- they prevent employers from hiring women for night shifts- instead of being regulatory, that is, requiring that employers provide special security for women at night. Important questions such as these then arise: Do these laws work against the employment of women in certain industries or within an industry in certain types of jobs? And how does this fact that women are excluded from certain industries then impact the access of women to higher education as well as the status of women?

In the departments they prefer not to take a female student because they assume that the student will get married and discontinue her education. Also, some faculty, both male and female, prefer male doctoral students since they can run around and get a job done more easily than women who are not as mobile owing to social restrictions.

A women scientist stated that at the time when she applied for this job one of the senior male scientist is hesitating because the application is a women and since the job involves a lot of traveling around and heavy work, he prefers a male. If he does not get one, then he will consider taking a female.

Sexual Harassment

The most extreme form of social exclusion is sexual harassment. Sexual harassment included extreme harassment in which male scientists expected to receive sexual favors from their juniors as well as verbal and other forms of abusive behavior. To have been sexually harassed is a matter of scandal especially for a young, unmarried women, and in the orthodox society it doubly intensifies her feelings, since she is often the one to be blamed and treated as if she invited it upon herself. Most of the data we collected in our case study on this subject were acquired through informal chats with the scientists. Also most of the data are on the sexual harassment of women doctoral students by their male thesis supervisors, since that is more common. Women faculty were quite candid about

these matters during these conversations they even named faculty who had such dubious reputations but they don't allow us that their statements to be officially recorded.

For instance, a student who had been harassed by a professor in her department, and when she complained about the matter to the HOD, he asked her to give her complaint in writing. She refused to do so, since she was afraid that it would probably jeopardize her career and life. So the men were never reprimanded. And that is not the first time he had harassed his students.

Among the 280 women scientists, there is only 16 women scientists mentioned a chronic problem of harassment of women by a group of male faculty. From the observations and interviews it was evident that faculty do little to counter sexual harassment. And though women did not complain that they had been discriminated against or had been harassed, in day-to-day matters, many of them felt that they are treated differently, often unequally, by male colleagues and authorities. These feelings of male faculty toward females manifest themselves in complicated ways; through indirect and sometimes unconscious sexism, but at other times extremely blatantly. One of the participants recounted how men treat the women condescendingly sometimes, without even realizing that they are doing so. She related how her HOD convenes committees for various administrative purposes and if there is a committee without a man on it, he says thing like, 'Can you manage?' or 'Are you sure? You are all ladies. Shall I put a man along with you?' He is extremely well-meaning, but patronizing, nevertheless.

Other is not as pleasant, as we found out in the case of one of the HODs who were quit arrogant when we interviewed him. *The point he was trying to make was that the male scientists, professors, readers and lecturers in his department are more productive than the women scientists, professors and lecturers. In his opinion, women are less productive, because of their domestic commitment. Both husband and wife are working, there are grown-up children. Their profession is secondary. Exceptions are there some has taken their assignment very seriously.* But there are males in that category as well. So we should not equate it.

The Problem of Security and Safety for Women

Although sexual harassment by colleagues is not one of their fears, the problem of safety and security was mentioned by some scientists when they were asked if they had ever found it a disadvantage to be a woman.

Most women move around quit freely, when they go for conferences, meetings, etc. But mainly during daylight hours. Women do not generally drive or use public transport such as taxicabs at night. According to a women scientists interviewed, sometimes it is very difficult to attend the conferences in the other cities, the way she managed to reach the conference site was not just an adventure, but a rather frightening and nerve-racking experience. She concluded that women have to often faced such problems and that they have to be very careful.

Many women scientists expressed concern about the lack of proper transportation and safety. As a result, they do not like to spend longer hours in their laboratories or work during weekends. In some of the institutes the e HODs interviewed, mentioned that they had to be extra careful of proper transportation and safety. These problems are not mentioned in some institutes. After a day- long sessions with the scientists in an institute, it was six o'clock in the evening and beginning to get dark. There was no transportation facility available in the campus.

Social Restrictions and Women's Mobility

Another manner in which patrifocality manifests itself and mandates women have no real place in the public arena is through restrictions on women's mobility and behavior. These restrictions act as serious barriers to their advancement as scientists. First, women find it more difficult to lobby the higher authorities on matters relating to their careers such as promotions. Second, women feel that they are not as effective in some of the daily work-related tasks because they cannot move around geographically as freely or because they are not expected to behave the way men do. Furthermore, male HODs also accept that this is a disadvantage for women, an impression which affects their chances of

upward career mobility. Finally, women are unable to develop and nurture informal contacts with officials in funding agencies. This is especially significant since such interactions are very important for obtaining research grants. Some of the male scientists also probably feel that way, but it is the perception of the women that men are less intimidated and hence more willing to follow that route.

