CSIR–UGC National Eligibility Test: a performance indicator of basic science education in Indian universities

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The performance of Indian universities in five subject areas (chemical, earth, life, mathematical and physical sciences) on the basis of the Council of Scientific and Industrial Research (CSIR)–University Grants Commission (UGC), National Eligibility Test (NET) conducted by CSIR during the period 2002–06 revealed that 60% of the students qualifying NET belonged to only 32 universities, and 16 universities out of these repeatedly showed their presence in each exam. It was observed by plotting the Lorenz curve that only ten universities contributed 50% of the selections from the top 32 universities. The results also indicated that the share of the top 20 universities in terms of the number of students who appeared was 41% and their share in the total selection was 33%. Activity index of the universities in different subject areas with respect to the number of students who appeared and those selected was examined to decipher the performance of the university in a particular discipline.

Keywords: Activity index, basic science education, Junior Research Fellowship, National Eligibility Test, performance indicator.

INDIA has built up an elaborate university system network to provide higher education and stimulate research in science and humanities since independence. Science education at the tertiary level is taught in around 400 universities and over 20,000 affiliated colleges. The National Eligibility Test (NET) was formulated to evaluate students from a wide spectrum of universities in a common platform in their subject areas, with an objective to ensure minimum standards for the entrants in research and teaching profession. The University Grants Commission (UGC) conducts NET in humanities and social sciences, whereas the Council of Scientific and Industrial Research (CSIR) conducts NET in basic sciences. A certain number of Junior Research Fellowships (JRFs) are awarded through NET, twice a year, to those holding M Sc or equivalent qualifications, with minimum 55% marks (50% for SC/ST/PH/VH candidates) in one of the five subject areas – chemical sciences; earth, atmosphere, ocean and planetary sciences; life sciences; mathematical sciences; and physical sciences. There are two papers and the selection is based on merit, considering the average of marks obtained in both the papers. The first paper (Paper-I) is objective type consisting of Part (A), which is of general nature, and Part (B) pertaining to the subject. The second paper (Paper-II) requires short descriptive answers to questions from the subject area to test the broad awareness of the scientific knowledge in the subject.

The CSIR NET has established enormous credibility over the years. It can be gauged by the simple fact that NET qualification has become a benchmark for selecting candidates for scientific projects, faculty positions and admission to Ph D programmes. The acceptability and popularity of NET has been constantly on the rise. Total enrolment for NET increased continuously over the years from about 25,000 in 1996 to more than 150,000 students in 2008 (Figure 1). A majority of the students appearing for NET are from life sciences (46%), followed by chemical sciences (24%), physical sciences (15%), mathematical sciences (12%) and the least (3%) from earth sciences (Figure 2).

Objective of the study

The objective of this study was to examine the performance of the students who appeared for CSIR–UGC NET for JRF from various universities during the period 2002–06. Activity index (AI) of a university in different subject areas with respect to the number of students who appeared and those selected was determined to indicate the performance of the university in a particular discipline.

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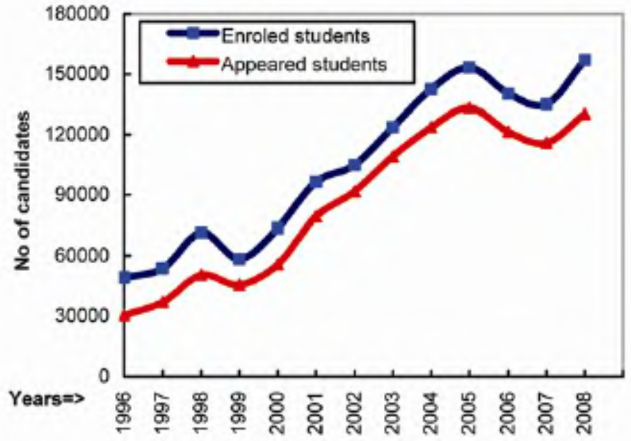

Figure 1. Enrolment profile of students in CSIR–UGC NET.

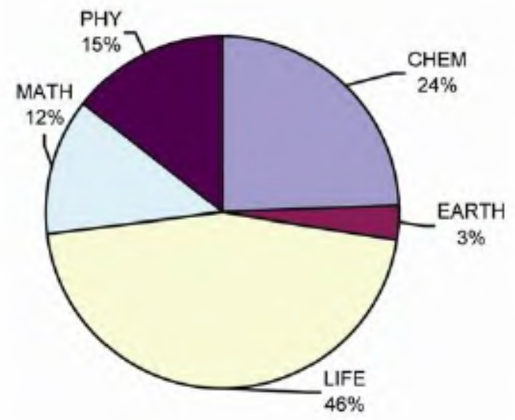

Figure 2. Subject-wise percentage of enrolment of students in CSIR–UGC NET.

Methodology

The performance of the students in CSIR–UGC NET for JRF in the ten exams conducted during the period 2002–06, was determined in terms of the number of students who appeared versus the number of students selected. Authentic and exhaustive query-based searches were made in the database created to rank the universities on the basis of their occurrence in the top 20, both in terms of number of students who appeared and those selected. Universities occurring at least seven times in the top 20 in the ten exams were included in the present study. The performance of the universities was judged on the basis of the total number of students selected and percentage of selection. During the period 2002–06, around 5 lakh students registered for CSIR–UGC NET for JRF from different parts of the country in five subject areas of basic sciences. Only 75% of the registered students appeared for writing the exam. Universities were ranked in decreasing order on the basis of the number of students who appeared and those selected.

