

Job Status and Career Profile of Women Engineers in India*

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The job profile and career status of women engineers who obtained their bachelor's degree during 1994–1998 has been studied. The study is motivated by the findings of an earlier study conducted during 1987–90 for the graduates of the period 1975–90. It was found that women enrolment in the engineering courses was on the increase but the job market was not open for them. Enrolment rates have gone up significantly since then. The estimated range today is 25–30%. Data reveals that 31% of the women engineers are unemployed. The job and career opportunities for them continue to be limited. Technical educational institutions are the main employment avenue with a noticeable increase in industrial employment. Unemployment is higher in the states and in the disciplines having higher enrolment. Getting the first job after graduation is the major hurdle in the career path of women engineers.

INTRODUCTION

PARTICIPATION of women in the engineering profession is important from the viewpoint of national development. It is also an important factor in improving the quality of life of women themselves. Despite the fact that the first woman obtained her engineering degree as early as in 1892, their presence in this important profession has traditionally remained low and this has been a matter of concern, the world over. The scenario in India has not been any different.

Because of the low presence of women in the engineering profession in India, a broad-based study entitled 'The Participation of Women in Engineering Courses and in the Engineering Profession' was taken up during 1987–90 under sponsorship of the Department of Science and Technology (DST), Government of India. The objectives of the study included: assessment of the participation level, analysis of the factors responsible for low participation and study of the job and career status of women engineers in India. The study was planned so as to provide a firm basis for status evaluation and to help in formulation of corrective strategies.

The overall framework of the study consisted of collection and analysis of the data on enrolment and out-turn trends (numbers graduating per year), personal/family background, job status, career profiles and career problems of women engineers. Women who had obtained their Bachelor's degree in engineering (BE, B.Tech., B.Sc.) during the sixteen-year period 1975–1990, in the country, in any branch of specialisation, constituted the sample of this study. Out of the total

sample size of about 20,000 [1], direct contact could be established with 4678 women engineers [2–4] and detailed personal, educational and professional data was obtained for 2753 through a structured, specially designed questionnaire. The data and analysis revealed that the number of women taking up engineering courses had increased significantly from only about 1% in 1975 to over 8% in 1990. However, the engineering job market was not open to accepting women as engineering professionals. About 26% (719 out of 2753) reported unemployed. The unemployment problem manifested itself more severely in the states and in the branches having higher enrolment rates and a larger population. Job opportunities for women engineers were limited in terms of sector of employment and the pace of their career growth was slow. The largest numbers were employed in Technical Educational Institutions followed by Government, Civil Services, Public Sector Units (PSU—the Government Autonomous Industrial Units) and R&D organisations. Non-acceptance of women engineers was particularly evident in the Private Sector Industry [2–4]. These findings, obviously, were a cause for serious concern.

The percentage enrolment of women in engineering colleges and institutions has increased substantially since the period of the aforementioned study. Today in some states, it ranges from 25 to 30% [5–8]. Taking into account the fact that the number of engineering colleges have also increased radically, the annual out-turn of women engineering graduates has increased many times. Compared to the earlier years therefore, the population of women engineers is growing at a much faster pace. If the job and career problems reflected by the previous study continue, the trend of increasing participation of women in

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Table 1. State-wise distribution of questionnaire respondents, direct sample and total sample

State	QRS	DS	TS
	Number (%)	Number (%)	Number (%)
Andhra Pradesh	81 (7.9)	189 (8.2)	1096 (9.3)
Delhi	39 (3.8)	70 (3.0)	497 (4.2)
Gujarat	122 (12.0)	262 (11.3)	1560 (13.3)
Karnataka	164 (16.1)	346 (15.0)	1319 (11.2)
Kerala	123 (12.1)	304 (13.2)	1181 (10.0)
Maharashtra	281 (27.6)	635 (27.5)	4311 (36.6)
Tamil Nadu	210 (20.6)	504 (21.8)	1814 (15.4)
Total	1020 (100.0)	2310 (100.0)	11 778 (100.0)

this important profession could be reversed. UNESCO's World Science Report 1996 has expressed this apprehension and stated, 'Recent growth in the numbers of women enrolling in the engineering courses shows signs of slowing, even reversing, in India'.

The present study, also sponsored by Department of Science and Technology, has been undertaken to reassess the employment and career status, and, career opportunities of women engineers in India, under significantly changed scenario of the nineties. Collection, compilation and analysis of the viewpoint of the employers on employment and performance of women as engineering professionals was an added important facet included in this study. This paper presents the data on the job and career status, and compares the findings with those of the previous study. The viewpoint of the employers will be presented in a separate paper.

