

Internet Equalizer?

**Gender Stratification and
Normative Circumvention in Science**

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Abstract

Gender and connectivity initiatives intended to promote development both assume that the Internet can have a significant impact on the careers and lives of women. This assumption is important to test, given prior research establishing the educational and organizational limitations on women in professional careers that increase the likelihood of restricted networks. Initial quantitative research available on the impact of the Internet based on quantitative data from 2000, shows improved access to the Internet for both men and women, but no evidence for Internet effects on productivity or professional networking. This study employs recent qualitative data from scientists in Kerala that modify these conclusions and provides some grounds for optimism. The domestic context, so important for women in a patrifocal society, has created conditions for change, as the interest in children's education and the presence of home computers has begun a process of 'circumvention' of gender roles that demands further study.

Internet technologies hold the promise of globalizing science by increasing communication, facilitating international collaboration, and improving access to information. Although previous works have examined the issue of gender differences in scientific attainment from an array of angles (Campion and Shrum 2003; Fox 1995; Fox and Long 1995; Gupta and Sharma 2002; Keller 1995; Kyvik and Teigen 1996; McElrath 1992; Ranson 2003; Wajcman 1995; Xie and Shauman 1998), the impact of the Internet on the careers of female scientists in developing areas has been neglected. This paper opens a sociological investigation of the degree to which the Internet will affect the resource acquisition capabilities of women scientists. We begin with the premise that gender inequalities in Indian science are not based on any widespread prejudice regarding the intellectual capacities of women, but rather the physical immobilities associated with patrifocal gender roles. These immobilities have been the most important limitation on female resource acquisition and career attainment. The concept of ‘circumvention’ is employed to describe perceived indications of change involving the use of Internet technologies for the acquisition of information and social capital.

If, through the use of Internet, female scientists are found to be circumventing gender codes that govern behaviour and limit productivity, the prospects of Internet technologies can be extended to include furthering social change. Based on empirical research among scientists in agricultural, environmental, and resource management fields in the university and government sectors in Kerala, we argue that in the chequered backdrop of the system of gender stratification in the developing world, the Internet has begun to function as an

equalizer, enhancing professional networks and knowledge entitlements of women scientists. In the long run this may heighten their resource acquisition capabilities and productivity. The theoretical underpinning of this postulate will dwell on the issues of inequality between sexes and the masculine nature of science, which are situated in the larger question of patriarchy as a social construct.

Our empirical data was collected in the state of Kerala in south-western India. Kerala is regarded as a distinctive regional setting, known for its high levels of social consciousness, political activism, and attention to women's issues. Ironically, it is also known as a land of paradoxes, known in the academic parlance as the 'Kerala Paradox', pointing to the contradictory problematic in various social sectors. In the backdrop of this unique societal milieu, the study specifically examined the professional environments of female scientists in Kerala and sought to determine the nature of Internet access and use among them in relation to their male counterparts. Further, it looked into the extent to which female scientists use the Internet to compensate social and organisational differences that limit their social networks and professional opportunities.

The paper will first address the manner in which socially constructed perceptions of gender affect resource acquisition capabilities and social networks of female scientists. It will then examine the unique social position of female scientists in the developing world and the degree to which the patrifocal social structure inhibits the advancement of their careers. Finally, we present evidence from semi-structured interviews of male and female scientists in research and academic institutions in or near the State capital of Thiruvananthapuram.

Earlier studies have maintained that the social networks of Indian women scientists are limited for several reasons. They have also submitted that female scientists have remained at a disadvantage to their male colleagues. In the context of these constraints faced by women scientists in a patrifocal environment, this study comes up with positive indications that the Internet could play an important role in the professional life of women scientists in establishing and sustaining their external professional contacts. However, whether the increased networking facility that Internet provides has really benefited women scientists in their acquisition capabilities and in overcoming their professional isolation is yet to be known. The indications seem to suggest that Internet technologies allow women scientists to acquire greater access to social and organizational resources outside of their local setting. Therefore, at present it may be postulated that Internet connectivity is helping women scientists to circumvent, but not yet undermine, the patrifocal social structure that reduces social capital and impedes career development.

We sought to determine how and to what extent Indian female scientists differ in terms of social and organizational resources and whether Internet use aids in surmounting the professional isolation that characterizes their careers. The paper submits that socially constructed inequalities between genders persist within scientific disciplines, serving to curb the career attainment and resource acquisition capacities of women scientists.

Gender and Scientific Careers

Feminist critiques of science and technology maintain that the masculine norms upon which science is constructed serve to actively exclude women from scientific careers as well as limit their contributions to scientific knowledge (Fox 1995, 1999; Fox and Long 1995; Keller 1995; Wajcman 1991, 1995)ⁱ. Fox and Long (1995) refer to this occurrence as

particularism, or ‘the consideration of functionally irrelevant characteristics such as race or sex in the allocation of rewards’ that is discriminatory ‘to the degree that race and sex affect the allocation of resources and rewards’ (53). According to Fox (1995), ‘gender shapes location, ranks, and rewards in science, which are connected with productivity’, meaning that increasing the numbers of women in scientific careers will not necessarily level the playing field (ibid). As the social and organizational environments of science as well as the social features of the workplace shape the career attainments of female scientists, improvements in the situation of women would require attention to structurally based factors such as allocation of resources and access to interaction and collaboration (222-223).

