REPORT

National Survey

on

"Quantification of Financial and Manpower Resources Devoted to R&D in Science and Technology from Higher Education Sector - North Zone"

Part II

Presentation of Data and Analytical Perspectives

Indian Geological Congress
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The ignorant work for their own profit, Arjuna;
the wise work for the welfare of the world without thought to themselves.
By abstaining from work, you will confuse the ignorant,
who are engrossed in their actions.
Perform all work carefully, guided by compassion.

- Bhagwat Gita

LIST OF ABBREVIATIONS USED

AICTE	=	All India Council for Technical Education
Annex.	=	Annexture
Append.	=	Appendix
BSS	=	Brain Storming Session
CAD	=	Computer Aided Design
Co-PI	=	Co-Project Investigator
DST	=	Department of Science and Technology
FTE	=	Full Time Equivalent
HRD	=	Human Resource Development
ICAR	=	Indian Council for Agriculture Research
ICMR	=	Indian Council of Medical Research
IGC	=	Indian Geological Congress
IIT	=	Indian Institute of Technology
INFLIBNET	=	Information and Library Network Centre
LPAC	=	Local Programme Advisory Committee
MCI	=	Medical Council of India
NST MIS & TT	=	National Science and Technology Management Information System and Technology Transfer
NST MIS	=	National Science and Technology Management Information System
PAC	=	Programme Advisory Committee of NST MIS Division of DST
PG	=	Post-graduate
PI	=	Project Investigator
Q - I/ II/ III	=	Questionnaire-I, II or III
Q - I - 1, 2	=	Item No.1 or 2 and so on of Questionnaire-I, II or III
R & D	=	Research and Development
R&D Exp.1	=	R&D Expenditure-I
R&D Exp.2	=	R&D Expenditure-II
Total R&D Exp.	=	Total R&D Expenditure = RDE - I + RDE - II
S&T	=	Science and Technology
S&T Exp.	=	Expenditure attributed to S&T
TS	=	Technical Session
UC/SE	=	Utilization Certificate and Statement of Expenditure
ZPAC	=	Zonal Programme Advisory Committee of the Project

List of abbreviations for Universities/Institutes in alphabetical order

ABBREVIATION	UNIVERSITY
Agra U	Dr. Bhim Rao Ambedkar University, Agra
AIIMS	All India Institute of Medical Sciences, New Delhi
Allahabad U	Allahabad University, Allahabad
Amritsar U	Guru Nanak Dev University, Amritsar
AMU	Aligarh Muslim University, Aligarh
Bareilly U	MJ P Rohilkhand University, Bareilly
BHU	Banaras Hindu University, Varanasi
CCSH(Hisar)	CCS Haryana Agricultural University, Hisar
CSAU	CS Azad University of Agriculture and Technology, Kanpur
CSM(Kanpur)	Chhatrapati Shahuji Maharaj Kanpur University, Kanpur
Dayalbagh	Dayalbagh Educational Institute, Agra
DU	Delhi University, Delhi

ABBREVIATION	UNIVERSITY
Faizabad U	Dr. Ram Manohar Lohia Avadh University, Faizabad
FRI	Forest Research Institute, Dehra Dun
Garhwal U	Hemwati Nandan Bahuguna Garhwal University, Srinagar(Garhwal)
GJU(Hisar)	Guru Jambheshwar University, Hisar
Gorakhpur U	Deendayal Upadhayaya Gorakhpur University, Gorakhpur
Gurukula	Gurukula Kangri Vishwaviyalaya, Hardiwar
HP(Palampur)	Himachal Pradesh Krishi Vishwavidyalaya, Palampur
HPU	Himachal Pradesh University, Shimla
IARI	Indian Agricultural Research Institute, New Delhi
IITK	Indian Institute of Technology, Kanpur
IITR	Roorkee University(IIT), Roorkee
IVRI	Indian Verterinary Reseach Institute, Izatnagar
Jammu U	Jammu University. Jammu Tawi

ABBREVIATION	UNIVERSITY
JH	Jamia Hamdard, New Delhi
Jhansi U	Bundelkhand University, Jhansi
JMI	Jamia Millia Islamia, New Delhi
JNU	Jawharlal Nehru University, New Delhi
KU(Srinagar)	Kashmir University, Srinagar
Kumaun	Kumaun University, Nanital
Kurukshetra U	Kurukshetra University, Kurukshetra
Lucknow U	Lucknow University, Lucknow
Ludhiana U	Punjab Agricultural University, Ludhiana
MDU	Maharshi Dyanand University, Rohtak
Meerut U	Chaudhary Charan Singh University, Meerut
MGKV	Mahatma Gandhi Kashi Vidyapeeth, Varanasi
National Museum	National Museum Institute of History of Art Conservation and Museology, New Delhi

ABBREVIATION	UNIVERSITY
Nauni(Solan)	Dr. Y S Parmar University of Horticulture and Forestry, Nauni
NDAg,Faizabad	ND University of Agriculture and Technology, Faizabad
NDRI	National Dairy Research Institute, Karnal
Pantnagar	GB Pant University of Agriculture and Technology, Pantnagar
PGI(Chandigarh)	Post Graduate Institute of Medical Education and Research, Chandigarh
PU(Chandigarh)	Panjab University, Chandigarh
PU(Patiala)	Punjabi University, Patiala
SGPGI	Sanjay Gandhi Post Graduate Institute of Medical Sciences, Lucknow
SKUA(Srinagar)	Sher-e-Kashmir University of Agricultural Science and Technology, Srinagar
SPA	School of Planning and Architecture, New Delhi
TIET(Patiala)	Thapar Institute of Engineering and Technology, Patiala

Acknowledgements

ACKNOWLEDGEMENTS

At the completion of the project, I feel grateful to a lot of people and for a lot of reasons and to express that gratefulness to all concerned, my vision of gratitudes spans the entire spectrum of activities we have had for nearly two and a half years. Given the situation as it obtained on my inadequate knowledge on R&D indicators in S&T and the methodology to use them for creating a data-bank of quantified inputs/ outputs, I happened to participate in the BSS-I programme on the invitation of Prof. G. Victor Rajamanickam, the Convenor of the programme, sponsored by NSTMIS Division of DST and held on 13th and 14th October, 1997 in Tamil University at Thanjavur. Besides being educated on the essential knowledge of the basic inputs, the occasion proved valuable for having known the dimensions of the vast convas of the project, unfolded by the trios: Dr. (Mrs.) A.R. Rajeswari, Former Adviser (NSTMIS), Dr. A.N.N. Murthy, Advisor & Head, NSTMIS, and Dr. G.J. Samathanam, PSO. I feel it a great pleasure to record my grateful thanks to Prof. G.V. Rajamanickam for giving me the opportunity to attend the BSS, which considerably improved my understanding of the project-related notions, and later on, proved immensely beneficial in the discharge of my duties for overall management of the project. It is this meeting that also brought us to the submission of the project proposal after the ball was set in motion by Prof. Rajamanickam. Foundation of the project for the North Zone was thus laid.

Before expressing my indebtness to any other project-related personality, I consider it my foremost duty to thank most sincerely

Prof. D.V. Singh, Chairman, PAC, NSTMIS Division of DST, who having realised the national importance of the project, subsequently recommended the proposal for funding. Prof. D.V. Singh, a distinguished mechanical engineer & a technocrat in the vanguard of his profession, continued to give proper directions and prognosis prudently and instil courage and confidence in the Zonal Coordinators at various developmental levels of the project.

For his peer-support, Dr. Laxman Prasad is profusely thanked and fondly remembered at the time of concluding the writing of the project report. Dr. Prasad, as Advisor and Head of NSTMIS Division, not only gave go-ahead with open-mind to the proposals of the four zonal coordinators on the recommendations of the PAC, but also had a sneak preview of the draft questionnaires prepared by the zonal coordinators. He also wrote a forwarding note for all the concerned academics and Heads of the institutions to herald the beginning of the survey programme. We do appreciate his engaging personality, which could be clearly perceptible from the careful vigil he maintained throughout the project duration.

Soon after BSS-4, Dr. A.N.N. Murthy left the DST for better prospects elsewhere and the mantle of monitoring and supervising operations of the project of such a scale of magnitude, with activities spread over the entire country, had fallen on Dr. G.J. Samathanam under the dynamic guidance of Dr. Laxman Prasad, who could rightly be said the *"kingpin"* of the project performance obligations and interest entailing national ramifications. My deepest gratitude go to him, who with his intellectual and professional ability,

created team-spirit in the whole group, managed different facets of the project programmes, participated visually in all the meetings to provide thrust for its onward development and above all saw that the activities do not suffer for want of funds from the DST – a man really of stupendous energy and stamina.

The contribution of the University of Roorkee, now IIT Roorkee from the beginning to the end has been of paramount cooperation. Prof. P.N. Godbole, Dean, Research & Industrial Liaison, deserves our heartfelt thanks for having allowed Dr. A.K. Sen to be one of the Project Investigators. We also continued to receive full cooperation and support of the university authorities for use of the guest-house and e-mail facilities and from Prof. A.K. Awasthi, in particular, for providing his Department's Committee Room for holding meetings as and when requested, and for his personal participation in LPAC meets regularly.

Managing the work of this magnitude requires a cohesive task-force of sincere & dedicated co-workers and I found these rare traits in my two colleagues: Prof. V.K.S. Dave and Dr. A.K. Sen. I owe more than I can express to Prof. V.K.S. Dave, who engaged himself devotedly in every facet of the project responsibilities with constant regard for quality, concepts, and details. His efforts and concern have been boundless and expression of my gratitude to him is beyond words. I am equally thankful to Dr. A.K. Sen for having done all that given to him with perfect sincerity and dedication.

As the project activities advanced, we sought directions, new ideas, and suggestions from a host of experts, who served as members of the

Local Project Advisory Committee, listed in annexure – XIII, especially the local members and the representatives of the DST, Shri Rakesh Chetal, Shri Parveen Arora, Dr. Abhai Narayan Rai and Shri C. Rajadurai. At progressive levels of the project, we also needed greater cooperation of the Zonal Coordinators, Prof. G.V. Rajamanickam, Prof. D.C. Goswami, and Prof. S.R. Jog. Exchange of information with them on various common issues flowed freely. All are thanked for having given their best in deliberations, which not only confined the decisions in DST's policy frame-work, but-also contributed significantly for achieving the results of this project, truly amazing source of information.

As a matter of fact, no report of the project of this magnitude is an individual effort. It needed personnel for good management, overall organisational setup, and efficient secretarial work. For all that, we acquired the services of two Programmers from Thanjavur, Sarva Sri J. Senthil Kumar and D. Sundararajan, in addition to Sarva Sri Himanshu Karnwal, Hemant Kalra and Ashwani. Shri Mukhram worked as Field Officer for most of the project tenure; all of them have sincerely discharged their duties, and enduring many difficult situations, worked with a team–spirit. I thank them all and also other staff-members of IGC, especially Shri K.C. Gulati and Shri K.C. Tiwari of the accounts section for maintaining project accounts neatly.

Lastly, my very special thanks and foremost gratitude go to Shri B.C. Bora and other members of the IGC Executive Council for permitting the acceptance of the project. Whatever has been accomplished would not have

been possible without the help and response of the Heads of the various institutions, academics, research workers & all those who were approached for response to questionnaires and secondary information, which comprise the hallmark of the project report/ data. Without naming individually, I am indebted to them all for sparing their time and necessary documents.

We were initially benefited by the discussions with Dr. R.P. Gangurde, Addl. Secretary, and Dr. S.M. Mukherjee, Joint Secretary, UGC and Prof. D.V. Singh, Deputy Chairman, and Prof. Ram Prabhu of the All India Council for Technical Education, Dr. S.L. Mehta, DDG, ICAR, New Delhi, and Dr. Sachdeva, Medical Council of India. On behalf of the Zonal Coordinators and on my personal behalf, I thank them for the guidance and encouragement they provided prior to launching the project activities.

Lastly, I shall fail in my duty if I do not acknowledge the trust that the Department of Science and Technology had placed in us for sponsoring this stupendous task of great responsibility under the aegis of IGC. This confidence is the best endorsement of our credibility and competence and its successful completion should be one more step forward in the intimate liaison, the IGC has maintained with various divisions of the DST; many thanks to the concerned officers for the trust and help given to us from time to time.

O.P. Varma

February 19, 2002
ROORKEE – 247 667

(O.P. Varma)
Project Investigator

Executive Summary

EXECUTIVE SUMMARY

R&D endeavours in the area of S&T constitute the national lifeline of the development of science & technology, be they in the institutions of higher learning, public sector research organizations, or the industry – private or public sector. The institutions of higher learning are also the major performers of research, but output in terms of R&D manpower has eluded the national effort. Efforts were made by DST in the past, to collect the required data in order to provide a national data-base on R&D in S&T without any special inputs. Teaching being the primary concern of universities, institutes and colleges, the teachers involved in research activities are to be evaluated by a set of unique *science indicators* side by side with the conventional measures used to assess the outcome of research inputs poured in by the national funding agencies as well as the industry. To evaluate and develop such science indicators four Brain-Storming Sessions (BSS) were sponsored by DST and held at Thanjavur (S), Pune (W), Guwahati (E) and Lucknow (N); the last event was organized under the aegis of Indian Geological Congress, at Lucknow in March, 1998.

These brain-storming sessions highlighted the relevance of such science data-base and enabled to design a set of three basic questionnaires for inviting responses from universities and institutes of higher learning, S&T Departments and teaching faculty. Being the nodal national repository of R&D data on science and technology, the DST decided thereupon, to entrust the responsibility of conducting this survey to the very people who were involved at the BSS stage and that is how the present investigating-

team came to be offered this job for the north zone, with enough financial sponsorship and timely release of grants.

After the pilot survey, covering 21institutions – universities, institutes and PG Colleges, an inter-zonal meeting reviewed the responses and made few modifications in the contents of questionnaires as well as in the methodology which was to be adopted. Software developed at north zone for data entry and data retrieval were largely accepted for all the zones. The reluctance to supply data-base by teaching community was overcome, partly by pursuation, and partly by using annual reports and budget papers to provide a data-base from 47 out of 58 S&T universities/institutes, and 17 out of the contacted 121 colleges, including engineering and medical colleges.

The data has been presented in 55 tables in the form of appendices, covering the universities/institutes and 13 appendices related to the colleges and is illustrated by 35 figures with 7 summary tables in the text. On special demand of DST, attempts were made to assess the full-time equivalent (FTE) faculty and ancillary staff to facilitate apportioning of the manpower and expenditure towards R&D. Low-level of response (21.46% of faculty) inhibits recommendations for free use of the results. Therefore, and a modified FTE(t) has been suggested in this report.

The total reported income of 47 universities/institutes of North Zone is around Rs.1805 crores. Out of which Rs.487 crores belongs to four reported institutes of national importance and Rs.582 crores belongs to 11 centrally-supported institutions. This forms 59.22% of the total for all the

universities. Among the State–supported universities, the support by Uttar Pradesh is comparatively less. Out of this total income, 62.83% is spent on S&T sector, out of which 31.64% goes towards R&D. The R&D expenditure, thus, comes out to Rs. 359/- crores in North Zone institutions covered in this report on the basis of FTE. About Rs.321 crore, almost 89%, goes to recurring expenses and a little over 10.5% towards non-recurring expenditure, which takes care of physical and instrumental requirement and innovation. Seventeen of the 47 universities/institutions attract sufficient extramural funds for R&D, although mostly it comes from R&D funding agencies of the Union Government, such as DST, CSIR, UGC, AICTE, etc.

Within the limitations of data-base, it can be safely concluded that around 42% of total R&D expenditure in north zone is carried out by agricultural and allied institutes, about 27% by medical institutes, and about 6% by engineering institutes, leaving a quarter for all the remaining multi-faculty and natural science-based universities. This is reflected in the R&D objective scenario for UNESCO requirement also.

Computations for FTE on R&D manpower is constrained by poor response status by teaching community as a whole. Use of FTE(t), which is derived by integrating the FTE per faculty value obtained from responses over the total staff (instead of only the responded staff). The total staff in the universities/institutes covered in this report is 10,054. The number of responding faculty is 2158 (21.46% of the total). The calculated FTE comes to 848 and the FTE(t) comes to 4415, forming 8.43% and 43.91%,

respectively, of the total faculty. Range-wise distribution of FTE becomes uniform if one uses FTE(t), rather than FTE. One cannot use FTE(t), however, where issues like gender are considered.

The estimated percentage of time devoted to research and extention is maximum in agricultural sector, followed by medical sector. Similarly, S&T expenditure on *applied research* is almost one-third of the total, being minimum *for experimental development*. This may be partly due to lack of facilities and interest in this sector and partly due to very heavy infrastructure demand for this type of research.