Plotting of Lorenz curve for universities ranked on the basis of selection

Lorenz curves are used to represent the proportionality of a distribution. To build the Lorenz curve, all the elements of a distribution must be ordered from the most important to the least important, and each element is plotted according to its cumulative percentage. Selection data of students of the 'top 32 universities in terms of selection' were taken for plotting the Lorenz curve.

Activity index of universities ranked on the basis of selection

AI characterizes the relative impact of the students who appeared and those selected from the universities in a given subject area. AI was first proposed by Frame[1], and further elaborated by Schubert and Braun[2]. The major advantage of using AI over absolute count of student enrolment and selection in a particular discipline of a particular university is that it takes into account both total enrolment as well as total selection. The AI of universities ranked among the 'top 32 in terms of selection' in CSIR–UGC NET during the period 2002–06 was examined using the formulae

$$\text{AI } (A) = (A_{ij}/A_{io})/A_{oj}/A_{oo})\} \times 100,$$

where A_{ij} is the total number of students from university i who appeared in subject j; A_{io} is the total number of students of university i who appeared in all subjects, A_{oj} is the total number of students of the top 32 universities who appeared in subject j, and A_{oo} is the total number of students of all the universities who appeared in all the subject areas

$$\text{and AI}(S) = (S_{ij}/S_{io})/S_{oj}/S_{oo})\} \times 100,$$

where S_{ij} is the total number of students selected from university i in subject j; S_{io} is the total number of students selected from university i in all subjects, S_{oj} is the total number of students selected from the top 32 universities in subject j, and S_{oo} is the total number of students selected from all the universities in all the subject areas.

An AI of 100 indicates that the number of students who appeared or were selected from a university in a given discipline corresponds precisely to the average of 32 universities. An AI more than 100 reflects higher than average activity, whereas an AI less than 100 indicates lower than average activity.

Results and discussion

Universities not only contribute to the development of intellectual capital, but also to the generation of new

Table 1. University ranking by number of students who appeared in CSIR–UGC NET 2002–06. Figures in parentheses represent occurrence of the universities in the top 20 in ten exams

Rank	University	Number of students who appeared
1	Ch. Charan Singh University, Meerut	15867(10)
2	Osmania University, Hyderabad	11241(10)
3	Mahatma Gandhi University, Kottayam	10417(10)
4	University of Madras, Chennai	10370(10)
5	University of Rajasthan, Jaipur	10251(10)
6	Chhatrapati Shahu Ji University, Kanpur	9586(10)
7	University of Pune, Pune	8601(10)
8	University of Calcutta, Kolkata	8467(10)
9	Andhra University, Visakhapatnam	8220(10)
10	University of Kerala, Thiruvananthapuram	8021(10)
11	Bharathidasan University, Tiruchirappalli	7929(10)
12	University of Delhi, Delhi	7240(10)
13	Bangalore University, Bangalore	7098(10)
14	University of Calicut, Kozhikode	6952(9)
15	Purvanchal University, Jaunpur	6662(10)
16	Madurai Kamaraj University, Madurai	6040(10)
17	Dr Bhim Rao Ambedkar University, Agra	5738(9)
18	University of Lucknow, Lucknow	5576(9)
19	Panjab University, Chandigarh	5517(10)
20	Maharshi Dayanand Saraswati University, Ajmer	5475(7)

knowledge. The success of a university is determined on the basis of the academic culture, infrastructure, faculty, research output and quality of students produced. Selection profile of NET-qualified candidates in the ten exams conducted during the period 2002–06 indicated that 60% of the students qualifying NET were from 32 universities, and 16 universities out of these consistently appeared in the top 20 in terms of the number of students selected.

University ranking by number of students who appeared

Twenty universities showed their presence at least seven times in the top 20 list of universities with respect to cumulative number of students who appeared in the ten exams conducted during the period 2002–06 and their share to total number of students who appeared was 41%. Sixteen universities out of the top 20 repeatedly reserved their place in all the ten examinations. Maximum cumulative number of students who appeared in the ten exams was from Ch. Charan Singh University, Meerut (15,867) followed by Osmania University, Hyderabad (11,241) and Mahatma Gandhi University, Kottayam (10,417). Though majority of the students who appeared were from state universities, amongst Central universities, only University of Delhi showed its presence at the 12th position in terms of the number of students who appeared (Table 1).

University ranking by number of students selected

Thirty-two universities showed their presence in the top 20 at least seven times with respect to cumulative number of students selected in the ten exams. These universities, comprising six Central universities, 25 State universities and one institute of national importance, contributed 60% of the total number of students selected. Sixteen universities out of 32 reserved their place in the top 20 in all the ten exams. The remaining universities appeared in the top 20 position nine times (six universities), eight times (six universities) and seven times (four universities). Maximum numbers of students selected were from University of Delhi, Delhi (756) followed by University of Calcutta, Kolkata (691) and Banaras Hindu University, Varanasi (410; Table 2).