Productivity (indicated by number of publications) is often utilized to measure sex differences within scientific disciplines. It is a critical aspect in which female scientists have remained at a disadvantage to their male colleagues (Campion and Shrum 2003; Cole and Zuckerman 1984; Fox 1995, 1999; Fox and Long 1995; Gupta and Sharma 2002; Kyvik and Teigen 1996; McElrath 1992; Ranson 2003; Xie and Shauman 1998). In response to the question of female scientist’s productivity, ‘two classes of explanations have been examined empirically: one dealing with gender discrimination of various kinds and the other with women’s greater obligations to marriage and family’ (Cole and Zuckerman 1984: 218). In the developed world, contemporary social action ignited by second wave feminism has served to curb outright discrimination on the basis of sex and, to some extent, revamp traditional gender roles. These social changes, however, have also functioned to obscure the ways in which the ‘historically pervasive association between masculine and objective, more specifically between masculine and scientific,’ continues to operate within scientific disciplines (Keller 1995: 187). For this reason, the particular characteristics leading to sex

differences in scientific productivity in the developed world have become somewhat illusive, although the sex differences themselves remain apparentⁱⁱ. Regarding women's greater obligation to marriage and family, recent studies of the developed world academic scientists have found that marriage and family responsibilities cannot fully account for the lower levels of productivity observed among womenⁱⁱⁱ. (Cole and Zuckerman 1987; Kyvik and Teigen 1996; Xie and Shauman 1998). Xie and Shauman even go so far as to hypothesize that, due to 'the additional economic resources and emotional support contributed by a spouse', marriage is a 'personal asset' that proves less beneficial to women scientists only in the sense that they are less likely to marry^{iv} (859).

The study conducted in the four centers of Indian Institute of Technology (IIT) in India by Gupta & Sharma (2003) also proved that the dual burden of women scientists has an impact on profession. The structure and ideology of patrifocality affected the lives and careers of highly educated women in science. This ideology is reflected in various social stereotypes about gender roles. Due to women's equal responsibility towards family and science, their definition of 'success' is quite different from a male scientist's. For a man, success means professional recognition, awards and the highest honors in the field. Women scientists, on the other, tend to think that 'a successful woman is one who can balance both home and career' (302). This redefinition of 'success', they argue, is a product of patrifocal social structures and ideology.

Gender, Social Networks, and Scientific Isolation

Within the Indian social context, no significant revisions of the patrifocal power structure have occurred, resulting in glaring examples of sex discrimination and gender roles inhibiting productivity among female scientists. The Indian system of gender stratification,

dubbed ‘patrifocality,’ and the resulting stereotypes, exert a powerful influence on professional women in Indian society^v. Patrifocality refers to kinship and family structures and ideology that gives precedence to men over women, and includes the following: subordination of individual to family, patrilineal inheritance, patrilocal descent and residence that reinforce the centrality of males, gender-differentiated family roles wherein woman’s nurturing and domestic roles versus man’s economic roles, patriarchal authority structures, regulation of female behavior, marriage system with an inherent practice of dowry, and an ideology emphasizing women’s chastity and subservience^{vi}.

Marriage and family obligations also visibly affect the careers of female scientists in India^{vii}. In spite of the prestige associated with employment in science and technology fields and the fiscal benefits of having an ‘earning wife’, many women are expected to abandon or interrupt their careers when doing so proves beneficial to their husbands. In the 1990s, there were a number of detailed studies on women in science, highlighting various patrifocal aspects of gender vis- a-vis occupation, marriage and family (Kumar 2001, Mukhopadhyay 1994, Krishnaraj 1991). Gupta & Sharma (2003) examined the social milieu of women academic scientists, parental influence on decision making in regard to the careers of their daughters, parents’ expectations, importance of marriage and the criteria involved therein. The support of parents and spouse are vital for the success of women scientists. These studies in general, point to the fact that married women in the developing countries continue to suffer from a dual burden^{viii}.

The successful internalization of social norms and an equal commitment to family and job, make women consider ‘success’ as balancing both. In the process, there are greater chances of the career being compromised than the family. As a consequence, women may

place a priority on familial responsibilities over career opportunities. The often-contradictory demands of home and career lead to the 'dual burden', 'role overload' or 'dual role syndrome' (Chakravarty 1986, Hirsch and Rapkin 1986, Rout et al. 1999). Essentially, despite education, and quality education, girls are still expected ultimately to be 'good wives' and boys continue to be tutored to expect to be served by the woman (Sharma 2004)

Marriage and family responsibilities alone, however, cannot explain women's lower professional performance in comparison to men. Gupta and Sharma (2002) claim that Indian married female scientists are more productive than their single, divorced, or widowed counterparts^{ix}. Despite the dual burden, there may not be any overall effect of marriage itself on research productivity. A more convincing explanation of the low rates of productivity and limited resource acquisition capabilities of Indian women is that their culture restricts their access to social capital, leaving them professionally isolated.

Evidence from Kerala shows that gender inequity is restricted to a few key dimensions that are broadly related to differences in human and social capital. Campion and Shrum (2003), for instance, found that women are less likely to acquire an advanced degree and more likely to experience educational and organizational 'localism' leading them to conclude that gender inequality in the research systems of the developing world might be based on systematic deficits in the acquisition of social rather than material resources.

Social networks impact scientific attainment in that they contain social capital, embedded resources available to network members to enhance productivity and facilitate collaboration (Lin 2001). These embedded resources heighten the outcomes of actions by facilitating the flow of information, exerting influence on agents making decisions about actors, functioning as a certification of competency, and reinforcing identity and recognition

(Lin 2001:20). Within hierarchical social structures, like those found in most scientific communities, network ties tend to be homophilous, therefore reducing the likelihood of ties between high status and low status actors. Additionally, actors in high status positions are further advantaged in that they have access to wider resources through the personal networks of high status ties ((Lin 2001:65).

Gupta and Sharma (2002) maintain that the social networks of Indian women scientists are limited for several reasons. First, their networks are basically gender homophilous due to social segregation in which informal interaction with unrelated men is problematic. Second, their networks are more locally oriented due to cultural constraints upon their geographic mobility. Finally, they lack female mentors and colleagues with whom they can safely collaborate. For these reasons, Indian women are increasingly likely to be professionally isolated. As one academic chemical engineer articulates: “I am the only woman in the department. It has a male culture. Men have their own tea clubs. I feel different and isolated. The colleagues talk very little with me” (Gupta and Sharma 2002: 907).