SAMPLE FOR THE STUDY

The group sampled in the present study consists of women engineering graduates who had obtained their degree during the period 1994–98 in the disciplines of Civil, Computer Science, Electrical, Electronics and Mechanical Engineering and were located in the states of Andhra Pradesh, Delhi, Gujarat, Karnataka, Kerala, Maharashtra and Tamil Nadu [10]. The definition of the group was derived from the findings of the previous study [2] in which it was noted that over 80% of the stock of women engineers belonged to the above

Table 2. Graduation year-wise distribution of questionnaire respondents, direct sample and total sample

Year	QRS	DS	TS
	Number (%)	Number (%)	Number (%)
1994	91 (8.9)	165 (7.1)	1231 (10.5)
1995	132 (12.9)	282 (12.2)	2174 (18.5)
1996	172 (16.9)	378 (16.4)	2540 (21.6)
1997	257 (25.2)	593 (25.7)	2732 (23.2)
1998	368 (36.1)	828 (35.8)	2743 (23.3)
No response	—	64 (2.8)	358 (3.0)
Total	1020 (100.0)	2310 (100.0)	11 778 (100.0)

Table 3. Branch-wise distribution of questionnaire respondents, direct sample and total sample

Branch	QRS	DS	TS
	Number (%)	Number (%)	Number (%)
Architecture	65 (6.4)	112 (4.9)	934 (7.9)
Civil	188 (18.4)	413 (17.9)	1756 (14.9)
Computer Science	170 (16.7)	458 (19.8)	2516 (21.4)
Electrical	154 (15.1)	360 (15.6)	1778 (15.1)
Electronics	354 (34.7)	797 (34.5)	3907 (33.2)
Mechanical	89 (8.7)	162 (7.0)	812 (6.9)
No Response	—	8 (0.4)	75 (0.6)
Total	1020 (100.0)	2310 (100.0)	11 778 (100.0)

mentioned states and disciplines. The discipline of Architecture was added in the present study.

Of about 60,000 total number of women engineers belonging to the sample under study [5], about 11,778 were located and direct communication was established with 2310. Finally detailed responses through a questionnaire were received from 1020 women. A state-wise, branch-wise and graduation year-wise analysis of the responses (Tables 1–3) confirmed that they were reasonably representative of the total sample. TS denotes Total Sample and refers to the total number of women engineers located; DS and QRS denote Direct Sample and Questionnaire Response Sample and refer to the population of women engineers with whom a direct communication was established and the respondents of the questionnaire, respectively [10]. The analysis presented in this paper is based on the replies received from QRS through completed questionnaires.

The questionnaire consisted of three parts. Part I requested the respondent to fill in some general data about herself; name, address, marital status, children, educational and training record, etc. Part II pertained to the perceptions, career goals and values of the respondent while Part III was concerned with obtaining information on the job status, career expectations and problems encountered. In this part, a distinction was made between those employed continuously after graduation, those unemployed since graduation, and those who belonged to neither of these two groups (pursuing further studies, intermittently employed, etc.).

An analysis of the data obtained from Part I of the questionnaire showed that the majority of the respondents had their schooling in a city or town,

Table 4. Employment status of the respondents

Status	Present study	Previous study
	Number (%)	Number (%)
P. G. student	148 (14.5)	142 (5.2)
Unemployed	312 (30.6)	719 (26.1)
Employed*	560 (54.9)	1892 (68.7)
Total	1020 (100.0)	2753 (100.0)

* Including self-employed respondents

the largest numbers having attended government, missionary or private schools. Very few attended municipal schools (those run by the city civic body). The medium of instruction for schooling was English for over 60%. Most planned to take up an engineering career at the high school stage and belonged to educated families. Father's or husband's of the respondents generally possessed a bachelor's degree or a higher qualification.

Job status

The job status of the women engineer respondents is discussed in this section. Employment status, sector of employment and the nature of work are the aspects of interest in this context.

Employment status

Data on the employment status of the respondents is given in Table 4. It can be seen that only 54.9% of the women engineers are employed. Further analysis of the data reveals that out of 54.9%, only 44.7% have been continuously employed after graduation, the remaining 9.3% intermittently employed. In the previous study, 68.7% of the respondents were employed [2]. Thus the employed fraction has reduced by 13.8%. The unemployed fraction has increased from 26.1% to 30.6%. It is important to mention that the unemployed were without a job for over a year at the time of data collection.