Fifteen universities out of the top 20 in terms of the number of students who appeared for the exam, also showed their presence in the top 32 universities in terms of selection. These universities contributed 33% of the total selected students. Ten universities amongst these, viz. University of Delhi, University of Rajasthan and University of Calcutta ranked between 1 and 5; Osmania University, University of Pune and Panjab University ranked between 6 and 10; Ch. Charan Singh University and Andhra University ranked between 11 and 15; Mahatma Gandhi University and University of Lucknow ranked between 16 and 20. Five universities, viz. Madurai Kamaraj University, University of Calicut, Maharshi Dayanand Saraswati University, University of Madras, and Chhatrapati Shahu Ji University, ranked between 21 and 32. The remaining five universities, viz. University of Kerala, Bharatidasan University, Bangalore University, Purvanchal University and Dr Bhim Rao Ambedkar University, in spite of being in the top 20 in terms of the number of students who appeared, could not make it to the top 32 universities in terms of selection.

Table 2. University ranking by total selection and selection percentage of students in CSIR–UGC NET 2002–06. Figures in parentheses represent occurrence of the universities in the top 20 in ten exams

University	Total selection	Rank	University	Percentage of selection
University of Delhi, Delhi	756(10)	1	Jawaharlal Nehru University, New Delhi	28.12
University of Calcutta, Kolkata	691(10)	2	University of Hyderabad, Hyderabad	13.60
Banaras Hindu University, Varanasi	410(10)	3	Indian Institute of Technology, Roorkee	11.92
University of Rajasthan, Jaipur	346(10)	4	University of Delhi, Delhi	10.44
University of Hyderabad, Hyderabad	294(10)	5	Jadavpur University, Kolkata	8.66
Indian Institute of Technology, Roorkee	288(10)	6	Banaras Hindu University, Varanasi	8.48
Jawaharlal Nehru University, New Delhi	284(9)	7	University of Calcutta, Kolkata	8.16
University of Pune, Pune	262(10)	8	G.B. Pant University of Agriculture and Technology, Pantnagar	8.06
Panjab University, Chandigarh	259(10)	9	M.S. University of Baroda, Vadodara	7.81
Osmania University, Hyderabad	247(10)	10	University of Burdwan, Bardhaman	6.27
Ch. Charan Singh University, Meerut	232(10)	11	Vidyasagar University, Midnapore	5.78
University of Burdwan, Bardhaman	194(10)	12	Himachal Pradesh University, Shimla	5.75
Jadavpur University, Kolkata	192(10)	13	Cochin University of Science and Technology, Kochi	5.05
Andhra University, Visakhapatnam	176(10)	14	Panjab University, Chandigarh	4.69
Vidyasagar University, Midnapore	172(10)	15	Aligarh Muslim University, Aligarh	4.24
Mahatma Gandhi University, Kottayam	159(10)	16	Pondicherry University, Puducherry	4.18
University of Lucknow, Lucknow	157(9)	17	University of Rajasthan, Jaipur	3.38
Utkal University, Bhubaneswar	148(9)	18	Utkal University, Bhubaneswar	3.20
Cochin University of Science and Technology, Kochi	142(9)	19	University of Pune, Pune	3.05
Himachal Pradesh University, Shimla	142(10)	20	University of Lucknow, Lucknow	2.82
Madurai Kamaraj University, Madurai	136(9)	21	University of Allahabad, Allahabad	2.81
University of Allahabad, Allahabad	134(8)	22	Guru Nanak Dev University, Amritsar	2.60
Aligarh Muslim University, Aligarh	131(8)	23	Madurai Kamaraj University, Madurai	2.25
G.B. Pant University of Agriculture and Technology, Pantnagar	126(7)	24	Osmania University, Hyderabad	2.20
Guru Nanak Dev University, Amritsar	124(8)	25	Andhra University, Visakhapatnam	2.14
University of Calicut, Kozhikode	119(9)	26	DDU Gorakhpur University, Gorakhpur	2.05
M. S. University of Baroda, Vadodara	112(8)	27	MD University, Ajmer	2.00
MD University, Ajmer	109(7)	28	University of Calicut, Kozhikode	1.71
University of Madras, Chennai	102(7)	29	Mahatma Gandhi University, Kottayam	1.53
Chhatrapati Shahu Ji Maharaj University, Kanpur	99(8)	30	Ch. Charan Singh University, Meerut	1.46
DDU University, Gorakhpur	94(7)	31	CSM Kanpur University, Kanpur	1.03
Pondicherry University, Puducherry	92(8)	32	University of Madras, Chennai	0.98

University ranking by percentage of selection

Thirty-two universities which had shown their presence in the top 20 for a minimum of seven times in the ten exams, were further ranked on the basis of percentage of selection. The selection percentage ranged between 0.98 and 28.12, with nineteen universities in the 0.98–5.0 range, nine universities in the 5–10 range and three universities in the 10–15 range. The top three institutions in terms of percentage of selection, viz. JNU (28.12%), University of Hyderabad (13.60%) and IIT Roorkee (11.92%) ranked at seventh, fifth and sixth positions respectively, in terms of the number of students selected. The top three institutions in terms of the number of students selected, viz. University of Delhi, University of Calcutta and Banaras Hindu University ranked at fourth, seventh and sixth positions respectively, in terms of percentage of selection (Table 2).