In this sense, female scientists can be seen to possess a lower degree of social capital than their male counterparts, for their network ties are usually homophilous by sex. Smith-Lovin and McPherson (1993) propose that homophilous networks ensue from a lifetime of socialization and that network theory can ‘explain how small, seemingly inconsequential differences between males and females in childhood or early adulthood can be transformed over the life course into dramatic levels of gender segregation and inequality’ (223). Gender homophilous ties to childhood playmates coupled with tendencies to respond differently to network structures result in dissimilar social realities, and therefore different locations in the

social structure, for girls and boys during their formative years. Women tend to occupy network positions that facilitate the flow of information about the private sphere of household and family while men contain resources that promote upward mobility in the public sphere of career and finance (Smith-Lovin and McPherson 1993:229). Ultimately, the networks of adult women are generally more densely connected and contain more ties to kin and neighbourhood while networks of adult men are less dense but more extensive and contain more ties to co-workers and social group members. It is in this distinctive context of the Indian system of gender stratification (Mukhopadhyay and Seymore 1994) that the study specifically focussed on the degree to which the Internet world of E-science allows women scientists in the State of Kerala increased access to social networks and collaborations, which facilitate productivity and therefore career advancement.

IDREF1 have made an attempt to examine the changes that have occurred in the research careers of women in developing areas in relation to their male counterparts in two phases: the first in 1994 and the second from 2000-2002. The study was undertaken during the time period when the Internet was extensively diffused throughout the scientific communities of the developing world. It was founded on the assumption that the widespread distribution of the Internet encompassed great potential for changing the status of women, given the localism identified by prior research as an important factor in gender disparity. They found that women in the second phase of the study reported possessing the Ph.D. and Masters Degree at the same rate as men, virtually eliminating the gender gap in education. Further, equivalent numbers of men and women reported access to information and communication technologies.

Over the same period of time the gender gap in educational and organizational localism became more pronounced. Women spent even less time abroad for either education or general reasons and made fewer travels away from their parent organization. This increase in localism, furthermore, did not appear to be a function of the Internet facilitating distance communication thus eliminating the need for travel, as women were still disadvantaged in terms of the size of their professional networks outside the local context. Their lower productivity in foreign journals and chapters in books were stated as one consequence of this deficit in social capital, unlike men who may be more successful with regard to scientific publications owing to their educational and travel experiences in foreign countries. Based on these findings, the authors argued that the Internet, ‘while helping to circumvent the international isolation of female researchers, has not yet improved the size of their external networks’ (IDREF1).

Context and Method

The State of Kerala in southwest of the Indian subcontinent has continued to draw considerable attention among scholars at home and abroad. Earlier the preoccupation was with its unique political and socio-cultural history^x. More recently, interest has been focussed on its paradoxical pattern of growth often referred to as the ‘Kerala Model of Development’, reflected in high social achievements on a weak economic base (George 1993; Oommen 1992, 1999; Ramachandran 1996). In the context of the growing incidence of crimes against women and mental ill health, serious doubts have been raised regarding the widely publicised ‘high status’ of women in Kerala in terms of conventional indicators like literacy and favourable sex ratio^{xi}. The concept of ‘status’ itself, in women’s literature has been criticised for its failure to recognise the unequal relations of power that exist between

men and women in society which systematically situate women in an inferior position inside and outside the household (Saradamoni 1994). This empirical investigation therefore, raised the pertinent question that given the restrictions patrifocal societal orientation placed on women in Kerala, whether Internet may be regarded as an equalizer.

Semi-structured interviews were conducted in 2003-2004 among ninety professionals working in four premier science institutes in Thiruvananthapuram district, the capital of Kerala. The four institutes included The Central Tuber Crops Research Institute (CTCRI), and Centre for Earth Science Studies (CESS) both of which are government research stations and the Science Departments of the University of Kerala (UK) and Kerala Agricultural University (KAU), the two academic centres situated in Thiruvananthapuram. The participants included those who are engaged in research and teaching.

All the respondents were called on with the assistance of an interview guide for an unstructured interview lasting for a minimum of one hour. The interviews were preceded by the perusal of the bio data and one of the recent published articles. The interviews were coded in Nvivo and were analysed using Boolean search tool. The study is presented with 'thick descriptions' of the qualitative data gathered in the semi-structured interviews as it is envisaged to give an ethnographic account of the experience of women scientists in E-science in the patrifocal social climate of Kerala.

Gender and Education

The sex wise distribution of the participants revealed a glaring disproportion with regard to the percentage of women scientists in Kerala. Out of the total number of 90 respondents from the four institutes, there were only 20 women scientists who constituted 23.3 percent of the total sample. In other words, the number of male scientists who partook in

the study came up to more than three times the number of female scientists. Hence, out of the 31 respondents in CTCRI there were only 10 females (32.3%) and in CESS, only two females forming a negligible percentage of 6.7% whereas the 28 male respondents represented 93.3 percent. The Science Departments of the University of Kerala contributed a total of 22 participants of which 18 (81.9%) were males and 4 were (18.1%) females, and finally, KAU comprised 7 participants out of who 2 were males (28.6%) and 5 (71.4%) females. Except in KAU, the qualitative interviews covered nearly all the scientists. So, the sex ratio of the respondents of the study, with the exception of KAU, is indicative of the real proportion of the gender in science profession in Kerala. This obvious disparity in the percentage of women working in the professional field of science in a state like Kerala, points to the male domination prevailing in the occupational structure of the society^{xii}.

All the respondents possessed a minimum degree of post graduation – master's degree (MSc/MA in India) and it is the basic qualification required for getting employed in a university or research institute in India. But in the case of higher education, the disproportionate sex ratio seems to be replicating. 59 out of a total of 70 representing 84.3% of the male respondents possessed doctorate which contributed 65.6% of the total sample, whereas females having doctorate degree contributed only 18.9% of the total respondents, although 17 (85% of total number of females) of them with doctorate degree. only a negligible portion of two male respondents (2.2% of the total respondents) obtained postdoctoral degree (DSc).

A more realistic picture of the situation of women scientists with regard to their higher education is revealed in the analysis of the qualitative data. Maya^{xiii} who is aged 50, has just submitted her doctoral thesis in one of the universities in Kerala after twenty-four

years of service in the institute. She has specialised in Geo-morphological Mapping. She joined in the Resource Analysis Division of CESS in 1981 as a junior technical assistant. Before that she was working in a Central Government organisation. She got married in 1980 and in the following year she had to accompany her husband to Kerala who was already working in CESS and so her career trajectory took a critical transition from the time of her marriage.