Women expressed inability to interact freely with higher authorities because the society misinterprets their actions. Women scientists are not given certain duties that would enhance their career experience.

The second problem is their fear that they are not able to get things done effectively on a day-to-day basis simply because they are women. This lack of effectiveness is a bigger problem for those women who are HODs themselves. For instance, one woman scientist said that she had to stay late in order to able to complete her administrative tasks, but found it very awkward to go home after sundown, even though security was not the problem. Her family did not appreciate it, and the neighbors gossiped. That gossip abated somewhat as she grew older. Another women HOD said that she finds it difficult to invite visitors and schedule meetings, lectures, workshops or conferences because, as a woman, she cannot entertain them in the evenings, take them out to dinner or shopping, etc. During the period of data collection, we observed that in general, women are not deputed to perform such duties.

Exclusion from the Scientific Community

The most serious obstacle faced by women scientists and one that is unique to researchers in the sciences is their inability to lobby for research grants when their proposals are being evaluated by funding agencies. This problem is due in part to the politicization of the academy and the manner in which science is practiced. According to many of the respondents in this study, research grant decisions can be influenced by informal chats and interactions between scientists and funding agency officials, but women are not expected to 'go down to that level'. Those who complained are fairly successful scientists, they have been successful in getting grants for research and have a number of

publications to their credit. But, according to them, the effort that they have had to put in has been substantially higher than that of men in similar situations.

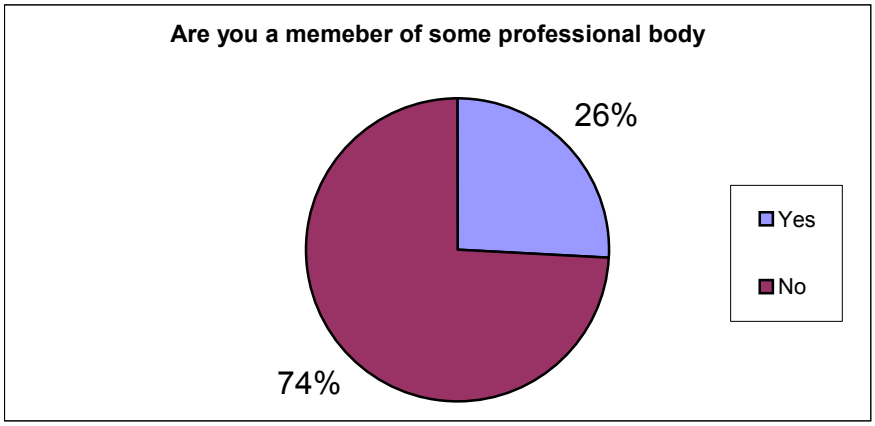
Women express strong feelings against the need to exercise such 'influence' in order to be successful. They feel that such grants should be based only on the merit of the proposal, who are absolutely certain that they are in science for the love of it, who enjoy doing their work, and who feel that 'science is our life', do manage to get quit a bit of research done in spit of such pressures. Yet even they feel that could have done better.

8. ENCOURAGEMENTS & INCENTIVES

It is very important that women scientist are encouraged and helped to establish themselves as professionals. They need to be given opportunities to enhance their professional image through the institution of prizes and awards for their contributions. This will immensely contribute to creating awareness amongst employers, parents, teachers and schoolgirl themselves.

Certain modifications in rules need to be provided to women professionals to help them cope up with the dual responsibilities of the home & profession. Sanctioning of the leave up to one year and flexible working hours are some of the suggestions often made. These facilities are relevant to the child bearing and rearing period.

Though there are forums of women scientists existing, they are not very active. The respondents were of the opinion that there should be some forum, which can take up the issues related to women scientists. This need is recommended strongly by the respondents. The forum should take up the organization of meetings and workshops on various facets of women in R&D sector. This in turn would help in publicizing the problems and creating awareness.



Promotional effort by Department of Science & Technology

Women constitute an important section of the workforce. However, the present situation of a large number of well-qualified women scientists who due to various circumstances have been left out of the S&T activities needs to be addressed. The problems faced are several but, significantly most often the break in their careers arises out of motherhood and family responsibilities. The option for revival of their profession is presently unavailable due to restrictions in age and qualification and no system at present address these issues.

