STUDY ON STATUS OF FOREIGN PARTICIPATION IN R&D ACTIVITIES OF SELECTED ORGANISATIONS IN INDIA

Volume 01

Catalysed & Supported by:

GOVERNMENT OF INDIA
Ministry of Science & Technology
Department of Science & Technology
National Science & Technology Management Information System (NSTMIS)

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PREFACE

National Science and Technology Management Information System (NSTMIS), a Division of Department of Science & Technology (DST), Government of India, entrusted National Foundation of Indian Engineers (NAFEN) to undertake the study entitled: **"Study on Status of Foreign Participation in R&D Activities of Selected Organisations in India"**

The study intends to explore the characteristics of R&D activities of select international organisations operating in India in identified sectors, other **than those covered under the R&D statistics database of Govt. of India.**

Data collected from 73 leading international R&D organisations in the manufacturing segment, 2 from institutional segment & 2 centres. Sectors covered in the study are Agriculture, Automobile, Bio-Technology, Chemical, Information Technology, Non Conventional Energy Sources, Pharmaceutical & Power.

A Local Project Advisory Committee (LPAC) was constituted under the Chairmanship of **Dr. Laxman Prasad,** Advisor & Head, National Science and Technology Management Information System (NSTMIS), Ministry of Science & Technology, Govt. of India. The members of the LPAC were from Academics & Industries. Detailed questionnaire for organisations & centers were finalised in a Brain Storming Session (BSS) held at New Delhi on **5th Dec., 2002**, wherein members of the Local Project Advisory Committee (LPAC) & some of the respondents participated.

The study has been divided into two volumes, **Volume I : Quantitative & Volume II : Qualitative** i.e. textual details. Volume I has five chapters : **Chapter I** includes Introduction, Objectives & Scope of the Study; **Chapter II** elaborates Methodology of the Study; **Chapter III** highlights R&D analysis for organisations in the manufacturing segment. Quantitative Analysis in each chapter contains five sections, Section-1 gives General Information; Section-2 details R&D Expenditure, Section-3 gives details of Full Time Manpower Employed, Section - 4 elaborates R&D Output and Section - 5 concludes General Information on R&D Output. **Chapter IV** contains detailed features of R&D analysis for institutional segment and is divided into five sections as in Chapter III. **Chapter V** deals with R&D analysis for Centres. The study concludes with Project Investigators' observations regarding the study.

Through out the working on this study, the aim had been to develop meaningful and informative data base on sectors covered in the study. We sincerely hope that the results of the study will be useful to the industry, policy planners, decision makers, academic insutites, R&D specialists and various research agencies of the country.

P.K. Gupta

Dr.P.K.Gupta
Project Investigator

New Delhi
30th November 2003

ACKNOWLEDGEMENTS

At the outset, National Foundation of India Engineers (NAFEN) would like to specially thank **Dr. Laxman Prasad,** Advisor & Head, National Science and Technology Management Information System (NSTMIS), Ministry of Science & Technology, Govt. of India, whose guidance and motivation for conducting this study has been immensly useful.

NAFEN is highly grateful to **Mr. Rakesh Chetal,** Advisor, NSTMIS, **Mr. Parveen Arora**, Director & **Dr. A.N.Rai**, Principal Scientific Officer, Dept. of Science & Technology, Ministry of Science & Technology, Govt. of India. Without their contineous help and guidance, it would have been impossible for NAFEN to complete the study.

NAFEN is also deeply obliged to all the members of Local Project Advisory Committee (LPAC) & all the respondents who spared their valuable time in providing us the data to complete the study.

Project Investigator is thankful to all his colleagues in NAFEN, who helped him in completing this study within the stipulated time.

New Delhi
30th November 2003

Dr.P.K.Gupta
Project Investigator

EXECUTIVE SUMMARY

National Science and Technology Management Information System (NSTMIS), a Division of Department of Science & Technology (DST), Ministry of Science & Technology, Government of India, entrusted National Foundation of Indian Engineers (NAFEN) to undertake the following study:

Study on Status of Foreign Participation in R&D Activities of Selected Organisations & Centres in India

The main highlights of the study are as follows :

- This study intends to explore the characteristics of R&D activities of select international Manufacturing Segment organisations, Institutional Segments & centres operating in India in identified sectors, other than those covered under the R&D statistics data base of Government of India.

- The study also intends to explore the latest scenario and to quantify input/output R&D resources in terms of Manpower, Finance, Infrastructure, Patents, Licensing, Technology Transfer, Know-how of Products/Systems/Processes/Software Programmes.

- 95 premier international organisations in the manufacturing segment, 2 organisations from institutional segment and 4 centres were surveyed.

- Period of review was selected as 1999-2002.

- Eight major sectors were selected for review viz. Agriculture, Automobile, Bio-Technology, Chemical, Information Technology (IT), Non Conventional Energy Sources (NCES), Pharmaceutical & Power.

The Analysis

Based on the data received, the position on various parameters has emerged as follows. The Analysis is in **5 Chapters**:-

Chapter I	-	**Introduction**
Chapter II	-	**Methodology of the Study**
Chapter III	-	**R&D Analysis for Manufacturing Segment**
Chapter IV	-	**R&D Analysis for Institutional Segment**
Chapter V	-	**R&D Analysis for Centres**

A. Analysis for Manufacturing Segment :

- **RESPONSE** **[Page No. 4 Table 3.01]***

Out of 95 identified organisations, 73 organisations responded resulting in an overall response of 77%. The maximum response of 91% was received from Bio-tech sector followed by Pharma sector with 89%, while the lowest response of 50% was received from Power sector.

- **ZONE-WISE RESPONSE OF R&D ORGANISATIONS SURVEYED**

[Page No. 5 Table 3.02]

Maximum 82% organisations responded from Northern India followed by 76% from Southern India.

- **WORLDWIDE LOCATION OF FOREIGN COLLABORATING ORGANISATIONS** **[Page No. 6 Table 3.04]**

Maximum 47% Foreign Collaborating Organisations are located in Europe followed by 44% in USA.

- **YEAR OF ESTABLISHMENT** **[Page No. 7 Table 3.05]**

33% of R&D organisations were established in India before 1990 & 67% after 1990.

- **YEAR OF COMMENCEMENT OF R&D ACTIVITIES** **[Page No. 7 Table 3.06]**

19% of organisations commenced their R&D activities in India before 1990 & 81% after 1990. However maximum 33% organisations started their R&D activities during the period 1999-2001.

- **CATEGORIES OF R&D ORGANISATIONS** **[Page No. 8 Table 3.07]**

Maximum 62% R&D organisations are subsidiaries of a foreign company followed by 32% as joint ventures.

- **TOTAL GROSS TURNOVER (GTO) (RUPEES MILLION)**

[Page No. 9 Table 3.08]

Total Gross Turnover for all the sectors taken together during the year 2001-2002 has increased appox. by 10% as compared with 2000-2001.

- **TOTAL EXPENDITURE ON ADVERTISEMENT AND NEW PLANT & MACHINERY FOR THE WHOLE ORGANISATION**

[Page No. 10 Table 3.09]

Automobile sector has made maximum expenditure on advertisement (Rs. 547 million) during the year 2000-2001 followed by Pharma sector (Rs. 279 million).

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* *Figures in [ ] brackets refer to the page numbers & table numbers of the report, for details.*

- **TOTAL EXPENDITURE ON ADVERTISEMENT AND NEW PLANT & MACHINERY FOR R&D ACTIVITIES [Page No. 11 Table 3.10]**

  Expenditure on new plant and machinery for R&D activities as a percentage of expenditure on new plant & machinery for the whole organisation is highest in I.T. sector i.e. 64% in the year 2001-2002 followed by Chemical sector 44%. Expenditure on advertisement for R&D activities as a percentage of expenditure for advertisement on the whole organisation is also highest in I.T. sector 42% in the year 2001-2002 followed by NCES sector 37%.

  It is seen from the above that I.T. sector is spending highest both for new plant & machinery and advertisement for R&D activitites during the year 2001-2002.

- **LINKAGES [Page No. 12 Table 3.11]**

  On an overall basis, organisations covered in the study have maximum Indian linkages with 66 private organisations followed by 61 R&D laboratories.

  Foreign linkages are maximum with 65 R&D Laboratories followed by 62 with private organisations.

- **RESOURCES ALLOCATION BY TYPE OF RESEARCH**

  [Page No. 13 Table 3.12]

  On an average basis, maximum time & resources 73% & 72% respectively are devoted by NCES sector followed by 51% & 52% respectively by Automobile sector on Experimental Development.

  On the Applied Research parameter, maximum time & resources 56% & 57% respectively devoted in Agriculture sector, followed by 55% & 54% in Pharma sector.

- **R&D EXPENDITURE BY SOURCES OF FUNDS [Page No. 14 Table 3.13] (Total R&D Expenditure Rs. 7934 million during 2001-2002)**

  R&D expenditure in Rs. million has increased from 2325 in the year 1999-2000 to 7934 in the year 2001-2002 i.e. an increase of 241%. Maximum total R&D expenditure was made in I.T. sector amounting to Rs. 5938 million followed by Rs. 566 million in Pharma sector during the year 2001-2002. There have been substantial rise in R&D expenditure for I.T. sector over the years (more than 5 times in three years).

- **R&D EXPENDITURE AS A %AGE OF GROSS TURNOVER (GTO)**

  [Page No. 15 Table 3.14]

  R & D expenditure as a %age of GTO was highest 5% in IT sector followed by Chemical sector 2.5% during the year 2001-2002.

- **MAN POWER [Page No. 16 Table 3.15]**

  Total Man power employed in the eight sectors covered in the study is 55094 as on 1st April 2002, out of which 15.5% are exclusively working for R&D activities.

- **PERSONNEL ENGAGED IN R&D ACTIVITIES [Page No. 17 Table 3.17]**

  For R&D activities alone, maximum 1930 Indian male are employed in I.T. sector followed by 892 in Pharma sector. Similarly maximum 962 Indian female are employed in I.T. sector followed by 490 in Automobile sector.
  On an overall basis, for all the sectors taken together in R&D activities, 67% are male employees and 33% are female.

- **ACADEMIC BACKGROUND** **[Page No. 18 Table 3.18]**

  Maximum Ph.D's & PG's 440 & 577 employed by I.T. sector followed by 126 & 195 in Automobile sector. Maximum Graduate's 814 employed by I.T. sector followed by 344 by Pharma sector.

- **GROSS TURNOVER (GTO) PER EMPLOYEE (RS. MILLION/EMPLOYEE)** **[Page No. 20 Table 3.20]**

  Maximum productivity in I.T. sector followed by Automobile sector. However, it may not be proper to compare the productivity of one sector with another sector due to various reasons like capital employed, nature of manpower employed, working conditions prevailing in an organisation and other infrastructural differences.

- **GROSS TURNOVER (GTO) PER R&D EMPLOYEE (RS. MILLION / EMPLOYEE)** **[Page No. 20 Table 3.21]**

  GTO in Rs. million / R&D employee highest in Automobile sector followed by Power sector.

- **R&D EXPENDITURE PER R&D EMPLOYEE (RS. MILLION/EMPLOYEE)** **[Page No. 20 Table 3.22]**

  R&D expenditure / R&D employee highest in I.T. sector followed by Bio-Tech sector.

- **PATENTS** **[Page No. 21 Table 3.23]**

  Maximum Indian patents 40 awarded in I.T. sector followed by 14 in Pharma sector during the year 2001-2002. Maximum foreign Patents 2 awarded in Bio-Tech sector in the year 2001-2002.

  Maximum patents 201 developed by I.T. sector followed by 78 by Pharma sector during the period of study.

- **R&D EXPENDITURE PER PATENT** **[Page No. 22 Table 3.25]**

  R&D expenditure in Rs. million / patent ranges from 11 to 61 in the year 2001-2002.

- **R&D OUTPUT** **[Page No. 23 Table 3.26]**

  In three years, 250 products and 49 processes have been developed, maximum 113 products developed in I.T. sector.

- **PUBLICATIONS** **[Page No. 24 Table 3.27]**

  In three years, 177 papers have been published in Journals, 388 Technical reports published and 12 papers published in conferences/seminars/symposia etc. Maximum 37% papers were published in Journals in Pharma sector, followed by 25% in Power sector. Maximum 58% papers published in conferences / seminars / symposia in Pharma sector followed by 25% in Bio-tech sector. Maximum 31% technical reports were published in I.T. sector followed by 21% in Pharma sector.

  In many cases, organisations may avoid publishing their papers due to their organizational policies.

- **R&D EXPENDITURE PER PUBLICATION** **[Page No. 25 Table 3.28]**

  R&D expenditure in Rs. million / publication was highest in I.T. sector. Sector-wise, it ranges from 2.6 to 114 during the year 2001-2002.

- **SKILL UPGRADATION** **[Page No. 26 Table 3.29]**

  In three years, 4583 R&D personnel deputed for conferences and 4901 deputed for training. Maximum R&D personnel deputed for conferences/seminars/symposia 1922 by I. T. sector followed by 959 by Pharma sector. Similarly maximum 2678 R&D personnel deputed for training by I.T. sector followed by 667 in Pharma sector during the period of study.

- **MAJOR USE OF R&D OUTPUT** **[Page No. 27 Table 3.30]**
  (Multi choice answers)

  On sector-wise analysis, it is observed that maximum 17 organisations have identified ***'Further R&D'*** in I.T. sector followed by 14 in Pharma sector as the major use of R&D output. Similarly 17 organisations in Pharma sector followed by 16 in I.T. sector have identified ***'Commercial & Marketing'*** as the second major use of R&D output. Out of 73 responding organisations, 66 organisations have stated ***'Further R&D'*** and 64 have stated ***'Commercial and Marketing'*** as the major use of R&D output.
  In some of the above areas, further in depth studies are required to probe developments in these types of areas.

- **SOURCES OF INNOVATION** **[Page No. 28 Table 3.31]**
  (Multi choice answers)

  Out of 73 respondent organisations 72 have identified ***'In-House R&D'*** as the crucial source of innovation followed by 47 identifying ***'Customers'*** as the next crucial source of innovation.

B. Analysis for Institutional Segment :

- **RESPONSE** **[Page No. 29 Table 4.01]**

  Response from institutional segment was 100%. Both the institutions commenced their R&D activities before 1990.

- **ZONE-WISE RESPONSE OF R&D ORGANISATIONS SURVEYED**
  [Page No. 29 Table 4.01]

  The response from institutions was 100%.

- **WORLDWIDE LOCATION OF FOREIGN COLLABORATING ORGANISATIONS** **[Page No. 29 Table 4.01]**

  Both institutions have FCO's located in Europe (Italy).

- **YEAR OF ESTABLISHMENT** **[Page No. 29 Table 4.01]**

  Both the institutions were established in India before 1990.

- **YEAR OF COMMENCEMENT OF R&D ACTIVITIES**
  [Page No. 29 Table 4.01]

  Both the institutions commenced R&D activities in India before 1990.

- **CATEGORIES OF R&D ORGANISATIONS** **[Page No. 29 Table 4.01]**

  ICRISAT is International Research Institute while ICGEB is International Research Centre.

- **TOTAL GROSS TURNOVER (GTO) (RUPEES MILLION)**
  [Page No. 30 Table 4.02]

  It is observed that in Total GTO, ICGEB recorded upward trend and ICRISAT downward.

- **EXPENDITURE ON ADVERTISEMENT AND NEW PLANT & MACHINERY**
  [Page No. 30 Table 4.03]

  ICRISAT made maximum expenditure of Rs. 106 million on new plant & machinery during the year 2000-2001.

- **LINKAGES** **[Page No. 31 Table 4.04]**

  ICRISAT & ICGEB both have linkages with Indian & Foreign Government, Private Organisations, Universities & R&D Laboratories. In addition ICRISAT also have linkages with Non Government Organisations.

- **RESOURCES ALLOCATION BY TYPE OF RESEARCH**
  [Page No. 31 Table 4.05]

  Maximum time & resources 60% and 60% respectively are devoted by ICRISAT on Experimental Development and ICGEB maximum time & resources 50% & 52% on basic research.

- **TOTAL R&D EXPENDITURE BY SOURCES OF FUNDS**
  [Page No. 32 Table 4.06]

  ICRISAT has maximum foreign funding and ICGEBN maximum Indian funding. It is observed that in R&D Expenditure, ICGEB recorded upward trend and ICRISAT downward.

- **R&D EXPENDITURE AS A %AGE OF GROSS TURNOVER (GTO)**
  [Page No. 32 Table 4.07]

  R & D expenditure as a %age of GTO witnessed downward trend from 99% to 75% during the period of study.

- **MAN POWER** **[Page No. 33 Table 4.08]**

  Total Manpower employed by both the institutions is 729, out of which 18% are employed in R&D activities.

- **PERSONNEL ENGAGED IN R&D ACTIVITIES** **[Page No. 33 Table 4.10]**

  Out of total 132 employees engaged in R&D activities alone, 23% are female employees.

- **ACADEMIC BACKGROUND** **[Page No. 34 Table 4.11]**

  ICGEB employs maximum Ph.D's 50.

- **GROSS TURNOVER (GTO) PER EMPLOYEE (RS. MILLION/EMPLOYEE)** **[Page No. 35 Table 4.13]**

  ICGEB has maximum GTO / employee (2).

- **GROSS TURNOVER (GTO) PER R&D EMPLOYEE (RS. MILLION/EMPLOYEE)** **[Page No. 35 Table 4.14]**

  ICRISAT has maximum GTO / R&D employee (27)

- **R&D EXPENDITUR PER R&D EMPLOYEE (RS. MILLION/EMPLOYEE)** **[Page No. 35 Table 4.15]**

  ICRISAT has maximum R&D expenditure / R&D employee

- **PATENTS** **[Page No. 36 Table 4.16]**

  ICGEB developed maximum patents 32, whereas ICRISAT developed no patent during the period of study.

- **R&D EXPENDITURE PER PATENT** **[Page No. 36 Table 4.17]**

  ICGEB has spent maximum R&D expenditure in Rs. million / patent (13).

- **R&D OUTPUT** **[Page No. 36 Table 4.18]**

  Total 3 products and 3 processes developed by ICRISAT and 6 processes developed by ICGEB. However, ICGEB developed no products during the period of study.

- **PUBLICATIONS** **[Page No. 37 Table 4.19]**

  700 papers published in journals by ICGEB followed by 449 by ICRISAT.
  No technical report published by ICGEB. ICRISAT generated 131 technical reports, ICGEB published maximum 1000 papers in conferences/seminars/symposia followed by 324 by ICRISAT during the period of study.

- **R&D EXPENDITURE PER PUBLICATION** **[Page No. 37 Table 4.20]**

  Maximum R&D expenditure in Rs. million / publication was (4.70) by ICRISAT during the year 1999-2000.

- **SKILL UPGRADATION** **[Page No. 38 Table 4.21]**

  ICGEB deputed 500 R&D personnel for training followed by 254 by ICRISAT. ICGEB also deputed 200 R&D personnel for conferences / seminars / symposia while ICRISAT deputed none during the period of study.

- **MAJOR USE OF R&D OUTPUT** **[Page No. 39 Table 4.22]**
  (Multi choice answers)

  "Technology Upgradation" has been found to be the major use of R&D output by both institutions.

- **SOURCES OF INNOVATION** **[Page No. 39 Table 4.23]**

(Multi choice answers)

Both institutions have identified ***'In-House R&D'*** & ***'Customer'*** as the crucial source of innovation.

C. Analysis for Centres :

- **MAIN FIELDS OF OPERATIONS** **[Page No. 40 Table 5.02]**

Both centres support R&D in Bio-tech., Information Technology (IT) and Non Conventional Energy Sources (NCES) sectors. In addition, IDRC supports R&D in Agriculture and IFCPAR supports R&D in Chemical, Pharmaceutical sectors as well.

- **GROSS FUNDS PROVIDED FOR R&D ACTIVITES (RUPEES MILLION)**

[Page No. 41 Table 5.03]

IFCPAR has reported maximum gross funds provided for R&D activites, followed by IDRC during the period of study. the gross funds provided by IDRC to institutes and NGO's whereas IFCPAR provided all the gross funds only to institutes during the period of study. Funding from IDRC had downward trend from 1999-2000 to 2000-2001 and in 2001-2002 they maintained the 2000-2001 level. IFCPAR maintained same level during the period of study.