Maya's career and her higher educational curve as a scientist were intimately linked to the successful career of her husband. Her career was drastically conditioned by her marital life and familial obligations and thus relegated to a secondary position vis-à-vis the profession of her husband. Her professional accomplishments were severely affected because of her transfer and appointment as a junior technical officer. Although in terms of seniority of service she was even at par with her husband, she had to remain a lower grade scientist for a long time. Quite evidently, the delayed submission of her doctoral thesis also was on account of her familial engagements as a housewife. She remarked: 'I have submitted (the thesis) and the viva would be some time now. That is also very late, but I thought, better late than never. And it is a challenge that even at my age... there is no age limit for learning'. Maya's case demonstrates the manner in which female scientists' education and career depend so much on their partners and familial circumstances.

Dr. Chandra, Professor and Head of a Department in the Agricultural College, has pointed to a deeper issue that inhibits women in their higher education.

We cannot move out freely after the household chores. And all husbands are not the same – if husband are co-operative then we can do some thing. My husband is not the kind who is supportive {...} He is very orthodox. He would get irritated with studying after marriage. He wanted me to have job but did not like me studying after marriage.

Given the attitude of the husband, Prof. Chandra could not even inform her husband when she decided to apply for her doctoral programme. She remembers that she could complete it 'with a lot of resistance from home'.

Location of higher education

The choice of place where women can pursue their higher studies like doctorate seemingly is limited to the locality where their family is stationed. Dr. Kumari did her Post graduation in Botany from the Department of Botany, University of Kerala. After that she really 'had no plans' as to the next programme in education.

While I was doing my dissertation work for MSc, my guide {...} asked me about my next plan. In fact I did not have any plans. I had got 65% at that time. Then he told me to continue here and join for PhD. I took up the CSIR- fellowship; even before I got the result I joined here for PhD and I continued my studies.

Apparently not only the mobility of professional and educated women is inhibited, but also the decision making power seem to be minimal or wanting. Dr. Mariam narrated her experience that confirmed the predicament of female professionals. She stood indecisive regarding her higher studies after completing her post graduation in flying colors: 'I graduated in Zoology (...) then I got 4th rank (...) that was a new course. When I came here I met Prof. K.K., the founder member of this department. He compelled me to do research. He was the person who introduced me to research. So I joined for research with him.

Contrarily, the situation of male scientists seems to be quite different. Whether married or unmarried, men were free to move around according to their interest and possibilities of admission. For instance, Dr. George, could choose to do both his post graduation and doctorate from prestigious academic institutes outside Kerala.

After my intermediate I happened to learn about the agricultural college at Allahabad. I had people belonging to my native place who studied in this particular institute. I found them in better position. And also I come from a family where my grand parents have farm. So I got interested in this field. Then

did graduation and post graduation in this field (in the University of Allahabad).
{...} After that I went for my PhD program at Indian Institute of Technology at Kharagpur

It is important to note that when Dr. George went for his doctoral programme he was a married person having raised a family of his own. Still he could choose to go to Indian Institute of Technology, Kharagpur, one of the premier centres of learning in India. This is generally the situation with male scientists in Kerala. Especially after their marriage, female scientists were not in a position to choose independently an educational institution for their higher studies. Marital values and family obligations inhibited them from moving out of their family and imposed normative and functional restrictions on them. For women, the gender climate in Kerala appears to be such that the freedom of choice and mobility is relative and incidental to the familial ideology and requirements.

Nevertheless, a few women scientists have done their doctoral studies in foreign universities. On closer scrutiny, it is found that in such cases their partners or male siblings take on foreign assignments and the women, as wives or sisters tend to accompany them. In effect, those female scientists did not make any independent decision to go abroad for studies; rather it was accomplished in association with the decision of authoritative male figures.

The element of safety in an alien environment is perhaps one of the important considerations coming in the way of women choosing the location of higher studies outside of their locality. This is apparently the reason why women tend to ensure the company of a male authority before seeking the possibilities of admission for higher studies outside India. The androcentric cultural climate in a way inhibits the decisions on education and the course of destiny of female scientists in Kerala. These findings are consistent with Gupta and

Sharma's (2004) assertion that family commitments and concerns about safety during travel often constrain the physical mobility of Indian women.

Cultural encumbrance

The scientific community generally agrees that there exists no marked difference between the genders in the quality of academic performance. In fact, all the respondents of the study accepted the fact that their experience showed that both boys and girls perform equally well both in studies and research. Some even felt that girls fare better than boys. One senior scientist at CESS aired this common sentiment of the scientific community regarding the academic performance of boys and girls:

I don't think that there is any conspicuous difference between their programmes (boys and girls) particularly in the academic output. Intellectually both groups are doing well. No difference at that level. When it comes to field activities, because of the practical consideration, boys are in bit more advantageous position – going in ship, cruise, travel etc...

However, when it comes to field visits and library and laboratory works in the odd hours girls seem to be much constrained. Dr. Kumar, professor in the University of Kerala has pointed out this aspect of cultural encumbrance affecting girls.

Indian women are very different from their counterparts abroad and the armoury of men. {...} If you ask a female student to be here after five in the evening, do you think that the student will be here? {...} You could label as cultural and you are so cautious about yourself and the society and you never let the women work according to their will or from the childhood itself she is groomed in such a way that she has restrictions around her. If you go to a foreign lab you will find a girl working up to 12 in the night and she walks off after that and she comes at 6 in the morning like men. So basically the so-called culture, which is made by human beings as an imaginary world around them and it, is unsafe for women to work in the laboratory {...}

Dr. Chandra, in fact subscribed to this when she said: 'men are more free to move around'. But Francis stated that marriage brings in radical change in this situation:

... but after the marriage the scenario can change, and it normally changes with the women scientists. They will have to be more preoccupied with

household affairs much more than their male counterparts and that can affect their professional performance and network.

Dr. Sethu, professor in the College of Agriculture had a noteworthy comment in this regard:

Once they (girls) are married and settled they become involved in their families and retreat into their families and they say they become out of touch with the developments in the field. {...} Family life is the most important part of a woman and they even sacrifice their career for it. For this the attitude of the society has to change...