Amongst the R&D FTE, the percentage of female FTE works out to 14.6%. This percentage is in inverse proportion of age and experience (in years), indicating that many female researchers opt out in later years for family reasons or otherwise. As for the qualifications, such as doctorate degree, 44.26% females have the doctorate degree as compared to 50.96% in males. As such the women researchers are not found far behind their male courter parts.

Just as faculty members are apportioned to R&D [and called FTE & FTE(t)], the auxiliary and administrative staff have also to be apportioned towards R&D activity. It came out that such deduced supporting staff correlate better with FTE(t).

The whole project emanated from an exercise of developing science indicators. Due to poor response, however, the ratios, or percentages, will not be nearer reality, as some of the known prestigious research institutions, such as AIIMS, Delhi Univ. IARI, JNU, IIT, Delhi, IIT (K), IIT (R),

Allahabad (U), and PU (Chandigarh) have poor staff response. But this does not absolve us to write off these well-thought-out science indicators. Efforts should, therefore, be directed towards getting the details from individuals in the institutions of higher learning as regulated routines and possibly, the DST, in collaboration with UGC, AICTE, MCI, IARI, etc., design a common questionnaire, based on the questionnaire III developed for this National Survey. This approach would not upset the faculty members, who currently receive a variety of questionnaires from a plethora of organizations – Government, semi-government, or non-government, throughout the year. A common strategy to develop the data-base will lead to a stronger and more complete national data-bank which can be used profitably by the user agencies.

CONTENTS

RECAPITULATION

After having formalised basic concepts and definitions of the terms for use in the project work and subsequently having gleaned the information and some experience through the pilot survey, the thrust of activities was directed to data acquisition from R&D personnel and management authorities of 53 universities, institutions of engineering and medicine, and about 125 PG colleges of science, engineering and medicine, located in the North Zone, comprising seven states and two national territories (Fig.1). Despatches of the questionnaires were made swiftly to all concerned, even though many Heads/Registrars of the academies and PG colleges had not responded to our initial enquiries. Reminders were, once again, sent to non-responding institutions by the Head of NSTMIS Division, DST, and the Project Investigator. When even these pursuations did not bear reasonable fruits, the matter was taken up, at times, even on personal basis through known and even nodding acquaintances with the result that quite a number of universities and institutions of national importance and privately-managed institutions came around to accept the proposal. The efforts were further strengthened by personal visits by the PI and the Co-PI, but- this, too, did not produce satisfactory results. As the project calendar was getting out of schedule, a meeting of the Zonal Coordinators was convened at Thanjavur on June 17-19, 2000 to find out the ways and means for gathering reasonably good amount of data. Among other things, decision was made to use secondary data as given in the annual budgets and annual reports of the institutions for the years 1997-98 and 1998-99.

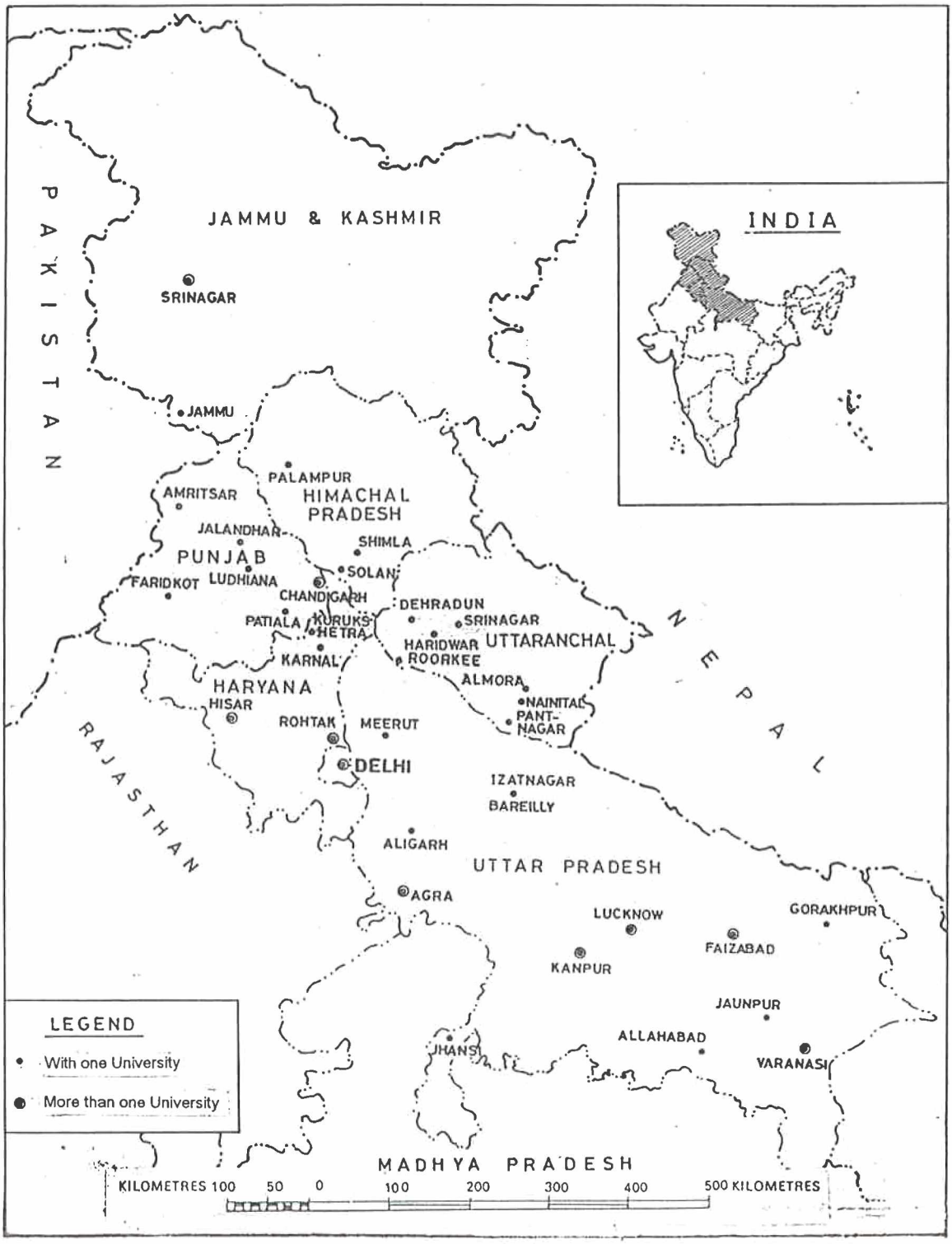


Fig.1. Spread of universities and institutes with S&T in North Zone.

Universities/Institutes

The above decision, although proved substantially useful for data-gathering, showed key-shift in the methodology of the data acquisition nearer to the desired target through the pedantically prepared questionnaires. But - even copies of the annual budgets and the reports from some universities, regretfully, had to be obtained through pursuations and personal visits, and seven of them never came forward at all to part with the information. In this part of the report we present the gathered data in tabular form, give its analytical perspectives, and also bring out salient features thereof on different modes with the help of illustrations and graphic representations. For better understanding of the inferences and systematic presentation of the data, report is devided into two sections: first, we discuss the results of our study of the data from universities & institutes, and later on we treat the collected data from post-graduate colleges.

UNIVERSITIES/INSTITUTES

PREAMBLE

Universities and institutes of higher learning have been established in India under the acts, enacted by the Union Parliament or State legislatures. As per legal provisions given therein, some of these are fully residential in character with constituent colleges, departments (often grouped into Faculty System), or institutes, situated within the campus, or outside, for example BHU & AMU. In addition, there are universities having affiliated colleges, which have no administrative linkage with the parent institution, but follow the academic regimen thereof. In this survey, about 200 colleges were

initially approached, but finally seventeen affiliated P.G. colleges responded; these have been studied separately to assess their contribution to R&D, howsoever, small it may be. On the other hand, there are certain universities/ institutes established by private trusts, which are recognized by the Government through the University Grants Commission (UGC), New Delhi, or Medical Council of India (MCI), Indian Council of Agricultural Research (ICAR), etc., and referred to as "Deemed Universities"; these also came under the purview of this survey. An alphabetical list of 58 universities of North Zone, including Deemed Universities, is given in Append.1 alongwith their year of establishment. During the last two years, 5 more universities/ institutes have come up, but as their establishment postdates the survey year (1998-99), they are not included in this survey. These are:

1. Guru Govind Singh Indraprastha Vishwavidyalaya, New Delhi (Previously this was the "South Complex" of Delhi University).
2. Allahabad Agricultural Institute, Allahabad.
3. Rajarshi Tandon Open University, Allahabad.
4. National Institute of Pharmaceutical Education and Research, Mohali (Punjab).
5. TERI School of Advanced Studies, New Delhi.

Out of the listed 58 universities, three viz., Central Institute of Higher Tribetan Studies and Sampurnand Sanskrit Vishvidyalaya, both in Varanasi, and Shri Lal Bahadur Shastri Rashtriya Sanskrit Vidyapeeth, in New Delhi, are non-S&T Universities; hence, kept out of this study. Out of 55 remaining Universities/Institutes, twelve offer specialized courses in agriculture and

related veterinary, forestry, horticulture and applied sciences. (Code nos. 043, 044, 066, 071, 082, 085, 095, 161, 162, 183 and 203 as given in Append.1), six offer specialized courses in engineering, technology and related applied sciences (code nos. 088, 090, 184, 916, 202 and 228), four offer specialized courses in medicine and allied sciences (code nos. 006, 018, 180 and 199) and the remaining thirty-three have multi-faculty dimensions. Out of these, nine Universities (code nos. 005, 007, 021, 047, 053, 060, 106, 130 and 203) offer a variety of courses in science, engineering, technology, agriculture, medicine, etc. Some of their constituent institutes compare well with the specialised ones in their own right, leaving 24 universities aside, which cater basically to natural sciences.

Five Institutes in North Zone are considered as **the Institutes of National Importance**. These are fully financed by Union Government through appropriate ministries. These are:-

1. All India Institute of Medical Science, New Delhi;
2. Indian Institute of Technology, New Delhi;
3. Indian Institute of Technology, Kanpur;
4. Post Graduate Institute of Medical Education and Research, Chandigarh; and
5. Indian Institute of Technology, Roorkee (formerly, University of Roorkee).

Apart from these five institutions, following 9 universities draw their finances mainly from the Union Government through UGC, or, other funding agencies of the Union Government at New Delhi. These are:

1. Aligarh Muslim University, Aligarh
2. Banaras Hindu University, Varanasi
3. Delhi University, Delhi
4. Forest Research Institute, Dehra Dun
5. Indian Veterinary Research Institute, Izatnagar,
6. Jamia Milia Islamia, New Delhi
7. Jawaharlal Nehru University, New Delhi
8. National Dairy Research Institute, Karnal, and
9. School of Planning and Architecture, New Delhi

Save fourteen universities, mentioned above, the remaining forty-one are financed primarily by the State governments and also through self-financing, or aided by Central (Union) Government, but only to some extent. The State governments provide little support to R&D activities and ordinarily research funds are largely derived from R&D supporting extramural organisations, such as UGC, AICTE, DST, CSIR, etc.

Response Status of Universities

Append.2 summarises the extent of received documents; namely, annual reports, annual budgets, Q1, Q2 and Q3. Out of the S&T universities in the North Zone, five did not respond at all, whereas only sixteen universities responded for Q1. A list of abbreviations used for universities/ institutes is given in the beginning on pp.ii. Out of these, five, viz., Faizabad, Nauni (Solan), Ludhiana, SKUA, (Srinagar) and TIET (Patiala) also supplied annual reports and budget papers. Barcilly U supplied only budget papers

and four, viz., BHU, Dayalbagh, Gurukula and JNU sent annual reports alongwith Q.I. Seven universities supplied only Q.I. Eleven universities/ institutes provided only the annual reports and budget papers, while nine provided the budget papers and another nine only annual reports. Neither Q.I, nor budget reports, or, annual reports were provided by HP (Palampur), IITD, IGNOU, KU (Srinagar), NDAg (Faizabad), PTU (Jalandhar) and PU (Patiala) and in such a horribly helpless situation of this kind, these, regretfully, had to he kept out of the purview of this study. For fuller information one may peruse through Append.1, which would convey the constraints felt during this study.

THE FTE: ITS NEED AND CONCEPTULIZATION

This study was undertaken to provide quantitative data and its analytical perspectives on the R&D funding and the manpower engaged in carrying out R&D activities in S&T institutions in India. Due to poor response from R&D workers not only primary initiatives were hampered, but many deductions and interpretations had to be considered tentative, inspite of making use of annual reports and annual budgets for the pertinent data, primarily due to the following three reasons:-

1. General reluctance of faculty members not to provide full details of their activities even for the preparation of annual reports. Only 21.46% faculty members responded to Q.III (Append.6).

2. Non-inclusion of extramural support in the budget owing to the fact that such supports are received by the institute for the designated research workers only.

3. Non-availability of the statements on year-wise, expenditure seldom given by the supporting agencies, say DST, CSIR, UGC, etc., timely.

As detailed earlier (p.19 of Report Pt.I), Q.I was supposed to provide financial details by the institutes, Q.II was to bring manpower details by the departments and Q.III was to extract ground details from the faculty members. A very crucial information indeed, which Project Monitoring Committee considered essential, related to **the percentage of time devoted by the teacher towards research or extention work**. This percentage gave the FTE Faculty (Full Time Equivalent) of a teaching faculty. In our view, for the purpose of calculating financial component of salary drawn by that individual, this concept may be acceptable, but for counting the individual in terms of FTE seems to be incorrect in Indian situation. This concept is a western concept, where all teachers do not draw their emoluments for 12 months and they have to draw their salaries for a part of the year through projects, they investigate for the industry, or otherwise. In India teaching positions are sanctioned in terms of teaching-load, although the teachers are supposed to do research for the betterment of their professional career and also to satisfy their academic urge and improve their teaching capabilities. In view of the Project Monitoring Committee directive, however, the concept of FTE in this report has been reluctantly used in two ways:

1. FTE – (Full Time Equivalent) as obtained on the basis of responses available in column 1.4.4 of Q. III by those faculty members, who

have responded to the query; summation of FTE Faculty values of an institution has been referred to as Total FTE Faculty.

2. FTE(t) – This has been derived by calculating average FTE per faculty member on the basis of responses and assuming this figure as representative, multiplying this value by the total number of faculty members in the Institute (Append.6). When we talk of averages, it is presumed, that the error, if any, will be cancelled, as large members are involved, but for want of real data, this FTE(t) seems to offer more reliable estimate than FTE. The reader may also refer to Fig.5 for a graphical assessment.

Income of Universities/ Institutes

The annual income of Universities/ Institutes of this zone vary within very wide limits, depending upon the S&T content, and R&D capabilities. (Append.3). The institutes of National Importance have, on the whole, maximum income, as brought out in Table 1.

Table 1. Annual income of Institutes of National Importance.

Institute	Annual Income
1. All India Institute of Medical Sciences, New Delhi.	2,48,13,83,000
2. IIT, Kanpur	64,57,88,000
3. PGIMER, Chandigarh	1,36,31,75,000
4. IIT, Roorkee (formerly UOR)	38,01,19,000
Total	**4,87,04,65,000**

This list does not contain data of IIT, New Delhi, as it was not received in spite of our best efforts, made time and again, personally and otherwise, while the data of IIT Roorkee, concerns with the period when it was University of Roorkee, supported by U.P. Government. In comparison to the Institutes of National Importance, and the universities supported by the Central (Union) Government individually have lesser quantum of income, although more than the remaining universities, as can be seen from Table 2.

Table 2. Annual income of universities/institutes supported by the Union Govt.

University	Annual Income
1. AMU, Aligarh	96,48,20,000
2. BHU, Varanasi	1,58,28,33,000
3. DU, Delhi	68,99,07,000
4. FRI, Dehra Dun	39,03,45,000
5. IARI, New Delhi	55,87,00,000
6. IVRI, Izatnagar	37,58,32,000
7. JMI, New Delhi	33,21,45,000
8. JNU, New Delhi	58,09,49,000
9. NDRI, Karnal	27,60,91,000
10. National Museum, New Delhi	45,69,000
11. SPA, New Delhi	7,31,37,000
Total	**10,69,97,93,000**

Among the above institutions, National Museum, New Delhi, has only two faculty members and eight members of research staff and most of the expenses are on R&D.

The universities receive grants-in-aids from one or the other government (State/Union) and also improve resources through fees collected from students, sale of prospectuses, application forms, brochures, etc., and interests earned on their long-term deposits, including the endowment funds. Fig.2. shows the extent of income earned by North Zone universities/ institutes.

