

A declining trend in the interest of fresh graduates for doctoral and post-doctoral training in different areas of science and technology

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This study was conducted for the period of 1989–96 on the interest among the master's and doctorate degree holders for pursuing doctoral and post-doctoral research through support of CSIR in the form of research scholarships. It was found that over the 1991–96 period there was on an average only 0.4% increase in the enrolment rate for predoctoral and post-doctoral stipendary scholarships, in contrast with over 2.1% growth rate in population and more than 5% rate of increase in enrolment to tertiary education courses. The observation suggests that the interest of fresh graduates in the pursuit of doctoral and post-doctoral studies in science has decreased in India in the recent years. It has been surmised that the reported drop in the number of scientific research publications from India is because of the drop in the number of persons conducting doctoral and post-doctoral research.

ECONOMIC growth of a country is dependent on the science and technology (S&T) outputs and application of the R&D results into agricultural and industrial production, maintenance of the health of the people and mitigation of environmental pollution. An S&T output is in the form of the research publications and the recent studies on the international publications pattern indicate that the number of S&T publications from India is falling¹. It is felt that this trend may negatively affect India's growth. The essential inputs for S&T developments include information, infrastructure, funds and manpower. On account of the large size of India's population, and simultaneous emphasis on primary, secondary and tertiary level education, the S&T manpower will continue to be of prime importance, when other inputs will continue to be limited. The contributors to the scientific literature are the established scientists and the doctoral and post-doctoral trainees associated with the former. A question in relation to the above that we have addressed is as to whether the decreasing trend in the number of papers published from India is related to any decreasing interest in the pursuit of science among young persons eligible to carry out doctoral and post-doctoral work? This question has been examined through a study of the trends in the demonstration of interest by fresh

graduates in the recent years in the pursuit of doctoral and post-doctoral education programmes.

Methodology

In India, the specialization in science begins at the secondary level of education at 10+2 level. All the science students have to study physics, chemistry, biology and mathematics to obtain the 10+2 certificate. Students opt for different disciplines of natural sciences, engineering and medicine at the graduate, post-graduate and doctoral levels. A number of agencies of the government offer fellowships to support education and training at the doctoral and post-doctoral levels, depending upon their interest in the specialization of the out-turnees. CSIR offers fellowships at doctoral level in two ways to the master's degree holders: (i) through a competitive CSIR-UGC national educational test (NET) conducted for offering the junior research fellowships (JRF) to the successful candidates; and (ii) by conducting oral interviews of the master's degree holders possessing two years of practical experience for offering senior research fellowships (SRF) and of the Ph D degree holders for the offer of research associateships (RA) and senior research associateships (SRA)^{2,3}. CSIR's fellowships and associateships roughly account for 50% of such opportunities offered in India and are much sought-after. The number of applications received for the award of these scholarships over the period 1989 to 1996 is thus fair

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indicative measure of the interest of graduates in the pursuit of higher education. The data on the population and out-turns from the university system³⁻⁵, and applications received in CSIR over the 1989 to 1996 period have been utilized here for parametering the developing trends in the area of higher education in science, engineering and medicine disciplines of the S&T in India.

Results

An analysis of the data on the number of applications received in the CSIR for its JRF, SRF, RA and SRA scholarship schemes is presented in Table 1.

The number of the examinees of the NET conducted by the Council of Scientific & Industrial Research and University Grants Commission (CSIR-UGC) for the selection of candidates for the JRF-ship grew at an average rate of only about 1.6% in 1993-94 and 5.2% in 1995-96 over the figures of 1991-92. While this marginal increase occurred in most of the natural science disciplines, the interest in the earth science discipline dropped considerably. The trend is also evident from Figure 1 *a* where the interest in the JRF-ship has been

measured as a ratio of the applicants and total post-graduate out-turn. In all the fields of science and engineering, the number of persons opting for SRF-ship of CSIR went progressively down during 1989 to 1996. There was drop in the interest to take SRF-ship of about 17% over the period 1991-92 to 1993-94. A further 13% drop took place between 1993-94 and 1995-96. Among all the disciplines in natural sciences, the drop in the interest of postgraduates for doctoral studies was particularly striking in physical sciences (including mathematical science) and earth sciences, where the percentage drop from 1991-92 to 1995-96 was about 36% and 54% respectively. The interest for the doctoral work in medicine and engineering also waned by 28% over 1991-92 to 1995-96. Similar trends emerged when the continuance of the interest in pursuit of sciences among master's degree holders was measured by the ratio between the applicants of SRF of CSIR for a particular year divided by the number of MSc graduates of two years earlier. These ratios for different scientific disciplines are shown in Figure 1 *b*. It will be seen that as compared to the ratios of 1989-90, which were in the range of 0.003 to 0.134 in the