- **LINKAGES** **[Page No. 41 Table 5.04]**

Both centres have linkages with Foreign Government.
IDRC has linkages with Indian NGOs whereas IFCPAR has linkages with Indian Government, Indian & Foreign Universities, R&D Laboratories and other Industries as well.

- **UTILIZATION OF FOREIGN FUNDS (R&D OUTPUT)**

[Page No. 48 Table 5.08]

Over a period of three years, 18 Indian patents and 18 Foreign patents have been applied by IFCPAR, whereas no patent applied by IDRC. No Indian or Foreign patent has been reported as awarded by any centre.

8 products and 3 processes have been developed by IDRC, whereas no product/process has been developed by IFCPAR over a period of 3 years.
No import substitute/design prototype have been reported as developed by any centre.

Total 285 papers published in journals by both the centres and 130 papers published in conferences/seminars/symposia by IFCPAR over a period of 3 years.

130 R&D personnel have been deputed for conferences/seminars/symposia by IFCPAR during the period of study. No personnel deputed for training by any centre.

Major Highlights at a Glance :

Position on various major parameters for the three segments covered in the study emerges as follows :-

(Year 2001-2002)

Sr. No.	Item	Segments		
		Manufacturing	Institutional	Centres
1.	**Total Gross Turnover (Rs. Million)**	**328957**	**1441**	**N.A.**
2.	**Total R&D Expenditure (Rs. Million)**	**7933.94**	**1079.38**	**N.A.**
3.	**Total Manpower (Nos.)**	**55094**	**729**	**N.A.**
	Male	40094	610	
	Female	15000	119	
4.	**Total Manpower for R&D Activities (Nos.)**	**8537**	**132**	**N.A.**
	Male	5728	101	N.A.
	Female	2809	31	N.A.
5.	**Patents (Nos.)**	**199**	**5**	**36**
(a)	Indian	195	5	N.A.
	Awarded	90		N.A.
	Applied	105	5	18
(b)	Foreign	4		N.A.
	Awarded	3		N.A.
	Applied	1		18
6.	**Publications (Nos.)**	**227**	**1140**	**146**
	Papers published in journals	74	468	106
	Technical Reports published	149	49	0
	Papers published in conferences / seminars / symposia etc.	4	623	40
7.	**Skill Upgradation (Nos.)**	**3755**	**364**	**40**
	R&D Personnel deputed for conferences / seminars / symposia etc.	1752	278	40
	R&D personnel deputed for Training programmes	2003	86	0
8.	**Gross Turnover / *Employees (Rs. Million)**	**5.97**	**1.98**	**N.A.**
9.	**Gross Turnover / R&D Employees (Rs. Million)**	**38.53**	**10.92**	**N.A.**
10.	**R&D Expenditure / R&D Employees (Rs. Million)**	**0.93**	**8.18**	**N.A.**
11.	**R&D Expenditure / Patent (Rs. Million)**	**11.39-61.21**	**12.75**	**N.A.**
12.	**R&D Expenditure / Publication (Rs. Million)**	**2.59-114.18**	**2.83**	**N.A.**

* Includes total employees working in an organisation

LIMITATIONS OF THE STUDY

During the course of conducting this study, following limitations were observed:

- Intention of this study was not to have any **inter-organisation comparisons**. In view of this, the status has been analysed **on sectorial basis** & **overall basis**.

- The study was limited to 8 identified sectors & 2 centers. Therefore, the projections are valid for these sectors only. No generalisation can be made for other sectors, where international organisations may be undertaking R&D activities with foreign participation.

- Centre for Monitoring of Indian Economy (CMIE) has developed a data base of manufacturing organisations totaling to approximately 8000 organisations as on 30th October 2003, out of which 145 organisations have more than 50% foreign equity holding. It is observed that for the eight identified sectors, 60 organisations are still to be covered for R&D activities in India with foreign participation.

  Apart from 60 manufacturing organisations referred above for the 8 identified sectors, there are 39 organisations (with more than 50% foreign equity) operative in other sectors like Consumer Durables, AC & Refrigeration sectors etc., which can also be taken up for exploring their R&D activities, making a total of 99 (60+39) organisations in the manufacturing segment.

  NSTMIS division may kindly like to consider to cover these 99 organisations in phase II as a separate study, for exploring further the nature of their R&D activities with foreign participation.

- No separate validation of data was possible by NAFEN. Report has been prepared based on the data received / collected from 73 organisations in the manufacturing segment, 2 organisations from the institutional segment & 2 centers, for a period of 3 years (1999-2002).

- Certain areas for major use of R&D output were identified. It was a multi choice questionnaire. Based on the data received in this study, in some of the areas, further in depth studies are required to probe developments in these areas.

- Regarding productivity, it may not be proper to compare the productivity of one sector with another sector due to various reasons like capital employed, nature of manpower employed, working conditions prevailing in an organisation and other infrastructural differences.

- Utmost care, which is humanly possible, has been taken to ensure that the data, both quantitative and qualitative (textual), is correct. However, still there might be some minor errors here & there, for which NAFEN deserves to be excused.

LOCAL PROJECT ADVISORY COMMITTEE

A Local Project Advisory Committee (LPAC) was formed to advice & guide NAFEN from time to time during the execution of the study. The composition of the LPAC is as follows:-

Chairman

Dr. Laxman Prasad	Advisor & Head	NSTMIS Division, DST, GoI

Members

Mr. Rakesh Chetal	Advisor	NSTMIS Division, DST, GoI
Mr. Parveen Arora	Director	NSTMIS Division, DST, GoI
Dr. A.N.Rai	Principal Scientific Officer	NSTMIS Division, DST, GoI
Dr. V.P.Gupta	Advisor	MST, Dept. of Bio-Tech., GoI
Mr. Vinnie Mehta	E.D.	MAIT
Mr. P.V. Bhat	AGM	BHEL
Smt. Meena Kumari	Dy. Director	NPTI
Mr. Vivek Singhal	President	All India Biotech Association
Dr. R.N.Sawant	Director	MNES, GoI
Dr. D.K.Bharadwaj	Group GM	NRDC
Ms. Archna Mudgal	Secretary	Pharmacy Council of India
Dr. R.K.Mittal	Principal Scientist, TC	ICAR
Mr. B.Bhanot	Director	ARAI
Mr. U.D.Bhangale	Sr. Asstt. Director	ARAI
Mr. Satish Jain	President	NAFEN
Mr. Rishi Kumar	Co. P.I. & Vice President	NAFEN
Dr. P.K.Gupta	P.I. & Secretary General	NAFEN

CHAPTER - 01

- INTRODUCTION
- OBJECTIVES OF THE STUDY
- SCOPE OF THE STUDY

1.01 INTRODUCTION

With Liberization, Privatization & Globalization of Indian Economy, Research and Development (R&D) has gained importance in the corporate world. Today, technology management is considered as the third established pillar/dimension for the success and sustaining global competitiveness. Technology management is a critical asset not only for enhancing competitiveness at micro level, but also for enhancing long-term social and economical growth at the national level. In the new century, the organizations are facing new challenges in the technology management area because of globalization and emergence of new economy.

Contributions of Science and Technology for improving the quality of life are well recognised around the globe. There is still ample scope for furthering the quality of life through scientific and technological development and thereby a key role to play in national development.

It is a well known fact that research and development in industries is essential for generating know-how necessary for production of quality goods, promoting efficiency, promoting exports and technological self-reliance needed in the country as well as for meaningful assimilation and further development of imported know-how. Research and Development in industrial sector is also essential for solving day-to-day production problems and for exploring the potential for future industrial expansion. The Government has taken several measures towards promoting industrial research in industry itself besides making attempts to establish workable linkages between national laboratories, educational institutions and industry.

There had been tremendous development in all these areas in the recent past. Of late, the government had been enacting liberalized policies towards merging of Indian economy with the global economy. The impetus has given boost to economic growth as well as pushed the developmental process.

With the above scenario prevailing, National Science & Technology Management Information System (NSTMIS), a Division of Ministry of Science & Technology, Government of India, entrusted National Foundation of Indian Engineers (NAFEN) to carry out a study on the following topic:

Study on Status of Foreign Participation in R&D Activities of Selected Organisations in India

1.02 OBJECTIVES OF THE STUDY

The main objectives of the study are:

- To study characteristics of R&D activities of select international organisations operating in India in identified sectors, other than those covered under the R&D statistics database of Govt. of India.
- To analyse the latest scenario and to quantify input / output R&D resources in terms of Manpower, Finance, Infrastructure, Patents, Licensing, Technology Transfer, Know-how of Products/Systems/Processes/Software Programmes etc.

1.03 SCOPE OF THE STUDY

Following Sectors were identified to be covered under the study:-

Sr. No.	Sector	Number of organisations selected	Total
A.	**Manufacturing Segment :**		
1.	Agriculture	05	
2.	Automobile	14	
3.	Bio-Technology	11	
4.	Chemical	05	
5.	Information Technology (IT)	24	
6.	Non Conventional Energy Sources (NCES)	11	
7.	Pharmaceutical	19	
8.	Power	06	
	Sub-Total A		**95**
B.	**Institutional Segment :**		
9.	Agriculture	01	
10.	Bio-Technology	01	
	Sub-Total B		**02**
C.	**Centres**	04	
	Sub-Total C		**04**
	Grand Total (A+B+C)		**101**

1.04 REFERENCE PERIOD

The study was confined to the reference period of 3 years i.e. (1999-2002). The required data was collected for these years, from the identified organisations.

CHAPTER - 02

- METHODOLOGY OF THE STUDY

2.01 METHODOLOGY OF THE STUDY

Following Methodology was adopted:

- The selection of organisations for the study had been made by NAFEN after extensively searching the listed organisations with sectorial associations on internet and various other trade directories etc
- The organisations which emerged from the above search, were scruitinised for their R&D association with foreign collaborating organisations, other than those covered under the R&D statistics database of DST, GoI.
- The list was finalised as per the above criteria.
- NAFEN designed a draft questionnaire alongwith the list of identified organisations.
- The above details were discussed in the Brain Storming Session (BSS) held at New Delhi on **5th Dec., 2002**, under the Chairmanship of **Dr. Laxman Prasad,** Advisor & Head, NSTMIS, MoST, GoI. In the BSS, members of the Local Project Advisory Committee (LPAC) & some of the respondents participated & gave their valuable suggestions regarding the questionnaire & the sectors selected.
- Questionnaire were finalized based on the comments given by the participants in the BSS.
- Mailed the pre-designed questionnaire to the identified respondents. **Annx. A** for organisations in both the segments i.e. manufacturing & institutional and **Annx. B** for centres.
- Initial follow-up through Phone / Fax / email.
- Collection of data by personal visits.
- Data feeding
- Analysis

CHAPTER - 03

- **R&D ANALYSIS - MANUFACTURING SEGMENT**

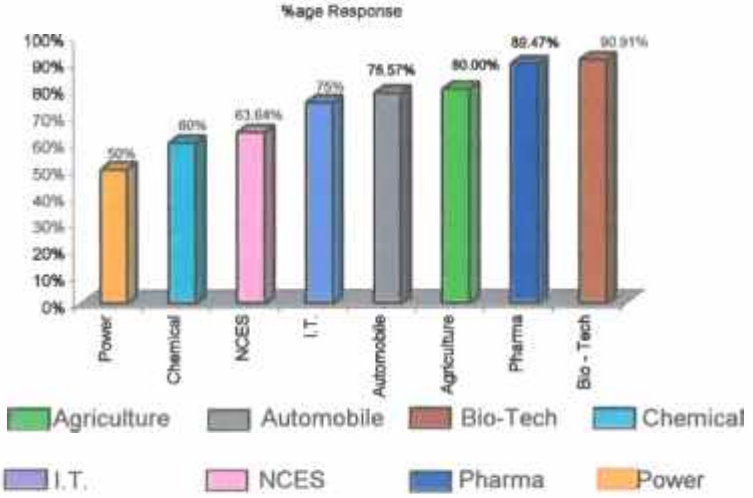
SECTION - 01

- GENERAL INFORMATION

Table 3.01

SECTOR WISE - RESPONSE PROFILE

Sr. No.	Sector	Number of Organisations Surveyed	Number of Organisations Responded	%age Response (Organisations Responded / Organisations Surveyed)
1	Agriculture	5	4	80.00
2	Automobile	14	11	78.57
3	Bio - Tech	11	10	90.91
4	Chemical	5	3	60.00
5	I.T.	24	18	75.00
6	NCES	11	7	63.64
7	Pharma	19	17	89.47
8	Power	6	3	50.00
	Total	**95**	**73**	**76.84**



OBSERVATIONS :

Out of 95 identified organisations, 73 organisations responded resulting in an overall response of 77%.

The maximum response of 91% was received from Bio-tech sector followed by Pharma sector with 89%, while the lowest response of 50% was received from Power sector.

Table 3.02

ZONE - WISE RESPONSE OF R&D ORGANISATIONS SURVEYED

(Number)

Sector / Zone	Agriculture	Automobile	Bio-Tech	Chemical	I.T.	NCES	Pharma	Power	Total	%age Response
West	3 (3)	3 (4)	4 (4)	1 (1)	(3)	3 (3)	6 (8)	2 (3)	22 (29)	75.86
South	(1)	7 (9)	6 (7)	1 (2)	10 (12)	4 (8)	7 (7)		35 (46)	76.09
North	1 (1)	1 (1)		1 (2)	8 (9)		3 (3)	(1)	14 (17)	82.35
East							1 (1)	1 (2)	2 (3)	66.67
Total	**4 (5)**	**11 (14)**	**10 (11)**	**3 (5)**	**18 (24)**	**7 (11)**	**17 (19)**	**3 (6)**	**73 (95)**	**76.84**

Note : figure in brackets indicate surveyed organisations.

OBSERVATION :

Maximum 82% organisations responded from Northern India followed by 76% from Southern India.

Table 3.03

ZONE - WISE LOCATION OF R&D UNITS OF RESPONDING ORGANISATIONS

(Number)

Sector / Zone	Agriculture	Automobile	Bio-Tech	Chemical	I.T.	NCES	Pharma	Power	Total	%age Response
West	3	3	4	1		2	6	2	21	28.77
South		7	6	2	13	5	8		41	56.16
North	1	1			5		1		8	10.96
East							2	1	3	4.11
Total	**4**	**11**	**10**	**3**	**18**	**7**	**17**	**3**	**73**	**100.00**

OBSERVATION :

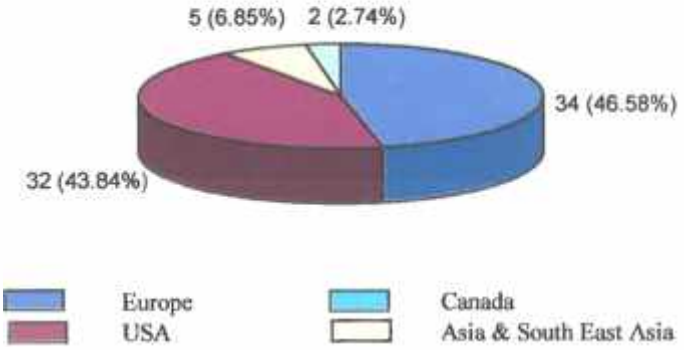
56% of R&D units were located in Southern India followed by 29% in Western India.

Table 3.04

WORLDWIDE LOCATION OF *FOREIGN COLLABORATING ORGANISATIONS (FCOs)

Sr. No.	Zone	Country	Total Number in the Zone
1	**EUROPE**	Belgium (2), Czech Republic (1), Denmark (3), Finland (1), France (3), Germany (5), Holland (2), Italy (4), Netherland (2), Sweden (1), Switzerland (3), U.K. (7)	**34 (46.58%)**
2	**USA**	U.S.A. (32)	**32 (43.84%)**
3	**CANADA**	Canada (2)	**2 (2.74%)**
4	**ASIA & SOUTH EAST ASIA**	Hong Kong (1) Japan (3) South Korea (1)	**5 (6.85%)**
	Total		**73 (100.00%)**

Note : figure in brackets for country indicate number of FCO's from each country. As regards total number of countries in the zone, the figure in brackets indicate %age.



OBSERVATIONS :

Maximum 47% Foreign Collaborating Organisations are located in Europe followed by 44% in USA.

*Please refer page 51, vol. 1 for definition of Foreign Collaborating Organisations (FCOs)

Table 3.05

YEAR OF ESTABLISHMENT OF R&D ORGANISATIONS IN INDIA

(Number)

Year of Commencement of R&D activities	Sector								Total	%age
	Agriculture	Automobile	Bio-Tech	Chemical	I.T.	NCES	Pharma	Power		
Before 1990		4	3	3	3	1	9	1	24	32.88
1990-1992		1	1		3	1	2	1	9	12.33
1993-1995	1		1		1	2	4		9	12.33
1996-1998	1	5	3		7	2	2		20	27.39
1999-2001	2	1	2		4	1		1	11	15.07
2002	0	0	0	0	0	0	0	0	0	0.00
Total	**4**	**11**	**10**	**3**	**18**	**7**	**17**	**3**	**73**	**100.00**

OBSERVATION :

33% of R&D organisations were established in India before 1990 & 67% after 1990.

Table 3.06

YEAR OF COMMENCEMENT OF R&D ACTIVITIES IN INDIA

(Number)

Year of Commencement of R&D activities	Sector								Total	%age
	Agriculture	Automobile	Bio-Tech	Chemical	I.T.	NCES	Pharma	Power		
Before 1990		3	2	1	1		7		14	19.18
1990-1992		1	2	1	4	1		1	10	13.69
1993-1995			1	1	2	1	2	1	8	10.96
1996-1998	2	2	1		5	3	1		14	19.18
1999-2001	1	4	4		6	2	6	1	24	32.88
2002	1	1					1		3	4.11
Total	**4**	**11**	**10**	**3**	**18**	**7**	**17**	**3**	**73**	**100.00**

OBSERVATION :

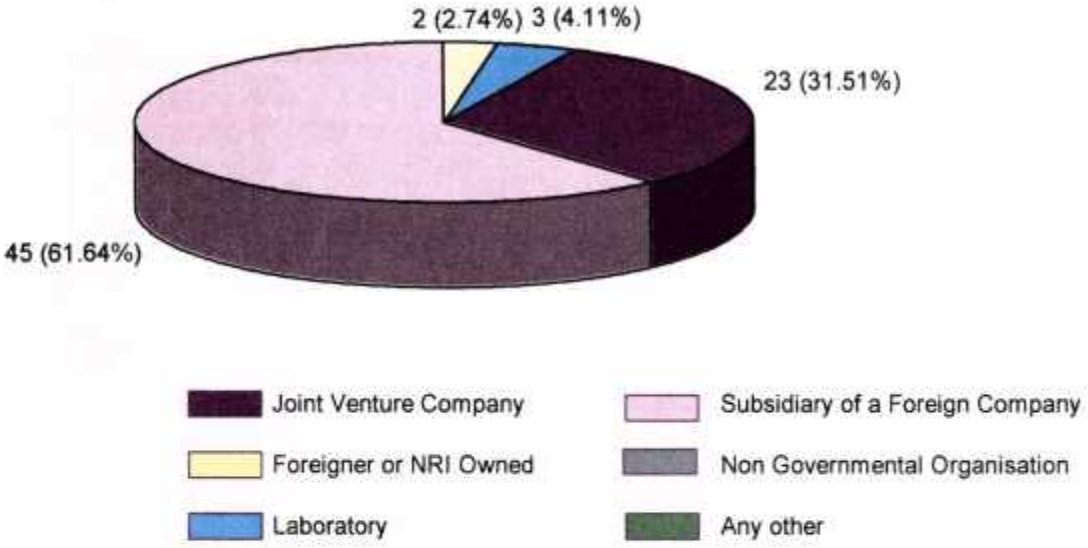
19% of organisations commenced their R&D activities in India before 1990 & 81% after 1990. However maximum 33% organisations started their R&D activities during the period 1999-2001.