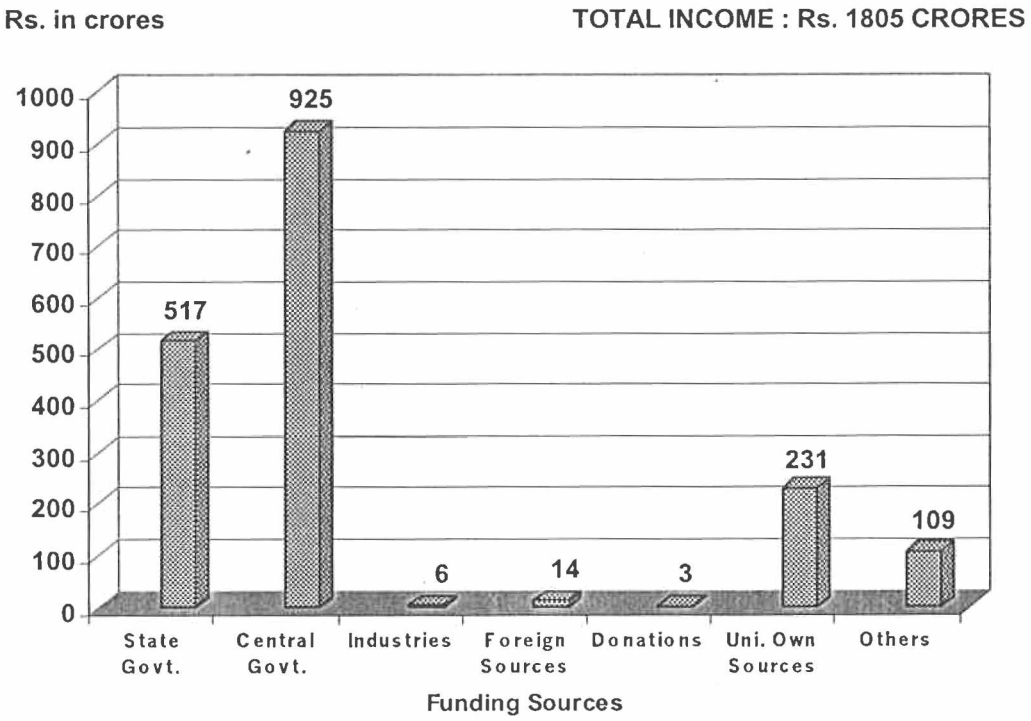


Fig.2. Contributions from various sources received by universities/institutes (NZ).

Funds are received towards Plan Expenditure or Non-Plan Expenditure (NP). Funds for Plan Expenditure are provided by the governments for building, equipments, library, campus developments etc., which form the capital, or assets, of the institution, usually on a five-year-plan period basis. By and large, these are for expenditure of

non-recurring (NR) type. The non-plan grants, on the other hand, cover largely the recurring (R) expenses, the establishment making the largest component. Other non-plan grants may be obtained for books and journals, laboratory, equipments, chemical & supplies, medicines, power-supply and other campus needs. Contributions from industrial consultancy, foreign sources, or donation, usually form endowments deposits and are usually not available for expenditure, save of minor nature. Only engineering universities and technological institutes earn income through industrial consultancy of worth-mentioning levels. Append.3 shows the total income individually of all the universities/ institutes.

Apart from the fifteen institutions, tabulated above, the remaining universities derive their income mostly through respective State Governments. The government grants to universities by each State is shown in Table 3. Among the state-supported institutions (Append.4), Chandigarh-based Punjab University got 30.09% support from the State and 53.57% from the Central Government. State of Haryana has four universities, out of which NDRI, Karnal, is centrally supported. CCSH (Hisar) got 98.95% of total grants-in-aid from the State. GJU Hisar, Kurkshetra U and MDU received 50.48%, 45.53% and 58.38% State support, respectively. It is strange that Kurukshetra U has not reported any central support.

Himachal Pradesh gives ample support to its universities, Nauni, (Solan) and HP (Palampur) were given 74.61% and 75.52% of grant, respectively, by the State. HPU got around 85.31% State support.

Jammu & Kashmir also provides enough support to its universities - 66.26% to Jammu University and 82.96% to SKUAST, Srinagar. Data about Kashmir University is not available. Punjab Government provided 59.11% grants-in-aid to Amritsar U and 78.86% to PAU (Ludhiana). It also provided 50.92% support to TIET, Patiala, which is a Deemed University.

The affairs in U.P. are, however, different. The State Govt. provided 86.06% grant to CSAU; 81.16% to SGPGI; 79.51% grant to Allahabad U; 77.49% grant to MGKV; 74.78% to Garakhpur U; 68.78% to NDAG, Faizabad; 62.52% to Lucknow U and 55.36% to Bareilly U. *Per contra*, the State grant to Meerut U, Jhansi U, Agra U, and CSM (Kanpur) were to the tune of 28.06%, 15.85% 12.47% and 10.19% respectively, whereas Faizabad U was not supported at all by the State Govt.

Out of those universities, which are now in Uttaranchal State, Garhwal U, and Pantnagar received 98.73% and 95.49% grant respectively from the State. Even Gurukula, a Deemed University, received 91.1% grant from the State. Seemingly, there appears to be a genuine desire on the part of the Govt. to support backward areas. The University of Roorkee (now, IITR) received 61.01% support and Kumaun received 57.07% support from the then–State Government (U.P.).

Table 3. Grants received by universities/institutes (NZ) from their respective States. In Rs. '000:

State	No.of Univ. Reported*	State Govt. Grant	Central Govt. Grant (all sources)	Total income of Institution's
Chandigarh	St U 1	177870	316673	591096
	In all 2	186900	1195988	1363175
Delhi	All 8	1379	3937900	4850257
Haryanaa	St U 4	925273	37520	1269814
	In all 5	925273	279045	1545005
H.P.	St U 3	524023	82752	660530
J&K	St U 2	391614	52667	537632
Punjab	St U 3	884580	137906	1256628
U.P. &	St U 19	2254120	306442	3459542
Uttaranchal	In all 24	2254332	3566976	7249229

* St U – Universities supported by State.
In all – All universities/institutes in the State.

Population-wise and GDP-wise studies could provide significant conclusion, but the data has not been received from all the universities and the study on this basis has, therefore, not been undertaken.

The total income given above is distributed by the universities to its all the departments, including administration, campus development along with healthcare, power and water-supply, library, S&T departments as well as non-S&T departments. As separate data on income of S&T departments

is not available, the ensuing discussion will, therfore, be on the basis of expenditure data only.

S&T and R&D Expenditures

Head-wise details of S&T expenditure of the universities are given in Append.5. Fig.3 gives a general picture for North Zone universities. In most of the cases the relevant details in Q.I were incomplete and hence budget documents and/or annual reports were invited and used. The figures given in Append.8 should, therefore, be taken as tentative in many cases. Those institutions, wherefrom no information has come do not figure in this and other tables that follow. The S&T Expenditure comprises two

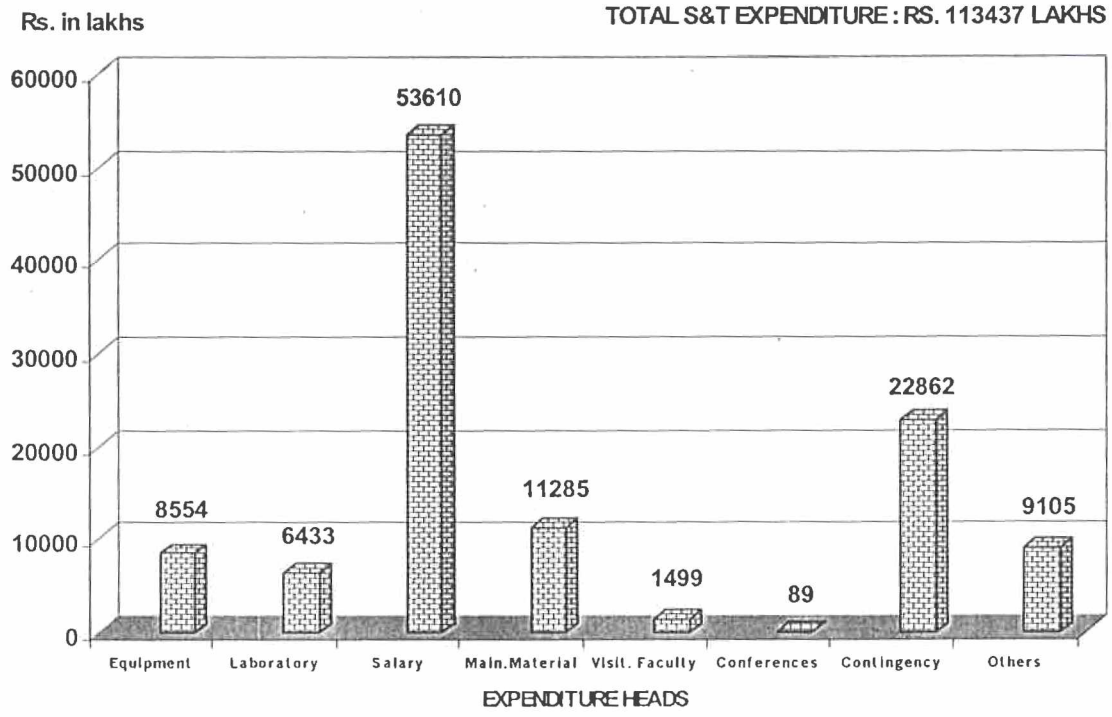


Fig.3. Head-wise details of S&T expenditure of universities/institutes (NZ).

components: S&T Exp.1 and S&T Exp.2: **S&T Exp.1**, contains expenditures on such facilities, which are commonly used for teaching and research in the departments, such as equipment, laboratory, maintenance & materials, visiting faculty, seminars, symposia/conferences, and contingency; while **S&T Exp.2** comprises salary component of teaching staff-members. These two components are further used in computing expenditure on research & development, the R&D expenses. The R&D Exp.1 (Append.7) is supposed to provide the expenses of the R&D component in respect of research staff and is given by:-

R&D Exp.1 = [S&T Exp.1/(PG + RS)] * RS

Where, PG = number of PG students, and

RS = number of research scholars

Another component of R&D expenses has been referred as **R&D Exp.2** (Append.8), which includes the R&D expenses on salary of staff on the basis of full-time-equivalent (FTE) of teaching staff (see pp.5-6) together with FTE of research staff (including scientific officers, field officers and others, if any).

One can obtain Research Time Equivalent of a faculty member from the percentage of time reported by him/her that had been spent on research and extension work (t_{r+e}) in column 1.4.4. of Q.III. Summation of such values (Σt_{r+e}) of all the responding faculties (N_{RF}) of an institute will give FTE(RF), i.e., full time equivalent of responding faculty of that institution. It is a number signifying the apportioned staff towards research. One can thus calculate FTE per faculty of an institute by dividing FTE(RF) by number

of responded faculty (N_{RF}) and obtain a factor.

$FTE(RF)/N_{RF}$ for each institution, representing average FTE per faculty (column 4, Append.10)

From S&T Exp2, one can then obtain R&D Exp2 by calculating a segment of expenditure on the apportioned staff, i.e.,

R&D Exp2 = R&D Exp2(RF) + R&D Exp2(RO), ---------- (1)

Where,

R&D Exp2(RF) = S&T Exp2 * $(FTE(RF)/N_{RF})$ ---------- (2)

And R&D Exp2(RO) = 100% salary of Research staff (including Pool Officers, Research Associates, SRF, JRF)

Append.7 gives the figure and computation of R&D Exp1; Append.8 gives the computation of R&D Exp2 and Append.9 gives the Total R&D Expenditure, which is the summation of R&D Exp1 and R&D Exp2. Share of S&T and R&D expenditures in total expenditure and in non-S&T are shown in Fig.4. As the number of faculty members, who have responded

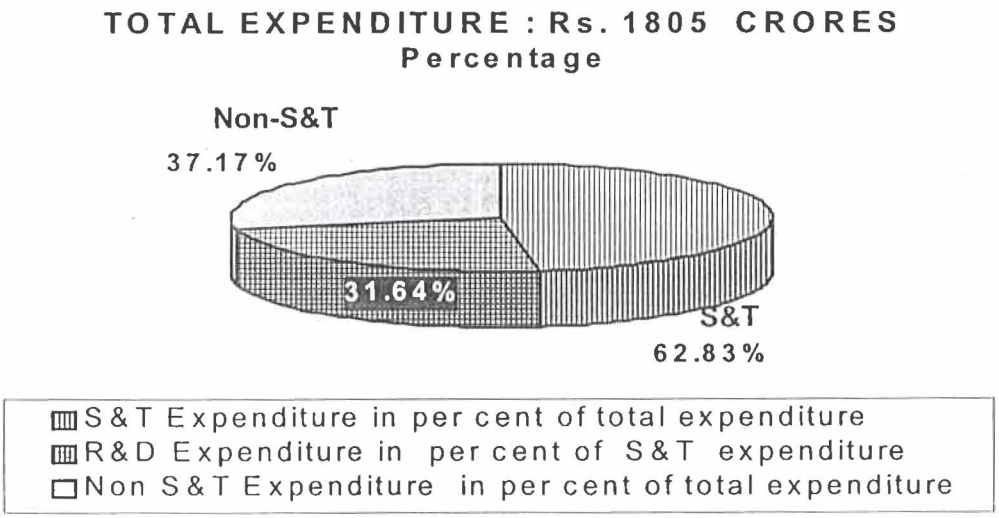


Fig.4. Share of total expenditure (NZ).

and returned Q. III, is none to reasonably satisfactory from one institution to another, the computed FTE values are not as reliable as one might have wished. As already stated, a via media has to be searched, therefore, to get fairly reasonable figures of FTE by assuming that the average percentages given in Table 1.4.4 of Q.III by teaching faculty of any institution could be integrated over the entire faculty of that institute. Thus, a new value, FTE(t) can be obtained (Append.10) thus,

$$FTE(t) = \frac{FTE(RF)}{N_{RF}} * TF, \text{ where}$$

$\frac{FTE\ (RF)}{N_{RF}}$ = the salary of FTE per faculty of an institution and

TF = total faculty in the institution

Fig.6 shows a plot between number of universities, and FTE or FTE(t) or total faculty by arranging the universities in ascending order of faculty size and plotting the summation of succeessve numbers. The trend of FTE(t) is what could be expected if all faculty would have responded. Fresh tables can thus be prepared by using FTE(t) and recalculating R&D Exp2 and the total R&D Expenditure. In Append.10, therefore, FTE(t), revaluated R&D Exp2(t) and Total R&D Exp(t) are provided. Comparison of R&D Exp2 data given in Append.8&9 with that of R&D Exp2(t) of Append.10, when seen in the light of data given in Append.20&21 and elsewhere which are prepared largely on the basis of Annual Reports, proves our contention. This is closer to reality as can be seen in case of

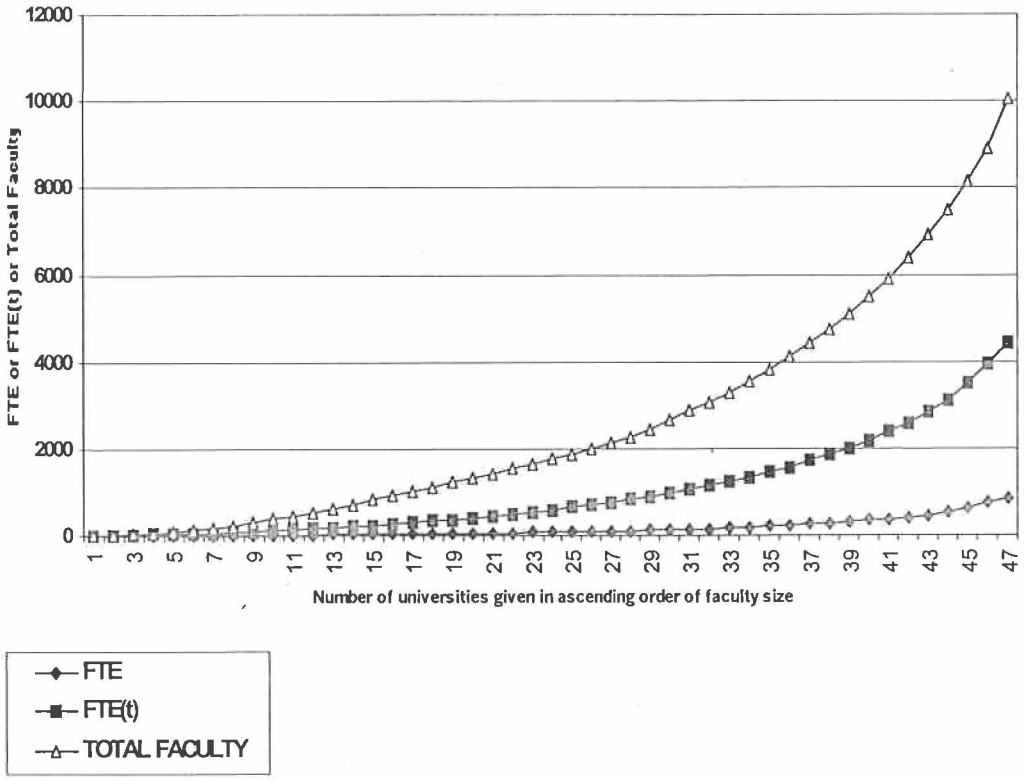


Fig.5. Number of universities shown in ascending order of FTE/FTE(t).