Table 1. Number of applicants for the CSIR's junior and senior research fellowships, research associateships and senior research associateships in different disciplines of natural sciences, medicine and engineering

Fellowship/associateship	Subject area	Number of candidates who applied for the fellowship/associateship in the years			
		1989 + 90 ^a	1991 + 92	1993 + 94	1995 + 96
Junior research fellowship (JRF)	Chemical science	4478	11,054	11,147	11,769
	Earth science	1551	3480	2384	1912
	Engineering science ^b	391	4141	2914	734
	Life science	6116	17,235	18,980	20,436
	Mathematical science	2415	6367	6366	7648
	Physical science	2493	7292	8552	9631
	Sub-total	17,444	49,569	50,343	52,130
Senior research fellowship (SRF)	Chemical science	801	731	698	610
	Earth science	299	382	251	175
	Engineering science	260	492	354	338
	Life science	1822	2081	1918	1610
	Medical science	414	508	365	337
	Physical science ^c	617	559	371	359
	Sub-total	4213	4753	3957	3429
Research associateship (RA)	Chemical science	535	664	684	597
	Earth science	122	239	273	242
	Engineering science	104	194	147	119
	Life science	964	1134	1232	1074
	Medical science	123	167	125	155
	Physical science ^c	231	372	467	467
	Sub-total	2079	2770	2928	2654
Senior research associateship (SRA)	Medicine	881	514	264	245
	Natural science	519	307	288	257
	Engineering/technology	138	98	49	17
	Sub-total	1538	919	601	519
Total		25,274	58,011	57,829	58,372

^a = For JRF, the figures are for the year 1990 only.

^b = The engineering discipline was discontinued from mid 1995.

^c = This broad subject includes mathematical science.