Table 3.07

*CATEGORIES OF R&D ORGANISATIONS IN INDIA

(Number)

Category of R&D Organisations	Sector								Total	%age
	Agriculture	Automobile	Bio-Tech	Chemical	I.T.	NCES	Pharma	Power		
Joint Venture Company	2	5	4	0	1	3	6	2	23	31.51
Subsidiary of a Foreign Company	2	6	4	2	17	4	9	1	45	61.64
Foreigner or NRI Owned	0	0	0	0	0	0	2	0	2	2.74
Non Governmental Organisation	0	0	0	0	0	0	0	0	0	0.00
Laboratory	0	0	2	1	0	0	0	0	3	4.11
Any other (Pl. specify)	0	0	0	0	0	0	0	0	0	0.00
Total	**4**	**11**	**10**	**3**	**18**	**7**	**17**	**3**	**73**	**100.00**



OBSERVATION :

Maximum 62% R&D organisations are subsidiaries of a foreign company followed by 32% as joint ventures.

*Please refer page 51, 52, vol. I for definitions of category of organisations

Table 3.08

TOTAL GROSS TURNOVER IN RUPEES (IN MILLION)

Sr. No.	Sector	No. of Responding Organisations	1999-2000	2000-2001	2001-2002
1	**Agriculture**	4	798	5237 (556.27)	6480 (23.73)
2	**Automobile**	11	70440	85626 (21.56)	107812 (25.91)
3	**Bio-Tech**	10	12147	16883 (38.99)	21428 (26.92)
4	**Chemical**	3	3091	3284 (6.24)	3441 (4.78)
5	**I.T.**	18	103604	127843 (23.40)	115802 (-9.42)
6	**NCES**	7	12307	16196 (31.60)	19113 (18.01)
7	**Pharmaceutical**	17	26059	31220 (19.81)	38346 (22.83)
8	**Power**	3	12087	13643 (12.87)	16535 (21.20)
	Total	**73**	**240533**	**299932 (24.69)**	**328957 (9.68)**

Note : figure in brackets indicate %age increase over previous year

OBSERVATION :

Total Gross Turnover for all the sectors taken together during the year 2001-2002 has increased approx. by 10% as compared with 2000-2001.

Table 3.09

TOTAL EXPENDITURE ON ADVERTISEMENT & NEW PLANT & MACHINERY FOR THE WHOLE ORGANISATION (IN RS. MILLION)

Sr. No.	Sector	No. of Responding Organisations	1999-2000		2000-2001		2001-2002	
			Expenditure on advertising	Expenditure on new plant & machinery	Expenditure on advertising	Expenditure on new plant & machinery	Expenditure on advertising	Expenditure on new plant & machinery
1	**Agriculture**	4	6.69	15.76	19.09	323.02	23.44	861.89
2	**Automobile**	11	198.50	11435.60	288.50	6590.40	546.90	6791.90
3	**Bio-Tech**	10	36.80	386.00	50.70	798.00	67.41	409.10
4	**Chemical**	3	13.90	14.80	18.10	17.80	23.30	38.00
5	**I.T.**	18	113.02	2144.75	144.93	2524.45	178.95	2225.79
6	**NCES**	7	20.50	64.50	28.60	183.80	37.10	226.00
7	**Pharmaceutical**	17	121.39	414.25	241.39	435.57	278.89	705.44
8	**Power**	3	34.60	596.00	49.80	70.00	87.20	76.4
	Total	**73**	**545.4**	**15071.66**	**841.11**	**10943.04**	**1243.19**	**11334.52**

OBSERVATIONS :

Automobile sector has made maximum expenditure on advertisement (Rs. 547 million) during the year 2001-2002 followed by Pharma sector (Rs. 279 million).

Table 3.10

TOTAL EXPENDITURE ON ADVERTISEMENT & NEW PLANT & MACHINERY FOR R&D ACTIVITITIES (IN RS. MILLION)

Sr. No.	Sector	No. of Responding Organisations	1999-2000		2000-2001		2001-2002	
			Expenditure on Advertising	Expenditure on new plant & machinery	Expenditure on Advertising	Expenditure on new plant & machinery	Expenditure on Advertising	Expenditure on new plant & machinery
1	Agriculture	4	1.47 (21.97)	8.87 (56.28)	2.72 (14.25)	14.99 (4.64)	3.35 (14.29)	29.84 (3.46)
2	Automobile	11	5.7 (02.87)	120.55 (01.05)	23.6 (08.18)	135.3 (2.05)	34 (6.22)	196.7 (2.9)
3	Bio-Tech	10	7.12 (19.35)	35.60 (09.22)	11 (21.70)	54.1 (6.78)	15.1 (22.4)	77.7 (18.99)
4	Chemical	3	1.4 (10.07)	7.50 (50.68)	1.7 (9.39)	10.05 (56.46)	1.9 (8.15)	16.7 (43.95)
5	I.T.	18	36.63 (32.41)	682.60 (31.83)	55.56 (38.34)	1459.3 (57.81)	75.81 (42.36)	1420.3 (63.81)
6	NCES	7	4.4 (21.46)	25.70 (39.84)	9.7 (33.92)	45.4 (24.7)	13.9 (37.47)	57 (25.22)
7	Pharmaceutical	17	16.9 (13.92)	72.60 (17.53)	24.72 (10.24)	97.55 (22.4)	33.76 (12.11)	125.98 (17.86)
8	Power	3	0.11 (00.32)	8.4 (01.41)	1.18 (2.37)	17.5 (25)	1.42 (1.63)	25.5 (33.38)
	Total	**73**	**73.73 (13.52)**	**961.82 (6.38)**	**130.18 (15.48)**	**1834.19 (16.76)**	**179.24 (14.42)**	**1949.72 (17.2)**

Note : figure in brackets indicate expenditure on R&D as a %age of expenditure on whole organisation for same parameter.

OBSERVATIONS :

Expenditure on new plant and machinery for R&D activities as a percentage of expenditure on new plant & machinery for the whole organisation is highest in I.T. sector i.e. 64% in the year 2001-2002 followed by Chemical sector 44%. Expenditure on advertisement for R&D activities as a percentage of expenditure for advertisement on the whole organisation is also highest in I.T. sector i.e. 42% in the year 2001-2002 followed by NCES sector 37%.

It is seen from the above that I.T. sector is spending highest both for new plant & machinery and advertisement for R&D activitites during the year 2001-2002.

Table 3.11

***LINKAGES**

(Number)

Sector / Linkages with	Agriculture		Automobile		Bio - Tech		Chemical		LT.		NCES		Pharma		Power		Total	Total	Total
	Indian	Foreign	Indian	Foreign	Indian	Foreign	Indian	Foreign	Indian	Foreign	Indian	Foreign	Indian	Foreign	Indian	Foreign	Indian	Foreign	Indian + Foreign
Government	1	0	9	3	7	6			13	4	7	3	11	6	2		50	22	72 (19)
Private Organization	3	4	11	10	8	6	1	1	18	18	7	7	16	14	2	2	66	62	128 (34)
University	2	0	1	1	8	2	1		11	5	1		2	1			26	9	35 (9)
Non Governmental Organization	2	0			3	0			1				3		1		10	0	10 (3)
R&D Laboratory	4	4	10	9	9	9	1	1	17	18	5	7	13	15	2	2	61	65	126 (33)
Any other (PL specify)	0	0	1		1	0	1			1			1	1	1		5	2	7 (2)

Note : figure in brackets indicate linkages of Indian and Foreign as a %age of total linkages.

OBSERVATIONS :

On an overall basis, organisations covered in the study have maximum Indian linkages with 66 private organisations followed by 61 R&D laboratories.

Foreign linkages are maximum with 65 R&D Laboratories followed by 62 with private organisations.

*Please refer page 51, vol. I for definition.

Table 3.12

*TYPE OF RESEARCH - TIME & RESOURCES (%AGE ON AVERAGE BASIS)

Sector / Category	Agriculture		Automobile		Bio-Technology		Chemical		I.T.		NCES		Pharmaceutical		Power	
	Time	Resources	Time	Resources	Time	Resources	Time	Resources	Time	Resources	Time	Resources	Time	Resources	Time	Resources
Basic Research	16.00	14.75	10.45	14	25.30	27.90	6.7	10	24.9	29	7	8.29	19.18	21.59	1.67	2.33
Applied Research	55.75	57.25	36.18	32.55	51.90	48.40	46.7	40	51.9	50.11	20	19.85	54.59	54	45	45.67
Experimental Development	25.75	26.25	51.09	52.36	17.90	21.00	33.3	38.33	17.1	16.72	73	71.86	20.53	21.29	45	46.33
Consultancy	2.50	1.75	0.46	0.18	4.90	2.70	13.3	11.67	6.1	4.17	-	-	5.7	3.12	5	4
Other Activities	-	-	1.82	0.91	-	-	-	-	-	-	-	-	-	-	3.33	1.67
Total	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

OBSERVATIONS :

On an average basis, maximum time & resources 73% & 72% respectively are devoted by NCES sector followed by 51% & 52% respectively by Automobile sector on Experimental Development.

On the Applied Research parameter, maximum time & resources 56% & 57% respectively devoted in Agriculture sector, followed by 55% & 54% in Pharma sector.

*Please refer page 52, vol. I for definitions.

SECTION - 02

- **R&D EXPENDITURE**

Table 3.13

R&D EXPENDITURE BY SOURCES OF FUNDS

(Rs. in million)

Sr. No.	Sector	1999-2000							2000-2001							2001-2002						
		R&D Expenditure	Exp. from Indian Origin			Exp. from Foreign Origin			R&D Expenditure	Exp. from Indian Origin			Exp. from Foreign Origin			R&D Expenditu	Exp. from Indian Origin			Exp. from Foreign Origin		
			Recurring	Non Recurring	Total	Recurring	Non Recurring	Total		Recurring	Non Recurring	Total	Recurring	Non Recurring	Total		Recurring	Non Recurring	Total	Recurring	Non Recurring	Total
1.	**Agriculture**	**31.56**	17.20	8.70	25.90	3.69	1.97	5.66	**83.04**	43.59	25.62	69.21	8.76	5.07	13.83	**105.46**	54.68	33.75	88.43	10.84	6.19	17.03
2	**Automobile**	**320.66**	158.56	92.23	250.79	42.70	27.17	69.87	**406.45**	202.25	116.13	318.38	53.65	34.42	88.07	**480.69**	237.55	139.20	376.75	62.99	40.95	103.94
3	**Bio-Tech**	**284.05**	126.88	83.42	210.30	44.12	29.63	73.75	**353.50**	158.30	105.50	263.80	53.70	36.00	89.70	**466.39**	212.63	142.77	355.40	66.47	44.52	110.99
4	**Chemical**	**77.28**	35.11	23.41	58.52	11.26	7.50	18.76	**82.10**	37.08	24.72	61.80	12.18	8.12	20.30	**86.03**	38.05	25.35	63.40	13.57	9.06	22.63
5	**I.T.**	**1034.95**	413.65	270.00	683.65	214.00	137.30	351.30	**1408.95**	571.98	370.48	942.46	285.05	181.44	466.49	**5937.54**	2193.37	1462.21	3655.58	1368.92	913.04	2281.96
6	**NCES**	**133.80**	71.60	47.20	118.80	8.87	6.13	15.00	**201.90**	108.63	71.93	180.56	12.72	8.62	21.34	**234.45**	125.16	83.57	208.73	15.54	10.18	25.72
7	**Pharma**	**384.62**	182.66	111.72	294.38	54.16	36.08	90.24	**479.59**	231.37	142.75	374.12	63.59	41.88	105.47	**566.42**	271.01	170.32	441.33	75.25	49.84	125.09
8	**Power**	**58.18**	25.89	16.54	42.43	9.58	6.17	15.75	**54.58**	24.71	15.50	40.21	8.69	5.68	14.37	**56.96**	26.74	15.88	42.62	8.94	5.4	14.34
	Total	**2325.1**	1031.55	653.22	1684.77	388.38	251.95	640.33	**3070.11**	1377.91	872.63	2250.54	498.34	321.23	819.57	**7933.94**	3159.19	2073.05	5232.24	1622.52	1079.18	2701.70

OBSERVATIONS :

R&D Expenditure in Rs. million has increased from 2325 in the year 1999-2000 to 7934 in the year 2001-2002 i.e. an increased of 241%.

Maximum total R&D expenditure was made in I.T. sector amounting to Rs. 5938 million followed by Rs. 566 million in Pharma sector during the year 2001-2002.

There has been substantial rise in R&D expenditure for I.T. sector over the years (more than 5 times in three years.)

Table 3.14

R&D EXPENDITURE AS A PERCENTAGE OF GROSS TURNOVER (RUPEES MILLION)

Sr. No.	Sector	No. of Responding Organisations	1999-2000		2000-2001		2001-2002	
			Gross Turnover	R&D Expenditure	Gross Turnover	R&D Expenditure	Gross Turnover	R&D Expenditure
1	Agriculture	4	798	31.56 (3.95)	5237	83.04 (1.59)	6480	105.46 (1.63)
2	Automobile	11	70440	320.66 (0.46)	85626	406.45 (0.47)	107812	480.69 (0.45)
3	Bio-Tech	10	12147	284.05 (2.34)	16883	353.5 (2.09)	21428	466.39 (2.18)
4	Chemical	3	3091	77.28 (2.50)	3284	82.1 (2.50)	3441	86.03 (2.50)
5	I.T.	18	103604	1034.95 (1.00)	127843	1408.95 (1.10)	115802	5937.54 (5.13)
6	NCES	7	12307	133.8 (1.09)	16196	201.9 (1.25)	19113	234.45 (1.23)
7	Pharmaceutical	17	26059	384.62 (1.48)	31220	479.59 (1.54)	38346	566.42 (1.48)
8	Power	3	12087	58.18 (0.48)	13643	54.58 (0.40)	16535	56.96 (0.34)
	Total	**73**	**240533**	**2325.10 (0.97)**	**299932**	**3070.11 (1.02)**	**328957**	**7933.94 (2.41)**

Note : figure in brackets indicate R&D Expenditure as a %age of Gross Turnover

OBSERVATION :

R&D Expenditure as a percentage of Gross Turnover was highest 5% in I.T. sector followed by Chemical sector 2.5% during the year 2001-2002 .

SECTION - 03

- **FULL TIME MANPOWER EMPLOYED**

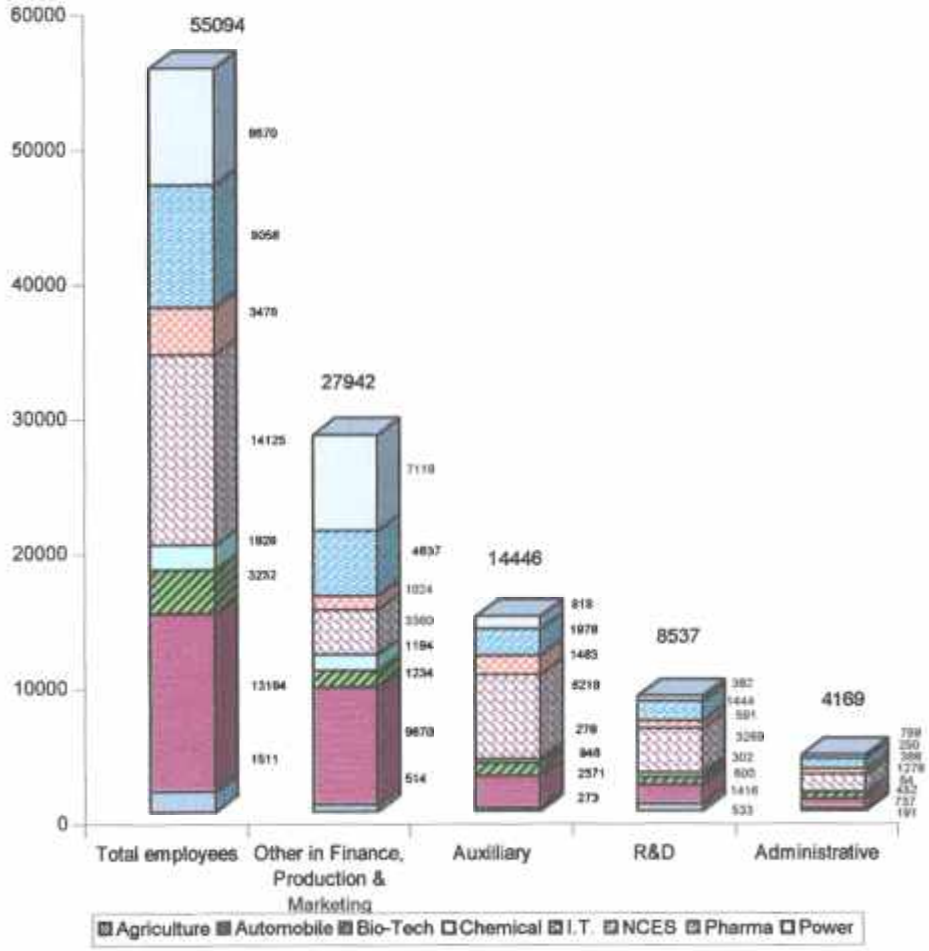
Table 3.15

FULL TIME MANPOWER EMPLOYED AS ON 1ST APRIL 2002

(Number)

Sr. No.	Sector	No. of Responding Organisations	Total Employees	Personnel employed in			
				R&D Activities	Auxilliary Activities	Administrative Activities	Other Activities like Finance Production & Mktg.
1	**Agriculture**	4	1511	533 (35.27)	273 (18.07)	191 (12.64)	514 (34.02)
2	**Automobile**	11	13194	1416 (10.73)	2371 (17.97)	737 (5.59)	8670 (65.71)
3	**Bio-Tech**	10	3232	600 (18.56)	946 (29.27)	452 (13.99)	1234 (38.18)
4	**Chemical**	3	1828	302 (16.52)	278 (15.21)	64 (3.50)	1184 (64.77)
5	**I.T.**	18	14125	3269 (23.14)	6218 (44.02)	1278 (9.05)	3360 (23.79)
6	**NCES**	7	3476	591 (17.00)	1463 (42.09)	398 (11.45)	1024 (29.46)
7	**Pharma**	17	9058	1444 (15.94)	1978 (21.84)	799 (8.82)	4837 (53.40)
8	**Power**	3	8670	382 (4.41)	919 (10.60)	250 (2.88)	7119 (50.72)
	Total	**73**	**55094**	**8537 (15.50)**	**14446 (26.22)**	**4169 (7.57)**	**27942 (50.72)**

Note : figure in brackets indicate activity-wise employees as a percentage of total employees.



OBSERVATION :

Total Manpower employed in the eight sectors covered in the study is 55094 as on 1st April 2002, out of which 15.5% are exclusively working for R&D activities.

Table 3.16

FULL TIME MANPOWER EMPLOYED AS ON 1st APRIL 2002 (GENDERWISE)

(Number)

Sr. No.	Sector	No. of Responding Organisations	Male			Female			Grand Total
			Indian	Foreign	Total	Indian	Foreign	Total	
1	Agriculture	4	863	34	897	607	7	614	1511
2	Automobile	11	9681	195	9876	3282	36	3318	13194
3	Bio-Tech	10	2126	51	2177	1047	8	1055	3232
4	Chemical	3	1560	12	1572	256		256	1828
5	I.T.	18	9571	368	9939	4069	117	4186	14125
6	NCES	7	2481	63	2544	932		932	3476
7	Pharma	17	6238	92	6330	2721	7	2728	9058
8	Power	3	6691	68	6759	1886	25	1911	8670
	Total	**73**	**39211**	**883**	**40094**	**14800**	**200**	**15000**	**55094**

OBSERVATION :

Total Man power employed in the eight sectors covered in the study is 55094, out of which 27% are female.