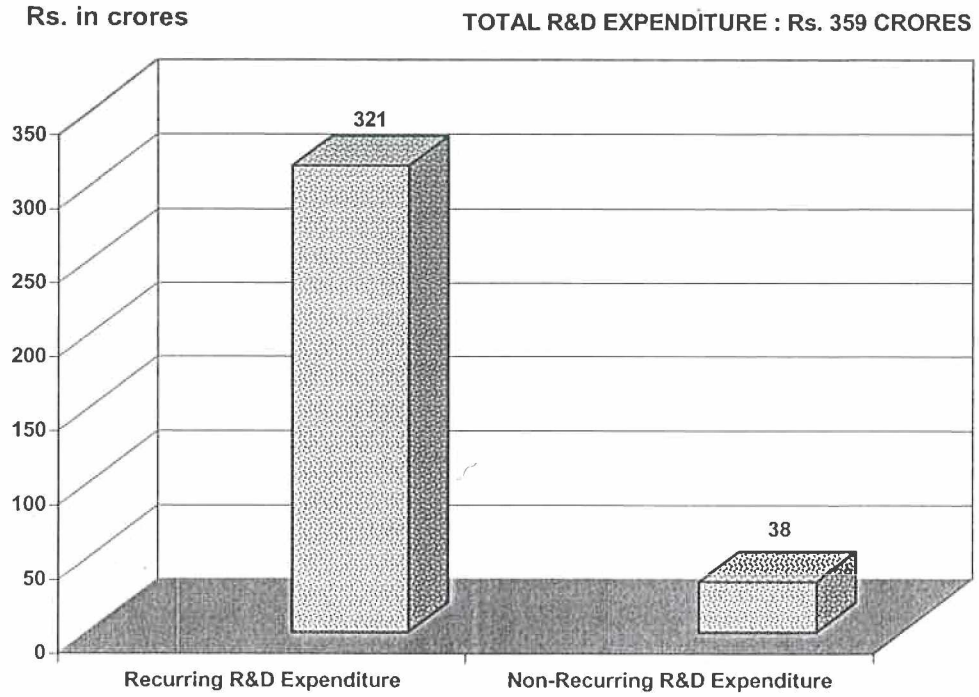
AMU, CCSH, (Hisar); Nauni (Solan); Pantnagar; Gurukula; JMI; Kumaun; Ludhiana U; SGPG; and TIET (Patiala); wherefrom the response has been quite up to the mark. Consequently, one should support using FTE(t) instead of FTE, as has been reluctantly used, in most of the tables here in order to have a uniformity amongst all the zones working for the project.

Append.11 gives the recurring(R) and non-recurring(NR) components of R&D expenditure. The overall percentage of recurring expenditure in total R&D expenditure comes out to 89.46%. Table 4 below summarises the ranges of percentages of recurring expenditure(RE).

Table 4. Range of recurring expenditure in universities.

Range of (RE)	No. of University
> 90%	23
80-90%	12
70-80%	2
60-70%	6
<60%	3

Very high recurring expenditure (Fig.6) indicates that the expenditure on equipments and laboratories is largely made from extramural research



Recurring Heads : Maintanance & Materials, Visiting Faculties, Symposium, and Seminar, Contigency and Salary

Non-Recurring Heads: Equipment and laboratory

Fig.6. Recurring & non-recurring R&D expenditure of the universities/institutes (NZ).

grants to the faculty members and have not been reported by the universities in general. The query on the list of equipments, costing more than Rs. 5.00 lakhs (column 2 in Q.II), has not been properly answered and only a few departments have supplied Q.II. The same information was also asked in Table 3.2 of Q.I, which was received only from 16 universities/institutes out of 58 and this information can hardly be considered representative of the whole set of institutions. Besides, high recurring expenditure has a telling effect on Indian research support system to institutes of higher learning, where more manpower and lesser basic material support is offered in consideration of their being more teaching institutions. No wonder that equipments in teaching laboratories of the universities are old, seldom giving correct values to the extent of being uninspiring to the students eager to learn basic science.

Append.12 provides the break-up of R&D Expenditure in terms of Intramural(I) and Extramural(E) contributions. Intramural sources include the university's own source, such as donation, consultancy, sale of publication, documents, etc., and the budgeted grants-in-aid from the state government or the central. All other grants are considered as extramural. In table 5, it may be noticed that in four universities intramural/extramural source ratio (I/E) is more than 100.

Table 5. Universities with intramural/extramural source ratio above 100.

Institution	I/E Ratio
Gorakhpur U	622.36
Agra U	322.23
CSM (Kanpur)	238.26
SGPGI (Lucknow)	187.17

These universities, either do not attract sufficient extramural funds for research or are satisfied with whatever they have. On the contrary, there are universities mostly centrally-supported, where I/E ratio is well below 10 (see Table 6).

Table 6. Universities with intramural/extramural ratio below 10.

Institution	I/E Ratio
JNU	0.69
IARI	1.56
Gurukula	1.94
FRI	3.03
Kumaun	3.26
Nauni (Solan)	4.35
CCSH, Hisar	4.71
IIT R	4.87
SKUA (Srinagar)	5.13
CSM (Kanpur)	5.35
NDAg, Faizabad	5.49
BHU	6.14
Ludhiana U	6.44
DU	6.83
HP, (Palampur)	7.94
MDU	9.41
IVRI	9.91

Table 6 gives examples of the universities, which draw sufficient funds from extramural sources for R&D work and may be considered on progressive path. Most of these are either centrally supported, or belong to the more favoured agricultural/engineering/technology sector. In current scenario, when the government wishes that universities should earn their expenditure, one may see in days to come, I/E ratio to fall appreciably to 0.1, or even lower. A general idea can be obtained from Fig.7.

Append. 13 shows the basic data on total expenditure, S&T expenditure, R&D expenditure, as per cent of the total expenditure and as per cent of S&T Expenditure (Fig.8). The least percentage is seen in MGKV, (Varanasi), which has only one S&T department and maximum in HP, Palampur, which is an agricultural university. Generally, R&D Expenditure in agricultural universities, as a group, is higher, than other

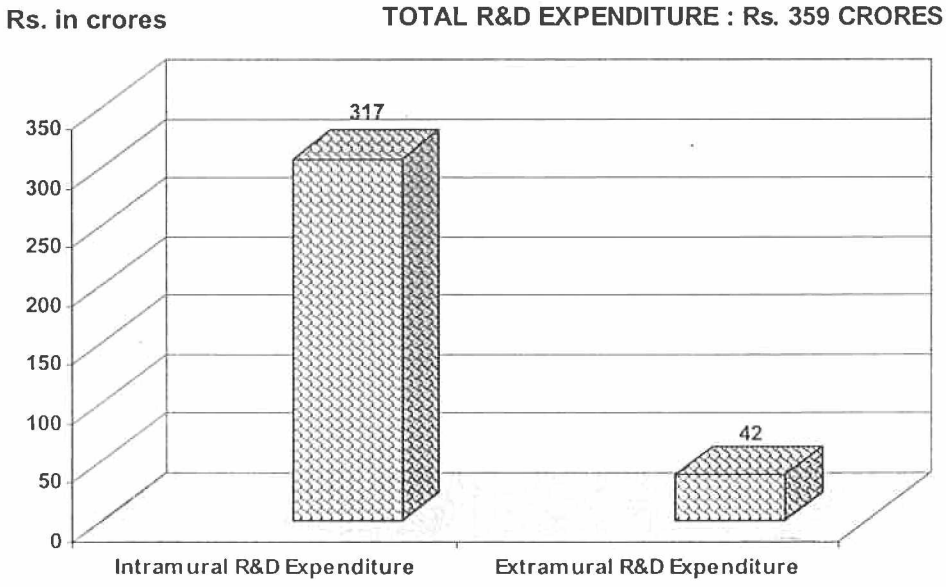


Fig.7. Comparative estimates of R&D expenditure for intramural/extramural grants (NZ).

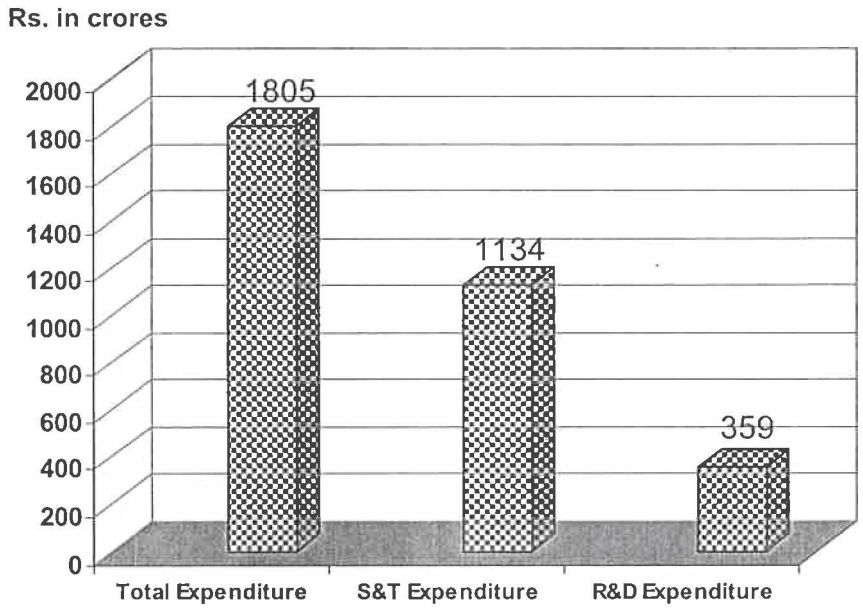


Fig.8. Share of S&T expenditure and R&D expenditure in the total expenditure of universities/institutions (NZ).

universities, as can seen in Append.14, where R&D Expenditure of universities/institutes is given in ascending order, by field-of-sciences as well as by-the-state in which the university is located. Fig.9, depicts the total R&D Expenciture by field of science, whereas Fig.10 shows the same in terms of percentage. In natural sciences, the R&D Expenditure is 24.79%, the amounts varying between 11,41,00/- in MGKV, to 15,59,30,000/- in AMU. Ten universities have R&D Expenditure of less than Rs.$10x10^6$, thirteen universities have R&D expenditure below Rs.$10x10^7$; and three universities (BHU, DU and AMU) having R&D Expenditure of the order of 10^8. The range is so large that average R&D expenses in a university for natural sciences come to Rs.3,41,44,077/-. In engineering & technology field, amounts for only five universities/ institutes, as available, are: three having R&D expenditure of the order of

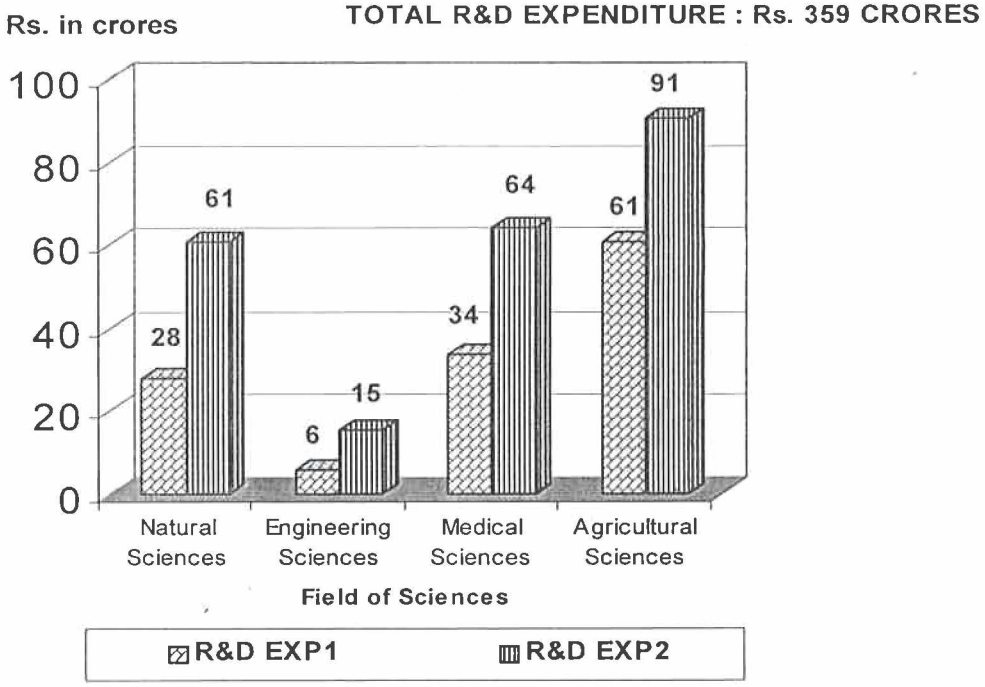


Fig.9. Total R&D expenditure by fields of sciences.

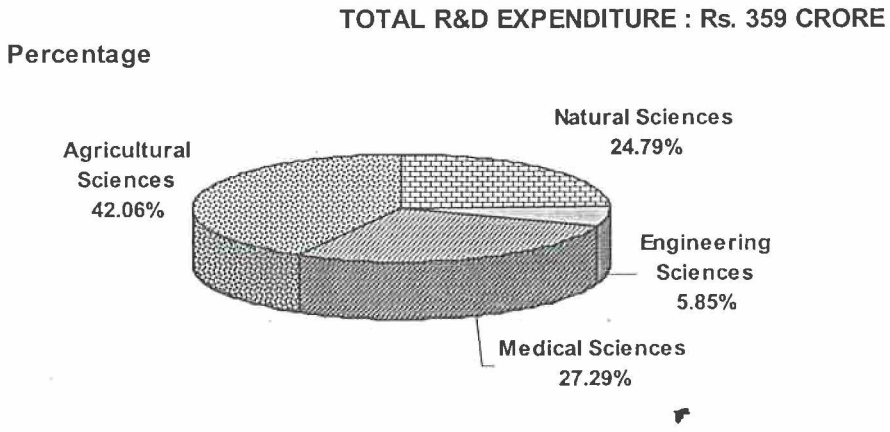


Fig.10. Percentage of R&D expenditure by fields of sciences.

10^6; IIT Roorkee, of the order of 10^7; and IIT Kanpur of the order of 10^8; whereas average R&D expenditure comes only to Rs.3,54,48,032/-, forming 5.85% of total North Zone R&D expenditure.

In five medical institutions, whose expenditures are available, two have R&D expenses of the order of Rs.10^7 and two (PGI Chandigarh and AIIMS New Delhi) have R&D expenses of the order of Rs.10^8, against the average figure of Rs.19,57,87,408/-, having a share of 27.29%. All averages heavily lean towards centrally supported universities, including institutes of national importance.

Amongst 11 agricultural institutes, R&D expenditures are, however, not that skewed as it varies between Rs.4,85,98,000 and Rs.26,67,28,000 with an average of Rs.13,75,43,360, a figure of order of 10^8. The share of agricultural science in total R&D expenditure is 42.06% (Fig.10).

Append.15 summarises field-wise R&D expenditure. It will be clear from this table that maximum R&D support goes to the agricultural sector, but institution-wise, the medical sector gets maximum grants and natural science sector, the least. This is fair, as India is basically an agricultural economy and health care and civil facilities (roads/water supply) being the concern and responsibilities of the Central and the State Governments.