Though the number of universities and colleges has increased tremendously over the years and massive efforts are being made for the development of human resource in S&T, the selection data indicate that less than 10% of the universities performed fairly well over the years in terms of number of students qualifying NET. It is a proven fact that world over, the institutions which excel in teaching do well in research. It is high time that we lay emphasis on quality teaching to increase overall standards of teaching and research in the country, if India is to compete globally for knowledge-based economy. Enrolment profile of CSIR–UGC NET qualified students indicates that 52% of the total students (7601) supported by CSIR as on 1 January 2009 were working in institutions, rated as top 35 in terms of publication output in Scopus International database[3], 1999–2006.

It has been observed that the universities which are in the top 20 in terms of registration performed poorly in terms of percentage of selection, except University of Delhi (rank 4); University of Calcutta (rank 7); Punjab University (rank 14); University of Rajasthan (rank 17) and University of Pune (rank 19). Five universities, viz. University of Kerala; Bharatidasan University; Bangalore University; Purvanchal University and Dr Bhim Rao Ambedkar University, which in spite of being in the top 20 in terms of

Table 3. Data for plotting Lorenz curve (top 32 universities)

Appearance	Selection	Selection/ appearance	Cumulative appearance count	Percentage of total appearance	Cumulative selection count	Percentage of total selection
1	2	3	4	5	6	7
			0	0.00	0	0.00
10370	102	0.010	10370	5.73	102	1.47
9586	99	0.010	19956	11.04	201	2.90
15867	232	0.015	35823	19.81	433	6.25
10417	159	0.015	46240	25.57	592	8.54
6952	119	0.017	53192	29.41	711	10.26
5475	109	0.020	58667	32.44	820	11.83
4575	94	0.021	63242	34.97	914	13.19
8220	176	0.021	71462	39.52	1090	15.73
11241	247	0.022	82703	45.73	1337	19.30
6040	136	0.023	88743	49.07	1473	21.26
4769	124	0.026	93512	51.71	1597	23.05
4761	134	0.028	98273	54.34	1731	24.98
5576	157	0.028	103849	57.43	1888	27.25
8601	262	0.030	112450	62.18	2150	31.03
4631	148	0.032	117081	64.75	2298	33.16
10251	346	0.034	127332	70.41	2644	38.16
2199	92	0.042	129531	71.63	2736	39.49
3090	131	0.042	132621	73.34	2867	41.38
5517	259	0.047	138138	76.39	3126	45.11
2810	142	0.051	140948	77.94	3268	47.16
2469	142	0.058	143417	79.31	3410	49.21
2978	172	0.058	146395	80.96	3582	51.70
3094	194	0.063	149489	82.67	3776	54.50
1434	112	0.078	150923	83.46	3888	56.11
1563	126	0.081	152486	84.32	4014	57.93
8467	691	0.082	160953	89.01	4705	67.90
4835	410	0.085	165788	91.68	5115	73.82
2217	192	0.087	168005	92.91	5307	76.59
7240	756	0.104	175245	96.91	6063	87.50
2417	288	0.119	177662	98.25	6351	91.66
2161	294	0.136	179823	99.44	6645	95.90
1010	284	0.281	180833	100.00	6929	100.00

registration, could not make it to the top 32 universities in terms of selections. The remaining ten universities in terms of percentage of selection ranked between 19 and 32; for instance, University of Lucknow (rank 20); Madurai Kamaraj University (rank 23); Osmania University (rank 24); Andhra University (rank 25); Maharshi Dayanand Saraswati University (rank 27); University of Calicut (rank 28); Mahatma Gandhi University (rank 29); Ch. Charan Singh University (rank 30); Chhatrapati Shahu Ji Maharaj Kanpur University (rank 31) and University of Madras (rank 32). To augment quality S&T human resource development in the country, we can (i) initiate improvement programmes in the universities showing prominence in terms of CSIR–UGC NET enrolment, but performing poorly in terms of percentage of selection and (ii) increase the number of seats and the relevant infrastructure in the universities which are good at percentage of selection, but poor in NET enrolment. The differences in percentage of selection of students from different universities in CSIR–UGC NET and with only 32 universities securing 60% of the fellowships repeatedly year after year, remind us that concerted efforts must be made to raise the overall standard of teaching in the country.

Plotting of Lorenz curve for the top 32 universities in terms of selection

Table 3 depicts the data and calculation for plotting the Lorenz curve. Columns 4 and 6 indicate the cumulative number of students who appeared and those selected respectively. Column 5 and 7 indicate these as percentages (Figure 3). The percentage of selection is plotted against that appeared in Figure 3. The results indicate that 50% of the selection is from ten universities, and the remaining 50% is contributed by 22 universities.

