Chapter III

Data Analysis & Findings

3.1 Introduction:

This chapter on analysis of the data aims to analyse the information obtained from the survey of selected R&D centres. The analysis is done in the order of and according to the research questions posed in Chapter III. Answers to these research questions are attempted with the information obtained from the responding firms.

To begin with, we first introduce the R&D centres approached for the survey and those which responded to the questionnaire. 119[1] R&D centres in different sectors were identified and 33 responded. The sector wise break up in terms of the numbers and percentages are given in Table 3.1. The following graph [Figure 3.1] is a graphical representation of the Table 3.1.

Table 3.1

Sector wise Break-up of R&D Centres participating in the Survey

Sectors	Number of centres contacted	Sector wise Percentage share of contacted R&D Centres	Number of centres for which information is available	Sector wise Percentage share of responding R&D Centres
Agriculture	12	10%	8 (of 5 companies)	21%
Automobile	12	10%	4	11%
Biotechnology & Pharmaceuticals	46	39%	16 (of 15 companies)	43.1%
Chemical	17	14%	3	8.5%
Computer Software & Hardware	24	20%	4	11%
Others	8	7%	2	5.4%
Total	119	100%	37	100%

[1] A list of these 119 R&D centers is given in Appendix I of this chapter.

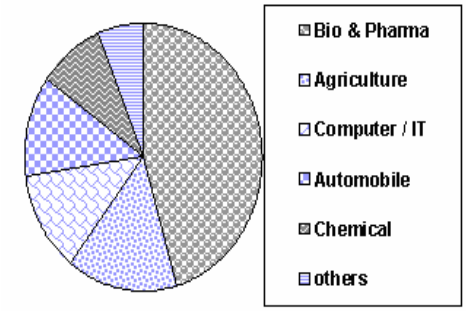

Figure: 3.1(a)

Sector wise Percentage share of R&D centres among the respondents

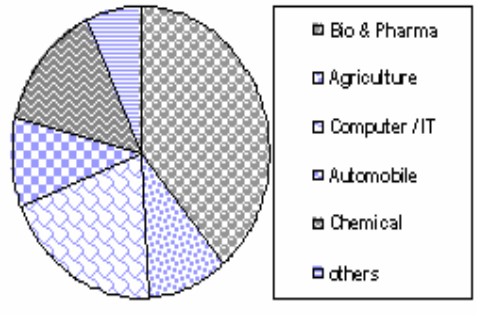

Figure: 3.1(b)

Sector wise Percentage share of R&D centres among those contacted

The names of the 33 R&D centres which participated in the survey and responded to the questionnaire are given in Table 3.2.

Table 3.2

Respondent Foreign R&D Centres

R&D Centre / Organisation in India	Parent Organisation
Agriculture	
1. Advanta India Limited	Advanta Netherlands Holdings BV
2. Monsanto Research Centre	Monsanto Company
3. Pioneer Hybrid International Seeds India Limited	Pioneer Hybrid International Seeds Limited
4. Seagram R&D Centre, Seagram India Private Limited	Pernod Richard
5. Semminis Vegetable Seeds India Limited	Seminis Incorporated
Automobile	
6. Daimler Chrysler Research Centre India	Daimler – Chrysler
7. Delphi Technical Centre India	Delphi Corporation
8. General Motors India Science Laboratory	General Motors
9. Toyota – Kirloskar Motor Private Limited	Toyota Motor Corporation
Biotechnology and Pharmaceuticals	
10. Astra Zeneca R&D	Astra Zeneca
11. Gangagen Biotechnologies Limited	Gangagen Incorporated
12. iGate Clinical Research India Limited	iGate Clinical Research International
13. Intervet India Private Limited	Intervet International BV
14. Indus Bio Sciences Private Limited	CiVentiChem
15. John F Welch Technology Centre	GE Healthcare Limited