Dr. Suresh in CESS opined categorically that ‘definitely a difference is perceived in girl students after marriage in terms of their commitment to work and study. Girls after marriage have to adjust their timings with their partners.

Dr. Jeya working in the College of Agriculture narrated her ‘not so smooth’ story of the transition from a student to housewife to being employed and then again being a student:

As I got married very early, I had told my husband that I was interested in studying and he was willing to allow. Immediately after marriage I joined for MSc. {...} everything was not smooth. sometimes Sundays also we would go for fieldwork {...} got earlier a job at Shoranur (Northern Kerala) but I did not go as my daughter was very young {...} Then I was in solid survey at Trivandrum and I joined here. But meanwhile he was sent on deputation to Coimbatore for PhD and so I also registered there for PhD and we did it together.

Later, it was after a legal battle that her appointment to the KAU was stabilised. More than these practical issues, she was concerned about the difficulties cropped up in their family on account of the differences on the questions of ‘household duties of wife’ and ‘women’s duties towards the family’ etc. Consequently, she was not able to realise her long cherished desire to do post-doctoral studies abroad and use the opportunity to attend a training programme in Netherlands. All these impinged on her career and professional accomplishments.

The gendered atmosphere seemingly stifling the career trajectory of female scientists and it is likely that their productivity in terms of publications is impaired. Women do not

publish in national and international journals or books as much as their male counterparts. Dr. Susi of College of Agriculture lamented when asked about the specific difficulties experienced in her career as a woman: ‘Right now I do not have any, but earlier I used to, since my husband was also away I had to look after both the children. I liked to attend the summer or winter courses organized by other universities, but I could not go, as I did not have any help at home’.

Visits Abroad

Notwithstanding these constraints, some female scientists have undertaken short-term foreign visits. The visits included short-term training programmes, conferences, workshops, seminars, symposia etc. However, compared to universities, women professionals from research institutes tend to undertake more foreign professional visits.

Women were less likely to be selective about the nature of opportunities and accept any chance that came their way rather than wait for more prestigious offers. Participation in seminars/conferences and presenting papers in such academic programmes, particularly at the international level, is regarded important for promotions and so female scientists made it a point to grab the opportunities.

Women scientists in Kerala, however tend to make relatively shorter foreign visits given the familial obligations and demands of the patrifocal social milieu. Compared to the female scientists, most of their male counterparts have undertaken many professional visits to foreign countries extending for many days. Dr. Maya, for instance, said about her husband: ‘ he was on maximum tour and only now he has settled down and not having much of touring’. Female scientists more likely to make foreign visits in a ‘business spirit’ and do not take time

off for other academic and non-academic activities. Familial concerns and obligations must be compelling the female professionals to return quickly.

Organizational Involvement

The female participants in the study, by and large occupied membership in professional organizations, and many of them claimed to be members in more than one organization. However, most of them confined themselves either to regional or national level organisations, and a very few of them held responsibilities or rose to leadership positions in these organizations. Their involvement in the activities of the professional organizations appeared to be low and minimal. Dr. Maya poignantly remarked:

When two of us are in the same field, we cannot leave the family and go, family comes into the picture. That was one setback for me. {...} And all this should be done at an earlier age and not at 50, I don't want to be familiarised with new people and suddenly I cannot take initiative {...} Some people say I have sidelined myself but may be I am like that... for the sake of the family. At least I can say that I have looked after the family and nobody can deny that.

Maya's experience is illustrative, especially since her husband is working in the same institute as a scientist. Maya's case may be regarded as typical of the professional women working in Kerala, that professional concerns get 'sidelined', as she has put it, for the sake of husband's profession and familial demands.

Nevertheless, a minority of female scientists were designated as referees to scientific journals and external examiners of viva voce of local and regional universities. For example, Dr. Padma was treasurer of Indian Society for Root Crops. But, the main Institute of the Indian Society for Root Crops is CTCRI in Thiruvananthapuram and the head office of the Society is situated from CTCRI. Dr. Padma has also worked as the member secretary of Research Advisory Committee for two consecutive terms and one term is for a period of three years. This is formal body to be constituted in every research centre according to the

directives of Indian Council of Agricultural Research. Even the scanty leadership positions that female scientists occupy are likely to be locally centred.

A small percentage of women occasionally attended annual conferences. Some of them have published papers in journals of the concerned professional bodies. Some journals have made it mandatory that authors be members of their respective professional body. Dr. Suma made a typical response in this regard: 'I am not an active member, but there is a rule that if you have to publish any paper, then you must be a member in your specialisation'. In comparison, male respondents reported a much higher involvement and an average of about three memberships in professional organizations. Additionally, organizational leadership positions among male scientists appear to be much higher than that of their female counterparts. Gupta and Sharma (2002) had perceived Indian women are expected to maintain a submissive demeanour.

Professional Contacts

Perhaps the most intriguing finding of this study is on the professional contacts of respondents. Many Indian women discussed their various professional contacts throughout the world. Female respondents mentioned far fewer contacts within their departments or within India and were more likely to describe their associations with various international scientists. Contrastingly, men reported extensively on contacts and collaborations within their departments, institutes, and regional areas.

Although women employed in the government sector seemed to list more local male contacts than their university counterparts, many of these men occupied supervisory positions and were expected to provide feedback. Similarly, the Indian male contacts of all Indian female respondents were more often identified as lab partners, former professors, or

dissertation advisors than scientists who sought them out on the basis of previous publications or for the purpose of collaboration. Contacts of these types were generally not used for collaboration, but rather ‘for external examination purposes, for setting question[s].’

The women in this study seem to rely more on international contacts than those at the local level, in contrast to the observations by Campion and Shrum (2003) and Gupta and Sharma (2002) in respect to the local orientation of Indian women’s social networks. More interestingly, the analysis of the quantitative data by IDREF1 also revealed contrary results. According to it, men reported significantly larger international networks than women in both phases (mean difference of 0.56 in 2000 and 0.35 in 2005) whereas women seemed to have more local contacts (mean difference of 0.16 in 2000 and 0.53 in 2005). Therefore IDREF1 argued that women scientists continue to exhibit localism not only in their educational and organizational environments, but also in their pattern of social relationships. In the transitional period that was systematically documented in 2000 study by IDREF1 did not reveal any benefit of the increased access of Internet to women to transcend their localism.