The "Women scientists scheme (WOS) has been evolved in this context, by the Department of Science & Technology (DST) for providing opportunities to women scientists and technologists between the age group of 30-50 years who desire to return to mainstream science and work as branch-level scientists. Though this endeavors of the Department, a concerted effort would be made to give women strong foothold into the scientific profession, help them re-enter into the mainstream and provide a launch pad for further forays into the field of science and technology, both from the point of view of pure science and its application to societal development

Under the scheme, women scientists are being encouraged to pursue research in frontier areas of science, on problems of societal relevance and to take up S&T based internship followed by self- employment. Three categories of scholarships, with research grants are available for Indian citizens. Scholarships are envisaged in institutional and non-institutional modes. Under the institutional mode, national and state-level organizational, recognized universities, educational institutions and R&D laboratories would be considered for grant by the department.

S&T based nongovernmental, voluntary and non-profit organizations working on societal issues and having the legal status of a registered society would be considered under the non-institutional mode. The various categories of scholarships available are indicated below:

Scholarships for research in Basic/ Applied sciences (WOS-A)

This category of scholarships is meant to encourage women scientists to pursue R&D in emerging and frontier areas of science and engineering. The women scientists will be provided flexibility to undertake research at a suitable institution depending on their area of interest. These scholarships are expected to provide opportunities to women scientists to get into scientific profession so that they are able to contribute to Science & Technology development. The overall concept is to ensure that large numbers of women scientists enter scientific activity in the country. DST has vast experience in promoting basic research in frontier areas of science and engineering and this new initiative will go a long way in bringing a large number of women scientists towards contributing to basic research.

Scholarships for research for research in S&T based societal programs (WOS-B)

This scholarship is specially intended to encourage women scientists involved in research and application of innovative solutions for various societal issues. This scholarship would be made available to the aspiring women scientists willing to work for the search, design adaptation and demonstration of Science & Technological skills and Techniques for improving the income generating activity and reducing drudgery of weaker section of our society in different occupations, capacity building on the societal programs at the grass root level etc.

Internship for the self-Employment (WOS-C)

This category is mainly focused to provide an opportunity to women scientists for self-employment by utilizing their specialized domain knowledge in areas such as patenting, proof reading, science journalism, technical translation, clinical pathology labs. Medical Transcription etc. The objective of this scholarship is to create a large pool of trained women workforce with experience in the diverse areas mentioned above and building up of a professional network. The scheme is meant to encourage women candidates, preferably those having a break in career and not having regular employment.

9. CAREER OPPORTUNITY IN OTHER PROFESSIONS

This chapter reveals interesting facts on imbalance distribution of women and men in the occupational system-specially in the field of S&T. Even today the total pool of S&T personnel in the country is very much a man's domain. Participation of women in science and technology is not only an important aspect in the social and economic development. All over the world the low participation of women in scientific profession has been a matter of concern. And the need for correction of the situation is their contribution to the field of Research & Development is preamble to formulation of appropriate measures.

It is an important issue recognized by all the societies, that education and career is not only the right of women, but also a key factor, which contributes to the economic and social development plans and programmes, Women's education and participation accelerates social and economic growth. The issues related to women constitute over half the global population, yet in many professions their contribution is small.

Women's empowerment has been a central issue on the agenda of various developmental sectors for so many years. Inequality between men & women is one of the most critical disparities in many societies. Women's participation at work is dependent on many factors that include caste, class, cultural practices, marital & educational status and agro-ecological conditions. Although the process of privatization as well as globalization has provided new opportunities for women, still there is a need to establish the positive link of these processes so that the cause of women can be addressed directly.

Education & career decision

Higher education is the most crucial sector in the educational system of a country. In fact this sector is the backbone of any industrialized country. This sector not only develops human capabilities to a maximum extent possible but also empowers a person with

knowledge, perceptions and ideas which will help him/her to contribute to the development process of society more meaningfully and rationally. However, higher education has remained still a after a cry for majority of the people in India and more so with regard to women. The participation of women in this sector to total enrolment in higher education is very low in the country.

We have seen that participation of women in higher education is highly disproportionate as compared to their male counter parts. A small number of women only reach the highest level of education in India. However, these level-wise participation rates hide a very important of women's enrolment reveals that women are highly underrepresented in professional courses and programmes.

A close look into the pattern of enrolment of women in higher education reveals another important aspect of their participation in various types of courses. In 1988-89, in Ph. D. courses out of 31386 who have enrolled, 10439 were girls. These figures are highly disproportionate to the total number of women working scientists working in R&D. Similar is the case of M. Sc. classes also. When 73347 have enrolled 24410 are women. In medicine also, the enrolment ratio of women does indicate a positive trend. But given the need for female medical professionals in the country women are still underrepresented in this faculty. They seem to excel only in the field of education.