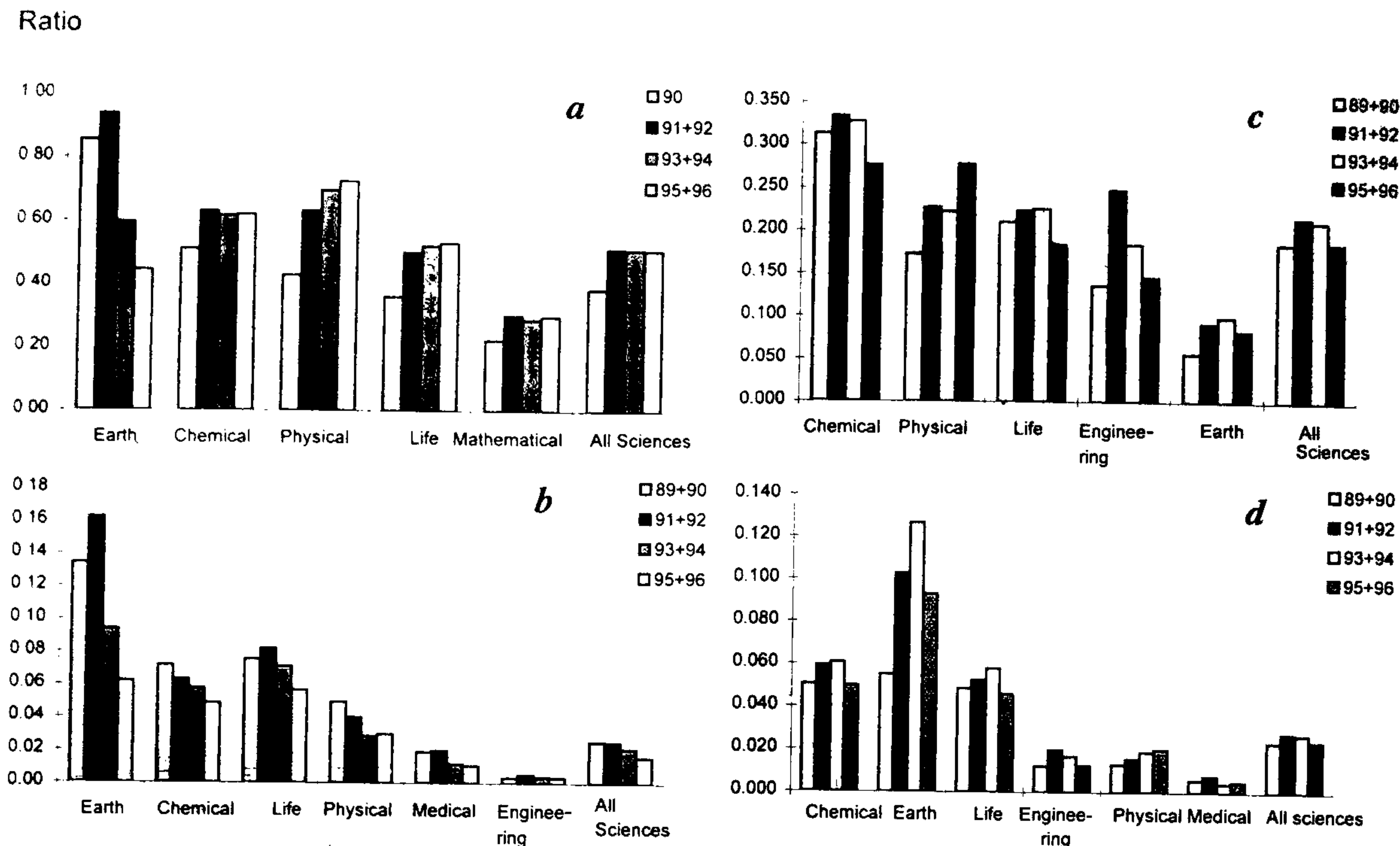


Figure 1. Subjectwise ratios of the number of applicants for a position and the total post-graduate out-turn. *a*, Ratios of the number of applicants for the CSIR-UGC junior research fellowships in a year and the total post-graduate out-turn of that year as well as of one year ago, for the period 1990 to 1996. *b*, Subjectwise ratios of the number of applicants for the CSIR senior research fellowships in a year and the total post-graduate out-turn of two years ago, for the period 1989 to 1996. *c*, Subjectwise ratios of the number of applicants for the CSIR research associateships in a year and the total doctorate out-turn of one year ago, for the period 1989 to 1996. *d*, Subjectwise ratios of the number of applicants for the CSIR research associateships in a year and the total post-graduate out-turn of five years ago, for the period 1989 to 1996.