16. Merck Development Centre Private Limited	Merck KgaA
17. Millipore India Limited, R&D	Millipore Corporation
18. Novartis India Limited	Novartis Pharmaceuticals Limited
19. Novo Nordisk India Private Limited	Novo Nordisk A/S
20. Pharma Net India Clinical Services Private Limited	Pharma Net AG
21. Pliva Research India Private Limited	Glaxo SKB
22. Quintiles India Limited	Quintiles Transnational
23. Roche Scientific Company India Limited	F. Hoffmann La Roche Limited
24. Warner Lambert Research And Development	Pfizer Incorporated
Chemical	
25. BASF India Limited	BASF – The Chemical Company
26. The Hindustan Lever Research Centre	Unilever
27. Sabic Research and Technology Private Ltd	Saudi basic Industrial Corporation
Computer Hardware and Software	
28. Lucent Technologies India Private Limited	Bell Labs, Lucent Technologies
29. IBM India Research Lab	International Business Machines Corporation
30. Texas Instruments India Private Limited	Texas Instruments
31. Xilinx India Limited	Xilinx Incorporated
Others	
32. Sandvik Asia Limited	Sandvik AB
33. Sanyo LSI Technology India Private limited	Sanyo Electronics Company limited

3.2 Research Questions:

3.2.1 Location Characteristics

The Location / Address of the R&D centres are given in Table 3.3. These centres are concentrated in 7 cities in India, namely Bangalore, Hyderabad, Delhi (National Capital Region), Mumbai, Pune and Aurangabad. Apart from these 7 cities Vadodara and Karnool hosts one R&D centre each from our set of 33 R&D organisations.

Table 3.3

Location of 33 R&D Centres

Agriculture		
R&D Centre / Organisation in India	**Address in India**	**City**
1. Advanta India Limited	405, 4th Floor 'A' Wing Carlton Towers ,No 1 Airport Road Bangalore 560008	Bangalore
2. Monsanto Research Centre	44/2A, Vasant business Park, NH-7, Bellary Road, Hebbal, Bangalore	Bangalore
3. Pioneer Hybrid International Seeds India Limited	3rd Floor Baba Khan's Millenium Centre, Raj Bhawan Road, Somaji Guda, Hyderabad	Hyderabad
4. Seagram R&D Centre, Seagram India Private Limited	Tower A, 5th Floor, Global Business Park, Mehrauli Gurgaon Road , Gurgaon - 122002	Gurgaon (Delhi –NCR)
5. Seminis Vegetable Seeds India Limited	24 Chite Gaon, Paithan Road, Aurangabad 431105	Aurangabed

Automobile		
R&D Centre / Organisation in India	**Address in India**	**City**
1. Daimler Chrysler Research Centre India	Daimler Benz house, 137 Infantry Road, Bangalore 560001	Bangalore
2. Delphi Technical Centre India	5th Floor, Innovative Building, International Tech Perk, Whitefield Road, Bangalore -560066	Bangalore
3. General Motors India Science Laboratory	Units 4-8, 3rd Floor, Creator Building, International Tech Park. Whitefield Road. Bangalore -560066	Bangalore
4. Toyota – Kirloskar Motor Private Limited	Plot No- 1, Bidadi Industrial Area, Ram Nagar Taluk, Bangalore 562109	Bangalore

Biotechnology and Pharmaceuticals		
R&D Centre / Organisation in India	**Address in India**	**City**
1. Astra Zeneca R&D	Bellary Road, Hebbal, Bangalore – 560024	Bangalore
2. Gangagen Biotechnologies Limited	5 AC, 705 II Block, Hennur Road, Banaswadi Layout, Bangalore 560043	Bangalore
3. iGate Clinical Research India Limited	iGate Clinical Research International Private Limited; 101-102, Alpha, Hiranandani Gardens, Powai, Mumbai – 400 076	Mumbai
4. Intervet India Private Limited	Intervet House; Behind Eden Gardens, 33 Nagar Road, Pune – 411014	Pune