The out-turn rates have increased with the passage of time. The data shows that the percentage of the unemployed has also increased with the year of graduation (Table 5). Simultaneous increase of the stock and the unemployed fractions implies that a larger number of women engineers remain without a job. This is not a happy scenario.

Finding the first job after graduation continues to be a major hurdle in the career path of women engineers. This is duly reflected by a higher percentage of unemployment amongst the younger members and the fact that the unemployed were without a job for over a year at the time of data collection. Resistance to entry in the job market seems to be the issue. This is aptly supported by the fact that participants of the study report having faced difficulties in being called for campus recruitment. It is further corroborated by the fact that 28.4% in the present study did not get their first job in the area of their specialisation. To a question as to what factors governed their accepting the first job, a significant number have responded with phrases like 'something better than nothing' or 'for experience'.

An important facet that emerged from the previous study was that the unemployment of women engineers was highest in Kerala, that too amongst those having a degree in Civil Engineering [2-4]. The overall unemployment amongst women engineers from Kerala was found to be 36% whereas unemployment amongst the women Civil Engineers from Kerala was over 50%.

The scenario presented by the present study is not very different in regard to the state of Kerala, which continues to have a high unemployment rate at 41.5%. However, the highest percentage of unemployment is now in Andhra Pradesh where 45.7% of the women engineers are unemployed. Unemployment in Karnataka and Tamil Nadu is 33.5% and 31.9% respectively.

On a branch-wise basis, the percentage unemployment amongst Electronics (37.3%) and Electrical (36.4%) Engineering graduates has increased significantly surpassing the unemployment amongst Civil Engineers, which is 30.9%. The unemployment amongst women engineers from Kerala who have a degree in Electronics Engineering is found to be as high as 70%, whereas for those from Andhra Pradesh with a degree in Electronics Engineering, it is found to be 65%. Even in Tamil Nadu and Maharashtra the percentage unemployment is highest amongst Electronics Engineering graduates, being 42.2% and 29.6% respectively. This scenario is not quite in tune with the general belief that Electronics is a good area for women engineers. It seems that there is now a big imbalance between the demand and supply of graduates in Electronics Engineering. It is necessary to verify whether or not such increased unemployment is generally applicable to all the graduates in Electronics Engineering, men and women, or is true only for women engineers.

Sector of employment

Table 6 contains the data on the sector of employment of respondents. The data pertains to the group employed at the time of data collection. Data on sector-wise distribution of the employed respondents as obtained in the previous study is also given in the table, for comparison.

It can be seen from the table that Technical Educational Institutions (TEI) continue to be the largest avenue for employment of women engineers. Out of the employed respondents, 26.9% in the previous study and 29.8% in the present study are employed in TEI. Government, Civil Services, R&D organisations (government or private) and PSU were the other organisations, where 49.8% of the respondents were employed at the time of the

Table 5. Unemployment v/s year of graduation

Year of graduation	1994	1995	1996	1997	1998	Total
No. of respondents	91	132	172	257	368	1020
Unemployed number (%)	14 (15.4%)	26 (19.7%)	47 (27.3%)	77 (30.0%)	148 (40.2%)	312 (30.6%)

Table 6. Types of employers

Type of employer	Present study Number (%)	Previous study Number (%)
Technical educational institutions	167 (29.8)**	490 (26.9)
Govt. or Civil Service	26 (4.6)	402 (22.0)
R&D organisations (Govt. and pvt.)	24 (4.3)	163 (8.9)
Public sector units	32 (5.7)	344 (18.9)
Private industry (large-scale)	103 (18.4)	232 (12.7)
Private industry (small-scale)	161 (28.8)	166 (9.1)
Others*	47 (8.4)	28 (1.5)
Total No. of employed respondents	560 (100.0)	1825 (100.0)

* Voluntary Organisations, No Response etc.

** Including computer institutes, coaching classes

previous study. The scenario has changed since then and this fraction has dropped to only 14.6% in the present study. Closing down of PSUs [9] is one of the likely reasons resulting in this change. (Last decade has witnessed radical changes in Indian industrial scenario with closure of many PSUs.)