Research Time

Column 1.4.4 of Q.III was meant for information about time spent on teaching, research, administration/management, training, extention/hospital/ field and others as individual's own estimate in percent. What normally is called "**extention**" in agricultural and engineering sector is the activity labeled as hospital, or field-duties, by medical institutes and field-work by many institutes of natural sciences. Time spent on research and extention,

too, has been counted towards research occupation. Fig.11 shows the estimated percentage of time per week devoted by the faculty members in various fields of sciences which is based on the data given in Append.16 which presents the mean values reported by responding faculties in various fields of activity. One cannot make much out of it in the case of engineering and medical institutions, as their numbers in this survey response has been very low - only five of each, but it is significant that around 50% time of the faculty is spent in research in agricultural institutes, as compared to 33% in natural sciences institutes. This is obvious as in most of the agricultural institutes there is a Research Officer and Research Office to

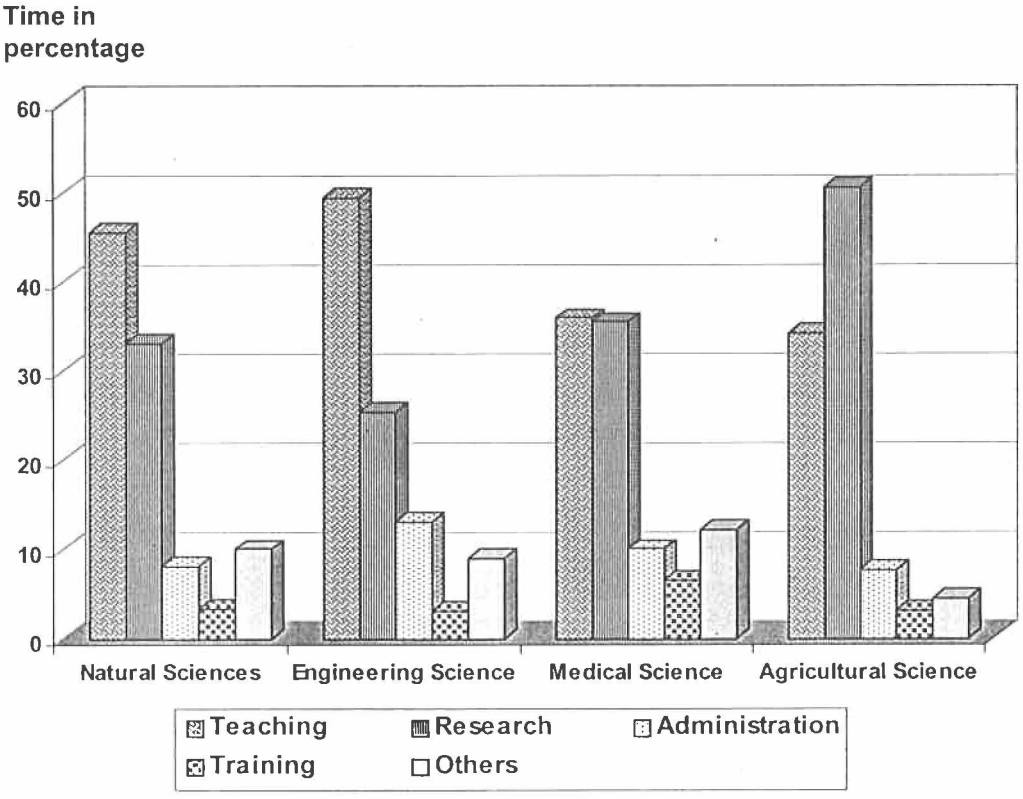


Fig.11. Estimated percentage of time per week spent by all the faculty members taken together in the four fields of S&T (NZ) .

maintain track and strict monitoring. The response to this survey has also been commendable from agricultural institutes; thanks to their cooperation. No doubt that mode values (Append.17) in agricultural science sector is 70 as compared to 20 in natural sciences and 40 each in engineering and medical sciences. This appendix also reports the mean and median values.

Spread of R&D Expenditure

Append.18 gives the total R&D expenditure in terms of R&D type, viz., basic research, applied research, experimental development and others (non-R&D or mixed type) as percent of S&T expenditure. This is how the Ministry of Scientific and Industrial Research classifies the S&T research. It will be seen that maximum attention is paid to applied research and minimum to experimental development. A general graphic view is presented in Fig.12.

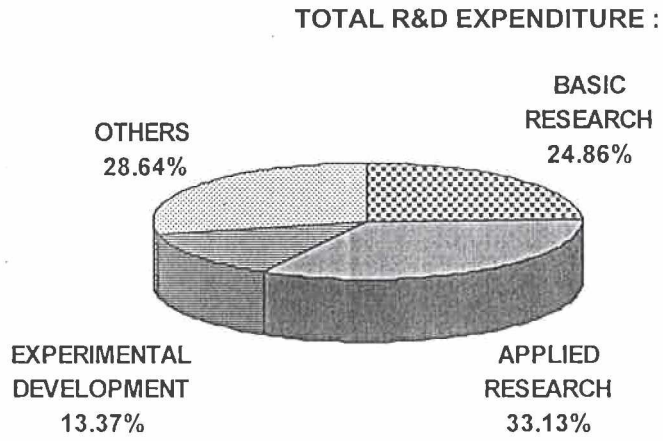


Fig.12. R&D expenditure by type of research in universities/institutes of North Zone (1997-98).

Append.19 further elucidates such conclusion, where R&D expenditure by major socio-economic objectives has been shown (Fig.13). This data-base is pursuant to UNESCO requirement, is presented to elucidate the concern of United Nation, which monitors the international data-bank. The conclusions drawn earlier about more attention being paid in India to educational institutions of agricultural and health sector is thus corroborated.

It is commonly perceived that Indian scientists are most productive in theoretical (basic) research and comparatively poor in experimental development. This is why in the long run we are forced to talk about technology import, or technology transfer, from the western developed world. Seeds perhaps are not sown properly in the educational corridor of

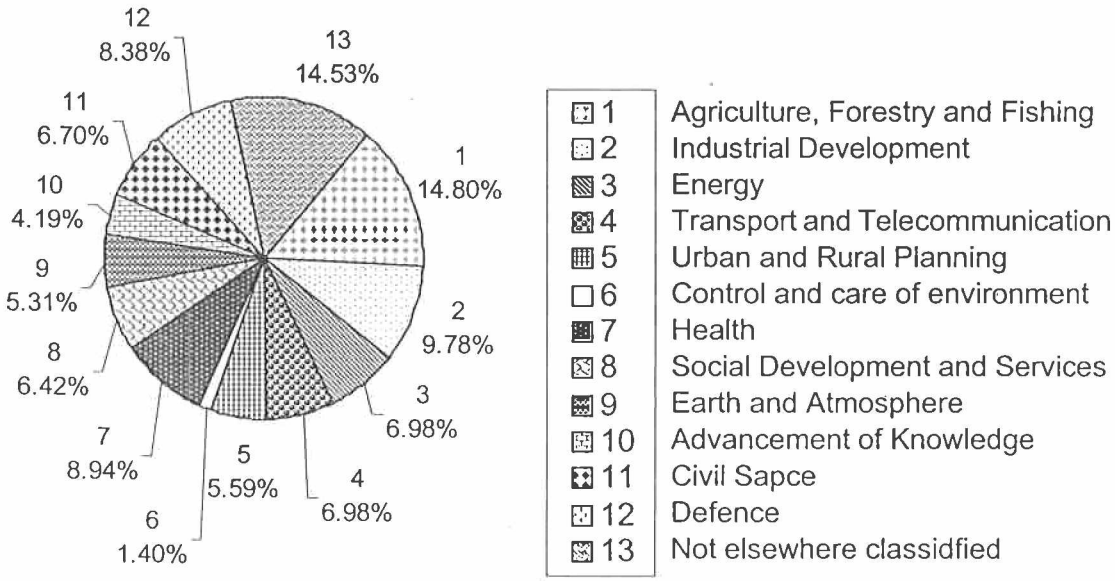


Fig.13. R&D expenditure by objectives (NZ).

our country. Facilities of carrying out experiments in laboratory and workshops are neither well provided at the schooling stage, nor encouragement is given at the research level. In fact, it is the former factor that prevents the scientist to opt for research in the area of experimental development is thus borne out by this study.

R&D Manpower

Total number of faculty members has been given in Append.6 alongwith the number of responded faculty, FTE and FTE(t). These numbers have been repeated in appropriate tables, wherever needed, for computational requirement. For example, total faculty is given in Append.10 and that of responded faculty in Append.8 and so on. As already deliberated the figures of responded faculty are utilized in computing FTE in Append.8 and FTE per faculty member in Append.10 alongwith calculated FTE (t) values. Fig.5, may be looked into in this context, once again.

FTE figures are used in calculating R&D expenditure and R&D manpower. The R&D manpower varies depending upon whether one uses FTE values or FTE (t) values. The total faculty, on the basis of data made available for the project, is 10054 in 47 north zone institutions, (except the colleges) and responses are available from 2158 faculty members representing 21.46% mean response. In case of 21 universities number of the response was more than the mean value. The distribution of response is shown in Fig.14.

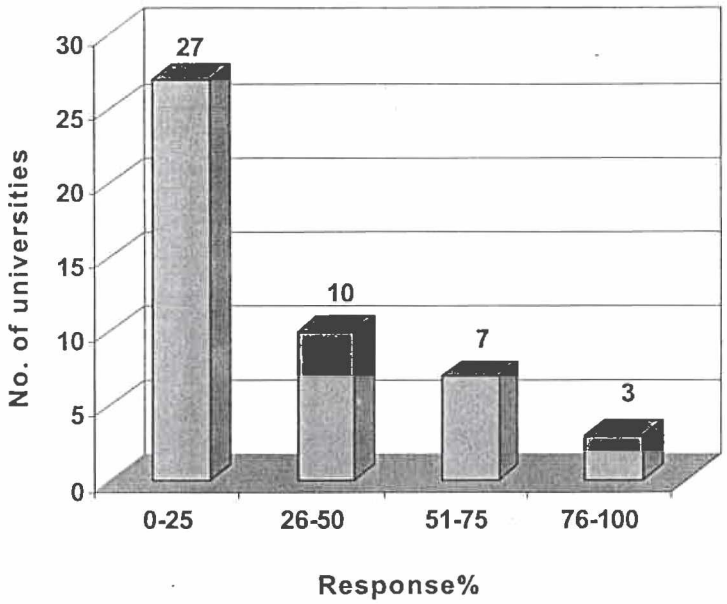


Fig.14. Response of universities.

Much prediction in such a scenario is not tenable. It is also not clear as to how much the data of the number of PG students (totaling 15544) and of research scholars (totaling 5910) is reliable, as these figures have been obtained either from Q.1 (27.59% response), or Q.II (received only from 255 department of 44 universities). These numbers are supposed to form the backbone of R&D expenditure computations (Append.7-10). Append.20 shows R&D FTE personnel per 100 faculty member and research staff for universities. For all universities, the number of personnel per 100 faculty members comes to 26.64, varying from 3.43% for Delhi University to 83.15 for Gurukula. Fourteen universities have R&D Personnel per 100 Faculty above this mean value of 26.64. These include Gurukula (83.15); National Museum (80); FRI (77.18); JNU (76.22); JH (56.21); Meerut (54.84); Kumaun (49.52); IVRI (44.38); IARI (40.96); IITR (40.13) and others. A perusal will lead to conclude that this value is partly based on response status, partly on

total income and R&D expenditure, and therefore, has much to do with the size of the operation also (number of students, & staff).

When R&D FTE is computed in percent of total staff (Append.21), the mean value for North Zone comes to 70.40. This value is totally dependent on responded staff. So where the response percentage is poor, the value is of no consequence. Similarly, where break-up of R&D personnel into Professor, Reader. Lecturer, etc., gender-wise is shown (as in Append.22), or as Pool Officer, Research Associate, SRF, etc., (Append.23), the data lose their significance, when the response status is poor. Append.24 shows R&D FTE Personnel by range and number of institutions (Fig.15), but nothing much can be made out from the table about the ground truth. However, when the same is studied in terms of FTE(t), (Fig.16) the data (Append.25) begin to speak for themselves (within the constraints of data source) as there is an appreciable change and the numbers are well distributed and not concentrated one side. It is true that certain type of studies cannot be made from FTE(t) values, such as gender-specific issues, or qualification issues. These have to be done either on the basis of faculty responses or FTE.

GENDER ISSUES

Append.26 gives gender-wise break-up of various R&D FTE personnel. Unfortunately, we cannot generalize gender details over the whole staff, as gender-specific details have to come from the individual or institutional sources. At the best male/female ratios or percentages can be worked out (Fig17). One can, however, discern the tendency to give some weightage in recruitment of females at Research Associates, SRF and JRF

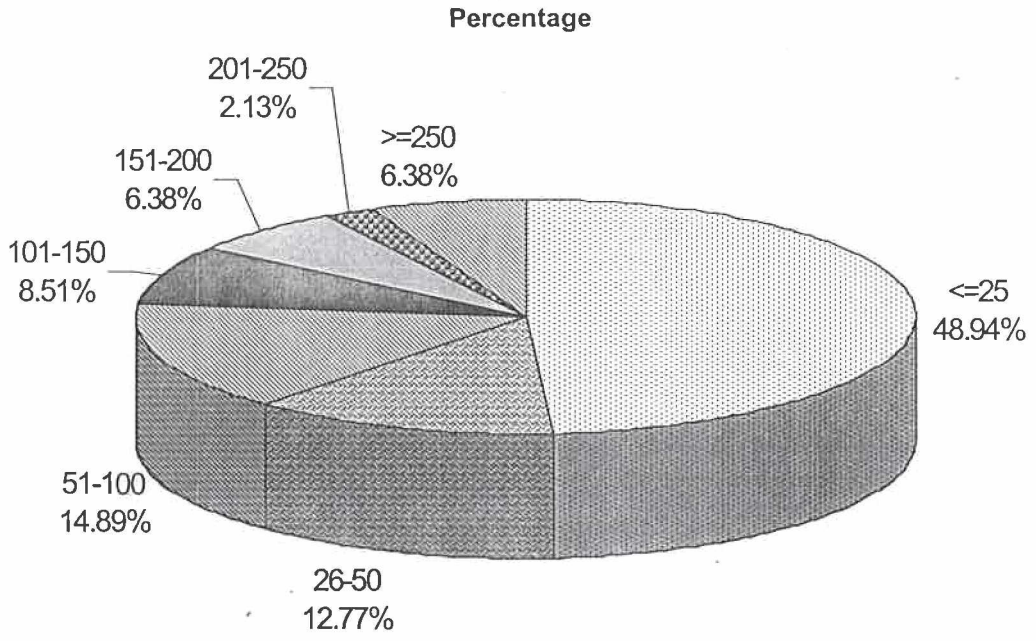


Fig.15. R&D FTE personnel by range and number of institutions (NZ).

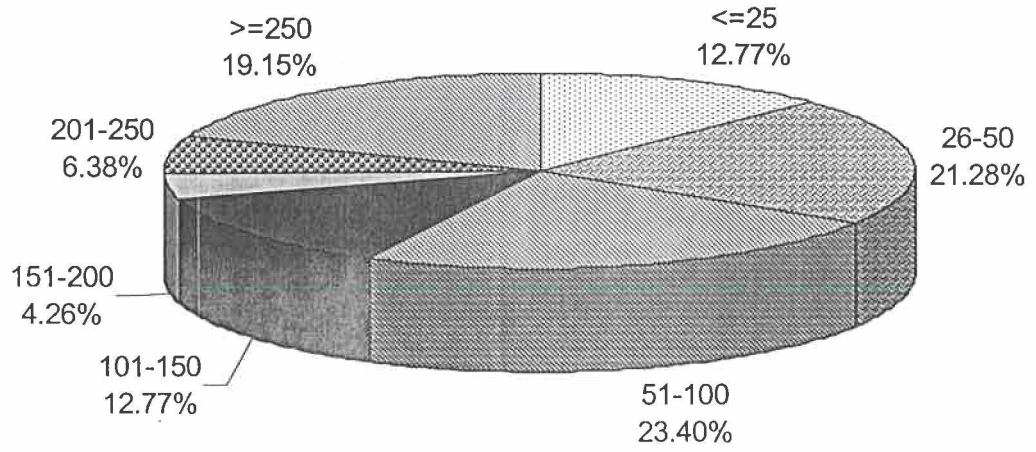


Fig.16. R&D FTE(t) personnel by range and number of institutions (NZ).

levels. Similar male/female ratio, when computed from available data from individual universities (Append.27-28), show a general tendency in medical institution to have better female presence.

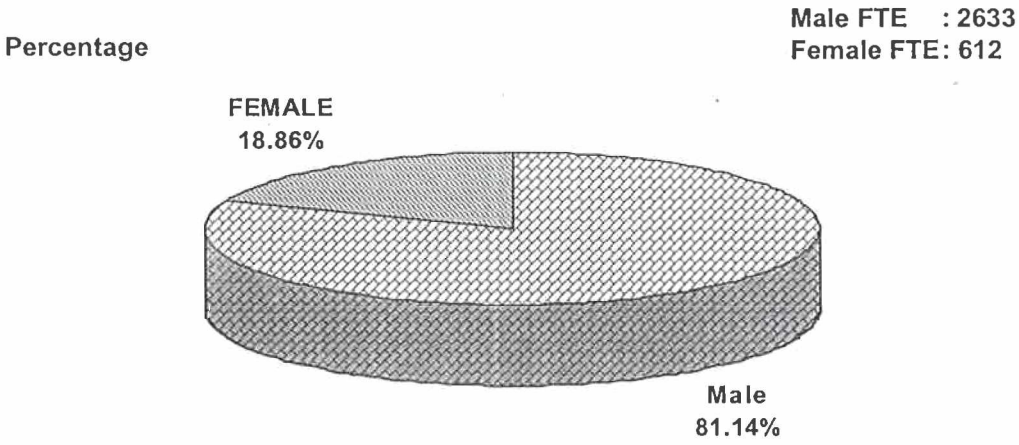


Fig.17. Percentage of R&D FTE personnel by gender (NZ).