Appearance versus selection of students – discipline-wise activity index

AI(A) and AI(S) values in different disciplines of the top 32 universities in terms of total number of students who

Table 4. Subject-wise appearance of students in CSIR–UGC NET of top 32 universities. Figures in parentheses represent activity index (AI)

University	Chemical science	Earth science	Life science	Mathematical science	Physical science	Total
University of Delhi, Delhi	1606 (86)	345 (124)	2304 (80)	1333 (126)	1652 (144)	7240
University of Calcutta, Kolkata	1260 (58)	341 (105)	4417 (131)	1225 (99)	1224 (91)	8467
Banaras Hindu University, Varanasi	791 (63)	639 (345)	1705 (89)	800 (113)	900 (117)	4835
University of Rajasthan, Jaipur	3276 (124)	821 (209)	4272 (105)	715 (48)	1167 (72)	10251
University of Hyderabad, Hyderabad	441 (79)	0 (0)	801 (93)	524 (165)	395 (115)	2161
Indian Institute of Technology, Roorkee	617 (99)	277 (299)	408 (42)	554 (156)	561 (146)	2417
Jawaharlal Nehru University, New Delhi	11 (4)	363 (939)	443 (110)	15 (10)	178 (111)	1010
University of Pune, Pune	3524 (159)	219 (66)	2925 (85)	690 (55)	1243 (91)	8601
Panjab University, Chandigarh	863 (61)	94 (44)	2433 (111)	1023 (126)	1104 (126)	5517
Osmania University, Hyderabad	5566 (192)	311 (72)	3143 (70)	1275 (77)	946 (53)	11241
Ch. Charan Singh University, Meerut	3317 (81)	10 (2)	6851 (108)	2962 (127)	2727 (108)	15867
University of Burdwan, Bardhaman	615 (77)	96 (81)	1082 (88)	620 (137)	681 (138)	3094
Jadavpur University, Kolkata	525 (92)	327 (385)	61 (7)	697 (214)	607 (172)	2217
Andhra University, Visakhapatnam	2778 (131)	318 (101)	3578 (109)	705 (59)	841 (64)	8220
Vidyasagar University, Midnapore	629 (82)	2 (2)	1071 (90)	748 (171)	528 (112)	2978
Mahatma Gandhi University, Kottayam	2957 (110)	134 (34)	3326 (80)	1475 (97)	2525 (152)	10417
University of Lucknow, Lucknow	1683 (117)	290 (136)	2261 (102)	623 (76)	719 (81)	5576
Utkal University, Bhubaneswar	814 (68)	367 (207)	1942 (105)	636 (94)	872 (118)	4631
Cochin University of Science and Technology, Kochi	377 (52)	700 (651)	736 (66)	486 (118)	511 (114)	2810
Himachal Pradesh University, Shimla	441 (69)	35 (37)	986 (100)	519 (143)	488 (124)	2469
Madurai Kamaraj University, Madurai	1672 (107)	59 (26)	2463 (102)	834 (94)	1012 (105)	6040
University of Allahabad, Allahabad	1173 (95)	178 (98)	1972 (104)	772 (111)	666 (88)	4761
Aligarh Muslim University, Aligarh	747 (94)	279 (236)	1101 (90)	488 (108)	475 (97)	3090
G. B. Pant University of Agriculture and Technology, Pantnagar	66 (16)	41 (69)	1314 (211)	52 (23)	90 (36)	1563
Guru Nanak Dev University, Amritsar	1010 (82)	1 (1)	1693 (89)	1064 (152)	1001 (132)	4769
University of Calicut, Kozhikode	1633 (91)	33 (12)	2093 (76)	1674 (164)	1519 (137)	6952
M.S. University of Baroda, Vadodara	195 (53)	37 (67)	832 (146)	195 (93)	175 (77)	1434
Maharshi Dayanand Saraswati University, Ajmer	1912 (135)	178 (85)	2439 (112)	428 (53)	518 (60)	5475
University of Madras, Chennai	2335 (87)	223 (56)	5352 (130)	1451 (95)	1009 (61)	10370
Chhatrapati Shahu Ji Maharaj Kanpur University, Kanpur	2089 (84)	19 (5)	5412 (142)	854 (61)	1212 (80)	9586
Deendayal Upadhyaya Gorakhpur University, Gorakhpur	1286 (109)	7 (4)	1733 (95)	706 (105)	843 (116)	4575
Pondicherry University, Puducherry	478 (84)	180 (214)	819 (94)	368 (114)	354 (101)	2199
	46687	6924	71968	26511	28743	180833

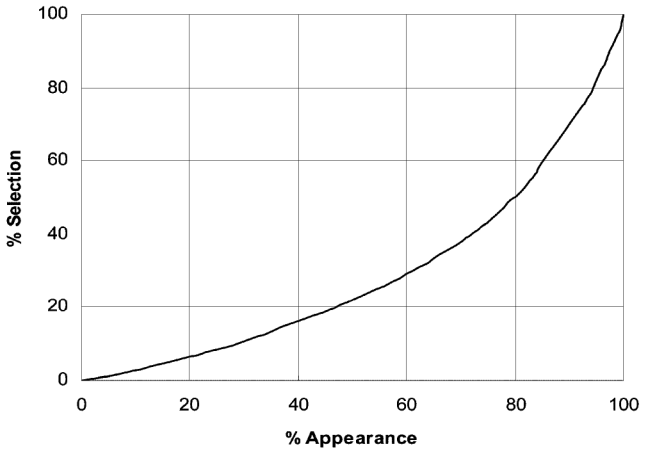

Figure 3. Lorenz curve for the top 32 universities.

appeared and those selected in NET are given in Tables 4 and 5 respectively. Based on the values of AI(A) and AI(S), universities have been classified into the following four categories (Table 6).