Employment in the large-scale private sector industry has increased from 12.7% in previous study to 18.4% in the current one. The growth of the IT industry and significant employment of women engineers as software professionals is the reason for this increase. Diminished employment in civil services and other government industrial/R&D organisations could also be related to the same phenomenon.

An increase in the employment fractions from 9.1% to 28.8% in the small-scale industrial sector is also to be noted. Whereas increased employment in large-scale private sector industry is a welcome trend and can be considered as an improvement over the previous scenario, the same does not necessarily apply for employment in the small-scale sector. More often than not, women have reported accepting employment in small-scale industry because of 'no other option'. A job in a small-scale industry is generally an

under-employment with a low salary. This is amply evinced by responses like 'something better than nothing' to a question where reasons for accepting a job were sought. 'Salary too low' and 'ad-hoc/temporary jobs', often stated as the reasons for refusing a job also endorse the fact.

In an overall sense, limited job opportunities in terms of sector of employment are reflected by the data of both the present and the previous study. Although some changes have taken place since the previous study, the situation is still far from satisfactory. What the data does not reflect and is a recorded fact that even today, there are industrial organisations having policies against hiring women engineers [2, 10] and they have no hesitation in making statements to such an effect.

Nature of work

Data on 'nature of work' matches with the data on the 'type of employer'. Teaching tops the list, as do the TEIs. This generally holds in both the studies with about 28% women engineers doing teaching (Table 7).

During the period between the two studies, 'R&D' and 'EDP/Computer' have interchanged places. Whereas 'R&D' stood only next to 'Teaching' in the previous study, it ranks fourth in the

Table 7. Nature of work

Nature of work	Present study Number (%) {rank}	Previous study Number (%) {rank}
(a) Teaching	138 (31.8) {1}	515 (28.2) {1}
(b) R&D	37 (8.5) {4}	296 (16.2) {2}
(c) Design	77 (17.7) {3}	293 (16.1) {3}
(d) Production	8 (1.8) {9}	74 (4.1) {7}
(e) Maintenance & troubleshooting	24 (5.5) {5}	145 (8.0) {5}
(f) Construct./erect./commissioning	16 (3.7) {8}	68 (3.7) {9}
(g) EDP/Computer	80 (18.4) {2}	167 (9.2) {4}
(h) Consultancy	20 (4.6) {7}	67 (3.7) {9}
(i) Project planning	21 (4.8) {6}	88 (4.8) {6}
(j) Marketing	4 (0.9) {11}	36 (2.0) {11}
(k) Finance	2 (0.5) {12}	7 (0.4) {12}
(l) Management	7 (1.6) {10}	69 (3.8) {8}
Total	434* (100.0)	1825 (100.0)

* Employed respondents who have answered the concerned question

present study. On the other hand 'EDP/Computer' has risen from 4th to 2nd rank. This is quite an expected happening because of the growth of the software industry. Design ranks third, in either study. 'Project Planning' follows 'Maintenance and Troubleshooting'. Comparatively small numbers involved in 'Production', 'Construction/Erection/Commissioning', 'Consultancy', and 'Management' need to be noted. Insignificant involvement in Marketing and Finance jobs and the unchanged status about these, over the last decade, also need to be underlined. On the whole therefore as far as the nature of work is concerned, the picture has remained essentially unchanged excepting for a significant increase in software, computer related jobs.

Career profile

Pace of career growth and the career problems are two important aspects of career profiles. Findings discussed in the following paragraphs have been derived from the data of both, the present and the previous study.

Pace of career growth

The extent of management responsibilities is considered as an indicator of the hierarchical position of a person in an organisation. In the earlier study [2], where the sample consisted of graduates over a 15-year time span, such data was

collected and analysed in an attempt to assess the career growth pattern of women engineers. The data of the employed respondents presented in Fig. 1 was received in response to a question asking whether or not they have management and/or administrative responsibilities, in the first study. Corroborative data was obtained through another question seeking information about the level of management to which the respondents belonged.

It is interesting to note that only 20% of the graduates of 1975-76 belonged to the upper management and that the same reduced to less than 5% for graduates of later years. This can be referred to as the 'glass ceiling' that women rarely cross. It is even more disheartening to note that a quarter of those who passed in 1975-76 had 'no management responsibilities' at all, even after 15 years. Increase of 'no management responsibilities' fraction amongst the graduates of later years is to be expected. All the same, the value of this fraction being over 40% for the graduates of 1977-78 and 54% for the graduates of 1979-80 certainly is a cause for concern and indicates the slow pace of career growth of women engineers.