Table 3.17

FULL TIME MANPOWER EMPLOYED FOR R&D ACTIVITIES AS ON 1st APRIL 2002 (GENDERWISE)

(Number)

Sr. No.	Sector	No. of Responding Organisations	Male			Female			Grand Total
			Indian	Foreign	Total	Indian	Foreign	Total	
1	Agriculture	4	289	30	319	209	5	214	533
2	Automobile	11	823	92	915	490	11	501	1416
3	Bio-Tech	10	369	34	403	194	3	197	600
4	Chemical	3	181	12	193	109		109	302
5	I.T.	18	1930	284	2214	962	93	1055	3269
6	NCES	7	388	46	434	157	0	157	591
7	Pharma	17	892	76	968	473	3	476	1444
8	Power	3	258	24	282	92	8	100	382
	Total	**73**	**5130**	**598**	**5728**	**2686**	**123**	**2809**	**8537**

OBSERVATIONS :

For R&D activities alone, maximum 1930 Indian male are employed in I.T. sector followed by 892 in Pharma sector. Similarly maximum 962 Indian female are employed in I.T. sector followed by 490 in Automobile sector.

On an overall basis, for all the sectors taken together in R&D activities, 67% are male employees and 33% are female.

Table 3.18

ACADEMIC BACKGROUND OF FULL TIME PERSONNEL EMPLOYED IN R&D ACTIVITIES AS ON 1st APRIL 2002

(Number)

Sr. No.	Sector	No. of Responding Organisations		Natural Sc M	Natural Sc F	Agri Sc M	Agri Sc F	Engg & Tech M	Engg & Tech F	Medical Sc M	Medical Sc F	Pharma M	Pharma F	Social S M	Social S F	Total
1	Agriculture	4	Ph. D.			34	20									54
			Post Graduate			55	32									87
			Graduate			65	35									100
			Diploma			72	64									136
			Others			78	78									156
			Total			**304**	**229**									**533**
2	Automobile	11	Ph. D.					83	43							126
			Post Graduate					126	69							195
			Graduate					199	103							302
			Diploma					243	132							375
			Others					235	183							418
			Total					**886**	**530**							**1416**
3	Bio-Tech	10	Ph. D.					4	8	34	15					61
			Post Graduate					11	4	51	23					89
			Graduate					10	5	76	35					126
			Diploma					9	7	70	42					128
			Others					24	21	86	65					196
			Total					**58**	**45**	**317**	**180**					**600**
4	Chemical	3	Ph. D.			2	1	15	10							28
			Post Graduate			1	0	51	23							75
			Graduate			6	2	91	14							113
			Diploma					25	6							31
			Others			7	5	35	8							55
			Total			**16**	**8**	**217**	**61**							**302**
5	I.T.	18	Ph. D.					320	116	2	2					440
			Post Graduate					400	170	3	4					577
			Graduate					563	240	5	6					814
			Diploma					472	258	8	7					745
			Others					440	241	5	7					693
			Total					**2195**	**1025**	**23**	**26**					**3269**
6	NCES	7	Ph. D.					38	15							53
			Post Graduate					53	27							80
			Graduate					84	47							131
			Diploma					100	55							155
			Others					103	69							172
			Total					**378**	**213**							**591**
7	Pharma	17	Ph. D.	3	1			9	4	52	14	57	31			171
			Post Graduate					11	6	57	18	87	46			225
			Graduate	2				14	8	67	29	146	78			344
			Diploma					10	14	59	50	145	77			355
			Others	2				16	13	39	40	159	80			349
			Total	**7**	**1**			**60**	**45**	**274**	**151**	**594**	**312**			**1444**
8	Power	3	Ph. D.					27	7							34
			Post Graduate					39	12							51
			Graduate					58	23							81
			Diploma					66	27							93
			Others					92	31							123
			Total					**282**	**100**							**382**
G. Total (1+2+3+4+5+6+7+8)				**7**	**1**	**320**	**237**	**4076**	**2019**	**614**	**357**	**594**	**312**	**0**	**0**	**8537**

OBSERVATIONS :

Maximum Ph.D's & PG's 440 & 577 employed by I.T. sector followed by 126 & 195 in Automobile sector. Maximum Graduate's 814 employed by I.T. sector followed by 344 by Pharma sector.

Table 3.19

LEVEL-WISE ACADEMIC BACKGROUND OF FULL TIME PERSONNEL EMPLOYED

Sr. No.	Sector	No. of Responding Organisations	Ph. D.	Post Graduate	Graduate	Diploma	Others	Total
1	Agriculture	4	54	87	100	136	156	533
2	Automobile	11	126	195	302	375	418	1416
3	Bio-Tech	10	61	89	126	128	196	600
4	Chemical	3	28	75	113	31	55	302
5	I.T.	18	440	577	814	745	693	3269
6	NCES	7	53	80	131	155	172	591
7	Pharma	17	171	225	344	355	349	1444
8	Power	3	34	51	81	93	123	382
	Total	**73**	**967 (11.33)**	**1379 (16.15)**	**2011 (23.56)**	**2018 (23.64)**	**2162 (25.32)**	**8537 (100.00)**

Note : figure in brackets indicate activity-wise employees as a %age of total employees.

OBSERVATION :

In R&D activities, for all the sectors taken together, 11% are Ph.D's and 16% are Post Graduates.

Table 3.20

GROSS TURNOVER (GTO) PER *EMPLOYEE AS ON 1st APRIL 2002

Sr. No.	Sector	No. of Responding Organisations	For the Year 2001-2002	
			Gross Turnover *(Rs. Million)*	Total Employees *(Nos.)*
1	Agriculture	4	6480	1511 (4.29)
2	Automobile	11	107812	13194 (8.17)
3	Bio-Tech	10	21428	3232 (6.63)
4	Chemical	3	3441	1828 (1.88)
5	I.T.	18	115802	14125 (8.20)
6	NCES	7	19113	3476 (5.50)
7	Pharmaceutical	17	38346	9058 (4.23)
8	Power	3	16535	8670 (1.91)
	Total	**73**	**328957**	**55094 (5.97)**

Note 1.: figure in brackets indicate GTO per employee

2.: *Includes total employees working in an organisation

OBSERVATION :

Maximum productivity in I.T. sector followed by Automobile sector. However, it may not be proper to compare the productivity of one sector with another sector due to various reasons like capital employed, nature of manpower employed, working conditions prevailing in an organisaton and other infrastructural differences.

Table 3.21

GROSS TURNOVER PER R&D EMPLOYEE AS ON 1st APRIL 2002

Sr. No.	Sector	No. of Responding Organisations	For the Year 2001-2002	
			Gross Turnover *(Rs. Million)*	R&D Employees *(Nos.)*
1	Agriculture	4	6480	533 (12.16)
2	Automobile	11	107812	1416 (76.14)
3	Bio-Tech	10	21428	600 (35.71)
4	Chemical	3	3441	302 (11.39)
5	I.T.	18	115802	3269 (35.42)
6	NCES	7	19113	591 (32.34)
7	Pharmaceutical	17	38346	1444 (26.56)
8	Power	3	16535	382 (43.29)
	Total	**73**	**328957**	**8537 (38.53)**

Note : figure in brackets indicate GTO per R&D employee

OBSERVATION :

GTO in Rs. million / R&D employee highest in Automobile sector followed by Power sector.

Table 3.22

R&D EXPENDITURE PER R&D EMPLOYEE AS ON 1st APRIL 2002

Sr. No.	Sector	No. of Responding Organisations	For the Year 2001-2002	
			R&D Expenditure *(Rs. Million)*	R&D Employees *(Nos.)*
1	Agriculture	4	105.46	533 (0.20)
2	Automobile	11	480.69	1416 (0.34)
3	Bio-Tech	10	466.39	600 (0.78)
4	Chemical	3	86.03	302 (0.28)
5	I.T.	18	5937.54	3269 (1.82)
6	NCES	7	234.45	591 (0.40)
7	Pharmaceutical	17	566.42	1444 (0.39)
8	Power	3	56.96	382 (0.15)
	Total	**73**	**7933.94**	**8537 (0.93)**

Note : figure in brackets indicate R&D expenditure per R&D employee

OBSERVATION :

R&D expenditure in Rs. million / R&D employee highest in I.T. sector followed by Bio-Tech sector.

GENERAL OBSERVATION APPLICABLE FOR TABLE NO. 3.20, 3.21 & 3.22

No consistent trend can be established because of varied nature of each sector as well as year-wise fluctuations.

SECTION - 04

- **R&D OUTPUT**

Table 3.23

PATENTS

(Number)

Sr. No.	Sector	No. of Responding Organisations	1999-2000				2000-2001				2001-2002			
			Applied		Awarded		Applied		Awarded		Applied		Awarded	
			Indian	Foreign	Indian	Foreign	Indian	Foreign	Indian	Foreign	Indian	Foreign	Indian	Foreign
1	Agriculture	4	2	0	0	0	5		2		4		5	
2	Automobile	11	8	1	4		10		7	1	10		10	
3	Bio-Tech	10	8	1	7	0	10	1	8	1	9		9	2
4	Chemical	3	1		2		4		1		4		2	
5	I.T.	18	27	0	12		40		25		57		40	
6	NCES	7	6	0	2		7		6		6		7	
7	Pharma	17	12		9		14	1	13		13	1	14	1
8	Power	3	2		1		2		3		2		3	
	Total	**73**	**66**	**2**	**37**	**0**	**92**	**2**	**65**	**2**	**105**	**1**	**90**	**3**

OBSERVATIONS :

Maximum Indian patents 40 awarded in I.T. sector followed by 14 in Pharma sector during the year 2001-2002.

Maximum foreign Patents 2 awarded in Bio-Tech sector in the year 2001-2002.

Table 3.24

OVER ALL STATUS OF PATENTS DURING THE PERIOD OF STUDY (1999-2002)

(Number)

Category	Agriculture	Automobile	Bio-Tech	Chemical	I.T.	NCES	Phar	Power	**Total**
Awarded									
Indian	7	21	24	5	77	15	36	7	**192**
Foreign	-	1	3	-	-	-	1	-	**5**
Applied									
Indian	11	28	27	9	124	19	39	6	**263**
Foreign	-	1	2	-	-	-	2	-	**5**
Total	**18**	**51**	**56**	**14**	**201**	**34**	**78**	**13**	**465**

OBSERVATION :

Maximum patents 201 developed by I.T. sector (Applied & Awarded) followed by 78 by Pharma sector during the period of study.

Table 3.25

R&D EXPENDITURE PER PATENT

Sr. No.	Sector	No. of Responding Organisations	1999-2000		2000-2001		2001-2002	
			R&D Expenditure (Rs. in million)	*Patent (Numbers)	R&D Expenditure (Rs. in million)	*Patent (Numbers)	R&D Expenditure (Rs. in million)	*Patent (Numbers)
1	**Agriculture**	4	31.56	2 (15.78)	83.04	7 (11.86)	105.46	9 (11.72)
2	**Automobile**	11	320.66	13 (24.67)	406.45	18 (22.58)	480.69	20 (24.03)
3	**Bio-Tech**	10	284.05	16 (17.75)	353.50	20 (17.68)	466.39	20 (23.32)
4	**Chemical**	3	77.28	3 (25.76)	82.10	5 (16.42)	86.03	6 (14.34)
5	**I.T.**	18	1034.95	39 (26.54)	1408.95	65 (21.68)	5937.54	97 (61.21)
6	**NCES**	7	133.80	8 (16.73)	201.90	13 (15.53)	234.45	13 (18.03)
7	**Pharmaceutical**	17	384.62	21 (18.32)	479.59	28 (17.13)	566.42	29 (19.53)
8	**Power**	3	58.18	3 (19.39)	54.58	5 (10.92)	56.96	5 (11.39)
	Total	73	2325.1	105 (22.14)	3070.11	161 (19.07)	7933.94	199 (39.87)

Note : 1. figure in brackets indicate R&D expenditure per patent
2. * Includes Indian and Foreign - Applied & Awarded

OBSERVATION :

R&D expenditure in Rs. million / patent ranges from 11 to 61 in the year 2001-2002.

Table 3.26

NEW DEVELOPMENTS

Sr. No.	Sector	No. of Responding Organisations	1999-2000		2000-2001		2001-2002		Total	Total
			Product (s)	Process (es)	Product (s)	Process (es)	Product (s)	Process (es)	Product (s)	Process (es)
1	Agriculture	4	1	1	2	3	2	3	5 (2.00)	7 (14.20)
2	Automobile	11	8		10		10		28 (11.20)	0 (0.00)
3	Bio-Tech	10	8	4	4	7	6	6	18 (7.20)	17 (34.69)
4	Chemical	3	2	1	5	1	4	1	11 (4.40)	3 (6.12)
5	I.T.	18	25	3	35	4	53	4	113 (45.20)	11 (22.45)
6	NCES	7	6		7		7		20 (8.00)	0 (0.00)
7	Pharma	17	18	4	16	3	15	1	49 (19.60)	8 (16.33)
8	Power	3	1	1	3	1	2	1	6 (2.40)	3 (6.12)
	Total	**73**	**69**	**14**	**82**	**19**	**99**	**16**	**250 (100.00)**	**49 (100.00)**

Note : figure in brackets indicate %age share of products and processes by each sector.

OBSERVATION :

In three years, 250 products and 49 processes have been developed, maximum 113 products developed in I.T. sector.

Table 3.27

PUBLICATIONS

(Number)

Sr. No.	Sector	No. of Responding Organisations	1999-2000			2000-2001			2001-2002			Total	Total	Total
			Papers published in Journals	Technical Reports published	Paper published in Conferences	Papers published in Journals	Technical Reports published	Paper published in Conferences	Papers published n Journals	Technical Reports published	Paper published in Conferences	Papers published in Journals	Technical Reports published	Paper published in Conferences
1	**Agriculture**	4	8	3	0	2	5	0	6	6	0	16 (9.04)	14 (3.61)	0 (0.00)
2	**Automobile**	11	6	19		8	16		7	20	0	21 (11.86)	55 (14.18)	0 (0.00)
3	**Bio-Tech**	10	6	14	0	4	15	3	5	19	0	15 (8.47)	48 (12.37)	3 (25.00)
4	**Chemical**	3		7			4		0	5	0	0 (0.00)	16 (4.12)	0 (0.00)
5	**I.T.**	18	1	35	0	4	41	2	8	44	0	13 (7.35)	120 (30.93)	2 (16.67)
6	**NCES**	7		13		1	10		1	18	0	2 (1.13)	41 (10.57)	0 (0.00)
7	**Pharma**	17	14	22		23	25	3	29	33	4	66 (37.29)	80 (20.62)	7 (58.33)
8	**Power**	3	12	6		14	4		18	4	0	44 (24.86)	14 (3.60	0 (0.00)
	Total	**73**	**47**	**119**	**0**	**56**	**120**	**8**	**74**	**149**	**4**	177 (100.00	388 (100.00)	12 (100.00

Note : figure in brackets indicate %age share of publications by each sector.

OBSERVATIONS :

In three years, 177 papers have been published in journals, 388 technical reports and 12 papers published in conferences/seminars/symposia etc.

Maximum 37% papers were published in journals in Pharma sector, followed by 25% in Power sector. Maximum 58% papers published in conferences / seminars / symposia in Pharma sector followed by 25% in Bio-tech sector. Maximum 31% technical reports published in I.T. sector followed by 21%) in Pharma sector.

In many cases, organisations may avoid publishing their papers due to their organisational policies.

Table 3.28

R&D EXPENDITURE PER PUBLICATION

Sr. No.	Sector	No. of Responding Organisations	1999-2000		2000-2001		2001-2002	
			R&D Expenditure (Rs. in million)	*Publications (Numbers)	R&D Expenditure (Rs. in million)	*Publications (Numbers)	R&D Expenditure (Rs. in million)	*Publications (Numbers)
1	**Agriculture**	4	31.56	11 (2.87)	83.04	7 (11.86)	105.46	12 (8.79)
2	**Automobile**	11	320.66	25 (12.83)	406.45	24 (16.94)	480.69	27 (17.80)
3	**Bio-Tech**	10	284.05	20 (14.20)	353.50	22 (16.07)	466.39	24 (19.43)
4	**Chemical**	3	77.28	7 (11.04)	82.10	4 (20.53)	86.03	5 (17.21)
5	**I.T.**	18	1034.95	36 (28.75)	1408.95	47 (29.98)	5937.54	52 (114.18)
6	**NCES**	7	133.80	13 (10.29)	201.90	11 (18.35)	234.45	19 (12.34)
7	**Pharmaceutical**	17	384.62	36 (10.68)	479.59	51 (9.40)	566.42	66 (8.58)
8	**Power**	3	58.18	18 (3.23)	54.58	18 (3.03)	56.96	22 (2.59)
	Total	**73**	2325.1	66 (14.01)	3070.11	184 (16.69)	7933.94	227 (34.95)

Note : 1 figure in brackets indicate R&D expenditure per publication

2. * Includes papers published in journals, conferences, seminars, symposia and technical reports.

OBSERVATION :

R&D expenditure in Rs. million / publication was highest in I.T. sector.

Sector-wise it ranges from 2.6 to 114 during the year 2001-2002.

Table 3.29

SKILL UPGRADATION OF R&D PERSONNEL

Sr. No.	Sector	No. of Responding Organisations	1999-2000		2000-2001		2001-2002		R&D personnel deputed for conferences/ seminars/ symposia etc.	R&D personnel deputed for training programmes
			R&D personnel deputed for		R&D personnel deputed for		R&D personnel deputed for			
			conferences/ seminars/ symposia etc.	training programmes	conferences/ seminars/ symposia etc.	training programmes	conferences/ seminars/ symposia etc.	training programmes	Total	Total
1	Agriculture	4	51	39	63	61	77	73	191 (4.17)	173 (3.53)
2	Automobile	11	205	175	223	195	266	255	694 (15.14)	625 (12.75)
3	Bio-Tech	10	105	93	121	113	134	139	360 (7.86)	345 (7.04)
4	Chemical	3	21	33	23	26	27	42	71 (1.55)	101 (2.06)
5	I.T.	18	539	639	642	919	741	1120	1922 (41.94)	2678 (54.64)
6	NCES	7	64	40	87	53	87	53	238 (5.19)	146 (2.98)
7	Pharma	17	279	190	311	215	369	262	959 (20.93)	667 (13.61)
8	Power	3	53	50	44	57	51	59	148 (3.22)	166 (3.39)
	Total	**73**	**1317**	**1259**	**1514**	**1639**	**1752**	**2003**	**4583 (100.00)**	**4901 (100.00)**

Note : figure in brackets indicate %age share of R&D personnel deputed for conferences/seminars/symposia and for training programmes by each sector.

OBSERVATIONS :

In three years, 4583 R&D personnel deputed for conferences and 4901 deputed for training.

Maximum R&D personnel deputed for conferences/seminars/symposia 1922 by I. T. sector followed by 959 by Pharma sector.

Similarly maximum 2678 R&D personnel deputed for training by I.T. sector followed by 667 in Pharma sector during the period of study.