The observation of this qualitative study could be interpreted in two ways. 1) indicating women breaking the barriers of professional localism. 2) showing only greater relevance of international contacts for female scientists and do not signal any real change in overcoming professional localism.

Internet Access

Having found the potential of Internet for professional networking and accessing information, women scientists seem to have realised the importance of uninterrupted and continuous access of Internet facility in their office premises. Jyothirmayi, a married junior scientist, aged 30 years, recalled the improved Internet facilities at the Institute:

Earlier i.e. about a year and a half back, we had the NIC Net (National Informatics Centre Connection). This was very slow and the system was such that our mails were routed through the NIC Net server. If the NIC Net server would be down, then or if we send mails on a Saturdays (which is a holiday for NIC Net) the mails would be sent only on the following working day. Thus communication was delayed because of these administrative bottlenecks. But now, we have the broadband connection and within an hour, in fact, we get replies to mails and we also send reply mails.

Jyothirmayi's comments on the improvement in electronic communication facilities points to the evolving significance of Internet in the lives of female scientists in Kerala. All respondents seem to be satisfied with the improved facilities in accessing Internet at the work place. Recently the government institutes provided LAN facilities. However none of them reported to have a personal Internet connection at work. Female respondents working in a research institute complained that it did not have Internet access outside of office hours except with special permission. Jeena said: 'although the connectivity is for 24 hours, we are able to access it only till office hours. At 3.30 in the afternoon (when the office time officially ends) they switch off the main server. There are occasions when you need to use it even after office hours- a couple of hours more'.

Respondents employed at the universities reported that all the departments have Internet connection. At the same time, they are unhappy with the number of computer systems available for the staff. In universities access to Internet was available all the time in common terminals like libraries and computer labs. Respondents from all the locations complained about the lack of adequate speed in downloading.

The Internet as an Equaliser?

Although most of the respondents both male as well as female reported using Internet for research related communication and accessing information, women respondents were more likely to mention communication with international contacts. Indian men reported

roughly equal amounts of communication with international colleagues and those in other parts of India, additionally several women scientists also mentioned that e-mail and Internet use had resulted in new opportunities. Many female respondents reported that the Internet had given them access to foreign journals with a view to publication. Similarly, a few others spoke of how e-mail facilitated their foreign visits and communication with the organizers of international conferences and workshops.

Jeena, a junior scientist in research institute told that in the wake of free access of Internet at the work place ‘{my} contact has become a lot really, otherwise contact was very less. Even when I go for training there also I get some help, otherwise we do not communicate’. She added: ‘we have stopped letters. We are ladies, you know, either phone or email, letters are very rare’. ‘We are ladies’ is a very loaded phrase and the application of Internet for professional networking and acquisition of resources in a way shows how cyber science plays the role of a social leveller.

Jeena has narrated an instance in which she could continue the professional relationship with a scientist from Madras University whom she met in a conference. In the course of her professional correspondence with him through email, she recalled that she could approach him for a fruitful discussion on plant diseases she was working on. She also remembered an occasion in which she was able to get a rare sample from an internationally renowned scientist working in a foreign research centre.

Respondents also find Internet very handy in searching for information and updating knowledge on the areas of their respective field of studies. Dr. Suma at the research institute even spent one full day in browsing when she was in need of some relevant information on organic farming. With regards to the time spent on Internet activity she said: ‘it depends upon

the nature of the work; sometimes continuously for the whole day. Once I was in the Internet for the entire day, browsing materials on organic farming. I got very good information on the subject and so I could formulate my project'.

Internet has an effect not only on the professional life of women scientists, but on their personal lives too. They are able to communicate with their kith and kin afar on a regular basis. Internet enables female scientists to transcend distance in their personal and professional communications. Dr. Bala, a senior scientist at the research centre has endorsed the personal and social dimensions of Internet:

Personally my life has improved. My sister and brother are abroad and we correspond regularly through email. My children who are doctors are computer savvy and we regularly mail to each other. In fact when my grandchild was born, the picture of the baby was sent by email to my relatives abroad. This would not have been possible if not for Internet and email and this system was not available, say about 10 yrs back.

Respondents seem to spend about half an hour to one hour daily for email transactions. Apparently, Internet has come to be an integral part of the professional life of female scientists so much so that some of them are now unable to imagine their professional life without it. Dr. Padma captures this shift in the scientists' profession:

Initially we were all apprehensive about computers. We were wondering if anything would happen to the system when we work on it. But once we got familiarized with computers and much after we did a course in computer, we have come to a situation where we cannot live without computer. It's a part of our work schedule now.

Conclusion

The study pointed to no evidence of any widespread belief in the intellectual inferiority of female scientists in Kerala. Instead, the patrifocal system of enforced physical immobilities created problems for women in science profession and adversely affected their acquisition of resources and productivity. Indications suggest that Internet as a medium of

communication, networking and information could emerge as a medium that could equalize gender positions in the research and academic sectors in Kerala. The study seems to reveal that Internet connectivity is helping women scientists to circumvent, but not yet undermine, the patrifocal social structure that reduces social capital and impedes career development.

This result, which is inversely different from the findings of the quantitative data in 2000 (IDREF1), provides some grounds for optimism. The emerging scenario of female scientists trying to overcome the prevailing localism perhaps interpreted in two contrasting ways: 1) It could be indicative of the beginning of a change — an optimistic change in the direction of transcending educational and academic localism within the climate of patrilocality. 2) It could also be interpreted as signs of greater relevance of international contacts for women but not signaling any real grounds of change. Internet could emerge as a level playing ground that connects women to the professional community at a distance, especially outside the country. In this evolving E-science environment, female scientists may physically remain located in Kerala, but their professional horizons could be expanding to far away places. The optimistic indications, however, only points to the need for undertaking further studies in the same direction in order to substantiate and understand the actual conditions of development and change in the patrifocal structure of Kerala society.