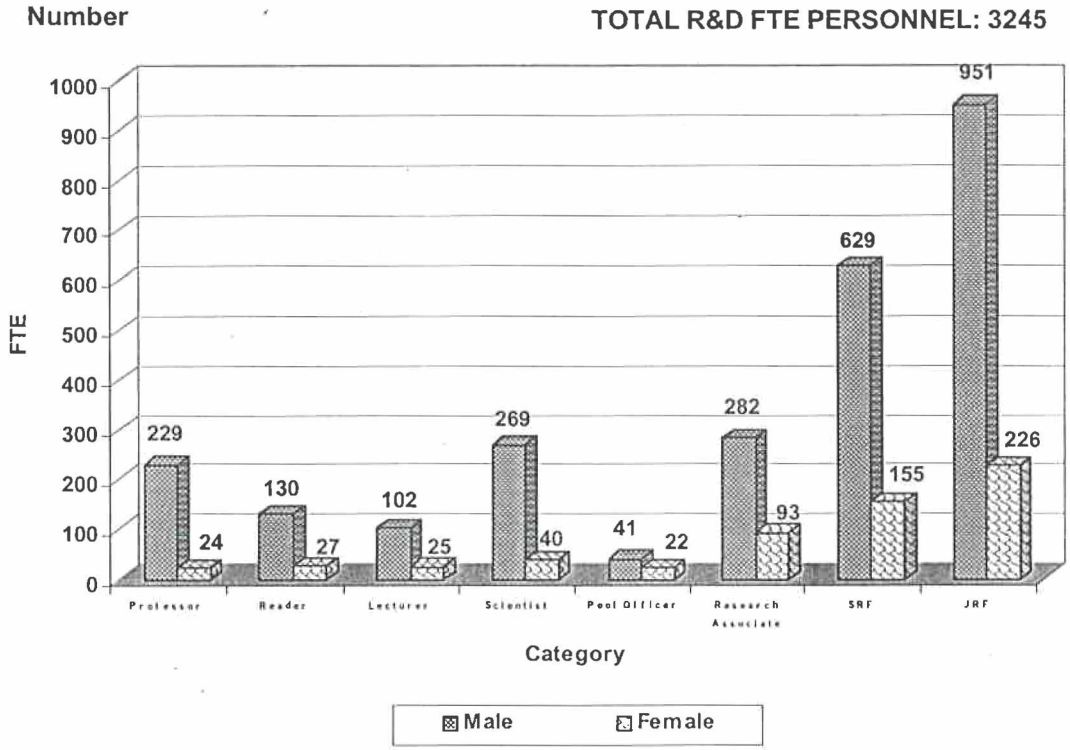


Fig.18. R&D FTE personnel by category and gender (NZ).

Append.25 also provides total expenditure calculated on the basis of salaries as received through Q.III. The total R&D expenditure in this case comes to Rs. 5,64,55,350/- (about 5.64 crores) in comparison to about

Rs.358.9 crore based on the data gathered from the budget papers, annual reports, and computations on the basis of average salary (for want of information in Q.III) (Append.9), the latter figure being larger by a factor of 63.64. Total faculty to responded faculty ratio comes out to 4.66 (10054 ÷ 2158). The total faculty/FTE faculty ratio comes out to 11.86 (10054 ÷ 848). Such gross mismatch indicates that in actual practice majority of the teachers get salaries far below the average, or, the salary scales have not been revised in many cases. Append.26, showing ranges of annual income for R&D FTE personnel, should be viewed in the light of the above comments. Append.27 depicts the gender distribution in R&D FTE personnel by ranges of age (Fig.19) (the mean value being 14.6% for females). The maximum percentage of females is 24% for the persons up to 30 years of age. With increasing age, women percentage is lowered, indicating the following possibilities: -

- More females are now being attracted towards teaching and research profession than previously.
- Women leave the service, or career, for family or personal reasons subsequently.
- There may be a general bias towards promotion against women. Although this is proved to the contrary as the percentage of women above sixty years is more (11%) than is the previous range (6%).

Append.28 provides R&D FTE gender distribution by experience (Fig.20). The conclusion, drawn above, holds equally good for the data computed in table. Whereas there is a general rise in the male faculty number, to the contrary, there is a fall in the number of women faculty, their strength coming down to 4% from 21% as experience increases.

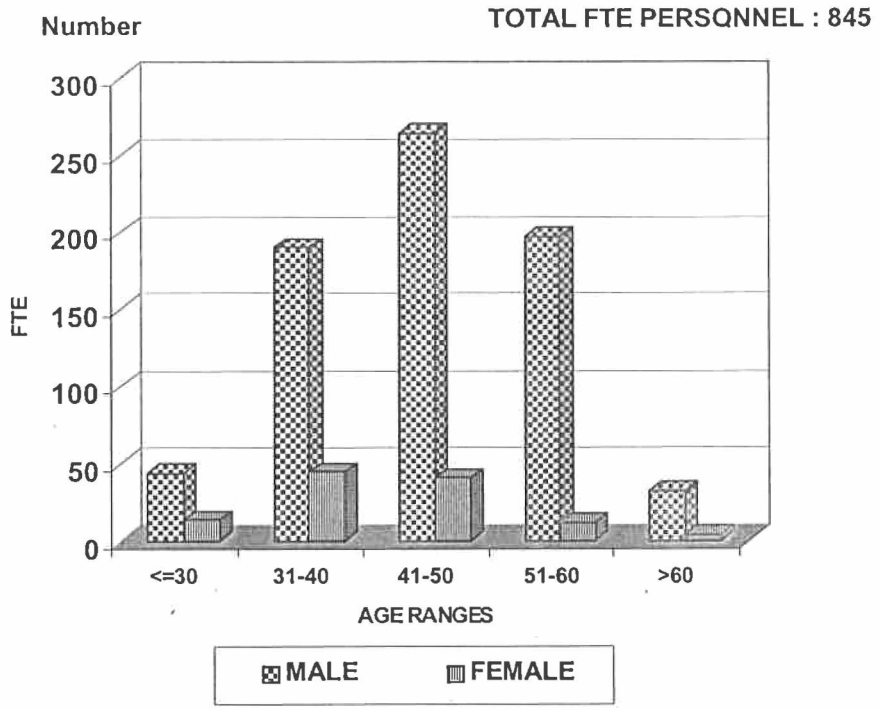


Fig.19. R&D FTE personnel by gender and age.

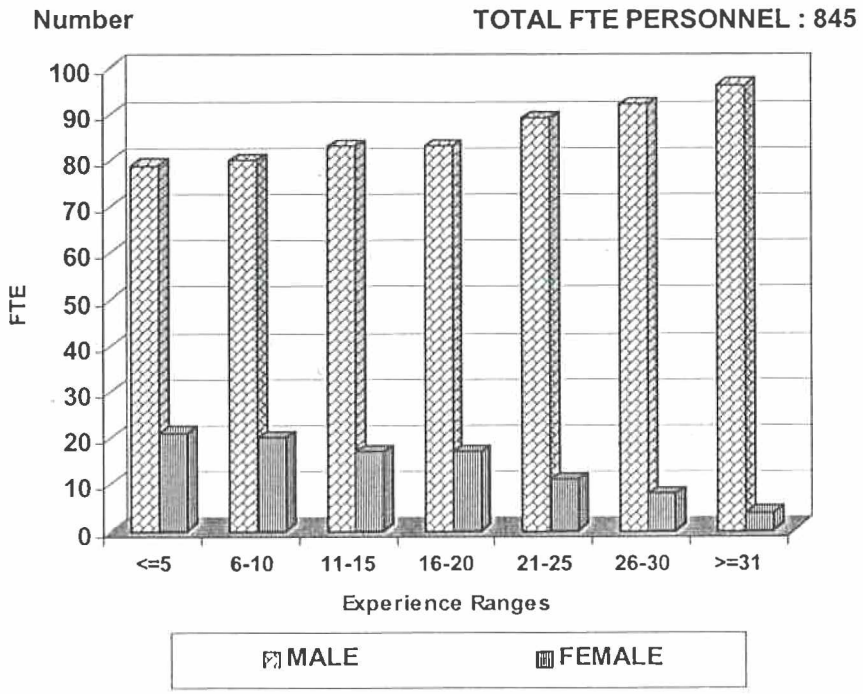


Fig.20. R&D FTE personnel by gender and experience.

In Append.29 (Educational qualification of faculty members), the doctorate degree holder response has been provided university-wise. Even a quick glance of the table will show a very encouraging scenario for women scientists as can be noted from the larger figures for women doctorate holders amongst themselves, compared to the male counterparts, in spite of their being 44.26% female doctorates against 50.96% doctorates in males.

Append.30 provides general data about doctorate degree holders amongst R&D personnel reduced to FTE. Over all, 51.8% R&D personnel have doctorate degrees. A quick glance of Fig.21 will be useful for a perception. The institutions wherefrom there is a significant response and the doctorate degree holders are less than half are: AMU (49.9%); FRI (5.56%); Pantnagar (16%); Gurukula (0%); JMI (34.48); and PAU Ludhiana (48.25%) and SGPI (7.69%).

TOTAL STAFF

Auxiliary and Administrative Staff

Append.31 shows the breakup of total staff and deduced staff in the North Zone institutions. Fig.22 gives a graphical account of total and supporting staff in the universities of North Zone.

Append.32 gives university-wise details of the total S&T faculty & responded faculty, as spoken of until now, and the total auxiliary and administrative staff in the university as a whole. Naturally, the latter group of staff have to be apportioned first to S&T departments and then further reduced to R&D component for any worthwhile survey. This has been achieved by utilizing the ratios between the budget of S&T and university's

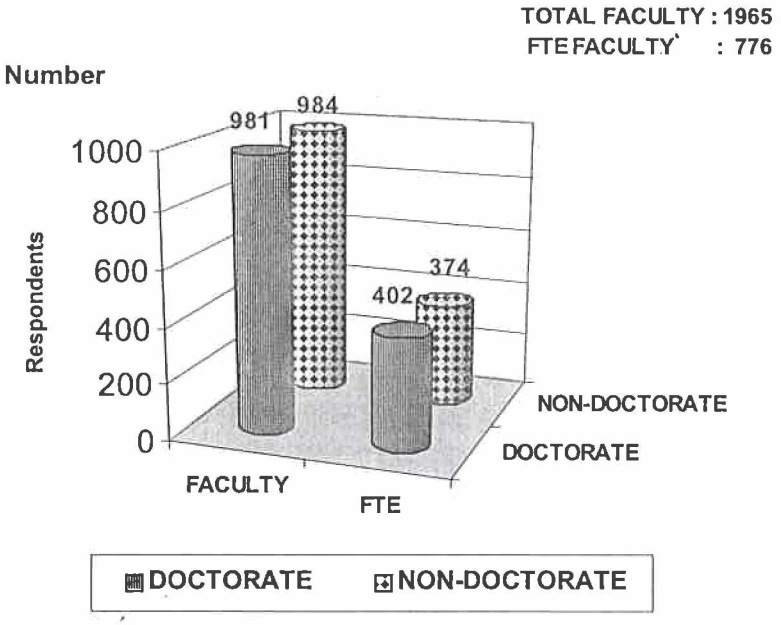


Fig.21. R&D faculty versus R&D FTE personnel by qualification.

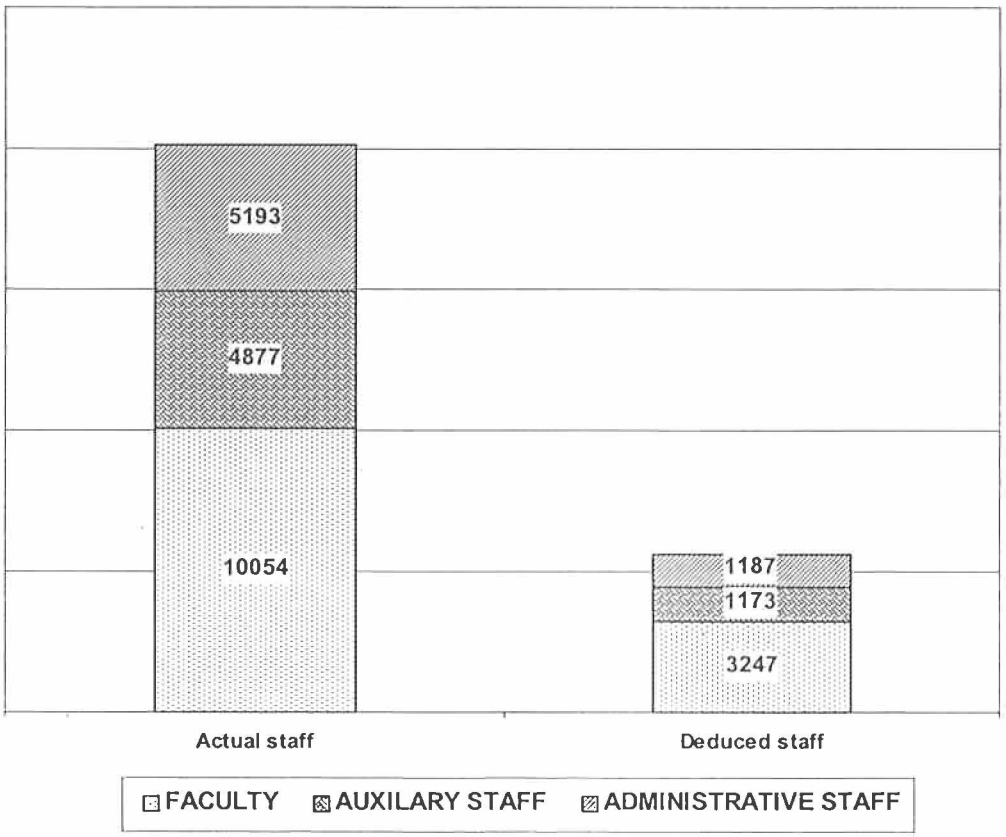


Fig.22. Faculty members versus supportive manpower engaged in R&D.

total budget and then using R&D/S&T ratio to compute the staff with the help of Q.I, or II, or from secondary sources. If such an exercise had been done by the universities themselves, the data would have been far more reliable, but only a few universities, have budget data on these lines. The computed results are provided in Append.32. The actual numbers may not indicate much, but proportionally the table does provide a structure of manpower distribution in the institutes of higher learning, should one keep in mind the percentage of response and compares with FTE(t), rather than FTE (given in Append.6). A few examples of ratios have been given in Table 7, taking out only these institutions from where some significant response of Q.III is available. Anyone, who is familiar with the functioning of universities, will agree that the last column of the table, where FTE(t) has been used, gives figures, which are seemingly nearer the ground-level.

Table 7. Ratio between deduced auxiliary staff and administrative staff by using FTE faculty & FTE(t) faculty.