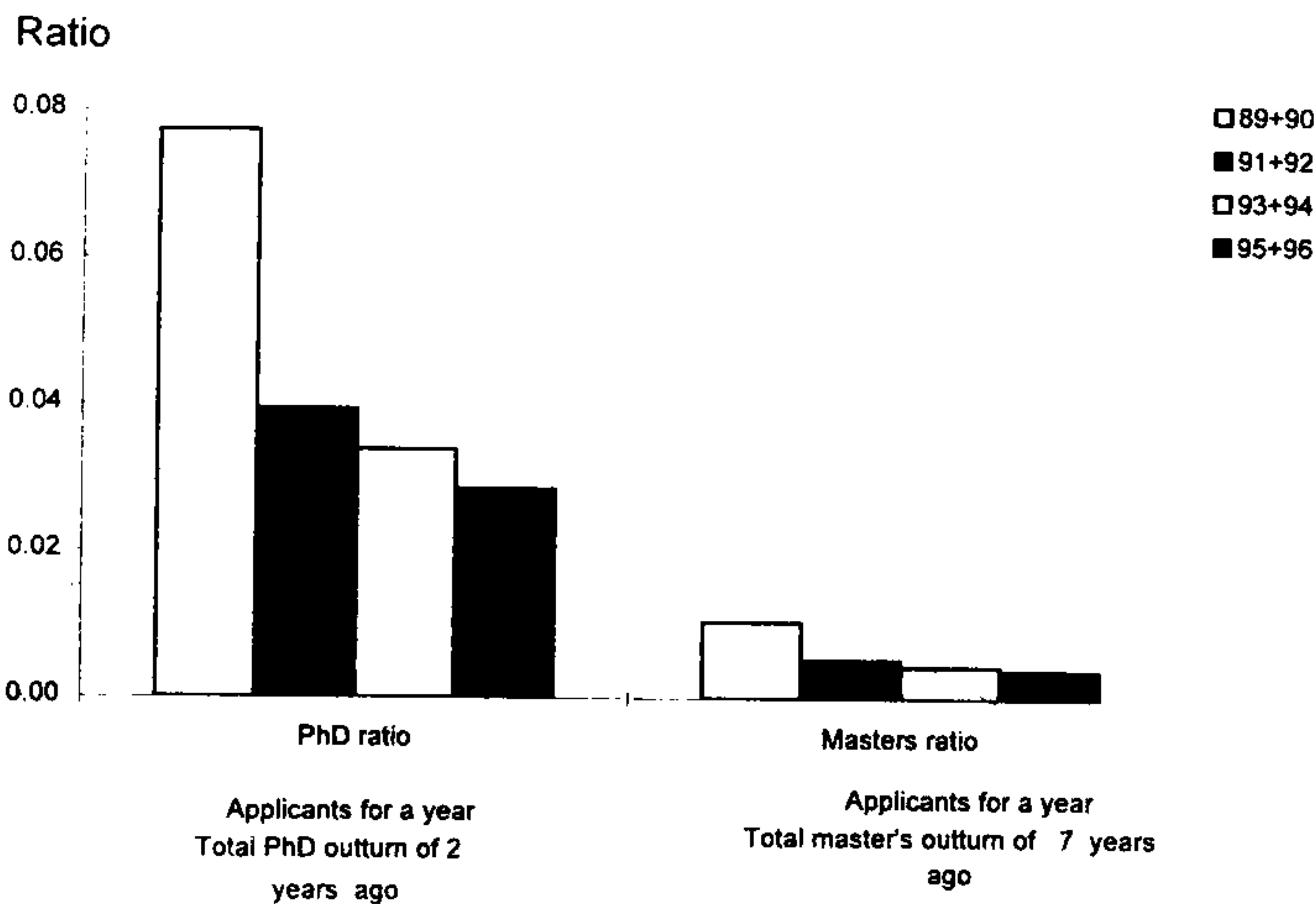


Figure 2. Subjectwise ratios of the number of applicants for the CSIR senior research associateships in a year and the total doctorate and post-graduate out-turn of two and seven years ago, for the period 1989 to 1996.

different disciplines, ranging from engineering to earth science, the comparative ratios in 1995-96 were in the range of 0.003 to 0.062. There has been reduction in the interest of continuing scientific research at the post-

doctoral level in most of the scientific disciplines except in the engineering science where the level of interest has continued to be stable.

The trend of interest in the pursuit of the post-doctoral

studies as RA is similar to that for doctoral studies as SRF as can be seen from Table 1 and Figures 1 *c* and 1 *d*. The number of persons opting for RA or post-doctoral research has gone down since 1993–94. In the engineering sciences, interest in the post-doctoral research dropped by about 20% over 1993 to 1996 period. There has been decline of interest in the RA-ship on an average of about 12% in other natural sciences disciplines, excepting physics where the interest has sustained. The drop of interest in the RA-ship has been a little less pronounced than that in SRF-ship presumably because

of the commitment to the scientific career already made by the scholars who are holding PhD or equivalent degree. It will further be noted from Figure 2 that there has been continuous decline in the interest in pursuing sustained post-doctoral research since 1989 in all the areas of science and engineering. Between 1989–90 and 1995–96 the drop in such interest has been to the extent of about 65%.

Figure 3 shows that the interest in the pre- and post-doctoral pursuit of scientific research has not been commensurate with the general growth of interest in the