Career problems

Career-related problems faced by women start right from the student stage. A large number state that they failed to get a placement of their choice

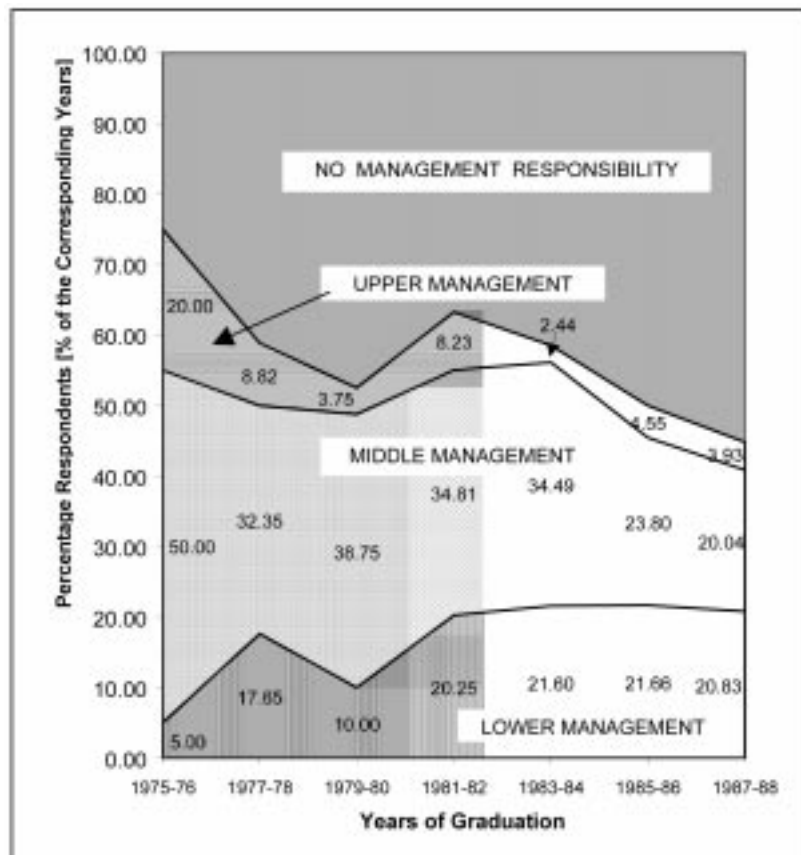


Fig. 1. Management/administrative responsibilities and years of graduation.

Table 8. What is the motivation for taking up further studies?

	Number	%
(a) Wanted to study further	80	54.1
(b) Did not get a job of choice so decided to go in for further studies	41	27.7
(c) Realised that teaching would suit better as a career	16	10.8
(d) Any other	11	7.4
Total	148	100.0

for training. Then follow the difficulties in getting a call for campus interview and a job through campus recruitment. In fact, getting the first job after graduation emerges as the major hurdle women engineers face during their professional career. A significant number, of those who opt for further studies, do so for want of a job (Table 8). Lack of opportunities, reluctance of the employers and requirement of experience, figure prominently as the factors resulting in such a situation. In certain states and locations, a need for having contacts for getting a job has been clearly expressed by the respondents. An overall scarcity of jobs and abundance of engineers is reflected in the responses through expressions like 'Too many applicants for a job', 'Too many competitors'. Some personal and family factors also restrict the job opportunities for women engineers, particularly at the entry level. These include hesitation of parents in letting the girls travel long distances for interviews and job and reluctance towards letting them stay alone. Married women necessarily look for a job in the vicinity of the place of their stay, at least in the same city. This constrains their job prospects.

Respondents have mentioned 'language difficulty during interviews', as one of the reasons for not getting a job. Lack of confidence and a feeling of incompetence has also been mentioned. The emergence of numerous private engineering colleges with insufficient facilities and faculty are responsible for this. New names used for the branch specialisations and lack of awareness of the employers about the same has also been mentioned as an issue. Although some of these factors may equally hold for men, they seem to be affecting women more severely.

Women engineers have strongly expressed the view that they do not get what they deserve in terms of jobs, promotions, salaries as well as professional recognition. 'Unsatisfactory work opportunities and environment' is the most frequently stated factor affecting their career. 'Low financial incentives' has also figured as a career problem. The job and career problems faced by women engineers are duly reflected by the typical quotations given below. Each of these is one out of many similar expressions of frustration received as a response to certain questions wherein a space for free expression was deliberately provided. The last number in the parenthesis at

the end of each quote is the year of graduation of the respondent.