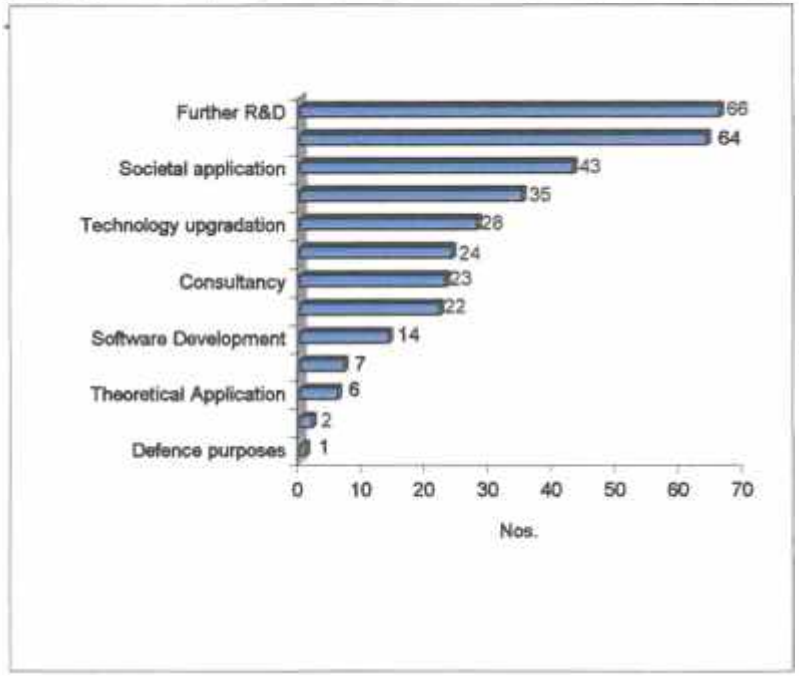
SECTION - 05

- GENERAL

Table 3.30

MAJOR USE OF R&D OUTPUT

Sr. No	Sector	No. of Responding Organisations	Theoretical Application	Commercial & Marketing	Defence Purposes	Further R&D	Consultancy	Creativity & Innovative Ideas	Software Development	Opening up a new area	Analytical Development	Technology Upgradation	Industrial Application	Societal Application
1	Agriculture	4	0	3		4	1	1	1	4	2	0	0	2
2	Automobile	11		10		11	1	6			1	10	4	6
3	Bio-Tech	10	5	5		10		6	1	5	2	3	0	7
4	Chemical	3		3		2		2					2	
5	I.T.	18	1	16	1	17	12	13	12	6		6	5	8
6	NCES	7		7		5		1				5	7	5
7	Pharmaceutical	17		17		14	6	5		7	2	1	3	14
8	Power	3		3		3	3	1				3	3	1
	Total	**73**	**6**	**64**	**1**	**66**	**23**	**35**	**14**	**22**	**7**	**28**	**24**	**43**



OBSERVATIONS :

On sector-wise analysis, it is observed that maximum 17 organisations have identified ***'Further R&D'*** in I.T. sector followed by 14 in Pharma sector as the major use of R&D output. Similarly 17 organisations in Pharma sector followed by 16 in I.T. sector have identified ***'Commerical & Marketing'*** as the second major use of R&D output.

Out of 73 responding organisations, 66 organisations have stated ***'Further R&D'*** and 64 have stated ***'Commercial and Marketing'*** as the major use of R&D output.

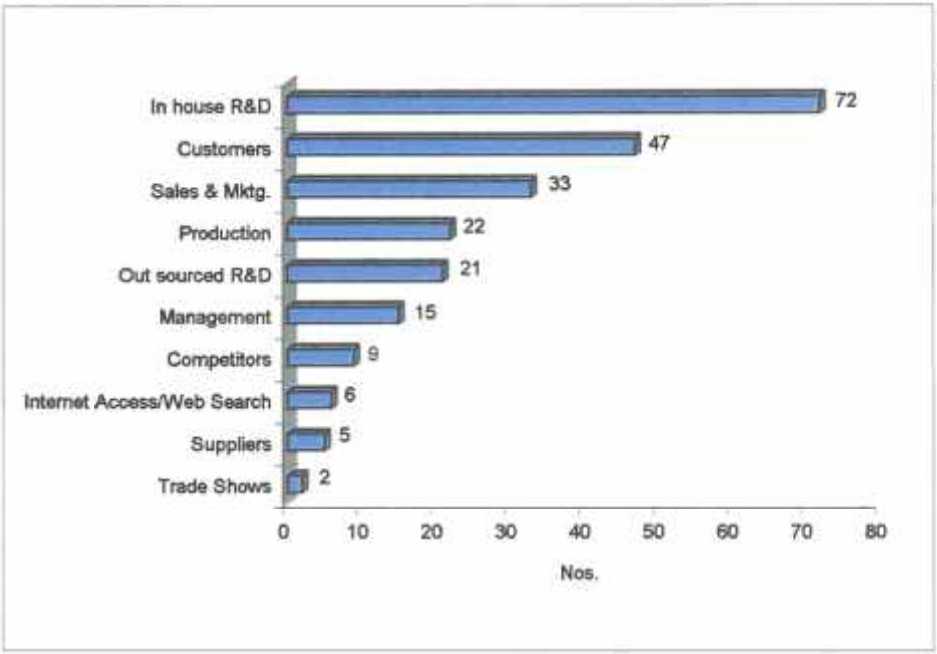
In some of the above areas, further in depth studies are required to probe developments in these areas.

Table 3.31

SOURCE OF INNOVATION

(Number)

Sr. No.	Sector	No. of Responding	Crucial	In house R&D	Out sourced R&D	Sales & Mktg.	Production	Management	Competitors	Customers	Suppliers	Trade Shows	Internet Access
1	Agriculture	4	Crucial	4		2	1	2		2		1	
2	Automobile	11	Crucial	11	4	7	5	5	5	6	1	1	
3	Bio-Tech	10	Crucial	10	1	1		1	1	7			
4	Chemical	3	Crucial	3		1	1			1			
5	I.T.	18	Crucial	18	13	6	1	4	1	10			6
6	NCES	7	Crucial	7	1	3	3	1		4			
7	Pharmaceutical	17	Crucial	16	2	12	9	2	1	14	4		
8	Power	3	Crucial	3		1	2		1	3			
	Total	**73**	**Crucial**	**72**	**21**	33	**22**	**15**	**9**	**47**	**5**	**2**	**6**



OBSERVATION :

Out of 73 responding organisations 72 have identified ***'In-House R&D'*** as the crucial source of innovation followed by 47 identifying ***'Customers'*** as the next crucial source of innovation.

CHAPTER - 04

- **R&D ANALYSIS - INSTITUTIONAL SEGMENT**

SECTION - 01

- GENERAL INFORMATION

Table 4.01

RESPONSE PROFILE

Sr. No.	Institution*	Location in India	Zone of *Foreign Collaborating Organisations	Institutions Surveyed	Institutions Responded	Year of Establishment	Year of Commencement of R&D activities	Category of Institution
1	International Crops Research Institute for the Semi-Arid Tropics (ICRISAT)	South (1) Hyderabad	Europe (Italy)	1	1	1972	1972	International Research Institute
2	International Centre for Genetic Engineering & Biotechnology (ICGEB)	North (1) Delhi	Europe (Italy)	1	1	1988	1988	International Research Centre

OBSERVATIONS :

Response from Institutional segment was 100%.

Both the institutions commenced their R&D activities before 1990.

*Please refer page 51, vol. I for definition

Table 4.02

TOTAL GROSS TURNOVER IN RUPEES (IN MILLION)

Sr. No.	Institution	1999-2000	2000-2001	2001-2002
1	ICRISAT	1179	1159	1016
2	ICGEB	25	325	425
	Total	**1204**	**1484**	**1441**

OBSERVATION :

It is observed that in Total Gross Turnover, ICGEB recorded upward trend and ICRISAT downward.

Table 4.03

EXPENDITURE ON ADVERTISEMENT & NEW PLANT & MACHINERY FOR THE WHOLE ORGANISATION (IN RS. MILLION)

Sr. No.	Institution	1999-2000		2000-2001		2001-2002	
		Expenditure on		Expenditure on		Expenditure on	
		advertisement	new plant & machinery	advertisement	new plant & machinery	advertisement	new plant & machinery
1	ICRISAT	Nil	77.82	Nil	105.59	Nil	17.53
2	ICGEB	Nil	Nil	Nil	Nil	Nil	Nil

OBSERVATION :

ICRISAT made maximum expenditure of Rs. 106 million on new plant & machinery during the year 2000-2001.

Table 4.04

LINKAGES*

Institution / Linkages with	ICRISAT		ICGEB	
	Indian	Foreign	Indian	Foreign
*Government	✓	✓	✓	✓
*Private Organisation	✓	✓	✓	✓
*University	✓	✓	✓	✓
*Non Governmental Organisation	✓	✓	-	-
*R&D Laboratory	✓	✓	✓	✓
*Any other (Pl. specify)	✓#	✓#	-	-

OBSERVATIONS :

ICRISAT & ICGEB both have linkages with Indian & Foreign Government, Private Organisations, Universities and R&D Laboratories. In addition, ICRISAT also have linkages with Non Governmental Organisations.

Other Research Institutions, Systems, Centres and Farmers etc.

Table 4.05

*TYPE OF RESEARCH -TIME & RESOURCES (PERCENTAGE BASIS)

Category	ICRISAT		ICGEB	
	Time	Resources	Time	Resources
Basic Research	-	-	50.00	52.00
Applied Research	25.00	25.00	50.00	48.00
Experimental Development	60.00	60.00		
Consultancy	10.00	10.00		
Other Activities	5.00	5.00		
Total	100.00	100.00	100.00	100.00

OBSERVATION :

Maximum time & resources 60% & 60% respectively are devoted by ICRISAT on Experimental Development and ICGEB maximum time & resouces 50% & 52% on Basic Research.

* Please refer page 51, 52, vol I for definitions

Table 4.06
TOTAL R&D EXPENDITURE BY SOURCES OF FUNDS

(Rs. in million)

Sr. No.	Institution	1999-2000							2000-2001							2001-2002						
			Exp. from Indian Origin			Exp. from Foreign Origin				Exp. from Indian Origin			Exp. from Foreign Origin					Exp. from Indian Origin			Exp. from Foreign Origin		
		R&D Expenditure	Recurring	Non Recurring	Total	Recurring	Non Recurring	Total	R&D Expenditure	Recurring	Non Recurring	Total	Recurring	Non Recurring	Total	R&D Expenditure	Recurring	Non Recurring	Total	Recurring	Non Recurring	Total
1	ICRISAT	1178.88	87.41	77.82	165.23	1013.65		1013.65	1159	91.49	105.59	197.08	961.92		961.92	1015.63	71.41	17.53	88.94	926.69		926.69
2	ICGEB	7.5*	1.35	0.90	2.25	3.15	2.10	5.25	48.75*	8.80	5.85	14.65	20.45	13.65	34.10	63.75*	11.50	7.65	19.15	26.75	17.85	44.60
	Total	1178.88	88.76	78.72	167.48	1016.8	2.1	1018.9	1159	100.29	111.44	211.73	982.37	13.65	996.02	1015.63	82.91	25.18	108.09	953.44	17.85	971.29

OBSERVATION :

ICRISAT has maximum Foreign funding and ICGEB maximum Indian funding.

It is observed that in R&D expenditure ICGEB recorded upward trend and ICRISAT downward

* There is wide fluctuations over the years. This is due to variability in timely receipt of grant from parent bodies like TWAS, Triestic, Italy, World Bank, USA etc.

Table 4.07
R&D EXPENDITURE AS A PERCENTAGE OF GROSS TURNOVER (GTO) (RUPEES MILLION)

Sr. No.	nstitutio	1999-2000		2000-2001		2001-2002	
		Gross Turnover	R&D Expenditure	Gross Turnover	R&D Expenditure	Gross Turnover	R&D Expenditure
1	ICRISAT	1179	1178.88 (99.99)	1159	1159 (100.03)	1016	1015.63 (99.96)
2	ICGEB	25	7.5 (30.00)	325	48.75 (15.00)	425	63.75 (15.00)
	Total	**1204**	**1186.38 (98.54)**	**1484**	**1207.75 (81.41)**	**1441**	**1076.38 (74.90)**

Note : figure in brackets indicate R&D Expenditure as a %age of GTO

OBSERVATION :

R&D expenditure as a percentage of GTO witnessed downward trend from 99% to 75% during the period of study.

SECTION - 03

- **FULL TIME MANPOWER EMPLOYED**

Table 4.08

FULL TIME MANPOWER EMPLOYED AS ON 1ST APRIL 2002

(Number)

Sr. No.	Institution	Total Employees	Personnel employed in		
			R&D Activities	Auxilliary Activities	Administrative Activities
1	ICRISAT	537	37 (6.89)	287* (53.45)	213* (39.66)
2	ICGEB	192	95 (49.48)	46 (23.96)	51 (26.56)
	Total	**729**	**132 (18.11)**	**333 (45.68)**	**264 (36.21)**

Note : figure in brackets indicate activity-wise employees as a percentage of total employees.

OBSERVATION :

Total Manpower employed by both the institutions is 729, out of which 18% are employed in R&D activities.

* High numbers of personnel under auxilliary and administrative activities is due to large number of field personnel assisting the R&D personnel working in the laboratory of ICRISAT.

Table 4.09

TOTAL NUMBER OF EMPLOYEES ON THE PAY ROLL OF THE INSTITUTION AS ON 1st APRIL 2002 (GENDERWISE)

(Number)

Sr. No.	Institution	Male			Female			Grand Total
		Indian	Foreign	Total	Indian	Foreign	Total	
1	ICRISAT	487	8	495	39	3	42	537
2	ICGEB	110	5	115	76	1	77	192
	Total	**597**	**13**	**610 (83.68)**	**115**	**4**	**119 (16.32)**	**729 (100)**

Note : figure in brackets indicate %age share of male & female out of total employees.

OBSERVATION :

Total Manpower employed in both the institutions is 729, out of which 16% are female employees.

Table 4.10

FULL TIME MANPOWER EMPLOYED FOR R&D ACTIVITIES AS ON 1st APRIL 2002 (GENDERWISE)

(Number)

Sr. No.	Institution	Male			Female			Grand Total
		Indian	Foreign	Total	Indian	Foreign	Total	
1	ICRISAT	26	6	32	2	3	5	37
2	ICGEB	64	5	69	25	1	26	95
	Total	**90**	**11**	**101 (76.52)**	**27**	**4**	**31 (23.48)**	**132 (100)**

Note : figure in brackets indicate %age share of male & female out of total R&D employees.

OBSERVATION :

Out of total 132 employees engaged in R&D activities alone, 23% are female employees.

GENERAL OBSERVATION APPLICABLE FOR TABLE NO. 4.08, 4.09 & 4.10:

No consistent trend can be established between the two institutions because of varied nature of their R&D activities.

Table 4.11

ACADEMIC BACKGROUND OF FULL TIME PERSONNEL EMPLOYED IN R&D ACTIVITIES AS ON 1st APRIL 2002

(Number)

Sr. No.	Institution		Natural Sc		Agri Sc		Engg & Tech		Medical Sc		Pharma Sc		Social S		
			M	F	M	F	M	F	M	F	M	F	M	F	Total
1	ICRISAT	Ph. D.			29	4			1						34
		Post Graduate			1										1
		Graduate			2										2
		Diploma													0
		Others													0
		Total			**32**	**4**									**37**
2	ICGEB	Ph. D.					29	21							50
		Post Graduate					26	9							35
		Graduate					10								10
		Diploma													0
		Others													0
		Total					**65**	**30**							**95**
G. Total (1+2+3+4+5+6+7+8)					**32**	**4**	**65**	**30**	**1**						**132**

Table 4.12

LEVEL-WISE ACADEMIC BACKGROUND OF FULL TIME PERSONNEL EMPLOYED IN R&D ACTIVITIES AS ON 1st APRIL 2002

(Number)

Sr. No.	Institution	Ph. D.	Post Graduate	Graduate	Diploma	Others	Total
1	ICRISAT	34	1	2			37
2	ICGEB	50	35	10			95
	Total	**84**	**36**	**12**	**0**	**0**	**132**

OBSERVATION :

ICGEB employs maximum Ph.D's 50.

Table 4.13

GROSS TURNOVER (GTO) PER EMPLOYEE

AS ON 1st APRIL 2002

Sr. No.	Institution	2001-2002	
		Gross Turnover *(Rs. Million)*	Total Employees *(Nos.)*
1	ICRISAT	1016	537 (1.89)
2	ICGEB	425	192 (2.21)
	Total	**1441**	**729 (1.98)**

Note : figure in brackets indicate GTO per employee

OBSERVATION :

ICGEB has maximum GTO / employee (2).

Table 4.14

GROSS TURNOVER (GTO) PER R&D EMPLOYEE

AS ON 1st APRIL 2002

Sr. No.	Institution	2001-2002	
		Gross Turnover *(Rs. Million)*	R&D Employees *(Nos.)*
1	ICRISAT	1016	37 (27.46)
2	ICGEB	425	95 (4.47)
	Total	**1441**	**132 (10.92)**

Note : figure in brackets indicate GTO per R&D employee

OBSERVATION :

ICRISAT has maximum GTO / R&D employee (27)

Table 4.15

R&D EXPENDITURE PER R&D EMPLOYEE

AS ON 1st APRIL 2002

Sr. No.	Institution	2001-2002	
		R&D Expenditure *(Rs. Million)*	R&D Employees *(Nos.)*
1	ICRISAT	1015.63	37 (27.45)
2	ICGEB	63.75	95 (0.67)
	Total	**1079.38**	**132 (8.18)**

Note : figure in brackets indicate R&D Expenditure per R&D employee

OBSERVATION :

ICRISAT has maximum R&D Expenditure / R&D employee

SECTION - 04

- **R&D OUTPUT**

Table 4.16
PATENTS

Sr. No.	Institution	1999-2000				2000-2001				2001-2002			
		Applied		Awarded		Applied		Awarded		Applied		Awarded	
		Indian	Foreign	Indian	Foreign	Indian	Foreign	Indian	Foreign	Indian	Foreig	Indian	Foreign
1	ICRISAT												
2	ICGEB	4	9		1			4	9	5			
	Total	4	9	0	1	0	0	4	9	5	0	0	0

OBSERVATION :

ICGEB developed maximum patents 32, whereas ICRISAT developed no patent during the period of study.

Table 4.17
R&D EXPENDITURE PER PATENT

Sr. No.	Insitution	1999-2000		2000-2001		2001-2002	
		R&D Expenditure	Patent	R&D Expenditure	Patent	R&D Expenditure	Patent
		(Rs. in million)	(Numbers)	(Rs. in million)	(Numbers)	(Rs. in million)	(Numbers)
1	ICRISAT	1178.88	NIL	1159.38	NIL	1015.63	NIL
2	ICGEB	7.50	14 (0.53)	48.75	3 (3.75)	63.75	5 (12.75)

Note : figure in brackets indicate R&D expenditure per patent

OBSERVATION :

ICGEB has spent maximum R&D expenditure in Rs. million /patent (13).

Table 4.18
NEW DEVELOPMENTS

(Number)

Sr. No.	Institution	1999-2000		2000-2001		2001-2002		Total	Total
		Product	Process (es	Product (s)	Process (es	roduct (	Process (es	Product (s)	Process (es)
1	ICRISAT	1	1	1	1	1	1	3	3
2	ICGEB		1				5		6
	Total	1	2	1	1	1	6	3	9

OBSERVATION :

Total 3 products and 3 processes developed by ICRISAT and 6 processes developed by ICGEB. However ICGEB developed no product during the period of study.

Table 4.19
PUBLICATIONS

Sr. No.	Institution	1999-2000			2000-2001			2001-2002			Total	Total	Total
		Papers published in Journals	Technical Reports published	Paper published in Conferences / seminars /symposia	Papers published in Journals	Technical Reports published	Paper published in Conferences / seminars /symposia	Papers published in Journals	Technical Reports published	Paper published in Conferences / seminars /symposia	Papers published in Journals	Technical Reports published	Paper published in Conferences / seminars /symposia
1	ICRISAT	128	32	90	154	50	91	167	49	143	449 (39.08)	131 (100.00)	324 (34.47)
2	ICGEB	196		197	203		323	301		480	700 (60.92)		1000 (75.53)
	Total	**324**	**32**	**287**	**357**	**50**	**414**	**468**	**49**	**623**	**1149 (100.00)**	**131 (100.00)**	**1324 (100.00)**

Note : figure in brackets indicate %age share of publications by both the institutions

OBSERVATIONS :

700 papers published in journals by ICGEB followed by 449 by ICRISAT.

No technical report published by ICGEB. ICRISAT generated 131 technical reports. ICGEB published 1000 papers in conferences/seminars/symposa followed by 324 by ICRISAT during the period of study.

Table 4.20
R&D EXPENDITURE PER PUBLICATION

Sr. No.	Institution	1999-2000		2000-2001		2001-2002	
		R&D Expenditure (Rs. in million)	Publications (Numbers)	R&D Expenditure (Rs. in million)	Publications (Numbers)	R&D Expenditure (Rs. in million)	Publications (Numbers)
1	ICRISAT	1178.88	250 (4.71)	1159.00	295 (3.93)	1015.63	359 (2.83)
2	ICGEB	7.50	393 (0.019)	48.75	526 (0.092)	63.75	781 (0.081)

Note : figure in brackets indicate R&D expenditure per publication

OBSERVATION :

Maximum R&D expenditure in Rs. million / publication was (4.70) by ICRISAT during the year 1999-2000.