ⁱ This list is in no way complete, as many other works on the topic have been published in recent years. Additionally, the scope of this paper does not include a complete account of the feminist critique of science and technology, particularly the use of gendered metaphors in scientific discourse and biased standards of evaluation (see Fox 1999 for a review).

ⁱⁱ Cole and Zuckerman (1984) found that women are only 57% productive as men, while Xie and Shauman's (1998) findings 'suggest that the female-to-male productivity ratio now hovers around 75-80 percent' (856), and those of Kyvik and Teigen (1996) show that within the three year period 1989-1991, female participants published 20% fewer article equivalents than did male participants.

ⁱⁱⁱ Xie and Shauman (1998) report that married academic scientists in America have been found to have higher levels of productivity than their single counterparts, although the high human capital of their spouses, and therefore the ability to hire outside assistance with household duties, may benefit women more than the institution of marriage itself. Similarly, Cole and Zuckerman (1987) have found that women scientists who marry and have families publish the same number of papers per year on average as their single counterparts. Among Norwegian academic scientists, Kyvik and Teigen (1996) have discovered that women with young children work fewer hours per week and publish less than male colleagues with similar family composition, but that these differences gradually decrease and nearly disappear once children reach the age of ten. This observed difference in productivity could also be due to in part to Norway's generous policy of maternity leave, in which women are granted nearly a year of paid absence.

^{iv} Additionally, testing for interaction between sex and marriage did not yield significant results, meaning that women and men benefit equally from marriage.

^v See Mukhopadhyay and Seymore 1994 p. 279.

^{vi} Gupta and Sharma (2002) identify the significant features of patrilocality as: 'subordination of individual interests to the welfare of the family; gender-differentiated family roles with females being associated with the 'private' sphere; gender differentiated family authority structure (with authority of same-generational males over socially equivalent females, such as husbands over wives, brothers over sisters); family control of marriage arrangements; patrilineal descent, inheritance, and succession; patrilocality residence, with daughters shifting allegiance to husband's family after marriage; and an ideology of 'appropriate' female behaviour that emphasizes chastity, obedience, and modesty' (902). For an elaborate discussion, see Mukhopadhyay and Seymour (1994).

^{vii} While American women scientists are less likely to marry than their male counterparts, this is not the case in India. For Indian women, marriage is culturally essential and defines their social status. By seeking a divorce, a woman risks stigmatising her entire family (Abraham 2000).

^{viii} The Time survey conducted by the Ministry of Programme Implementation, Government of India (2000) has shown that females spent about double the time as compared to males in activities relating to taking care of children, the sick and elderly. It is startling that the educational level of women had no significant impact on such activities.

^{ix} This discrepancy could be due to the fact that, within the Indian social system, married women are held in higher regard than single women, who are often less respected and more socially isolated. In fact, married respondents were found to be more productive than single women and productivity was greater in higher age groups (Gupta and Sharma 2002, 294).

^x For instance, Kerala is known for the formation of the first elected Communist Government of the world in Independent India and matrilineal kinship organisation among dominant communities like Nayers.

^{xi} For a discussion, see, Mridul Eapen and Praveena Kodoth *Demystifying the 'high status' of women in Kerala – An attempt to understand the contradictions in social development*, CDS, 2001.

^{xii} Kerala is the only state in the Indian subcontinent where the female sex ratio is higher (1058 females to 1000 males), and female literacy and education have achieved surprisingly high levels compared to the national average, (Literacy levels Total 90.92%; Males 94.20%, Females 87.86%).

^{xiii} The names are faked to safeguard anonymity and confidentiality.

References

- Abraham, Margaret. 2000. *Speaking the Unspeakable*. New Jersey: Rutgers Press.
- Campion, Patricia and Wesley Shrum. 2004. 'Gender and Science in Development: Women Scientists in Ghana, Kenya, and India', *Science, Technology, and Human Values*, 29(4): 459-485.
- Chakravarthy, Radha. 1986. 'Productivity of Indian Women Scientists.' *Productivity* 27, No. 3: 259-69.
- Chanana, Karuna. 2000. 'Treading the Hallowed Halls: Women in Higher Education', *Economic and Political Weekly*, 35, No. 12: 1012-22.
- _____. 'Hinduism and Female Sexuality: Social Control and Education of Girls in India.' *Sociological Bulletin*, 50, No. 1 (2001): 37-63.
- Cole, Jonathan R. and Harriet Zuckerman. 1984. 'The Productivity Puzzle: Persistence and Change in Patterns of Publication of Men and Women Scientists' in M. W. Steinkamp and M. L. Maehr. Greenwich (eds.), *Women in Science*, Connecticut and London: JAI Press. 2: 217-258.
- _____. 1987. 'Marriage, Motherhood, and Research Performance in Science.' *Scientific American*, 25: 119-125.
- Eapen and Kodoth. 2001. *Demystifying the 'high status of women in Kerala – An attempt to understand the contradictions in social development*. Thiruvananthapuram: Centre for Development Studies.
- Fox, Mary Frank. 1995. 'Women in Scientific Careers' in S. Jasanoff, G. Markle, J. Peterson and T. Pinch (eds.) *Handbook of Science, Technology, and Society*, Newbury Park: Sage. pp. 205-223.
- _____. 1999. 'Gender, Hierarchy, and Science' in J.S. Chafetz (ed.) *Handbook of the Sociology of Gender*, New York: Kluwer Academic/Plenum Publishers. pp.441-458.
- Fox, Mary Frank and Scott J. Long. 1995. 'Scientific Careers: Universalism and Particularism.' *Annual Review of Sociology*, 21: 45-71.
- George, K. K. (1993). *Limits to Kerala Model of Development: An analysis of fiscal crisis and its implications*. Thiruvananthapuram: Centre for Development Studies.
- Gupta, Namrata and Arun K. Sharma. 2002. 'Women Academic Scientists in India.' *Social Studies of Science*, 32 (5-6): 901-915.
- _____. 2003. 'Patrifocal Concerns in the Lives of Women in Academic Science: Continuity of Tradition and Emerging Challenges.' *Indian Journal of Gender Studies*, 10, No. 2, 279-306.
- Haraway, Donna. 2002. 'The Science Question in Feminism and The Privilege of Partial Perspective' in J. A. Kourany (ed.) *The Gender of Science*. Upper Saddle River, NJ: Prentice Hall (361-371).