The trend in the employment sector:

Professional and technical occupational category is an important constituent of overall occupations in any country. Though it occupies the middle level status in the hierarchy of occupations, it forms the core of the white-collar job market in India, and in most of the developing and developed countries the tastes and aspirations of the rising middle class are geared to these occupations. In India, over the years, this occupational category has gained considerable importance and momentum. Development process of society affects different sections of its population differently. On the same line of argument, the development process of the Indian society has also affected its different sections, especially men and women differently. The last three decades, the Indian economy has

witnessed a structural transformation, broadly in favors of the industrial sector. However the development process instead of benefiting women has put more burdens on them.

The institutional and social factors in our society have given new dimensions to gender, particularly gender specified jobs in our economy, which is reflected in the disproportionate representation of women across occupations and the corresponding differential status enjoyed by them in the labor market. The common denominator is gender, and this concept of gender is female subordination which has its origin at home, and this concept of gender has been transmitted outside the home over to various sectors of our economy - education, employment etc. Therefore, understanding of the gender differences in representation and status of individuals in various sectors in the country is important.

The distribution of women employees among various occupational divisions in the category shows that the largest segment of women employees both in private and public sector was constituted by teachers, and their relative percentage is high in the private sector. The second most important division in which women could be seen in considerable proportion, in terms of their total representation, was medicine, and their percentage was relatively more in private sector. As social scientists, women were mainly concentrated in the public sector. Women's participation in the service sector is quite traditional first, because employment in this sector and in its various divisions does not require much advanced educational preparation nor it requires very high level of professional or technical skills.

Position of women in selected services:

There are some services the selection to which is based on successful performance in the competitive examinations, held at all India level and in rigorous personal interviews. Most of the service in this category is comparatively "prestigious" and well paid. An examination of personnel positions of various services, however reveals that these prestigious' and well-paid and well-provided services are still predominantly male preserves. Entry in these areas by female is very marginal.

A service wise analysis reveals some more interesting aspects of the inter-service distributional patterns of women employees. Getting into foreign services is considered a highly priced achievement. However the number of female personnel as compared to their male counterparts in these services are marginal. They constitute only 9.58 percent of the total personnel. Women representation could be found still very poor in the Indian customs and central exercise services. They constitute only 5 percent. Similarly, in income tax services the percentage share of female personnel to total is highly disproportionate to their numbers. Though exact data is not available as per the date the data of 1987 reflects and speak a great deal about women's under representation in various services. In the Indian Audit and accounts services also their number was marginal. They constituted only 10.01 percent in 1987. In Indian Postal Services, the share of female personnel was only 10 percent. Some more important services where women have been dismally underrepresented are Indian Economic Services (1.99 percent), Indian Statistical services (4.72 per cent), Indian Forest Service (0.57 percent) and Central Secretariat Services (3.36 Per cent). The pattern of distribution of women employees among various divisions of professional and technical occupations in both private and public sector perhaps indicates the fact that such a distributional pattern is the outcome of existing social traditions and policy directions of the government. The existing socio-cultural patterns and traditions influence policy directions and in turn influence individual aspirations and choices. This is reflected in the countries five-year plan. However, women's share in engineering and other related technical occupations including physical sciences was quite marginal in 1982. Similar situation could also be found in the U.K. and other developed countries. The changes in social attitudes and institutions cannot be brought about very rapidly. It is however, necessary to accelerate this process of change by deliberate and planned efforts. Responsibility for this acceleration has to be shared by the state and the community particularly that section of the community which believes in the equality of women. There is increasing awareness amongst the policy makers, the society and women themselves about the need for enhancing women's economic participation as a means of advancing their status. However, significant improvement in women's economic participation is yet to come

about and there is a long way to go, particularly in the face of continued conservative societal mindset in several parts of the country regarding the role of women in the world of work.

There are many research studies conducted regarding women and their employment status. But studies with specific focus on women scientists R&D sector has not been done so far. The study is an attempt in an integrated manner and hence it would be interesting to analyze the effect, that increasing women earning university degrees, receiving professional training and entering the workforce, have had on the traditional imbalanced distribution of women and men in the occupation system in the field of S&T.

Women who choose science as a career are indeed a special group. They are committed both to an academic career and to the pursuit of science struggling against formidable odds. The problems of women in profession have been often as primarily problems that can meet by creating support services. But there are more important attitudinal problems as well. Even if adjustments are made at the behavioral level but if basic perception is not changed, problems will remain. Under the best of the circumstances-a working women carries maximum responsibilities - the job outside and the housel-keeping job at home. At some points she experiences a conflict about the primacy to be given to one or the other.