Table 4.21

SKILL UPGRADATION OF R&D PERSONNEL

Sr. No.	Institution	1999-2000		2000-2001		2001-2002		R&D personal deputed for conferences/ seminars/ symposia etc.	R&D personal deputed for Training Programmes
		R&D personal deputed for		R&D personal deputed for		R&D personal deputed for			
		conferences/ seminars/ symposia etc.	Training Programmes	conferences/ seminars/ symposia etc.	Training Programmes	conferences/ seminars/ symposia etc.	Training Programmes	**Total**	**Total**
1	ICRISAT	96	-	82	-	76	-	254 (33.69)	-
2	ICGEB	146	43	152	71	202	86	500 (66.31)	200 (100.00)
	Total	**242**	**43**	**234**	**71**	**278**	**86**	**754 (100.00)**	**200 (100.00)**

Note : figure in brackets indicate %age share of total R&D personnel by both the institutions

OBSERVATION :

ICGEB deputed 500 R&D personnel for training followed by 254 by ICRISAT. ICGEB also deputed 200 R&D personnel for conferences/seminars/symposia while ICRISAT deputed none during the period of study.

SECTION - 05

- GENERAL

Table 4.22

MAJOR USE OF R&D OUTPUT

Area	ICRISAT	ICGEB
1. Theoretical Application		
2. Commercial & Marketing		
3. Defence purposes		
4. Further R&D	✓	
5. Consultancy		
6. Creativity & Innovative Ideas		
7. Software Development		
8. opening up a new area		
9. Analytical development		✓
10. Technology upgradation	✓	✓
11. Industrial application		✓
12. Societal application		
13. any other application		

OBSERVATION :

"Technology Upgradation" has been found to be the major use of R&D output by both the institutions.

Table 4.23
SOURCE OF INNOVATION

Institutions	Crucial	In house R&D	Out sourced R&D	Sales & Mktg.	Production	Management	Competitors	Customers	Suppliers	Trade Shows	Internet Access
ICRISAT	Crucial	✓				✓		✓			✓
ICGEB	Crucial	✓			✓		✓	✓			

OBSERVATION :

Both institutions have identified ***'In-House R&D'*** & ***'Customer'*** as the crucial source of innovation.

CHAPTER - 05

- R&D ANALYSIS - CENTRES

Table 5.01

RESPONSE PROFILE

Sr. No.	Name of Centre Surveyed	Response
1	International Development Research Centre (Canada) (IDRC)	✓
2	Indo-French Centre for the Promotion of Advanced Research (IFCPAR)	✓
3	Indian Council of Medical Research	Not Responded
4	World Health Organization	Not Responded

OBSERVATION :

Response from Centres 50%.

Table 5.02

MAIN FIELDS OF OPERATIONS

Sr. No.	Centre	Agriculture	Bio-Tech	Chemical	I.T.	Pharmaecutical	NCES	Others
1	IDRC	✓	✓		✓		✓	
2	IFCPAR		✓	✓	✓	✓	✓	✓
	Total	1	2	1	2	1	2	1

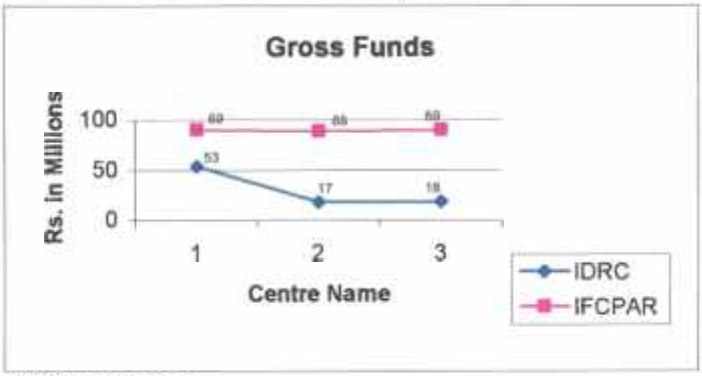
OBSERVATION :

Both centres support R&D in Bio-Tech., Information Technology (IT) and Non Conventional Energy Sources (NCES) sectors. In addition, IDRC supports R&D in Agriculture and IFCPAR supports R&D in Chemical, Pharmaceutical sectors as well.

Table 5.03

GROSS FUNDS PROVIDED FOR R&D ACTIVITIES
(IN RUPEES MILLIONS)

r. N	Centre	1999-2000	2000-2001	2001-2002
1	IDRC	53.00	17.00	18.00
2	IFCPAR	89.00	88.00	89.00
	Total	142.00	105.00	107.00



OBSERVATION :

IFCPAR has reported maximum gross funds provided for R&D activities, followed by IDRC during the period of study. The gross funds provided by IDRC to Institutes and NGO's whereas IFCPAR provided all the gross funds only to Institutes during the period of study. Funding from IDRC had downward trend from 1999-2000 to 2000-2001 and in 2001-2002 they maintained the 2000-2001 level. IFCPAR maintained same level during the period of study.

Table 5.04

LINKAGES

Sr. No.	Centre	Government		Pvt. Organisation		University		NGO		R&D Laborator		Any other	
		Indian	Foreign	Indian	Foreign	Indian	Foreign	Indian	Foreign	Indian	Foreign	Indian	Foreign
1	IDRC		✓					✓					
2	IFCPAR	✓	✓			✓	✓			✓	✓	✓	✓
	Total	1	2			1	1	1		1	1	1	1

OBSERVATIONS :

Both centres have linkages with Foreign Government.

IDRC has linkages with Indian NGOs whereas IFCPAR has linkages with Indian Government, Indian & Foreign Universities, R&D Laboratories and other Industries as well.

Table 5.05

ORGANISATION-WISE FUNDING DURING 1999-2000

Centre Name	*Sr. No.*	*Name of the Organisation*	*Amount Funded in Rs. Million*	*Year of Funding*
International Development Research Centre (IDRC)				
	1.	Foundation for Revitalisation of Local Health Traditions / Centre for Science and Environment	20.05	1999-2000
	2.	Society for Himalayan Environmental Research (SHER), Dehradun	1.14	1999-2000
	3.	National Council for Applied Economic Research, New Delhi	14.84	1999-2000
	4.	Indian Institute of Forest Management, Bhopal, M.P.	1.25	1999-2000
	5.	Child and Social Welfare Society	0.94	1999-2000
	6.	People's Clinic Trust, Chittor, Andhra Pradesh	1.35	1999-2000
	7.	International Institute for Rural Reconstruction; IRDC in-house Project – RAF Delhi	1.70	1999-2000
	8.	IUCN – The World Conservation Union, RAF – Delhi	0.55	1999-2000
	9.	Academy of Development Science	1.03	1999-2000
	10.	UTTHAN – Centre for Sustainable Development and Poverty, Allahanad	0.85	1999-2000
	11.	IDRC In-House Project – RAF	0.48	1999-2000
	12.	Tata Energy Research Institute, New Delhi	8.40	1999-2000
		Total	**52.58**	
Indo-French Centre for the Promotion of Advanced Research (IFCPAR)				
	1.	Mehta Research Institute of Mathematics & Mathematical Physics	0.50	1999-2000
	2.	Madras Christian College, Chennai	0.68	1999-2000
	3.	National Chemical Laboratory, Pune	0.84	1999-2000
	4.	All India Institute of Medical Sciences, New Delhi	2.91	1999-2000
	5.	Institute of Plasma Research, Gandhinagar	2.00	1999-2000
	6	Inter University Centre for Astronomy & Astrophysics, Pune	2.24	1999-2000
	7.	Indian Association for the Cultivation of Science, Kolkata	1.70	1999-2000
	8.	Tata Institute of Fundamental Research, Mumbai	1.60	1999-2000
	9.	National Chemical Laboratory, Pune	1.84	1999-2000
	10.	University of Pune, Pune	0.72	1999-2000
	11.	National Aerospace Laboratories, Bangalore	1.67	1999-2000
	12.	National Chemical Laboratories, Pune	1.43	1999-2000
	13.	National Physical Laboratories, New Delhi	2.10	1999-2000
	14.	Indian Institute of Technology, Kanpur	1.62	1999-2000
	15.	G.H.Patel Institute of Material Sciences, Vallab Vidyanagar	1.71	1999-2000
	16.	Bhavnagar University, Bhavnagar	0.33	1999-2000
	17.	National Centre for Basic Sciences, Kolkata	1.15	1999-2000
	18.	Institute of Physics, Bhubaneshwar	2.62	1999-2000
	19.	Indian Institute of Science, Bangalore	0.26	1999-2000
	20.	Tata Institute of Fundamental Research, Mumbai	0.17	1999-2000
	21.	Chennai Mathematical Institute, Chennai	0.43	1999-2000
	22.	School of Life Sciences, Devi Ahilya University	1.91	1999-2000
	23.	University of Delhi, Delhi	0.98	1999-2000
	24.	Tata Institute of Fundamental Research, Mumbai	1.03	1999-2000

25.	Indian Institute of Technology, Kanpur	1.30	1999-2000
26.	Indian Institute of Technology, Kanpur	2.08	1999-2000
27.	National Chemical Laboratories, Pune	1.87	1999-2000
28.	Indian Institute of Sciences, Bangalore	1.83	1999-2000
29.	Tata Research Development & Design Centre, Pune	2.13	1999-2000
30.	University of Hyderabad, Hyderabad	1.14	1999-2000
31.	National Chemical Laboratories, Pune	1.95	1999-2000
32.	Indian Institute of Sciences, Bangalore	0.64	1999-2000
33.	Indian Statistical Institute, Kolkata	2.06	1999-2000
34.	All India Institute of Medical Sciences, New Delhi	2.14	1999-2000
35.	Indian Institute of Technology, New Delhi	1.76	1999-2000
36.	Bose Institute, Kolkata	2.01	1999-2000
37.	Tata Institute of Fundamental Research, Pune	1.35	1999-2000
38.	Tata Institute of Fundamental Research, Mumbai	0.31	1999-2000
39.	Indian Institute of Technology, New Delhi	1.18	1999-2000
40.	National Chemical Laboratories, Pune	2.41	1999-2000
41.	Tata Institute of Fundamental Research, Mumbai	1.29	1999-2000
42.	National Institute of Oceanography, Goa	1.23	1999-2000
43.	Tata Institute of Fundamental Research, Mumbai	0.18	1999-2000
44.	Indian Institute of Sciences, Bangalore	0.07	1999-2000
45.	Tata Institute of Fundamental Research, Mumbai	0.13	1999-2000
46.	King George's Medical College, Lucknow	1.53	1999-2000
47.	Banaras Hindu University, Varanasi	1.68	1999-2000
48.	Thapar Institute of Engineering & Technology, Patiala	1.53	1999-2000
49.	Madras Christian College, Chennai	0.61	1999-2000
50.	University of Agricultural Sciences, Bangalore	1.40	1999-2000
51.	Tumour Biochem Cancer Institute, Chennai	1.84	1999-2000
52.	Madurai Kamraj University, Madurai	0.89	1999-2000
53.	Central Coffee Research Institute, Chicamanglour	1.11	1999-2000
54.	NCCS, Pune	0.16	1999-2000
55.	Inter University Center for Astronomy & Astrophysics, Pune	0.61	1999-2000
56.	Indian Institute of Technology, New Delhi	1.25	1999-2000
57.	University of Pune, Pune	1.34	1999-2000
58.	Astronomy & Astrophysics Physical Research Lab., Ahmedabad	0.74	1999-2000
59.	Indira Gandhi Centre for Atomic Research, Kalapakkam	0.28	1999-2000
60.	Indian Association of the Cultivation of Science, Jadavpur	0.88	1999-2000
61.	Tata Institute of Fundamental Research, Mumbai	0.004	1999-2000
62.	Punjab Agricultural University, Ludhiana	1.11	1999-2000
63.	National Chemical Laboratories, Pune	1.70	1999-2000
64.	National Chemical Laboratories, Pune	1.13	1999-2000
65.	National Institute of Oceanography, Goa	0.91	1999-2000
66.	Indian Institute of Technology, Mumbai	0.96	1999-2000
67.	Central Glass & Ceramic Research Institute, Kolkata	1.41	1999-2000
68.	Tata Energy Research Institute, New Delhi	1.11	1999-2000
69.	National Geophysical Research Institute, Hyderabad	0.82	1999-2000
70.	Indian Institute of Sciences, Bangalore & TIFR, Mumbai	0.03	1999-2000
71.	Devi Ahilya University, Indore	2.54	1999-2000
	Total	**89.074**	

Table 5.06

ORGANISATION-WISE FUNDING DURING 2000-2001

Centre Name	*Sr. No.*	*Name of the Organisation*	*Amount Funded in Rs. Million*	*Year of Funding*
International Development Research Centre (IDRC)				
	1.	IDRC In-House Project – RAF	0.82	2000-2001
	2.	Institute of Development Studies, Jaipur	8.64	2000-2001
	3.	Indian Institute of Management, Society for Research and Initiatives for Sustainable Technologies and Institutions (SRISTI)	7.20	2000-2001
		Total	**16.66**	
Indo-French Centre for the Promotion of Advanced Research (IFCPAR)				
	1.	Indian Statistical Institute, Kolkata	2.06	2000-2001
	2.	All India Institute of Medical Sciences, New Delhi	2.14	2000-2001
	3.	Indian Institute of Technology, New Delhi	1.76	2000-2001
	4.	Bose Institute, Kolkata	2.01	2000-2001
	5.	Tata Institute of Fundamental Research, Pune	1.35	2000-2001
	6.	Tata Institute of Fundamental Research, Mumbai	0.31	2000-2001
	7.	Indian Institute of Technology, New Delhi	1.18	2000-2001
	8.	National Chemical Laboratories, New Delhi	2.41	2000-2001
	9.	Tata Institute of Fundamental Research, Mumbai	1.29	2000-2001
	10.	National Institute of Oceanography, Goa	1.23	2000-2001
	11.	Tata Institute of Fundamental Research, Mumbai	0.52	2000-2001
	12.	Chennai Mathematical Institute, Chennai	0.04	2000-2001
	13.	Indian Institute of Sciences, Bangalore	0.02	2000-2001
	14.	Tata Institute of Fundamental Research, Mumbai	0.015	2000-2001
	15.	School of Life Science, Devi Ahilya University, Indore	1.91	2000-2001
	16.	Indian Institute of Technology, Kanpur	0.52	2000-2001
	17.	Tata Research Development & Design Centre, Pune	1.95	2000-2001
	18.	Indian Institute of Technology, Kanpur	0.64	2000-2001
	19.	University of Hyderabad, Hyderabad	0.66	2000-2001
	20.	National Chemical Laboratories, Pune	1.78	2000-2001
	21.	Indian Institute of Science, Bangalore	0.48	2000-2001
	22.	University of Delhi, Delhi	0.98	2000-2001
	23.	National Chemical Laboratory, Pune	1.71	2000-2001
	24.	Indian Institute of Sciences, Bangalore	1.83	2000-2001
	25.	Tata Institute of Fundamental Research, Mumbai	0.18	2000-2001
	26.	Indian Institute of Sciences, Bangalore	0.09	2000-2001
	27.	Institute of Mathematical Science, Chennai	0.09	2000-2001
	28.	Tata Institute of Fundamental Research, Mumbai	0.19	2000-2001
	29.	King George's Medical College, Lucknow	1.67	2000-2001
	30.	Banaras Hindu University, Varanasi	1.68	2000-2001
	31.	Thapar Institute of Engineering & Technology, Patiala	1.53	2000-2001
	32.	Madras Christian College, Chennai	1.04	2000-2001
	33.	University of Agricultural Sciences, Bangalore	1.51	2000-2001
	34.	Tumour Biochem Cancer Institute, Chennai	1.84	2000-2001
	35.	Madurai Kamraj University, Madurai	1.53	2000-2001

36.	Central Coffee Research Institute, Chicamanglour	1.49	2000-2001
37.	NCCS, Pune	1.91	2000-2001
38.	School of Life Sciences, Hyderabad	1.33	2000-2001
39.	Bose Institute, Kolkata	0.997	2000-2001
40.	Indian Institute of Sciences, Bangalore	2.20	2000-2001
41.	Central Drug Research Institute, Lucknow	1.17	2000-2001
42.	Tata Institute of Fundamental Research, Mumbai	0.77	2000-2001
43.	Centre for Cellular & Molecular Biology, Hyderabad	1.80	2000-2001
44.	Institute of Pathology, New Delhi	0.80	2000-2001
45.	Central Drug Research Institute, Lucknow	0.30	2000-2001
46.	Christian Medical College, Vellore	0.32	2000-2001
47.	Inter University Center for Astronomy & Astrophysics, Pune	0.66	2000-2001
48.	Indian Institute of Technology, New Delhi	1.25	2000-2001
49.	University of Pune, Pune	1.34	2000-2001
50.	Astronomy & Astrophysics Physical Research Lab., Ahmedabad	1.48	2000-2001
51.	Indira Gandhi Centre for Atomic Research, Kalapakkam	1.12	2000-2001
52.	Indian Association of the Cultivation of Science, Jadavpur	2.11	2000-2001
53.	Tata Institute of Fundamental Research, Mumbai	0.02	2000-2001
54.	Inter University Center for Astronomy & Astrophysics, Pune	0.12	2000-2001
55.	Indian Institute of Sciences, Bangalore	0.66	2000-2001
56.	UP State Observation, Nanital	0.16	2000-2001
57.	Punjab Agricultural University, Ludhiana	1.11	2000-2001
58.	National Chemical Laboratories, Pune	1.70	2000-2001
59.	National Chemical Laboratories, Pune	1.69	2000-2001
60.	National Chemical Laboratories, Pune	0.74	2000-2001
61.	Regional Research Lab., Thiruvananthpuram	1.16	2000-2001
62.	Indian Institute of Chemical Technology, Hyderabad	1.80	2000-2001
63.	Indian Institute of Chemical Technology, Hyderabad	1.60	2000-2001
64.	National Chemical Laboratories, Pune	1.40	2000-2001
65.	National Institute of Oceanography, Goa	0.91	2000-2001
66.	Indian Institute of Technology, New Delhi	0.60	2000-2001
67.	Bangalore University, Bangalore	0.98	2000-2001
68.	Indian Institute of Technology, Mumbai	0.96	2000-2001
69.	Central Glass & Ceramic Research Institute, Kolkata	1.54	2000-2001
70.	J.L.Nehru Aluminum Research Devp. & Design Centre, Nagpur	0.96	2000-2001
71.	Indian Institute of Technology, Mumbai	0.42	2000-2001
72.	Institute of Armament Technology, Pune	0.78	2000-2001
73.	Bhaba Atomic Research Institute, Mumbai	0.72	2000-2001
74.	Tata Energy Research Institute, New Delhi	1.89	2000-2001
75.	University Deptt. Of Chemical Technology, Mumbai	1.46	2000-2001
76.	National Geophysical Research Institute, Hyderabad	1.23	2000-2001
77.	University of Kalyanai, Kalyani	1.6	2000-2001
78.	Indian Institute of Sciences, Bangalore & TIFR, Mumbai	0.10	2000-2001
	Total	**87.502**	