(i) AI(A) < 100 and AI(S) < 100; universities with less than the average enrolment and selection in NET.

(ii) AI(A) < 100 and AI(S) > 100; universities with less than the average enrolment, but more than the average selection in NET.

(iii) AI(A) > 100 and AI(S) > 100; universities with more than the average enrolment and selection in NET.

(iv) AI(A) > 100 and AI(S) < 100; universities with more than the average enrolment, but less than the average selection in NET.

Universities where AI(A) < 100 and AI(S) > 100 and universities where AI(A) > 100 and AI(S) > 100, in general, indicate better performance in a particular discipline.

Higher education in basic sciences is fundamental for generating intellectual prowess necessary to sustain and augment economic growth and prosperity. While the world is moving rapidly towards a knowledge-based economy, foreign institutions are striving hard for the higher education market. Universities where academic pursuits are encouraged, scholarship is prized and mediocrity is not consciously elevated, are invariably preferred. Unfortu-

Table 5. Subject-wise student selection in CSIR–UGC NET of top 32 universities. Figures in parentheses represent AI

University	Chemical science	Earth science	Life science	Mathematical science	Physical science	Total
University of Delhi, Delhi	126 (54)	22 (47)	424 (139)	53 (69)	131 (138)	756
University of Calcutta, Kolkata	256 (121)	19 (45)	231 (83)	102 (145)	83 (95)	691
Banaras Hindu University, Varanasi	94 (75)	29 (115)	225 (136)	31 (74)	31 (60)	410
University of Rajasthan, Jaipur	159 (150)	45 (212)	74 (53)	14 (40)	54 (124)	346
University of Hyderabad, Hyderabad	103 (114)	0 (0)	100 (84)	57 (190)	34 (92)	294
Indian Institute of Technology, Roorkee	67 (76)	33 (186)	85 (73)	49 (167)	54 (149)	288
Jawaharlal Nehru University, New Delhi	1 (1)	90 (515)	144 (126)	3 (10)	46 (129)	284
University of Pune, Pune	85 (106)	10 (62)	131 (124)	15 (56)	21 (64)	262
Panjab University, Chandigarh	47 (59)	2 (13)	104 (100)	51 (193)	55 (169)	259
Osmania University, Hyderabad	172 (227)	0 (0)	60 (60)	13 (52)	2 (6)	247
Ch. Charan Singh University, Meerut	46 (65)	0 (0)	100 (107)	47 (199)	39 (133)	232
University of Burdwan, Bardhaman	106 (178)	7 (59)	23 (29)	17 (86)	41 (168)	194
Jadavpur University, Kolkata	70 (119)	40 (339)	1 (1)	40 (204)	41 (169)	192
Andhra University, Visakhapatnam	110 (204)	7 (65)	48 (68)	4 (22)	7 (32)	176
Vidyasagar University, Midnapore	128 (242)	1 (9)	12 (17)	22 (126)	9 (42)	172
Mahatma Gandhi University, Kottayam	77 (158)	4 (41)	49 (76)	14 (86)	15 (75)	159
University of Lucknow, Lucknow	54 (112)	17 (176)	56 (88)	13 (81)	17 (86)	157
Utkal University, Bhubaneswar	48 (106)	10 (110)	41 (69)	12 (80)	37 (198)	148
Cochin University of Science and Technology, Kochi	15 (34)	52 (596)	49 (86)	15 (104)	11 (61)	142
Himachal Pradesh University, Shimla	25 (57)	1 (11)	107 (187)	3 (21)	6 (34)	142
Madurai Kamaraj University, Madurai	35 (84)	0 (0)	88 (160)	9 (65)	4(23)	136
University of Allahabad, Allahabad	29 (70)	4 (49)	58 (107)	19 (139)	24 (142)	134
Aligarh Muslim University, Aligarh	13 (32)	10 (124)	69 (131)	14 (105)	25 (151)	131
G. B. Pant University of Agriculture and Technology, Pantnagar	0 (0)	4 (52)	119 (234)	1 (8)	2 (13)	126
Guru Nanak Dev University, Amritsar	30 (79)	0 (0)	65 (130)	14 (111)	15 (96)	124
University of Calicut, Kozhikode	38 (104)	1 (14)	45 (94)	18 (148)	17 (113)	119
M.S. University of Baroda, Vadodara	4 (12)	1 (15)	102 (226)	5 (44)	0 (0)	112
Maharshi Dayanand Saraswati University, Ajmer	43 (128)	4 (60)	38 (86)	11 (99)	13 (95)	109
University of Madras, Chennai	54 (172)	1 (16)	33 (80)	6 (58)	8 (62)	102
Chhatrapati Shahu Ji Maharaj Kanpur University, Kanpur	23 (76)	0 (0)	43 (108)	18 (178)	15 (120)	99
Deendayal Upadhyaya Gorakhpur University, Gorakhpur	37 (128)	1 (17)	29 (76)	11 (115)	16 (135)	94
Pondicherry University, Puducherry	33 (117)	11 (194)	43 (116)	5 (53)	0 (0)	92
	2128	426	2796	706	873	6929