Distribution of women in S&T profession

Commitment and creativity in a profession are not merely functions of individual competence or excellence, but is product of the social environment as well. Opportunities for involvement in challenging & stimulating activities are essential for occupational or professional identity leading to development of competence and greater productivity. Restriction of opportunities not only creates frustration, but reduces effectiveness.

Some of the scientists told us during the interactive meetings that Intelligence and imagination alone are not sufficient to make successful professionals-acceptance, recognition and challenging interaction with other professionals are necessary for creative

work. When the question of low representation was asked to the respondents they had a mixed kind of opinion.

Reason for the low representation of women scientist

The mode of operation of the scientific research community makes it different for women to carry on in an equal footing with their male counterpart in S&T oriented jobs. Not only the time commitment is based on a male pattern of work and career, men often find it difficult to include women in the social networks and to appoint women to positions of authority over women." Continuity of career' being the norm for the male, society does its best to ensure this but where women are concerned society's attitude remains ambivalent, discontinuity in women's career being accepted as natural and inevitable.

Most parents discourage their daughters in this profession	Non acceptability of women scientist in the Indian society	A job in this is too demanding for women to combine with family responsibilities	Women today want to work occasionally and on part time basis	Difficulty to suitable placing in job
62	11	116	13	78

The personnel policy for women professionals required an approach and combination of measures enabling them to fulfill their multiple roles of professionals as well as home builders, without undue tension. An analysis of the "division of labour" among researchers by a study of NISTADS also reflects as unequal treatment for the women professional on a day to day level The study shows that while women scientist spend on an average 64% of their time on activities such as experimental development work inside as well as outside the research unit, men spent 60% of their time for such activity. For other scientific activities viz. teaching, consultancy, extension, documentation, standardization, women scientists spend about 26% of their time against 30% for men. But in administrative activity within research group women scientists spend a low figure of less than 4% time relative to men who spend 7%. The latter indicates hierarchical distinction of labour in science against women. The women scientists have also seen to have less opportunity to participate in professional functions such as being members of scientific societies, editors of journals and members of committees of other institutions.

Level of involvement of scientists in different R&D activities

Type of activity	Women	Men
Analytical Dimension	47	64
Identification of area of Interest	29	42
Problem precision, conceptualization Formulation and analysis	47	60
Orientation and perception of methods And techniques	56	60
Research design	51	62
Empirical: Dimension		
Literature review	66	57
Collection and production Of data including experimental work	65	74
Results: Detailed analysis, interpretation And conclusions	52	62

Source: (Chakravarthy, R) Productivity of Indian Women scientists problems & perspectives. NISTADS (1986))

A recent NISTADS study on Indian women scientist have revealed an emerging trend of comparative increased of younger women scientist in total S&T stock, but low representation of women above 50 years. The latter phenomenon has been explained as a consequence of the initial low entry of women in the area of scientific research.

Age group	% in total women scientists	% in total Men scientists
30 and below	35.0	16.1
31-40	36.4	42.0
41-50	25.4	31.0
50 and above	3.3	11.0

Source: (Chakravarthy, R) Productivity of Indian Women scientists problems & perspectives. NISTADS (1986))

Teaching as a profession:

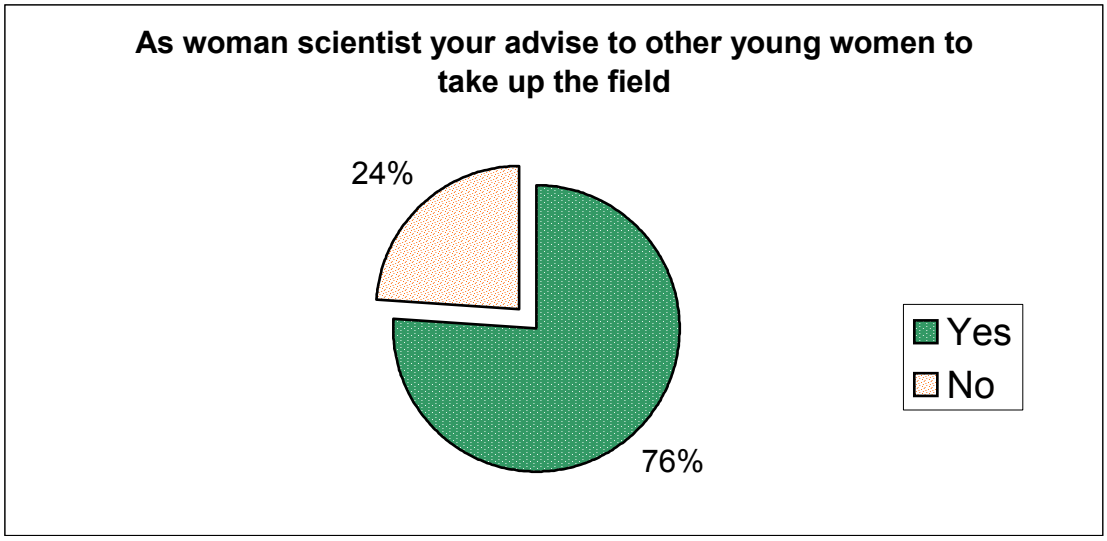
Teaching is the only profession where women are highly concentrated as compared to their male counterparts. There are several; reasons for women's concentration in this occupation. First the time stringency in this occupation is considerably less, besides flexibility of school hours. These factors seem to help women to cope both with their household chores and professional engagements and in that occupation hours of work and holidays almost totally congruent with the care of families. Second, given the nature of teaching learning process, the teaching job is not complicated and demanding. Yet, teaching profession is being held as a respectable profession in India.