Table 5.07

ORGANISATION-WISE FUNDING DURING 2001-2002

Centre Name	*Sr. No.*	*Name of the Organisation*	*Amount Funded in Rs. Million*	*Year of Funding*
International Development Research Centre (IDRC)				
	1.	CREDEP	1.70	2001-2002
	2.	Arya Vaid Sala (AVS)	1.10	2001-2002
	3.	NEPED, POU	13.24	2001-2002
	4.	IDRC In-House Project–RAF / National Botanical Research Institute	0.36	2001-2002
	5.	South Asia Network for Food Ecology and Culture (SANFEC)	1.60	2001-2002
		Total	**18.00**	
Indo-French Centre for the Promotion of Advanced Research (IFCPAR)				
	1.	Indian Statistical Institute, Kolkata	1.71	2001-2002
	2.	All India Institute of Medical Sciences, New Delhi	1.25	2001-2002
	3.	Indian Institute of Technology, New Delhi	0.56	2001-2002
	4.	Bose Institue, Kolkata	1.70	2001-2002
	5.	Tata Institute of Fundamental Research, Pune	1.13	2001-2002
	6.	Tata Institute of Fundamental Research, Mumbai	0.26	2001-2002
	7.	Indian Institute of Technology, New Delhi	0.98	2001-2002
	8.	National Chemical Laboratories, Pune	1.00	2001-2002
	9.	Tata Institute of Fundamental Research, Mumbai	0.21	2001-2002
	10.	National Institute of Oceanography, Goa	1.23	2001-2002
	11.	Tata Institute of Fundamental Research, Mumbai	0.18	2001-2002
	12.	Indian Institute of Sciences, Bangalore	0.09	2001-2002
	13.	Indian Statistical Institute, New Delhi	1.07	2001-2002
	14.	Tata Institute of Fundamental Research, Mumbai	0.02	2001-2002
	15.	Indian Statistical Institute, Bangalore	0.05	2001-2002
	16.	Institute of Mathematical Science, Chennai	0.13	2001-2002
	17.	Tata Institute of Fundamental Research, Mumbai	0.19	2001-2002
	18.	King George's Medical College, Lucknow	1.67	2001-2002
	19.	Banaras Hindu University, Varanasi	1.68	2001-2002
	20.	Thapar Institute of Engineering & Technology, Patiala	1.53	2001-2002
	21.	Madras Christian College, Chennai	1.04	2001-2002
	22.	University of Agricultural Sciences, Bangalore	1.51	2001-2002
	23.	Tumour Biochem Cancer Institute, Chennai	1.84	2001-2002
	24.	Madurai Kamraj University, Madurai	1.53	2001-2002
	25.	Central Coffee Research Institute, Chicamanglour	1.49	2001-2002
	26.	NCCS, Pune	1.91	2001-2002
	27.	School of Life Sciences, Hyderabad	1.33	2001-2002
	28.	Bose Institute, Kolkata	0.997	2001-2002
	29.	Indian Institute of Sciences, Bangalore	2.40	2001-2002
	30.	CDRI, Lucknow	1.41	2001-2002
	31.	Tata Institute of Fundamental Research, Mumbai	0.84	2001-2002
	32.	Centre for Cellular & Molecular Biology, Hyderabad	1.96	2001-2002

33.	Institute of Pathology, New Delhi	0.96	2001-2002
34.	CDRI, Lucknow	1.80	2001-2002
35.	Christian Medical College, Vellore	1.94	2001-2002
36.	Sri Ramchander Medical College & Research Institute, Chennai	0.85	2001-2002
37.	Indian Institute of Sciences, Bangalore	0.58	2001-2002
38.	Inter University Center for Astronomy & Astrophysics, Pune	0.66	2001-2002
39.	Indian Institute of Technology, New Delhi	1.25	2001-2002
40.	University of Pune, Pune	1.34	2001-2002
41.	Astronomy & Astrophysics Physical Research Lab., Ahmedabad	1.48	2001-2002
42.	Indira Gandhi Centre for Atomic Research, Kalapakkam	1.12	2001-2002
43.	Indian Association of the Cultivation of Science, Jadavpur	2.11	2001-2002
44.	Tata Institute of Fundamental Research, Mumbai	0.02	2001-2002
45.	Inter University Center for Astronomy & Astrophysics, Pune	0.13	2001-2002
46.	Condensed Matter Physics Research Centre, Kolkata	0.37	2001-2002
47.	Indian Institute of Sciences, Bangalore	1.17	2001-2002
48.	Indian Institute of Sciences, Bangalore	1.98	2001-2002
49.	UP State Observation, Nanital	0.94	2001-2002
50.	Centre for Theoretical Studies, IIS, Bangalore	0.035	2001-2002
51.	Saha Institute of Nuclear Physics, Kolkata	0.89	2001-2002
52.	Indian Institute of Astrophysics, Bangalore	0.72	2001-2002
53.	Centre for Advanced Technology, Indore	0.07	2001-2002
54.	Punjab Agricultural University, Ludhiana	1.11	2001-2002
55.	National Chemical Laboratories, Pune	1.70	2001-2002
56.	National Chemical Laboratories, Pune	1.69	2001-2002
57.	National Chemical Laboratories, Pune	0.74	2001-2002
58.	Regional Research Lab., Thiruvananthpuram	1.99	2001-2002
59.	Indian Institute of Chemical Technology, Hyderabad	1.80	2001-2002
60.	Indian Institute of Chemical Technology, Hyderabad	2.10	2001-2002
61.	National Chemical Laboratories, Pune	1.87	2001-2002
62.	Indian Institute of Sciences, Bangalore	0.28	2001-2002
63.	National Chemical Laboratories, Pune	0.05	2001-2002
64.	National Institute of Oceanography, Goa	0.91	2001-2002
65.	Indian Institute of Technology, New Delhi	1.03	2001-2002
66.	Bangalore University, Bangalore	1.06	2001-2002
67.	Indian Institute of Tropical Meterology, Pune	1.07	2001-2002
68.	Indian Institute of Technology, Mumbai	0.96	2001-2002
69.	Central Glass & Ceramic Research Institute, Kolkata	1.54	2001-2002
70.	J.L.Nehru Aluminum Research Devp. & Design Centre, Nagpur	1.64	2001-2002
71.	Indian Institute of Technology, Mumbai	0.72	2001-2002
72.	Institute of Armament Technology, Pune	1.04	2001-2002
73.	BARC, Mumbai	0.86	2001-2002
74.	National Chemical Laboratories, Pune	1.03	2001-2002
75.	Tata Energy Research Institute, New Delhi	1.89	2001-2002
76.	University Deptt. Of Chemical Technology, Mumbai	1.46	2001-2002
77.	Centre for Cellular & Molecular Biology, Hyderabad	1.34	2001-2002
78.	National Geophysical Research Institute, Hyderabad	1.23	2001-2002
79.	University of Kalyanai, Kalyani	1.6	2001-2002
80.	Aquatic Toxicology Centre, Industrial Toxicology Research Centre, Lucknow	0.81	2001-2002
81.	Indian Institute of Sciences, Bangalore & TIFR, Mumbai	0.10	2001-2002
	Total	**88.932**	

Table 5.08
Utilization of Foreign Funds (R&D Output)

Sr. No.	Centre	Year	Patents				Product(s) Developed	Process(es) Developed	Papers Published in		Skill Upgadation : R&D Personnel Deputed for	
			Applied		Awarded				Journals	Conferences/Seminars/ Symposia	Conferences/Seminars/ Symposia	Training Programs
			Indian	Foreign	Indian	Foreign						
1	**International Development Research Centre (Canada) (IDRC)**	1999-2000					6	1	3			
		2000-2001						2	1			
		2001-2002					2		6			
2	**Indo-French Centre for the Promotion of Advanced Research (IFCPAR)**	1999-2000	6	6					75	50	50	
		2000-2001	6	6					100	40	40	
		2001-2002	6	6					100	40	40	
	Total		18	18			8	3	285	130	130	

OBSERVATIONS :

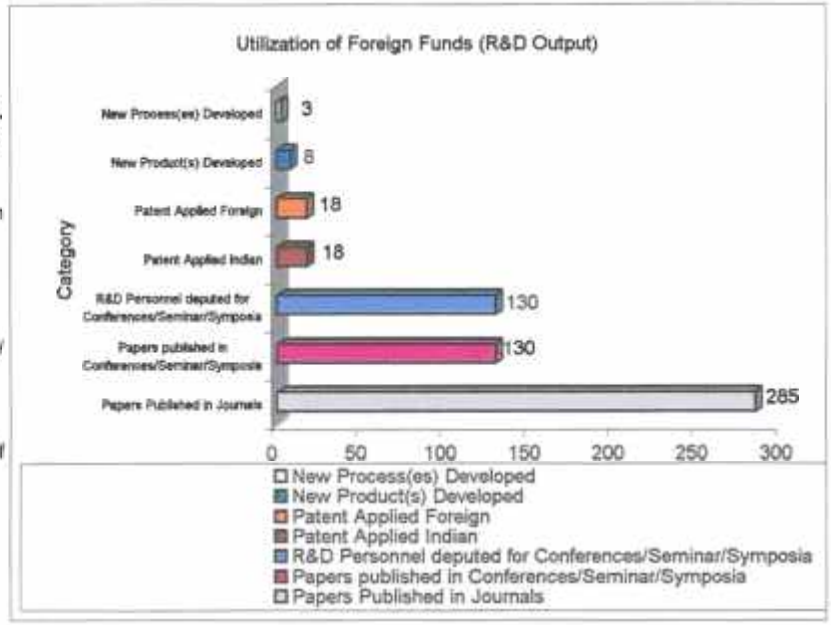
Patents :
Over a period of three years, 18 Indian patents and 18 Foreign patents have been applied by IFCPAR, whereas no patent applied by IDRC. No Indian or Foreign patent has been reported as awarded by any centre.

Product(s) / Process(es) developed:
8 products and 3 processes have been developed by IDRC, whereas no new product / process have been developed by IFCPAR over a period of 3 years.

No import substitute / design prototype have been reported as developed by any centre.

Publications :
Total 285 papers published in journals by both the centres and 130 papers published in conferences / seminars/symposia by IFCPAR over a period of 3 years.

Skill Upgradation :
130 R&D personnel have been deputed for Conferences/seminars/symposia by IFCPAR during the period of study. No personnel deputed for training by any centre



SUMMARY

During the last decade from 1990 onwards, the process of liberalization, privatization and globalization (LPG) of Indian economy started. The process resulted in many Multinationals setting up their operations in India. Some of the pioneer global corporations have set up their **R&D operations** in India to take advantage of availability of low cost human resources including technical trained manpower and a well developed infrastructure. Due to the entry of global multinationals, there has been an upward thrust in R&D activities in India in various sectors. In fact, many MNCs are making India as a R&D hub.

In view of above scenario, National Science and Technology Management Information System (NSTMIS), Department of Science and Technology, Government of India entrusted NAFEN to undertake a study entitled **"Study on status of foreign participation in R&D activities of selected organisations in India".** The main objectives of the study are as follows :

— To study characteristics of R&D activities of select international organisations operating in India in identified sectors, other than those covered under the R&D statistics database of government of India.

— To analyse the latest scenario and to quantify input / output R&D resources in terms of manpower, finance, infrastructure, patents, licensing, technology transfer, know how of products / systems / processes / software programs etc.

— 73 organisations in the manufacturing segment, 2 in the institutional segment and 2 centres responded and furnished data as per a pre-designed questionnaire and discussions during visits for data collection, against 95 surveyed in manufacturing segment, 2 in institutional segment and 4 centres.

NATIONAL R&D SCENERIO

At the national level, total investment on R&D activities attained a level of Rs. 129015.40 million in 1998-99. Out of the total expenditure incurred, 89.4% came from Central Government and 10.6% from the State Government. Nearly 3.08 lac personnel (including 3% female employees) were employed in R&D establishments in the country, out of which, 31% were performing R&D activities. 1800 patents were sealed during the year 1998-99, out of which 645 (36%) were Indian patents.

PRESENT R&D STUDY

Since this particular R&D study refers to the period from 1999-2000 onwards, and is limited to the eight identified sectors, it is not possible to compare the data of this study with the national scenario. Following are the major findings of the study, segment - wise

A. Manufacturing Segment :

It is observed from the R&D study that for all the eight sectors taken together, the Gross Turnover increased from Rs. million 240533 in 1999-2000 to Rs. million 328957 in 2001-2002 i.e. an increase of 37% during the period of the study (1999-2002). As compared with 2000-2001, the increase in 2001-2002 is appox. 10%. As on 1st April 2002, total manpower employed by 8 sectors is 55094 (including 27% female), out of which 8537 working for R&D activities alone (including 33% female). The total R&D expenditure for all the eight sectors taken together increased from Rs. 2325 million in 1999-2000 to Rs. 7934 million in 2001-2002 i.e. an increase of 241% during the period of study (More than double). Total 465 patents were sealed during the period of study (1999-2002) out of which 455 (98%) were Indian patents. Total 177 papers published in journals, papers published in conferences / seminars / symposia and 388 technical reports published by 8 sectors during the period of study (1999-2002).

B. Institutional Segment :

It is observed from the R&D study that for both the institutions taken together the gross turnover over increased from Rs. Million 1204 in 1999-2000 to Rs. Million 1441 in 2001-2002 i.e. an increase of 20% during the period of study (1999-2002). However as regards, R&D expenditure, there is decrease from Rs. 1186 million in the year 1999-2000 to Rs. 1079 million in the year 2001-2002 i.e. an decrease of 10% approximately. As on 1st April 2002, total manpower employed by 2 institutions is 729 (including 16% female) out of which 132 working for R&D activities alone (including 23% female). Total 32 patents were sealed during the period of study (1999-2002) out of which 13 (41%) were Indian patents by ICGEB (ICRISAT – Nil patent). Total 1149 papers published in journals, 1324 papers published in conferences / seminars / and symposia and 131 technical reports published during the period of study (1999-2002) by both the institutions (except ICGEB - Nil contribution in technical report).

C. Centres :

It is observed that funding for both the centres taken together, has decreased from Rs. 142 million in the year 1999-2000 to Rs. 107 million in the year 2001-2002 i.e. a decrease of 25% during the period of study (1999-2002). Total 36 patents were sealed by IFCPAR out of which 18 (50%) were Indian (IDRC – Nil patent) during the period of study (1999-2002). Similarly 285 papers published in journals by both the centres and 130 papers published in conferences/seminars/symposia by IFCPAR (IDRC-Nil contribution). No technical report published by any centre.

TERMINOLOGIS USED

Applied Research:

Applied Research may be defined as any original investigation undertaken in order to acquire new knowledge. It is, however, directed primarily towards a specific practical aim or objective.

Basic Research :

Basic research may be defined as any experimental or theoretical work undertaken primarily to acquire new knowledge of the underlying foundations of phenomena and observable facts, without any particular or specific application or use in view.

Expérimental Development:

Experimental development may be defined as any systematic work, drawing on existing knowledge gained from research and / or practical experience that is directed to produce new materials, products and devices, to install new processes, systems and services, and to improve substaintially those already produced or installed..

Foreign Collaborating Organisation (FCO):

Any organisation from abroad having tie up with an Indian organisation for mutual business purposes.

Foreigner or NRI Owned :

A company owned by a foreign national (not of Indian Origin) or a company owned by an NRI i.e. an Indian citizen who stays abroad for employment or for carrying on any business or vocation or for any other purpose in circumstances indicating an indefinite period of stay outside India.

Institution:

An organization founded and united for a specific purpose

Joint Venture :

Co-operation of two or more individuals or enterprises in a specific business enterprise, rather than in a continuing relationship as in a partnership.

Laboratory :

A work place for the conduct of scientific research.

Linkages :

Relationships technical or financial.

NGO (Non Governmental Organisation) :

NGOs include groups and institutions that are entirely or largely independent of government and that have primarily humanitarian or cooperative rather than commercial objectives. They are private agencies. NGOs include charitable and religious associations that mobilize private funds for development, distribute food and family planning services and promote community organization. They also include independent cooperatives, community associations, women's groups and pastoral associations. Citizen groups that raise awareness and influence policy are also NGOs.

Other Activities:

Other activities would include R&D for consultancy etc.

Resource :

Resources include financial resources and %age devoted to each area of research.

Subsidiary :

A company that is completely controlled by another company.

Time :

%age of time devoted to each area of research.

PROJECT INVESTIGATOR'S OBSERVATIONS

Following are the observations and findings of the Project Investigator (P.I.):

- This is a study covering select organisations & select sectors. Therefore, no generalisation should be made on the overall situation.

- Centre for Monitoring of Indian Economy (CMIE) has developed a data base of manufacturing organisations totaling to approximately 8000 organisations as on 30th October 2003, out of which 145 organisations have more than 50% foreign equity holding. It is observed that for the eight identified sectors, 60 organisations as per CMIE database are still to be covered for R&D activities in India with foreign participation (please refer table attached - Page 54).

  Apart from 60 manufacturing organisations referred above for the 8 identified sectors, there are 39 organisations (with more than 50% foreign equity) operative in other sectors like Consumer Durables, AC & Refrigeration sectors etc., which can also be taken up for exploring their R&D activities, making a total of 99 (60+39) organisations in the manufacturing segment (please refer table attached - Page 54).

  NSTMIS division may kindly like to consider to cover these 99 organisations in phase II as a separate study, for exploring further the nature of their R&D activities with foreign participation.

- Report has been prepared based on the data received / collected from primary & secondary sources. No separate validation by NAFEN is possible.

- Intention of the study is not to have any inter-organisation comparisons. In view of this, the status has been analysed on sectorial basis & overall bases.

- There was resistance in most of the cases to furnish the data. Vary intensive follow up was necessitated through personal visits / phone / fax / email etc.

- In many cases, it is seen that organisations may avoid publishing their papers due to their organisational policies.

- Certain areas for major use of R&D output were identified. It was a multi choice questionnaire. Based on the data received in this study, in some of the areas, further in depth studies are required to probe developments in these areas.

- Regarding productivity, it may not be proper to compare the productivity of one sector with another sector due to various reasons like capital employed, nature of manpower employed, working conditions prevailing in an organisation and other infrastructural differences.