'What will you do when you get married?' This question is asked only to female candidates despite the fact that men tend to change jobs more often (as I have seen). A question about your future is quite hard to answer and I have felt this has been a major reason for rejection. A few companies which came to college also clearly stated that they did not require female engineers. (wom-4/KRL/EL/98)

In some states, like in our Gujarat, ladies seats (15%) are reserved. But if after completion of BE there is no scope to work as an engineer then what is the use of reserving these seats for women? If hard work, costly education like BE, is not able to give us a job (even at Rs.3000) then what is the meaning behind it? In future women will have to think before seeking admission to engineering or we can say that no lady will take admission in this type of field. (wom-320/GUJ/EL/98)

I accepted my engineering. But after the completion all my dreams went like bubbles of the water. I was not allowed to go in search of a job. Due to my family situation, I was not allowed for further studies. But now after a long struggle I am doing my MBA in BIM by distance education and working as a part-time lecturer in the near by government engineering college. Women have to struggle. (wom-77/KAR/ELN/96)

I consider myself to be a thoroughly professional worker. I valued my company's goals and made sure that my goals were a mirror image of my company's future plans and aspirations. However, my disappointment is evident. After 1½ years of service to my company, I find that there is no 'up' for me. I can only move 'down' or 'side-ways'. As a female, I will always have to settle for a dull mediocre desk job. It stifles my productivity. I don't get to learn as much as I would on-site. (wom-18/MAH/CIVIL/97)

You have to really work hard to convince others that you are the same person with same efficiency and sincerity even though now you are married. (wom-503/MAH/EN/95)

Civil engineering is a field considered unsuitable for women as it involves lot of fieldwork. So the employers are doubtful about the capability of woman to work efficiently under harsh conditions of site. (wom-155/GUJ/CIVIL/98)

It can be seen that the general tone of the quotations is that of anger, frustration and disappointment at all stages, may it be a job interview, a job or promotion opportunities.

CONCLUSIONS

1. Data on the employment status of women engineers shows a decrease in the employed fraction from 68.7% in the previous study to 54.9% in the present study. The unemployed fraction has increased and there is a significant increase in the number of PG students.
2. The out-turn rates have increased with the passage of time and so has the percentage of the unemployed. Simultaneous increase of both

implies that a larger number of women engineers are without a job. Unemployment is higher in the states and branches having higher out-turn rates. In the present study the highest unemployment is in Andhra Pradesh, whereas in the previous study, it was highest in Kerala. On a branch-wise basis, the highest unemployment is now found amongst Electronics and Electrical Engineering graduates, whereas earlier it was highest amongst Civil Engineering graduates.

3. Technical educational institutions continue to be the main employment avenue for women engineers, the percentage increasing from 26.9% in the previous study to 29.8% in the present study. There has been a significant drop of employment in government/civil services and public sector units and a significant increase in the numbers and percentages employed in the private sector. This could be attributed to the decreasing importance of the public sector and the upsurge of IT industry. A fairly large number of women engineers are employed in small-scale private industry. Unlike employment in the large-scale private sector, this does not imply a positive development. The responses clearly indicate acceptance of such jobs for want of better ones.
4. Teaching predominates as the nature of work followed by EDP/Computer in the present study, whereas in the previous study, R&D was the second ranker in nature of work. Involvement in Marketing and Finance related jobs has remained insignificant.
5. Women face difficulties in getting the preferred training placement as a student, in being called

for campus interviews and in getting a job through campus recruitment. These career problems have been reported in both studies. In fact getting the first job after graduation has continued to be the major hurdle in the career path of women engineers. No change is reflected on this count.

6. Considering management and administrative responsibilities as indicators of positions acquired in the hierarchical ladder, the data not only reflects a slow pace of career growth of women engineers, but also affirms the presence of a glass ceiling. Very few women engineers attain the upper management levels, most getting stranded in the middle levels.

Thus the scenario about the employment status has changed only as far as the sector of employment is concerned. All other facets have remained unchanged in the past decade. Change, if any, is either not noticeable or is not towards anything better as perceived by women engineers themselves. This is different from the previous study where the respondents perceived that some changes for the better were taking place. Enhanced manifestation of the problems may be due to the increased number of affected subjects. The situation calls for immediate and active remedial measures.

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