nately, the vast network of State-funded universities, with some notable exceptions, appears to be in a condition where academic performance, both in teaching and research, needs attention. If remedial measures are not taken immediately, we may lose our prized human resource to foreign institutions. The recent London Times Higher Education rankings of the world's top 200 universities[4] included six from China, four from Hong Kong, three from South Korea, one from Taiwan and only two from India (Indian Institute of Technology Delhi, rank 154, and Indian Institute of Technology Bombay, rank 174). Research-based universities that are able to compete with the world's best institutions are being established by these South Asian countries to position themselves for leadership in knowledge-based economies of the coming era.

Realizing the need of revamping the higher education system, the problem is addressed in two ways: (i) establishing new institutions with focused academic curriculum and world-class faculty and infrastructure and (ii) bringing qualitative improvement in the existing institutions and science education pattern by reforming the curriculum, upgrading infrastructure and service conditions to attract high quality faculty and students. Eight new Indian Institutes of Technology, 30 new Central universities, five new Indian Institutes of Science Education and Research, and 20 new Indian Institutes of Information Technology are being established. Fund for Improvement of S&T infrastructure in universities and higher educational institutions (FIST) scheme of the Department of Science & Technology (DST) is already in place to strengthen and modernize the existing S&T infrastructure. National Assessment and Accreditation Council (NAAC) accreditation criteria may be initially adopted while recommending universities for revamping. NAAC, an autonomous body, was established by the UGC to assess and accredit institutions of higher education. A number of criteria and assessment indicators based on curriculum, teacher learning evaluation, research consultancy and extension, infrastructure and learning resource, student support and progression, governance and leadership, and innovative practices are being used as guidelines to measure the quality of an institution. The number of qualified candidates in national/state-level tests, the

Table 6. Classification of the top 32 universities based on AI in different disciplines

Discipline	AI(A) < 100 and AI(S) < 100	AI(A) < 100 and AI(S) > 100	AI(A) > 100 and AI(S) > 100	AI(A) > 100 and AI(S) < 100
Chemical science	University of Delhi, Delhi Banaras Hindu University, Varanasi Indian Institute of Technology, Roorkee Jawaharlal Nehru University, New Delhi Panjab University, Chandigarh Ch. Charan Singh University, Meerut Cochin University of Science and Technology, Kochi Himachal Pradesh University, Shimla University of Allahabad, Allahabad Aligarh Muslim University, Aligarh G. B. Pant University of Agriculture and Technology, Pantnagar Guru Nanak Dev University, Amritsar M.S. University of Baroda, Vadodara Chhatrapati Shahu Ji Maharaj Kanpur University, Kanpur	University of Calcutta, Kolkata University of Hyderabad, Hyderabad University of Burdwan, Bardhaman Jadavpur University, Kolkata Vidyasagar University, Midnapore Utkal University, Bhubaneswar University of Calicut, Kozhikode University of Madras, Chennai Pondicherry University, Puducherry	University of Rajasthan, Jaipur University of Pune, Pune Osmania University, Hyderabad Andhra University, Visakhapatnam Mahatma Gandhi University, Kottayam University of Lucknow, Lucknow Maharshi Dayanand Saraswati University, Ajmer Deendayal Upadhyaya Gorakhpur University, Gorakhpur	Madurai Kamaraj University, Madurai
Earth science	University of Hyderabad, Hyderabad University of Pune, Pune Panjab University, Chandigarh Osmania University, Hyderabad Ch. Charan Singh University, Meerut University of Burdwan, Bardhaman Vidyasagar University, Midnapore Mahatma Gandhi University, Kottayam Himachal Pradesh University, Shimla Madurai Kamaraj University, Madurai University of Allahabad, Allahabad G. B. Pant University of Agriculture and Technology, Pantnagar Guru Nanak Dev University, Amritsar University of Calicut, Kozhikode M.S. University of Baroda, Vadodara Maharshi Dayanand Saraswati University, Ajmer University of Madras, Chennai Chhatrapati Shahu Ji Maharaj Kanpur University, Kanpur Deendayal Upadhyaya Gorakhpur University, Gorakhpur	–	Banaras Hindu University, Varanasi University of Rajasthan, Jaipur Indian Institute of Technology, Roorkee Jawaharlal Nehru University, New Delhi Jadavpur University, Kolkata University of Lucknow, Lucknow Utkal University, Bhubaneswar Cochin University of Science and Technology, Kochi Aligarh Muslim University, Aligarh Pondicherry University, Puducherry	University of Delhi, Delhi University of Calcutta, Kolkata Andhra University, Visakhapatnam
Life science	University of Hyderabad, Hyderabad Indian Institute of Technology, Roorkee	University of Delhi, Delhi Banaras Hindu University, Varanasi University of Pune, Pune	Jawaharlal Nehru University, New Delhi Ch. Charan Singh University, Meerut	University of Calcutta, Kolkata University of Rajasthan, Jaipur