Comparison of R&D Organisations Covered in the Study vis-à-vis CMIE Database

(Number)

(1) Sr No.	(2) Sectors	(3) Organisations already surveyed in the R&D Study (Manufacturing Segment)	(4) Organisations in the CMIE database with more than 50% foreign equity (Manufacturing Segment)	(5) Organisations common in both R&D study and CMIE database	(6) Balance Organisations	(7) Organisations already covered in DST database	(8) Organisations which can be considered for a further R&D Study as Phase II
1.	Agriculture	05	08	-	08	02	06
2.	Automobile	14	09	-	09	04	05
3.	Biotech	11	-	-	-	-	-
4.	Chemical	05	44	-	44	16	28
5.	I.T.	24	14	-	14	01	13
6.	NCES	11	-	-	-	-	-
7.	Pharma	19	10	09	01	01	-
8.	Power	06	09	01	08	-	08
	Total	**95**	**94**	**10**	**84**	**24**	**60**

Other Sectors from CMIE Database

Sr. No.	Other Sectors included in CMIE Database	No. of Organisations in CMIE Database excluding already covered in DST Database
1.	CERAMIC	04
2.	ENGINEERING Incl. AC, Refrigeration and Consumer Durable	25
3.	MARINE	01
4.	MINING	01
5.	STEEL	04
6.	TEXTILE	04
	TOTAL	**39**

A

STUDY ON STATUS OF FOREIGN PARTICIPATION IN R&D ACTIVITIES OF SELECTED ORGANISATIONS IN INDIA

2002-2003

QUESTIONNAIRE

(To be filled in by the organizations directly undertaking R&D activities in India with foreign participation)

Study Sponsored by:

GOVERNMENT OF INDIA
MINISTRY OF SCIENCE & TECHNOLOGY
DEPARTMENT OF SCIENCE & TECHNOLOGY
NATIONAL SCIENCE & TECHNOLOGY MANAGEMENT
INFORMATION SYSTEM (NSTMIS)
NEW DELHI -110 016 (INDIA)

Please read the instructions before filling the questionnaire

1. The questionnaire contains 5 sections marked A, B, C, D and E.
2. Please ensure that the number of characters/ alphabets does not exceed the number of boxes given. Wherever necessary, abbreviations may be used.
3. All alphabets should be filled in BLOCK LETTERS.
4. Please fill complete information for the items applicable to your organization. IN CASE EXACT DATA ARE NOT AVAILABLE, USE ESTIMATES.
5. Please stick to the units in which figures are asked e.g. Rs. Million should be given in Rs. Million only and not in Rs. Thousands or crores. (10 lacs equal to 1 Million)
6. Please ensure that **last two shaded boxes** in each case are filled with numeric value after decimal point (leaving aside Section –C). Please do not put decimal in the boxes e.g. Rs. 201.434 millions should be given after being rounded to two decimal places in the boxes as shown:

0	0	2	0	1	4	3

And Rs. 201.345 or Rs. 201.436 lakhs etc. Should be shown as

0	0	2	0	1	4	4

The completed Questionnaire should be returned to

Dr. P.K. Gupta
Secretary General
National Foundation of Indian Engineers (NAFEN)
New Delhi-110 005 (INDIA)
Phone: +91-11- 2585 3104/ 4212/ 0446, 25740547
Fax: +91-11- 25789399
E-mail: cstnafen@vsnl.com or cstnafen@eth.net
Web: www.nafenindia.com

SECTION –A

GENERAL INFORMATION

1	Name of the organization in India	
2	Name of the foreign collaborating organization	
3	Country of origin of the foreign collaboration organization	
4	Name of the Respondent	
5	Designation of the Respondent	
6	Communication Address	
	City	
	State	
	Pin Code	
	Phone:	
	Fax:	
	E-mail	
8	Year of establishment of the organisation in India	
9#	Location of R&D Unit in India	
10	Year of commencement of R&D activities in India	

11 Category of the organization in India (tick mark (✔) the appropriate Box(es) against each item :-

A.	Joint Venture Company	☐
B.	Subsidiary of a Foreign Company	☐
C.	Foreigner or NRI Owned	☐
D.	Non Governmental Organization (NGO)	☐
E.	Laboratory	☐
F.	Any other (Pl. specify) _____	

# In case of more than one location in India, please indicate separately.	
◆	
◆	
◆	
◆	

12 Main field of operations of R&D activities in India (pl. tick mark ✔)

Agriculture	☐	Automobile	☐	Chemical	☐	Biotech	☐	I.T.	☐
Pharmaceutical	☐	Power	☐	Non Conventional Energy Sources				☐	

13 Funding arrangements of R&D operations in India (pl. tick mark ✔)

			% age				% age
I	Internal Funding a) *From Indian operations* b) *From parent organization*	☐ ☐		II	Financial Institutions from India	☐	
III	Financial Institutions from abroad	☐		IV	Any other (please specify) _____		

4 Major Product(s)/ Systems/ Processes/ Software Programmes undertaken in your organization which best describe the objectives of your organization's R&D activities

- _____
- _____
- _____
- _____
- _____

15 Gross Turnover in Rupees *(in million)*

1999-2000	2000-2001	2001-2002

16 Expenditure on advertisement and new plant and machinery for the whole organization and R&D activities in Rs. million

Year	For the whole organization **(should include expenditure on R&D activities also)**		For R&D activities **only**	
	Expenditure on Advertising in Rs. million	Expenditure on new plant & machinery in Rs. Million	Expenditure on Advertising in Rs. million	Expenditure on new plant & machinery in Rs. million
1999-2000				
2000-2001				
2001-2002				

17 Are you having any linkages with ? (pl. tick mark ✔)

	Indian	Foreign
Government	☐	☐
Private Organization	☐	☐
University	☐	☐
Non Governmental Organization	☐	☐
R&D Laboratory	☐	☐
Any other (Please specify) _____	☐	☐

18 Estimated Percentage of Time & Resources devoted to the following activities :-

	Areas	Time*			Resources#		
a.	Basic Research						
b.	Applied Research						
c.	Experimental Development						
d.	Consultancy						
e.	Other Activities _____						
	Total (a+b+c+d+e)	100%			100%		

DEFINITIONS

1. **BASIC RESEARCH**
   Basic research may be defined as any experimental or theoretical work undertaken primarily to acquire new knowledge of the underlying foundations of phenomena and observable facts, without any particular specific application or use in view.

2. **APPLIED RESEARCH**
   Applied Research may be defined as any original investigation undertaken in order to acquire new knowledge. It is, however, directed primarily towards a specific practical aim or objective.

3. **EXPERIMENTAL DEVELOPMENT**
   Experimental development may be defined as any systematic work, drawing on existing knowledge gained from research and/ or practical experience that is directed to produce new materials, products and devices, to install new processes, systems and services, and to improve substantially those already produced or installed.

4. **OTHER ACTIVITIES**
   Other activities would include R&D for consultancy etc.

Note: * **Time:** %age of time devoted to each area of research.
Resources: Resources include financial resources & %age devoted to each area of research.

SECTION –B

INFORMATION ON R&D EXPENDITURE

1. Expenditure on R&D in millions of Rupees

Years	1999-2000	2000-2001	2001-2002 @
Revenue/ Recurring			
Capital/ Non recurring			
Total expenditure			

Sources of Funding

a. **Indian origin**			
-- Revenue/ Recurring			
-- Capital/ Non recurring			
Total Funding (2a)			
b. **Foreign origin**			
-- Revenue/ Recurring			
-- Capital/ Non recurring			
Total Funding (2b)			
Grand Total (2a+2b)			

NOTE: If you have more than one R&D unit in India, please fill the above data separately for each of such R&D unit by attaching extra sheets.
@ In the absence of actual expenditure, provide estimated expenditure.

Please do not put decimal in the boxes e.g. Rs. 201.434 millions should be given after being rounded to two decimal places in the shaded boxes as shown:

0	0	2	0	1	4	3

And Rs. 201.345 or Rs. 201.436 lakhs etc. Should be shown as

0	0	2	0	1	4	4

DEFINITIONS

1. **REVENUE/ RECURRING EXPENDITURE**

Revenue or recurring expenditure includes the cost of wages salaries and all labour costs, minor equipment expendable supplies expenditure on office and labour supplies, materials, books, journals, rent of buildings, travel and postal services.

2. **CAPITAL/ NON –RECURRING EXPENDITURE**

Expenditure on purchase of major installation, machinery and equipment, land for building, new buildings or large scale improvements, modifications and repair to buildings and fixed installations, land improvement work and other expenditure are included under capital/ nonrecurring expenditure.

SECTION –C

INFORMATION ON FULL TIME MANPOWER EMPLOYED

R&D Unit: .....
(If you have more than one R&D unit in India, please fill the data separately for each of such R&D unit by attaching extra sheets)

1. Give details of personnel employed in your organization (as on 1st April, 2002) as below :-

e.g. 203 persons should be written as:

0	2	0	3

	*Total number of employees on the pay roll of the company (I)	No. of S&T personnel employed for R&D activities (II)	Personnel employed on auxiliary activities in R&D Unit (III)	Personnel employed for administrative activities in R&D unit (IV)
1. **Male (M)**				
Indian origin				
Foreign National				
2. **Female (F)**				
Indian origin				
Foreign National				
TOTAL (1-2)				

* This will include all category of personnel employed viz. those employed in Finance, Production, Marketing, Sales, R&D etc.

DEFINITIONS

1. R&D ACTIVITIES

Research and experimental development (R&D) activities can be defined as any systematic and creative work undertaken in order to increase the stock of knowledge and the use of this knowledge to devise new applications. R&D activities include any one or more of the categories or research such as basic research, applied research and experimental development.

2. ADMINISTRATIVE ACTIVITIES

Administrative activities refer to those tasks which are clerical, secretarial, and administrative in character. For example, personnel providing services such as security, janitorial, and maintenance can be classified as administrative activities.

3. AUXILIARY ACTIVITIES

Auxiliary activities refer those tasks such as maintenance and operation of specialized R&D (or S&T) equipment and machinery, preparing materials and equipment and carrying out experiments, tests and analysis. For example the activities carried out by medical assistants, computer programmers, surveyors, draughtsmen, survey interviewers and investigators can be classified as auxiliary activities.

2. Please give the academic background of **FULL TIME** personnel employed in R&D activities **(as given in Column (I I) of Q. 1 in Section -C)**

Qualification

Field of R&D		Ph.D.	Post Graduate	Graduate	Diploma	Others	Total
Natural Sciences	M						
	F						
	T						
Agricultural Sciences	M						
	F						
	T						
Engineering & Technology	M						
	F						
	T						
Medical Sciences	M						
	F						
	T						
Pharmaceutical Sciences	M						
	F						
	T						
Social Sciences	M						
	F						
	T						

M = Male
F = Female
T = Total

SECTION –D

UTILIZATION OF FOREIGN FUNDS (R&D OUTPUT)

(If required, please attach extra sheets)

1. Give information on the number of each item** **completed in year 1999-2000.**

Sno.	Items completed**		Nos.		Please indicate broad areas
			Indian	Foreign	
1.	Patents	Applied			Indian
					Foreign
		Awarded			Indian
					Foreign

Sno	Items completed**	Nos.	Please indicate broad areas
1.	New product (s) developed		
2.	New process (es) developed		
3.	Import substitutes developed		
4.	Design prototypes developed		
5.	Papers published in Journals		
6.	Technical Reports published		
7.	Papers published in Conferences/seminars/ symposia etc.		
8.	R&D personnel deputed for conferences/ seminars/ symposia etc.		
9.	R&D personnel deputed for Training programmes		

** Products/ Systems/ Software Programmes

UTILIZATION OF FOREIGN FUNDS (R&D OUTPUT)

(If required, please attach extra sheets)

2. Give information on the number of each item** **completed in year 2000-2001.**

Sno.	Items completed**		Nos.		Please indicate broad areas
			Indian	Foreign	
1.	Patents	Applied			Indian
					Foreign
		Awarded			Indian
					Foreign

Sno	Items completed**	Nos.	Please indicate broad areas
1.	New product (s) developed		
2.	New process (es) developed		
3.	Import substitutes developed		
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5.	Papers published in Journals		
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7.	Papers published in Conferences/seminars/ symposia etc.		
8.	R&D personnel deputed for conferences/ seminars/ symposia etc.		
9.	R&D personnel deputed for Training programmes		

** Products/ Systems/ Software Programmes

UTILIZATION OF FOREIGN FUNDS (R&D OUTPUT)

(If required, please attach extra sheets)

3. Give information on the number of each item** **completed in year 2001-2002.**

Sno.	Items completed**		Nos.		Please indicate broad areas
			Indian	Foreign	
1.	Patents	Applied			Indian
					Foreign
		Awarded			Indian
					Foreign

Sno	Items completed**	Nos.	Please indicate broad areas
1.	New product (s) developed		
2.	New process (es) developed		
3.	Import substitutes developed		
4.	Design prototypes developed		
5.	Papers published in Journals		
6.	Technical Reports published		
7.	Papers published in Conferences/seminars/ symposia etc.		
8.	R&D personnel deputed for conferences/ seminars/ symposia etc.		
9.	R&D personnel deputed for Training programmes		

** Products/ Systems/ Software Programmes

SECTION –E

GENERAL

(tick mark ✔ the appropriate Box against each item)

1. Major use of R&D output

Area	(✔)	Nos.	Area	(✔)	Nos.
For Theoretical application	☐		For Opening up a new area	☐	
For Commercial & Marketing	☐		For Analytical development	☐	
For Defence purposes	☐		For Technology upgradation	☐	
For further R&D	☐		For Industrial application	☐	
For Consultancy	☐		For Societal application	☐	
For Creativity & Innovative Ideas	☐		For any other application* *(please specify)*	☐	
For Software development	☐		* _____		

2. How valuable are the following for your R&D activities?

Source of Innovation	Not Valuable	Valuable	Crucial
In-house R&D			
Out Sourced R&D			
Sales & Marketing			
Production			
Management			
Competitors			
Customers			
Suppliers			
Trade Shows			
Internet Access/ Web Search			

3. Any other comments/ views, which you may like to give :

_____

_____

_____

_____

Date : | | | | | | | | |

Place: | | | | | | | | | | | | | | | | | | | | |

Signature of the respondent

_____

Please return the filled in questionnaire to NAFEN by at the following address:

Dr. P.K. Gupta
Secretary General
National Foundation of Indian Engineers (NAFEN)
Shanti Chambers, 3rd Floor, 11/6B, Pusa Road, New Delhi-110 005 (INDIA)
Phone: +91-11- (2585) 3104/ 4212/ 0446, 25470547 Fax: +91-11- 25789399
E-mail: cstnafen@vsnl.com or cstnafen@eth.net
Web: www.nafenindia.com

B

STUDY ON STATUS OF FOREIGN PARTICIPATION IN R&D ACTIVITIES OF SELECTED ORGANISATIONS IN INDIA

2002-2003

QUESTIONNAIRE

(To be filled in by the organizations providing foreign funding for R&D activities in India)

Study Sponsored by:

GOVERNMENT OF INDIA
MINISTRY OF SCIENCE & TECHNOLOGY
DEPARTMENT OF SCIENCE & TECHNOLOGY
NATIONAL SCIENCE & TECHNOLOGY MANAGEMENT
INFORMATION SYSTEM (NSTMIS)
NEW DELHI -110 016 (INDIA)

Please read the instructions before filling the questionnaire

1. The questionnaire contains 3 sections marked A, B and C.
2. Please ensure that the number of characters/ alphabets does not exceed the number of boxes given. Wherever necessary, abbreviations may be used.
3. All alphabets should be filled in BLOCK LETTERS.
4. Please fill complete information for the items applicable to your organization. IN CASE EXACT DATA ARE NOT AVAILABLE, USE ESTIMATES.
5. Please stick to the units in which figures are asked e.g. Rs. Million should be given in Rs. Million only and not in Rs. Thousands or crores. (10 lacs equal to 1 Million)

The completed Questionnaire should be returned to

NAFEN

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Secretary General
National Foundation of Indian Engineers (NAFEN)
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Fax: +91-11- 25789399
E-mail: cstnafen@vsnl.com or cstnafen@eth.net
Web: www.nafenindia.com

SECTION –A

GENERAL INFORMATION

1	Name of the organization in India	
2	Country of origin	
3	Name of the Respondent	
4	Designation of the Respondent	
5	Communication Address	
	City	
	State	
	Pin code	
	Phone:	
	Fax:	
	E-mail	
6	Year of establishment of the organisation in India	
7	Year of commencement of foreign funds provided for R&D activities in India	
8	Main field of operations for providing foreign funding for R&D activities in India (pl. tick mark ✔)	Agriculture ☐ Automobile ☐ Chemical ☐ Biotech ☐ I.T. ☐ Pharmaceutical ☐ Power ☐ Non Conventional Energy Sources ☐
9	Major Product(s)/ Systems/ Processes/ Software Programmes for which foreign funds are provided for R&D activities in India	•

10 Gross funds provided for R&D activities (in Rupees million)

1999-2000	2000-2001	2001-2002

	Sector wise funds provided for R&D activities # (Rupees million)									
	AGRI	B.T.	PHARMA	AUTO	PW	CHE	IT	NES	Others	Total*
1999-2000										
2000-2001										
2002-2003										

Total should tally with the above gross funds

11 Nature of R&D for which foreign funds are provided :-

		Sector wise % age#							
		AGRI	B.T.	PHARMA	AUTO	PW	CHE	IT	NES
a.	Basic Research								
b.	Applied Research								
c.	Experimental Development								
d.	Consultancy								
e.	Other Activities (Pl. specify)								
	Total (100%)								

Please refer below :-

1. Agriculture	[AGRI]	2. Automobile	[AUTO]	3. Chemical	[CHE]
4. Biotech	[B.T.]	5. Information Technology	[IT]	6. Pharmaceutical	[PHARMA]
7. Power	[PW]	8. Non Conventional Energy Sources	[NES]		

12 Are you having any linkages with ?

	Indian	Foreign
Government	☐	☐
Private Organization	☐	☐
University	☐	☐
Non Governmental Organization	☐	☐
R&D Laboratory	☐	☐
Any other (Pl. specify) _____		

DEFINITIONS

1. BASIC RESEARCH
Basic research may be defined as any experimental or theoretical work undertaken primarily to acquire new knowledge of the underlying foundations of phenomena and observable facts, without any particular or specific application or use in view.

2. APPLIED RESEARCH
Applied Research may be defined as any original investigation undertaken in order to acquire new knowledge. It is, however, directed primarily towards a specific practical aim or objective.

3. EXPERIMENTAL DEVELOPMENT
Experimental development may be defined as any systematic work, drawing on existing knowledge gained from research and/ or practical experience that is directed to produce new materials, products and devices, to install new processes, systems and services, and to improve substantially those already produced or installed.

4. OTHER ACTIVITIES
Other activities would include R&D for consultancy etc.

13 Please provide information in respect of the organizations funded during 1999-2002

(If required, please attach extra sheets)

Sr.No.	Name of the organization	Amount funded in Rs. Million	Year of funding

SECTION –B

UTILIZATION OF FOREIGN FUNDS (R&D OUTPUT)

(If required, please attach extra sheets)

1. Give Information on the number of each item** completed in year 1999-2000 for which you have provided funds.

Please give sector wise details Sector _____

Sno	Items completed**		Nos.		Please indicate broad areas
			Indian	Foreign	
1.	Patents	Applied			Indian
					Foreign
		Awarded			Indian
					Foreign

Sno	Items completed**	Nos.	Please indicate broad areas
1.	New product (s) developed		
2.	New process (es) developed		
3.	Import substitutes developed		
4.	Design prototypes developed		
5.	Papers published in Journals		
	Technical Reports published		
7.	Papers published in Conferences/seminars/ symposia etc.		
8.	R&D personnel deputed for conferences/ seminars/ symposia etc.		
9.	R&D personnel deputed for Training programmes		

** Products/ Systems/ Software Programmes

#

1. Agriculture	[AGRI]	2. Automobile	[AUTO]	3. Chemical	[CHE]
4. Biotech	[B.T.]	5. Information Technology	[IT]	6. Pharmaceutical	[PHARMA]
7. Power	[PW]	8. Non Conventional Energy Sources	[NES]		

UTILIZATION OF FOREIGN FUNDS (R&D OUTPUT)

(If required, please attach extra sheets)

2. Give information on the number of each item** completed in year 2000-2001 for which you have provided funds.

Please give sector wise details

Sector _____

Sno	Items completed**		Nos.		Please indicate broad areas
			Indian	Foreign	
1.	Patents	Applied			Indian
					Foreign
		Awarded			Indian
					Foreign

Sno	Items completed**	Nos.	Please indicate broad areas
	New product (s) developed		
2.	New process (es) developed		
3.	Import substitutes developed		
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8.	R&D personnel deputed for conferences/ seminars/ symposia etc.		
9.	R&D personnel deputed for Training programmes		

** Products/ Systems/ Software Programmes

#

1. Agriculture	[AGRI]	2. Automobile	[AUTO]	3. Chemical	[CHE]
4. Biotech	[B.T.]	5. Information Technology	[IT]	6. Pharmaceutical	[PHARMA]
7. Power	[PW]	8. Non Conventional Energy Sources	[NES]		

UTILIZATION OF FOREIGN FUNDS (R&D OUTPUT)

(If required, please attach extra sheets)

3. Give information on the number of each item** completed in year 2001-2002 for which you have provided funds.

Please give sector wise details

Sector _____

Sno	Items completed**		Nos.		Please indicate broad areas
			Indian	Foreign	
1.	Patents	Applied			Indian
					Foreign
		Awarded			Indian
					Foreign

Sno	Items completed**	Nos.	Please indicate broad areas
1.	New product (s) developed		
2.	New process (es) developed		
3.	Import substitutes developed		
4.	Design prototypes developed		
5.	Papers published in Journals		
6.	Technical Reports published		
	Papers published in Conferences/seminars/ symposia etc.		
8.	R&D personnel deputed for conferences/ seminars/ symposia etc		
9.	R&D personnel deputed for Training programmes		

** Products/ Systems/ Software Programmes

#

1. Agriculture	[AGRI]	2. Automobile	[AUTO]	3. Chemical	[CHE]
4. Biotech	[B.T.]	5. Information Technology	[IT]	6. Pharmaceutical	[PHARMA]
7. Power	[PW]	8. Non Conventional Energy Sources	[NES]		

SECTION –C

GENERAL

1. Any other comments/ views, which you may like to give :

Date :

Place:

Signature of the respondent

Please return the filled in questionnaire to NAFEN by _____ at the following address:

Dr. P.K. Gupta
Secretary General
National Foundation of Indian Engineers (NAFEN)
Shanti Chambers, 3rd Floor, 11/6B, Pusa Road, New Delhi-110 005 (INDIA)
Phone: +91-11- 2585 3104/ 4212/ 0446, 25470547 Fax: +91-11- 25789399
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Web: www.nafenindia.com