All these factors contribute greatly to the feeling among women to aspire for teaching profession. Social attitudes also are responsible to great extent for women's participation in teaching-it is not considered a male profession only. The social attitudes seem to have influenced government's policy decisions too. Here, an attempt has been made to examine women's employment as teachers various levels and faculties from school education to collegiate and university level education.

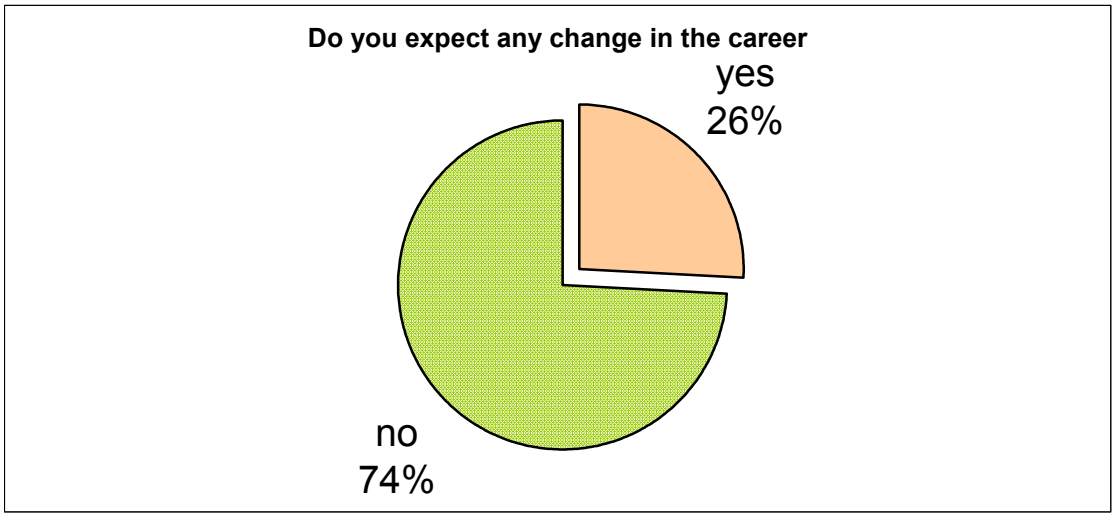
Type of Institution	**Men**	**Women**	**Total**	**Percentage of women**
Universities	27,461	4,322	31,783	13.59
Institutions deemed to be universities	1,876	347	2,223	15.60
Institutions of national importance	2,580	223	2,803	7.95
Research institutions	1,047	161	1,208	13.32

Women employment in other institutions for higher education

Institutions for higher education (Degree standard and above)	**Men**	**Women**	**Total**	**Percentage of women**
Arts, science and commerce	1,31,687	45,129	1,76,816	25.52
Agriculture & Forestry	4,405	404	4,809	8.20
Business management	299	28	327	8.56
Education	3,717	1,581	5,298	29.84
Engg. Tech & Architecture	12,001	860	12,861	6.68
Law	2,270	185	2,455	7.53
Medicine & Allopathy	13,720	4,346	18,066	24.05
Ayurveda & Unani	2,095	408	2,503	16.30
Homeopathy	1,282	127	1,409	9.01
Dentistry	432	268	700	38.28
Nursing	16	304	320	95.00
Pharmacy	443	94	537	17.50
Public Health	91	17	108	15.54
Music & Fine arts	997	306	1303	23.48
Oriental Studies	2807	314	3121	10.06
Physical education	527	92	619	14.86
Social work	138	111	249	44.56
Veterinary science	1685	63	1,748	3.60
Other institutions	420	196	616	31.8



When the question of how to increase the representation of women scientists was discussed, a question was included to take into account what the existing scientist has to say to the future generation. 76% told that they wish more and more girls should come to the profession, because it is challenging and rewarding. The 24% who spoke against the profession told that there is much pressure and directly or indirectly it affects your family life.