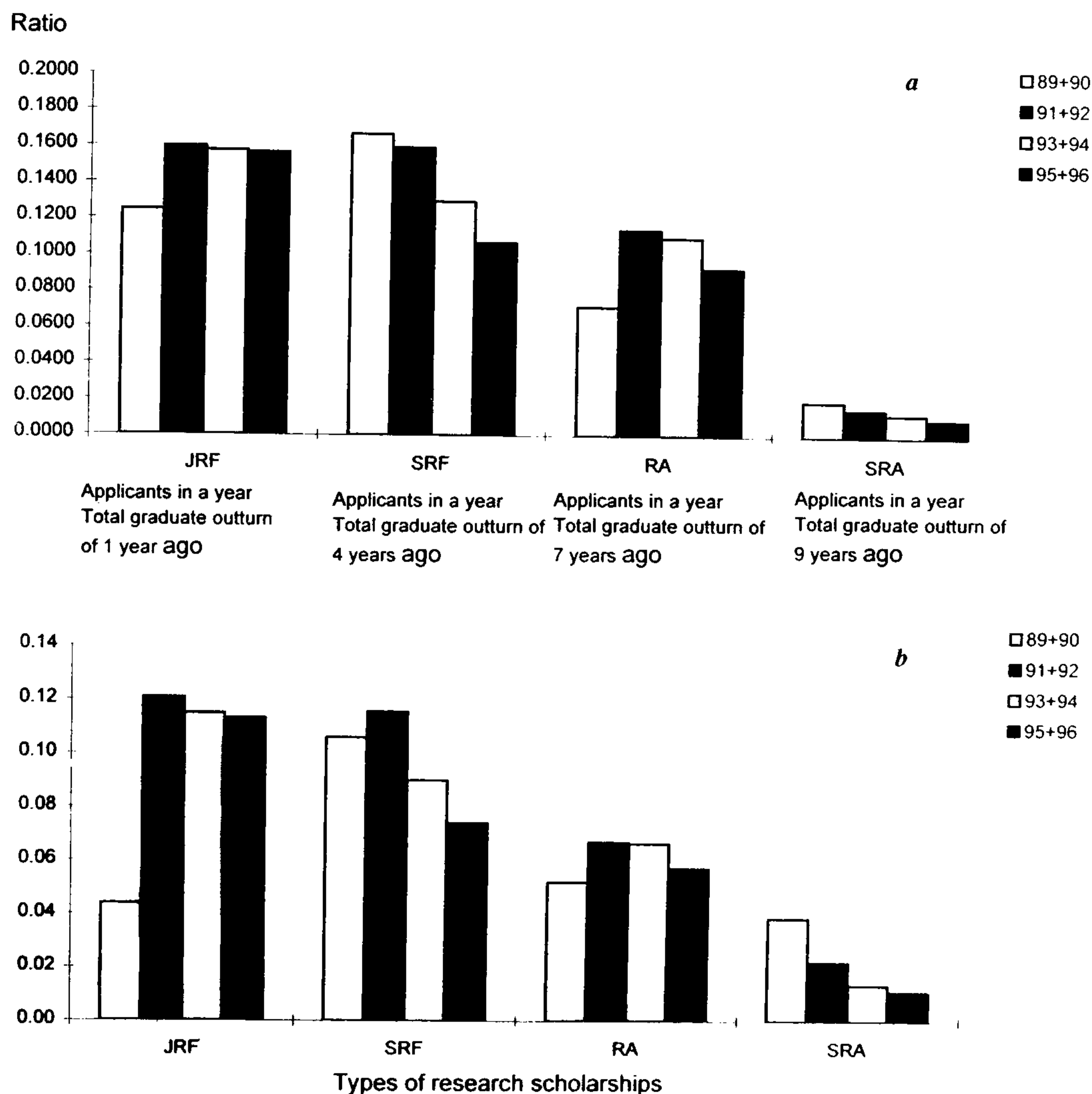


Figure 3. *a*, Yearwise ratios of the number of applicants for the CSIR junior and senior research fellowships, research associateships and senior research associateships in a year and the total graduate out-turn of one, four, seven and nine years ago respectively, for the period 1989 to 1996 (JRF is for the year 1990 only and not 1989 + 90). *b*, Yearwise ratios of the number of applicants for the CSIR JRF, SRF, RA and SRA research scholarships in a year and the total population of 20–34 years of age group, for the period 1989 to 1996 (JRF is for the year 1990 only and not 1989 + 90).

tertiary education and population rise. There has actually been a decline in interest, marginal in the case of pre-doctoral research through JRF-ship and a rather high level of erosion of interest in the pre-doctoral and post-doctoral research through SRF-ship, RA-ship and SRA-ship.

Discussion

Briefly, the above results have shown that over the 1991 to 1996 period, there was, on an average, only 0.4% increase in the enrolment rate for pre-doctoral and post-doctoral stipendary research scholarships in the form of JRF, SRF, RA and SRA of CSIR. This contrasts with about 2.1% growth rate in population and more than 5% rate of increase in the enrolment into tertiary education courses over the same period³. The answer to the question posed in the introduction is apparent from the above results. The interest in the pursuit of doctoral and post-doctoral studies in science has decreased in India in the recent years. It is also possible to conclude that the drop in the number of publications from India might be for the same reason. In this regard it is to be noted that the doctoral and post-doctoral research work done by the research scholars under the guidance of senior scientists is largely the basis of much of the work published from the country. Evidently, the career in science does not seem to be the main attraction for fresh graduates/post-graduates any more.

What are the reasons for the above developments? It is surmised that the drop in interest in scientific research among the young people in India may be related to the scarcity of job opportunities in the university system

and academic institutions, the former being more or less static in size and the latter having undergone a 10% cut. It seems that these forces are driving those students, who showed interest in a career in science at the 10+2 and graduate levels, from sciences to the vocational diploma level courses and trade and commerce-related areas at masters and doctoral levels. Another reason for the erosion of interest in science and engineering-related research careers among the younger generation may be due to the fact that avenues of employment have suddenly brightened in the manufacturing, trade and marketing sectors, partly on account of the liberalization of the nation's economy. However, the scientifically trained manpower will continue to be a prime need for the country. Scientists, engineers and medical doctors will be required in large numbers for the technological developments in agriculture, industry and medicine to improve the quality of life of the people. There is a need for all concerned to discuss this issue in detail for evolving a strategy for the growth of trained manpower in science and engineering in the country.

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