(*Contd*)

Table 6. (*Contd*)

Discipline	AI(A) < 100 and AI(S) < 100	AI(A) < 100 and AI(S) > 100	AI(A) > 100 and AI(S) > 100	AI(A) > 100 and AI(S) < 100
	Osmania University, Hyderabad University of Burdwan, Bardhaman Jadavpur University, Calcutta Vidyasagar University, Midnapore Mahatma Gandhi University, Kottayam Cochin University of Science and Technology, Kochi University of Calicut, Kozhikode Deendayal Upadhyaya Gorakhpur University, Gorakhpur	Aligarh Muslim University, Aligarh Guru Nanak Dev University, Amritsar Pondicherry University, Puducherry	Madurai Kamaraj University, Madurai University of Allahabad, Allahabad G. B. Pant University of Agriculture and Technology, Pantnagar M.S. University of Baroda, Vadodara Chhatrapati Shahu Ji Maharaj Kanpur University, Kanpur	Andhra University, Visakhapatnam University of Lucknow, Lucknow Utkal University, Bhubaneswar Maharshi Dayanand Saraswati University, Ajmer University of Madras, Chennai
Mathematical science	University of Rajasthan, Jaipur Jawaharlal Nehru University, New Delhi University of Pune, Pune Osmania University, Hyderabad Andhra University, Visakhapatnam Mahatma Gandhi University, Kottayam University of Lucknow, Lucknow Utkal University, Bhubaneswar Madurai Kamaraj University, Madurai G. B. Pant University of Agriculture and Technology Pantnagar M.S. University of Baroda, Vadodara Maharshi Dayanand Saraswati University, Ajmer University of Madras, Chennai	University of Calcutta, Kolkata Chhatrapati Shahu Ji Maharaj Kanpur University, Kanpur	University of Hyderabad, Hyderabad Indian Institute of Technology, Roorkee Panjab University, Chandigarh Ch. Charan Singh University, Meerut Jadavpur University, Kolkata Vidyasagar University, Midnapore Cochin University of Science and Technology, Kochi University of Allahabad, Allahabad Aligarh Muslim University, Aligarh Guru Nanak Dev University, Amritsar University of Calicut, Kozhikode Deendayal Upadhyaya Gorakhpur University, Gorakhpur	University of Delhi, Delhi Banaras Hindu University, Varanasi University of Burdwan, Bardhaman Himachal Pradesh University, Shimla Pondicherry University, Puducherry
Physical science	University of Calcutta, Kolkata University of Pune, Pune Osmania University, Hyderabad Andhra University, Visakhapatnam University of Lucknow, Lucknow G. B. Pant University of Agriculture and Technology, Pantnagar M.S. University of Baroda, Vadodara Maharshi Dayanand Saraswati University, Ajmer University of Madras, Chennai	University of Rajasthan, Jaipur University of Allahabad, Allahabad Aligarh Muslim University, Aligarh Chhatrapati Shahu Ji Maharaj Kanpur University, Kanpur	University of Delhi, Delhi Indian Institute of Technology, Roorkee Jawaharlal Nehru University, New Delhi Panjab University, Chandigarh Ch. Charan Singh University, Meerut University of Burdwan, Bardhaman Jadavpur University, Calcutta Utkal University, Bhubaneswar University of Calicut, Kozhikode Deendayal Upadhyaya Gorakhpur University, Gorakhpur	Banaras Hindu University, Varanasi University of Hyderabad, Hyderabad Vidyasagar University, Midnapore Mahatma Gandhi University, Kottayam Cochin University of Science and Technology, Kochi Himachal Pradesh University, Shimla Madurai Kamaraj University, Madurai Guru Nanak Dev University, Amritsar Pondicherry University, Puducherry

numbers admitted and dropouts, and their rankings in the overall merit list of candidates seeking admission, are some of the factors that reflect the institutional effectiveness. As the number of students qualifying NET from a particular institution is a direct reflection of the academic quality, it may also be included as an additional parameter while assessing the excellence of an institution.

In the knowledge-based economy, emphasis is being laid world over to produce more number of Ph Ds in S&T. In the year 2003, India produced around 6318 Ph Ds in science and engineering[5,6], compared to 12,238 from China and almost 30,000 from USA in the year 2005. As a national responsibility, efforts are being made by CSIR to augment the number of Ph Ds by identifying and nurturing budding, young scientific talent and providing financial support in the form of JRF through NET. CSIR provides financial support to nearly 8000 students at any given time to pursue Ph D in universities and R&D institutions. During 2007–08, the number of fellowships awarded by CSIR was increased by 50% to enlarge the pool of students pursuing Ph D. India has significant advantages in the 21st century knowledge race. It has an established higher education sector – the third largest in the world in student number after China and the US, and the highest number of young people. Empowerment of creative young minds to carry out research guided by curiosity and new ideas will prepare India to meet the challenges of the 21st century.

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