University	FTE Faculty	FTE(t) Faculty	Deduced Aux. & Adm. Staff	Ratio Col.2÷ Col.4	Ratio Col.3÷ Col.4
All	848	2158	2360	0.36	0.91
AMU	91	208	153	0.59	1.36
AIIMS	7	136	251	0.03	0.54
BHU	36	182	27	1.33	6.74
CCS (Hisar)	106	494	189	0.56	2.61
Nauni (Solan)	43	216	141	0.30	1.53
IARI	28	301	152	0.18	1.98
JMI	31	35	27	1.15	1.30
PU (Chandigarh)	30	76	22	1.36	3.45
IIT, R	24	121	39	0.61	3.10
SGPI	13	33	32	0.40	1.03

SCIENCE INDICATORS

After four very painstaking brain- storming sessions (BSS) and several post–BSS meetings, a set of science indicators was developed for the National Survey. Most of these were exercises to bring out a variety of R&D jobs, which teachers perform in universities and institutes. Naturally, such a pedantic exercise resulted in making Q.III a ten page documents, which was responded by only about 21.46% of the total faculty. To comment, therefore, on the usefulness of the science indicators for the whole exercise is difficult. Naturally, the two appeals and the value of such a national-level data was not bought by the majority of teachers. Append.36-55 and Fig.23-29 show responses to the queries related to the science indicators

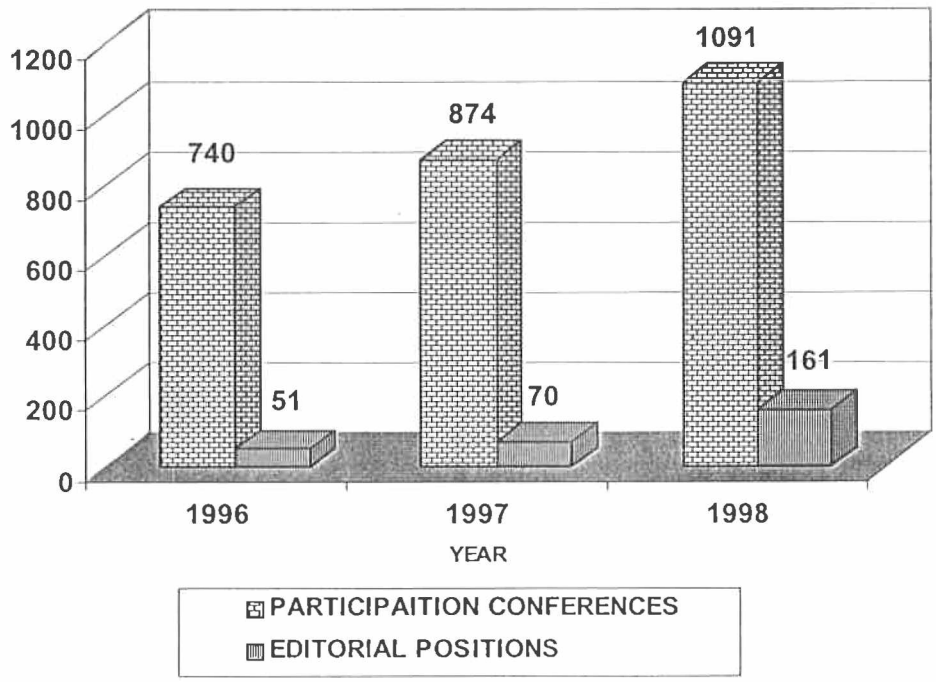


Fig.23. Conferences participation and editorial positions held by faculty members during three years (1996-1998).

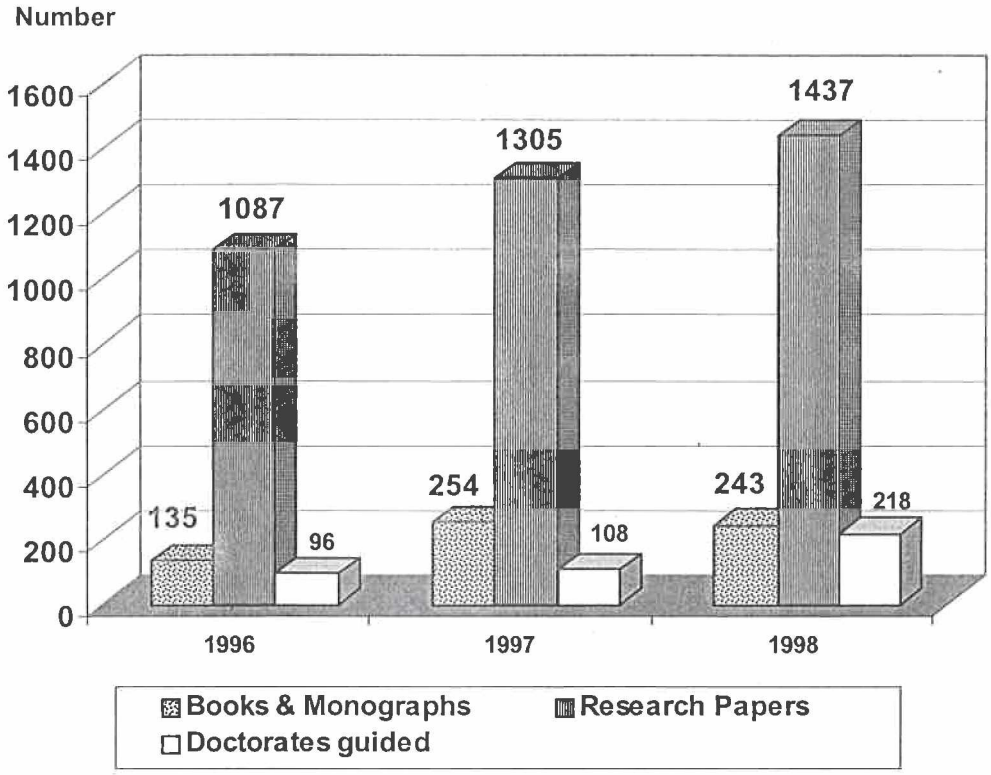


Fig.24. Comparative figure of books, monographs and papers published by faculty members and doctorates guided during three years from 1996 to 1998.

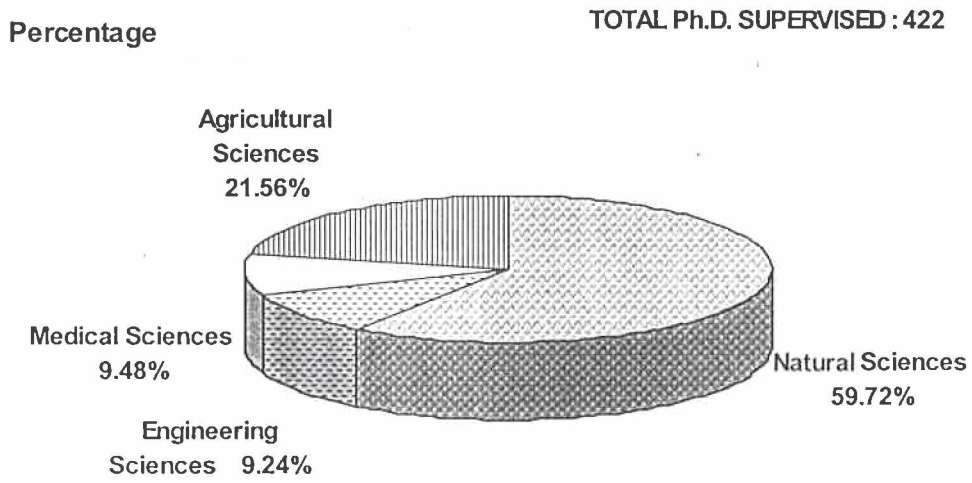


Fig.25. Field of science-wise breakup of Ph.D. supervised by faculty members during the last three years (1996-1998).

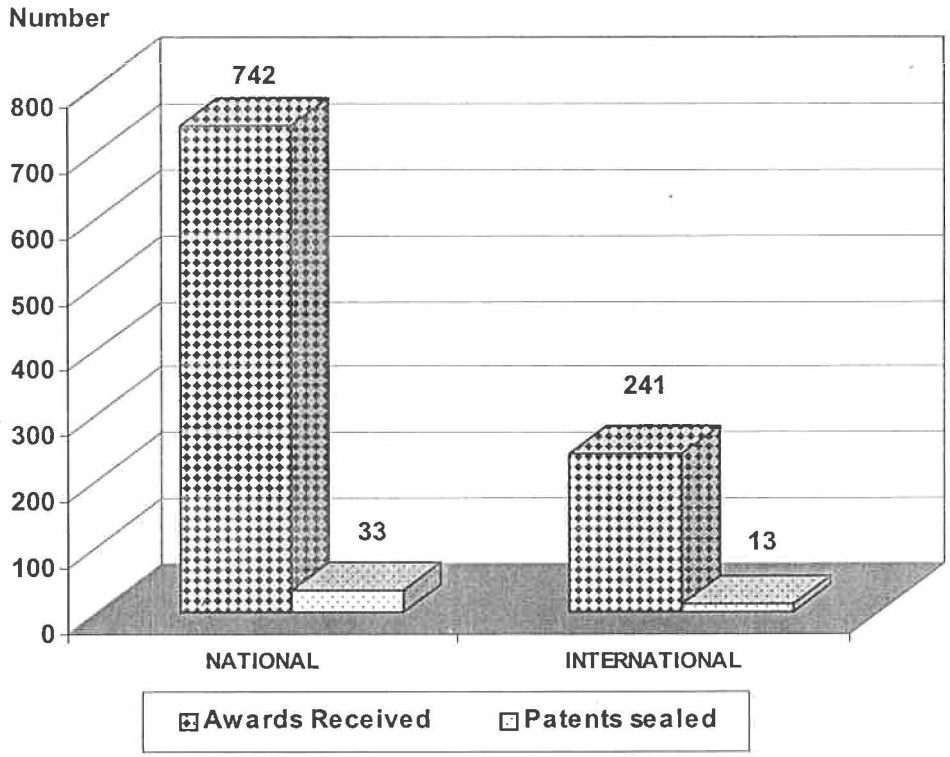


Fig.26. Number of national and international awards received, patents sealed by faculty members during three years from 1996 to 1998.

FACULTY INVOLVED	: 282
FACULTY NOT INVOLVED	: 1876
NON-RESPONSE	: 7896

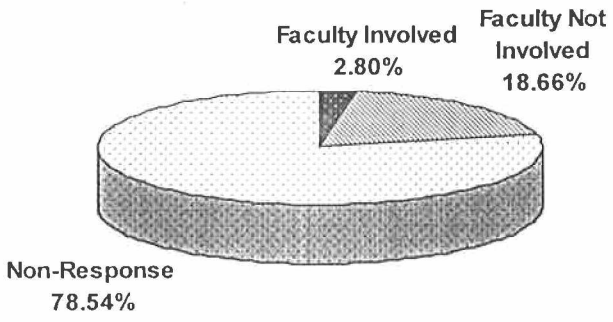


Fig.27. Faculty participation in editorial responsibilities.

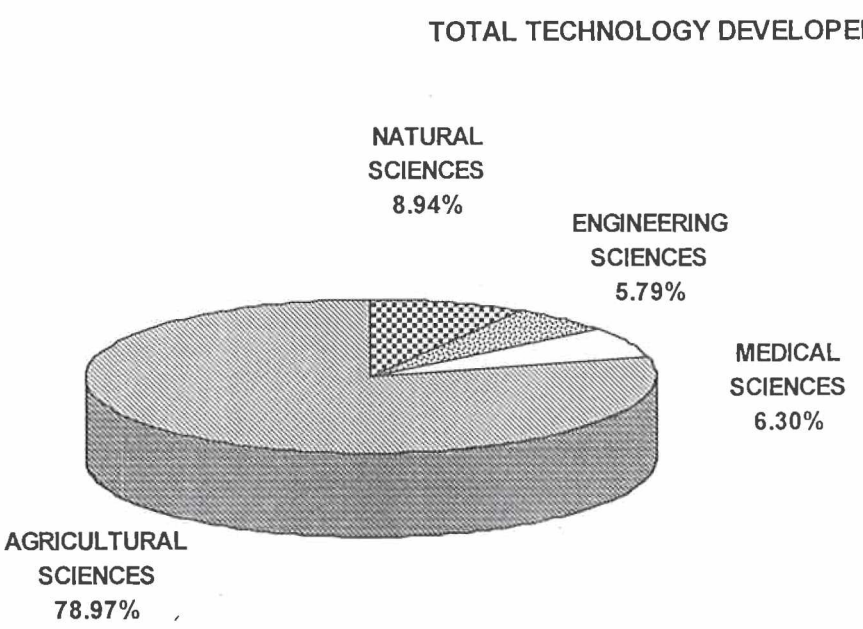


Fig.28. Field of science-wise breakup of technology, developed by faculty members during the last five years (1993 to 1998).

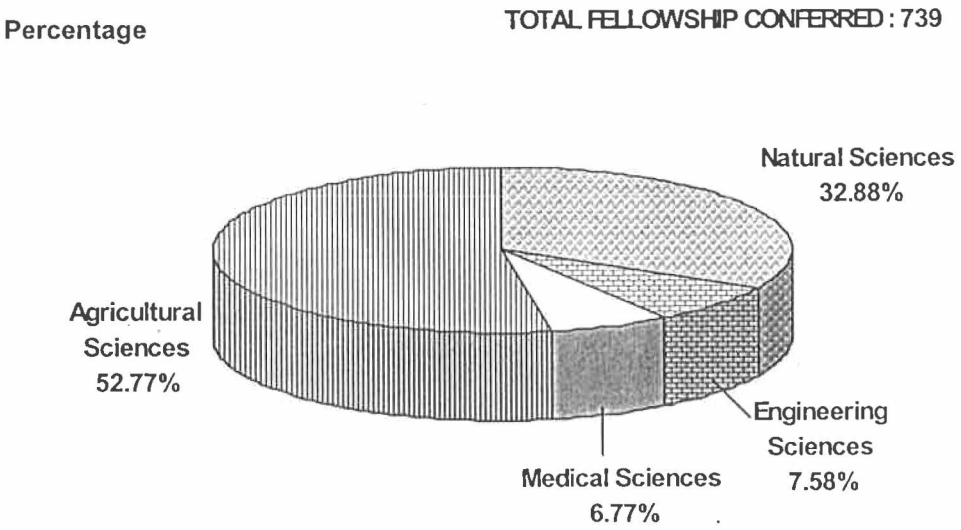


Fig.29. Field of science-wise breakup of fellowship conferred on faculty members as on date.

Post-Graduate Colleges

and are encouraging. It is true that a generalisation cannot be drawn, but that the recommendations of BSS were in order is amply proved. Efforts should continue, therefore, to devise a mechanism by which teachers gladly provide the data as was asked for. The real worth of the teachers and large volume of time-consuming R&D activities in which most of them are engaged would come to the surface and speak about the quality of their research.

POST-GRADUATE COLLEGES

Comments

There are over 2000 Post-Graduate colleges in the North Zone, which offer S&T, engineering, & medical courses with R&D components. Out of these, about 200 colleges were selected for the survey, and contacted for the appointment of Institutional Coordinators. Dispatches of the questionnaires were made to all of them. Of these, seventeen colleges responded with great pursuation, including 2-3 visitations. The colleges, which have responded, comprise 12 science colleges, 4 engineering colleges and one medical college. Grant-in-aid received by each of them is given in Append.53.

Regret to report that the overall data collected is too meager to synthesize and compare the R&D status of different colleges to arrive at some worthwhile results that could be representative of the whole, or the majority of the population, undertaken for the survey. However, the available

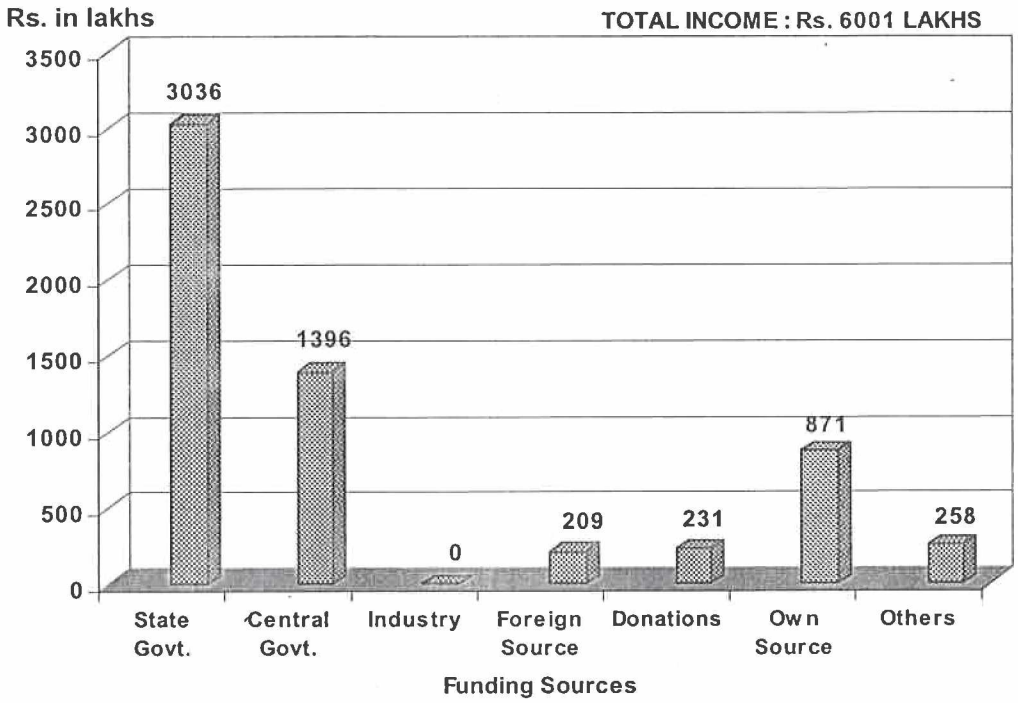


Fig.30. Contributions from various sources received by colleges (NZ).