If not satisfied with the present profile, we asked them whether they would like to make a change in their career, 26% told us that they are expecting a change, in which 3% told that they wish to go abroad /migrate for better opportunities. 11% told that they want to

go into academic line, because it will give them satisfaction, money & convenience. 12% told that they are interested in the private sector, because the infrastructure, encouragement and the incentives are higher in the private sector. 74% told that they don't expect any change and they are very satisfied & happy with their present career and they wish more and more women should come in for this profession.

This chapter has been a fact facing exercise in the Indian context. The facts establish provide the reference points needed to understand the current status of women in scientific profession. There are different set of issues and problems concerning women scientists. The first set relates to their participation in higher studies and second to the problems encountered in the profession.

10. CONCLUSION

This study documents the unheard voices of the women scientists: women, who, as middle class, highly educated academics and members of what have traditionally been a well-respected profession, should be among the most privileged in the country; yet who, by virtue of being women, are marginalized by a patriarchal society and a patriarchal science.

The study goes beyond the question of access of women into science, to investigate the perceptions of academic women scientist in regard to different aspects of their careers, their teaching and their research, their lives, and their views on science and its value. The following are the main areas of analysis:

- Perception of career paths: career orientations and priorities, successes and failures;
- Relationships with colleagues, male and female;
- Research interests, communication strategies, linkages with other scientists;
- Gender issues at the workplace and the intersection of family and work-life; and
- Perceptions of science and its value

Through ethnographic techniques such as in-depth interviews and participant observation, the study develops a 'collective biography' or career life-histories of participants. Also, by situating the study in the workplace of the respondents, we have been able to analyze individual issues and concerns as well as institutional causes and effects.
What is the portrait that emerges from the study?

FINDINGS

This study makes a significant contribution to two areas of scholarship: feminist research on women in science from a comparative and research on Indian higher education and the professoriate, with an emphasis on national issues in scientific research. The study also combines two methodological approaches by asking major questions of the participants themselves and also by objectively observing them in their work situations.

Most of the respondents in this study are from urban back-ground and have had their early education in private schools, where the medium of instruction was English as well as Hindi. The average age of the ground was 40 years. An overwhelming majority were married to men with a comparable educational and professional status. Judging from their own positions as academics and from that of their husbands, the participants in this study belong to the urban middle class. By Indian standards, they are fairly well-off. Many of them own a house, a car, and their children have been or are being educated in private schools in the city.

Both class and caste have played an important role in their educational decisions, as has also family-based structures such as patrifocality. Most of the women here are from the class in which, with minor exceptions, the higher education of both boys and girl is taken for granted. The majority of the participants are also from the 'forward' or upper castes which have a long-standing tradition of education. Thus many of them say that their 'family atmosphere was encouraging', in other words, supportive of education for children, or that both parents 'encouraged them to study further'. It is not clear that this is related to the educational level of their parents: in most cases the fathers are professionals, but the mothers are not as highly educated. Yet, respondents do not say that their fathers encouraged them more than their mothers did to go ahead and work for their highest degree. Those who are familiar with Indian families of this class will easily understand that it is the overall cultural milieu in a family, not merely the educational

level of individual members that has an influence on educational decisions. On the whole, families have been very supportive: half the respondents said that they are more educated than all of their siblings, although owing to the influence of patrifocality, this usually meant that, in many cases, boys are more educated than their sisters.

Overall two portraits emerge, as we have classified earlier: that of Indian women as scientists and that of Indian scientists as women.

WOMEN AS SCIENTISTS

Problems in Research

The most serious problems which affect research are non-cooperation. As a community of scientists, the group lacks cohesiveness. There is almost no collaborative research among scientists, male or female. Many women complain that interactions among faculty are successful only if they are confined to simple requests, such as for the use of equipment, and that collaborative research can prove to be very stressful owing to uncooperative attitudes among scientists.

Discrimination

Women scientists tend to be discriminated against more often than man scientists. This discrimination takes place quite openly; there is nothing secret or subtle about it. They are for instance is discouraged from seeking admission in certain specializations or handling important projects or attending conferences in India or abroad.

Working Hours

Uncertain and long working hours are important factors towards women opting out to take up scientist as profession. This fact was recognized by overwhelming respondents. Even those have opted this profession has also preferring administrative work, in which working hours are fixed.

The Problem of Security and Safety for Women

The problem of safety and security was another problem women scientists told when they were asked if they had ever found it a disadvantage to be a woman. Most women move around quit freely, when they go for conferences, meetings, etc. But mainly during daylight hours. Women do not generally drive or use public transport such as taxicabs at night.