-
- Hirsch, Barton J and Bruce, D. Rapkin. 1986. 'Multiple Roles, Social Networks and Women's Well-Being.' *Journal of Personality and Social Psychology*, 51:1237-47
- Hurlbert, Jeanne S., Valerie A. Haines, and John J. Beggs. 2000. 'Core Networks and Ties Allocation: What Kinds of Routine Networks Allocate Resources in Non routine Situations?' *American Sociological Review*, 65(4): 598-618.
- India, Government of. 2000. 'The Time Use Survey.' Ministry of Statistics and Programme Implementation, New Delhi.
- Jordonova, LJ. 1980. 'Natural Facts: A Historical Perspective on Science and Sexuality.' in *Nature, Culture and Gender*, edited by C. M. a. M. Strathern. UK: Cambridge University Press.
- Keller, Evelyn Fox. 1995. 'The Origin, History, and Politics of the Subject Called 'Gender and Science': A First Person Account' in S. Jasanoff, G. Markle, J. Peterson, and T. Pinch (eds.) *Handbook of Science, Technology, and Society*. Newbury Park: Sage (80-94).
- Keller, Evelyn Fox. 1992. 'Gender and Science: an Update.' in *Secrets of Life, Secrets of Death, Essays on Language, Gender and Science*, edited by E. F. Keller. New York and London: Routledge.
- Krishnaraj, Maithreyi. 1991. *Women and Science: Selected Essays*. Bombay: Himalaya Publishing House.
- Kumar, Neelam. 2001. 'Gender Stratification in Science: An Empirical Study in the Indian Setting.' *Indian Journal of Gender Studies*, 8:51-67.
- Kyvik, Sven and Mari Teigen. 1996. 'Child Care, Research Collaboration, and Gender Differences in Scientific Productivity.' *Science, Technology, and Human Values*, 21(1): 54-71.
- Lin, Nan. 2001. *Social Capital*. Cambridge: University Press.
- McElrath, Karen. 1992. 'Gender, Career Disruption, and Academic Rewards.' *The Journal of Higher Education*, 63(3): 269-281.
- Mitter, Swasti. 1995. 'Beyond the politics of difference: an introduction.' in *Women Encounter Technology - Changing Patterns of Employment in the Third World*, edited by S. M. a. S. Rowbotham. London: Routledge.
- _____. 1995. 'Information technology and working women's demands.' in *Women Encounter Technology: Changing Patterns of Employment in the Third World*, edited by S. M. A. S. Rowbotham. London: Routledge.
- Mukhopadhyay, Carol Chapnik. 1994. 'Family Structure and Indian Women's Participation in Science and Engineering.' Pp. 103-32 in *Women, Education and Family Structure in India*, edited by C. C. Mukhopadhyay, and Susan Seymour. Colorado: Westview Press.
- Mukhopadhyay, Carol Chapnik, and Susan Seymour. 1994. *Women, Education and Family Structure in India*. Colorado: Westview Press.

-
- Oommen, M. A. 1992. *The Kerala Economy*. New Delhi, Oxford and IBH.
- Oommen, M. A., Ed. 1999. *Kerala's Development Experience* Vol. 1 & 11. New Delhi: Concept Publishing.
- Pattatucci, Angela M. 1998. *Women in Science: Meeting Career Challenges*. New Delhi: Sage Publications.
- Ramachandran, V. K. 1996. *On Kerala's Development Achievements. Indian Development: Selected Regional Perspectives*. Delhi: Oxford University Press
- Ranson, Gillian. 2003. 'Beyond 'Gender Differences': A Canadian Study of Women's and Men's Careers in Engineering.' *Gender, Work, and Organizations*, 10(1): 22-41.
- Ridgeway, Cecilia. 1997. 'Interaction and the Conservation of Inequality: Considering Employment.' *American Sociological Review*, 62: 218-235.
- Rout, Usha Rani, Sue Lewis, and Kagan Carolyn. 1999. 'Work and Family Roles: Indian Woman in India and the West.' *Indian Journal of Gender Studies*, 6:91-104.
- Rowbotham, Sheila. 1995. 'Feminist approaches to technology.' in *Women Encounter Technology: Changing Patterns of Employment in the Third World*, edited by S. M. a. S. Rowbotham. London: Routledge.
- Saradmoni, K 1994. Women, Kerala and Some Development Issues, *Economic and Political Weekly*, 29(9): 501-509)
- Sharma, Kalpana. 2004. 'Can science be woman-friendly?' *The Hindu*, June 13. Retrieved August 4, 2004 (<http://www.thehindu.com/thehindu/mag/2004/06/13/stories/2004061300150300.htm>)
- Sharma, Kalpana. 2004. 'What happens to girls?' *The Hindu*, June 27. Retrieved August 4, 2004(<http://www.thehindu.com/thehindu/mag/2004/06/27/stories/2004062700180300.htm>).
- Smith-Lovin, Lynn and J. Miller McPherson (1993). 'You Are Who You Know: A Network Approach to Gender' in P. England (ed.) *Theory on Gender: Feminism on Theory*. New York: Aldine de Gruyter (223-251).
- Tilly, Charles. 1998. *Durable Inequality*. California: University of California Press.
- Wajcman, Judy. 1991. *Feminism Confronts Technology*. University Park, PA: The Pennsylvania State University Press.
- _____. 1995. 'Feminist Theories of Technology' in S. Jasanoff, G. Markle, J. Peterson, and T. Pinch (eds.) *Handbook of Science, Technology, and Society*. Newbury Park: Sage (189-204).
- Xie, Yu and Kimberly A. Shauman. 1998. 'Sex Differences in Research Productivity: New Evidence about an Old Puzzle.' *American Sociological Review*, 63(6): 847-870.