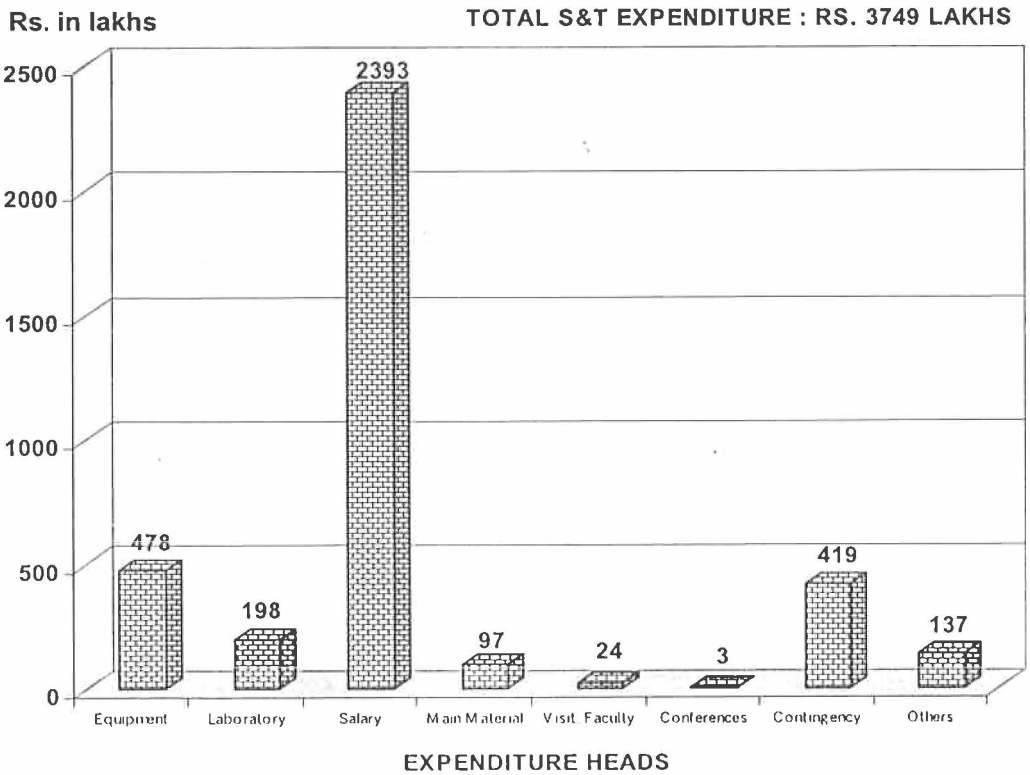


Fig.31. Comparative figure of total S&T expenditure in PG colleges - head-wise (NZ).

data, not-withstanding its smallness, has been analysed and fully examined on various modes (Append. 53 to 65), although the inferences drawn, presented hereunder, may not be enough.

Analytical Perspective

Only one medical college, that is, the Himalayan Institute of Medical Science, Dehra Dun, a private sector institution, responded to release some information on repeated trials through Q.1. It has income, primarily, from three sources: (1) foreign sources, Rs.20,975,000.00, (2) donations, Rs.23,120,000.00, and (3) own sources, Rs.338,00,000.00, with a total of Rs.77,845,000.00.

In regard to the four engineering colleges, information has been collected from annual budget reports. It is found that Motilal Nehru Regional Engineering College, Allahabad, received the highest grant of Rs.1,3,30,57,000.00 from four sources, maximum being from the Central Govt., for the year (1997-98) amounting to Rs. 579,49,000.00 (see Append.61).

When we examine the data of science colleges, it is noted that the Bareilly College, Bareilly, a very old science college in the region – gets grant mainly from the State Govt. (U.P.). In 1997-98, it received of Rs.59,895,000.00, from the State Govt., supplemented by the Central Govt. by a small amount of Rs. 17,92,000.00, whereas the least resources, were allotted to St. Johns College, Agra (Append. 61).

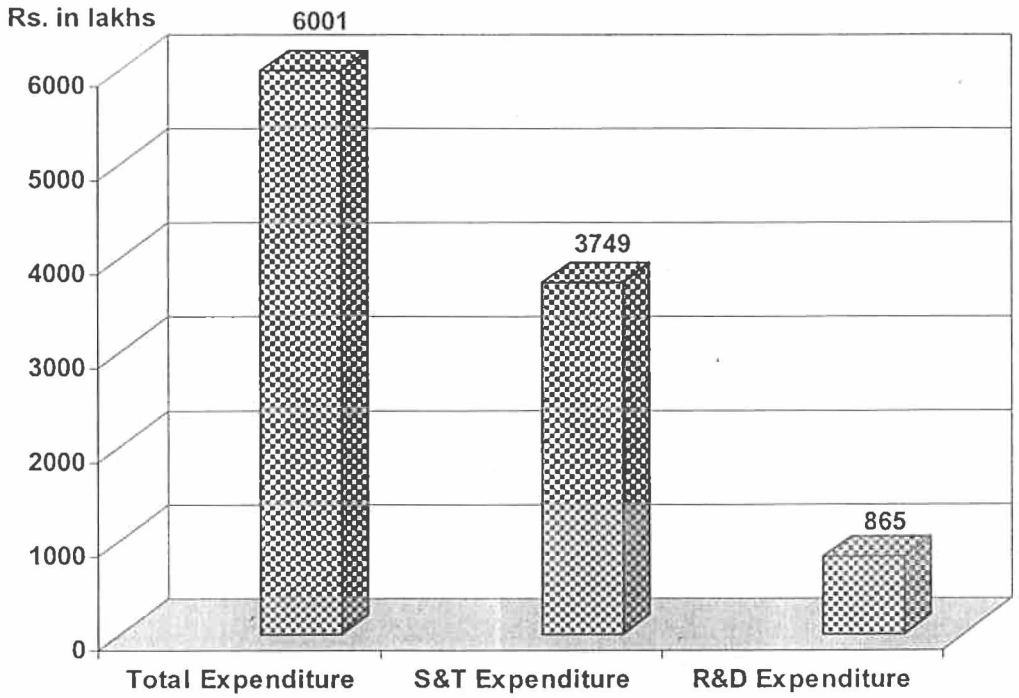


Fig.32. R&D expenditure versus total expenditure and S&T expenditure (NZ).

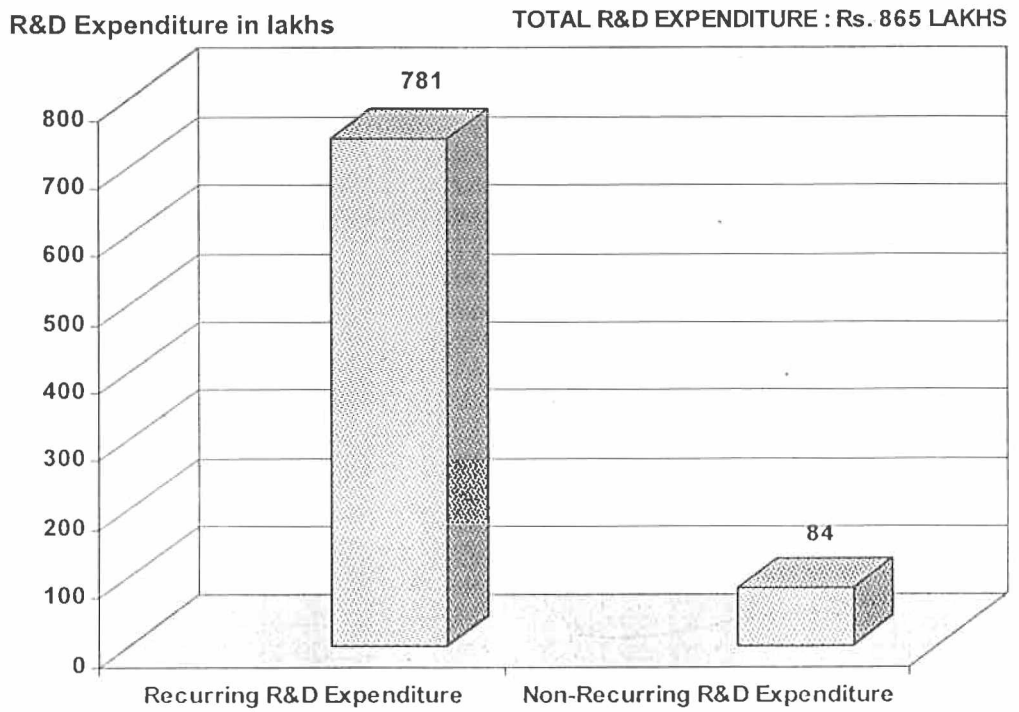


Fig.33. Total recurring and non-recurring R&D expenditure in colleges (NZ).

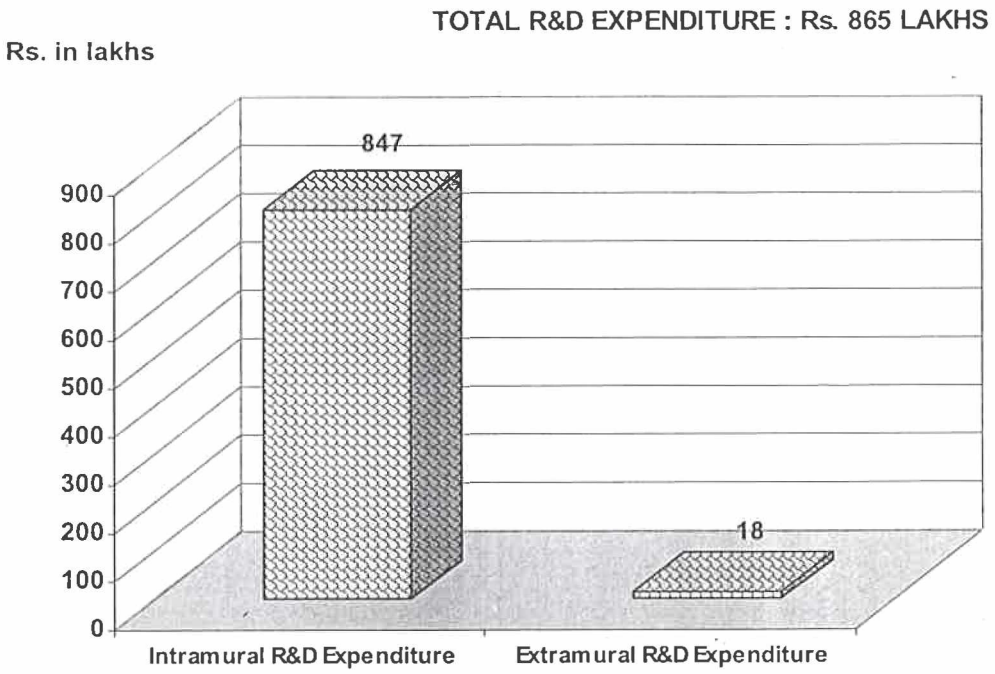


Fig.34. Comparative figure of intramural/extramural R&D expenditures for colleges (NZ).

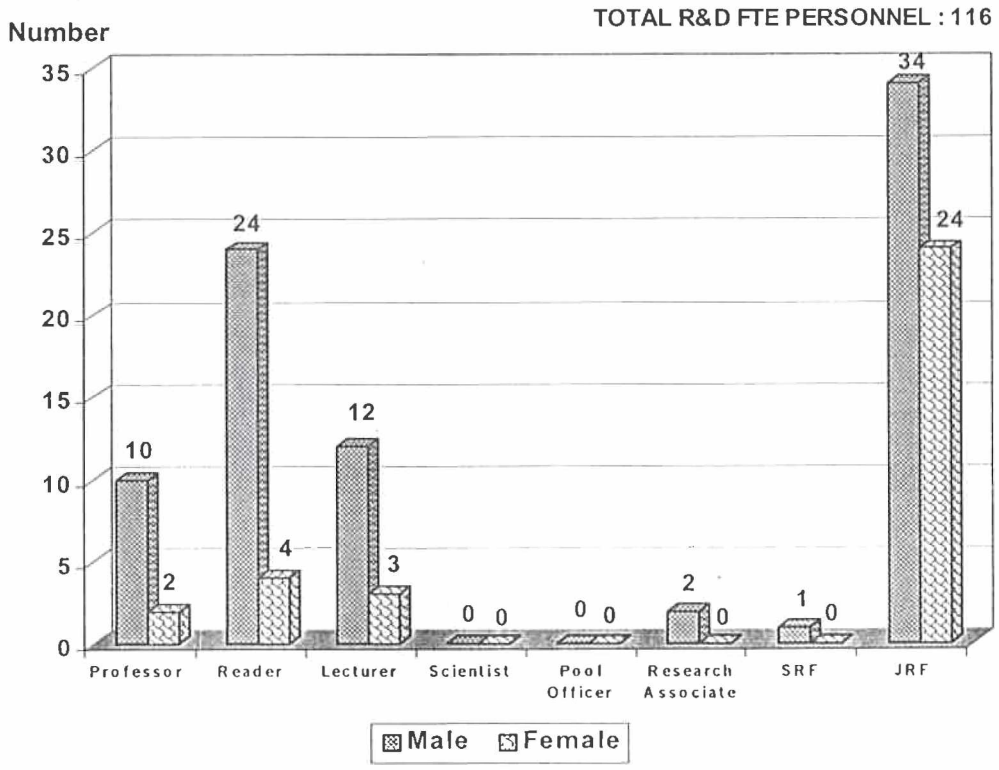


Fig.35. Comparative diagram for R&D FTE personnel by category and gender (NZ).

Plots of data on contributions received from 17 colleges from various sources indicate that the State Govts. are major contributors to the incomes of the colleges (Fig.1). Out of this, bulk goes to salary component of the staff and 62.47% for S&T and of this, only 23.07% for R&D (Fig.3). In Fig.5, we have shown R&D expenditure divided into intramural and extramural. It may be noted that most of the expenditure on R&D is from intramural sources.

Because of the dearth of information from most of the colleges, it would not be appropriate to make any generalizations for expenditure on R&D FTE personnel. However, the available data is tabulated in Append. 65 to glean the information on 17 colleges, and that is of no consequence.

CONCLUSIONS & RECOMMENDATIONS

- We proceeded to launch a well-conceived and nationally vital project with passionate desire and vigor to fill the void at the national repository of *R&D statistics in S&T*. For the fulfillment of this objective, we formed a team of competent and committed workers, established administrative setup for the management of the pertinent services and also developed an excellently designed and inclusive set of six questionnaires to collect information through a nicely inter-woven programme of survey of higher education sector.
- Although with considerable difficulties and pursuations, management of 81% of the universities/institutions eventually came forward to release the data through the already prepared fully-fledged documents.

The academics, by and large, showed not much appreciable interest in responding to the inquiries, for one reason or the other. The response has, however, been only meager from the post-graduate colleges. As a result, such a well-thought and organized central programme couldn't lead to tangible results, while a lot of money and efforts had gone into its making and execution.

- To overcome this inertia in teachers, we feel that positive and firm steps are called for by regularly inspiring healthy motives among the academics to part with scientific data on their performance in R&D. For this, it would be better if a sort of built-in mechanism in each and every institution is created on permanent basis to get the required data from the teachers and research personnel in the universities & institutes, research organisations, and post-graduate colleges, offering S&T courses.
- We are very much conscious of the relevance and importance of such a data at the national level for creating a data-bank, very much usable in a number of key-sectors. Realization of the same on the part of responders would have, no doubt, given life and meaning to the outcome, we had desired to bring out. but, alas! the purpose couldn't be fully achieved owing to several reasons, especially the unwillingness of the elite of some academies, more so of post-graduate colleges.
- The survey, among other things, aimed at locating scientific talents with R&D-building qualities in various institutes. The efforts in this direction also got subdued primarily due to casual attitude of the

responders towards doing such a small task of filling up the questionnaires and their return to the Intuitional Coordinators, who were just at hand.

- With all that, stated above, and other sundry reasons, there is significant amount of missing data from quite a number of institutions and from most of the post-graduates colleges; hence, lacunae in compiled results. Suggestion is, therefore, made that the DST may create an on-going mechanism for continuous additions to the already collected data to help building up ever uptodate documentations so that our data-bank is ever active and a dynamic source of information on science statistics. A permanent agency, preferably a NGO in each zone, be established to collect, catalogue & update the data for reference & use.
- Lastly, as said above, the success in our study had not been as we would have wished. We may, therefore, search our hearts, if there has been any failure on our part to create motivation in the minds of researchers to the desired level, be they academics, heads of intuitions, or the departments. To overcome their apathy, some kind of message be devised and communicated to goad them on for future enquiries.

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

Post-Graduate Colleges

Additional Appendices