ACADEMIC SCIENTIST AS WOMEN

Organization of Scientific Research

The manner in which science is practiced is perhaps the most serious concern, and one that is unique for the women scientist. Family responsibilities also restrict travel for conferences or training. Moreover, even when they are in New Delhi, there are certain social restrictions that preclude women from socializing with male or female officials after office hours. Many women do not like the idea of having to lobby for getting a project sanctioned and are therefore not really opposed to these social restrictions. But they see themselves at a disadvantage because such practices in science require them to transgress their principles.

Child-care

The agencies does not provide institutional child-care and although older scientists say that they have not had many problems, younger scientists, it was observed, are quit harassed with problems of child-care. Most of the older scientists said that they were given a great deal of support from their extended families or that they were able to find 'nannies' for the children. They agreed that it is becoming increasingly difficult to find adequate child-care. Lack of institutional child-care is obviously a reflection of a systemic bias against the employment of women outside the home. This bias exists even in western countries and child-care is an acute problem worldwide. But, as see in the discussion on informal factors that affect career paths, women at the institutes cannot afford to take time off to look after their children. Re-entry to the profession is difficult because of age-based restrictions. In this study, the only woman who was forced to

interrupt her career said that she is having a variety of problems in her career because of her age.

Exclusion from the Mainstream

Women's chances of obtaining senior and more influential administrative position are affected by social restrictions placed upon them. For instance, many women do not travel around on their own. And they especially do not travel or socialize with males, colleagues or others. This is due to an inherent diffidence caused by their gendered socialization, as well as due to societal restrictions. This retards their ability to communicate informally and network with other scientists. It also creates the impression among heads of departments, male and female, that women are less effective in accomplishing administrative objectives simply because they are women.

Discrimination and Sexual Harassment

Discrimination is subtle and takes place because of both the attitude of women scientist towards their cultural role as women and the attitude of male authorities toward them. What are more overt are the unequal gender relations in the workplace that reflect the patriarchal views of male colleagues and subordinates. This is clearly observed in day-to-day matters, in which men tend to treat women faculty as inferiors, sometimes in the most well-meaning manner; secretarial and other administrative staff does not respect them as they would the men; heads of departments are often patronizing; and men expect women to adjust to them in all work matters.

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Specific Recommendations under Project "STATUS OF WOMEN SCIENTISTS IN DELHI: IDENTIFICATION OF PROBLEMS & THEIR SOLUTIONS" Undertaken By SOCIETY FOR ENVIRONMENT & DEVELOPMENT, DELHI

Following recommendations based on the findings of the above mentioned project are made by the research team of the SED.

1. Although the study has successfully identified the problems of women scientists are facing in Delhi and lower participation of women in S&T, there are need for more research and studies on region wise to assess the gravity of the problem, factors responsible, efforts made so far, bottlenecks etc.

2. Media both print and electronic should be persuaded to provide more coverage to women achievers in S&T to encourage more women participation.

3. Mass Awareness campaign be launched in schools & colleges to encourage girls to pursue science and choose scientist as career option. NCW & DWCD and DST should collaborate with scientific voluntary organizations to take up campaign.

4. Inequality and patriarchal society is responsible for less number of women taking science and pursuing higher education in this discipline. There is need for education & awareness programme among the lower and lower middle class for treating their daughters equal to their sons in education.

5. There should be incentives in terms of scholarships for girls to carry out higher education in science.

6. Although fair number of women scientist are in life-science and medical science, very few women scientists are in agriculture and engineering field. More girls be encouraged to take higher education in these fields.

7. Policy should be framed for encouragement of gender participation in research projects. NCW could work with UGC, CSIR, ICMR, ICAR and other agencies to made it mandatory to have at least one women in every research project.

8. Since child-care is identified major bottleneck in choosing scientist as career, child-care facilities such as crèche be set up in major R&D institutions.

9. Transfer policy of women scientist and their spouse be made in such a way that women scientist need not to scarifies her job for sack of family. In rare cases she should be given flexibility to rejoining after break.

10. Basic facilities should be provided in R&D institutes as per requirements of women scientists like toilets and transport facilities during odd hours as provided by call centres.

11. NCW should run campaigns on sexual harassment of women scholars in universities and scientists in institutes.

12. Gender sensitization for both male and female scientist in major R&D institutes. This can be done through UGC, CSIR, IAIR, ICMR etc. in collaboration with NCW and respective state women commissions.

13. Formation of Task-force at Institute level comprising senior scientists including women, intellectuals and other eminent persons to take stock of the situation on regular basis, suggest actions and follow-up measures.