5. Indus Bio Sciences Private Limited	Plot Number 148 - 150, 1st Floor, IDA mallapur, Hyderabad - 500076	Hyderabad
6. John F Welch Technology Centre	Plot No -122, Export Promotion Industrial Park, Phase II, Hoodi Villege, Whitefield Road, Bangalore- 560066	Bangalore
7. Merck Development Centre Private Limited	1A, 2, MIDC; TALOJA; PANVEL Dist Raigad, Panvel – 410218	Mumbai
8. Millipore India Limited, R&D	50A, Phase II, Ring Road, Peenya, Bangalore -560056	Bangalore
9. Novartis India Limited	Novartis India Limited, Pharmaceuticals Division, 6th floor Royal Insurance building, 14J Tata Road Mumbai 400020	Mumbai
10. Novo Nordisk India Private Limited	8th Floor; Raheja Towers; 26/27, M. G. Road; Bangalore	Bangalore
11. PharmaNet India Clinical Services Private Limited	Unit 1101, Level II; Millenia Tower B; 1 & 2 Murphy Road, Ulsoor, Bangalore -560008	Bangalore
12. Pliva Research India Private Limited	S2 & S3 Madhura Classic, Corlim, Tiswadi, Goa-403 110	Goa
13. Quintiles India Limited	1) Quintiles Research (India) Private Limited; 2B, Nitesh Broad way, 9/3. M. G. Road; Bangalore 560001 (2) 851 Solitaire Corporate Park; 167, Guru Hargovinji Marg, Chakala, Andheri Mumbai -400093	Bangalore, Mumbai
14. Roche Scientific Company India Limited	1st Floor, B/2 Amarchand Mansion, Madam Cama Road, Mumbai -400039	Mumbai
15. Warner Lambert Research And Development	Warner Lambert India Private Limited; Pfizer Centre; Patel East; S. V. Road; Jogeshwari (West); Mumbai- 400102	Mumbai

Chemical		
R&D Centre / Organisation in India	**Address in India**	**City**
1. BASF India Limited	Thane site, Thane Belapur Road, Trans thane Creek Area, Thurbe, Thane, Mumbai 400705	Mumbai
2. The Hindustan Lever Research Centre	Hindustan Lever House; 165/166, Backbay Reclamation; Mumbai - 400020	Mumbai
3. Sabic Research and Technology Private limited	Plot No 5/6, Savli GIDC Estate, Savli - Vadodara High Way, Vadodara	Vadodara

Computer Hardware and Software		
R&D Centre / Organisation in India	**Address in India**	**City**
1. Lucent Technologies India Private	Lucent Technologies India Private Limited; Bell Labs Innovations, Golf View Campus, Bangalore 560017	Bangalore
2. IBM India Research Lab	Block 1, IIT Campus, Hauz Khas, New Delhi 110016	New Delhi
3. Texas Instruments India Private Limited	Bagmane Tech Park, # 66/3 Byrasandra, C V Raman Nagar, Bangalore 560093	Bangalore
4. Xilinx India Limited	21, 7th Main, 1st Block Koramangala, Bangalore India 560034	Bangalore

Others		
R&D Centre / Organisation in India	**Address in India**	**City**
1. Sandvik Asia Limited	Mumbai- Pune Road,Dapodi Pune - 411012	Pune
2. Sanyo LSI Technology India Private limited	Unit 03, Level 08, Discover Block, International Tech Park, White Field Road, Bangalore 560066	Bangalore

i. Concentration of Foreign R&D Centres in India

Table 3.4(a) shows sector wise concentration of R&D centres in different states of India. From the above table, it is evident that Karnataka, and more precisely Bangalore hosts a largest concentration of R&D centres among our sample of 37 R&D centres belonging to 33 organisations. This concentration is highest in the Automobile sector with all 4 Automobile R&D centres being situated in Bangalore. In IT sector and "others" sector, 50% of the firms are situated in Delhi.

Table 3.4(a)
Sector wise concentration (in absolute numbers) of 37 R&D centres (of 33 organisations) in different states of India

	Total number of R&D Centres	**IT**	**Bio & Pharma**	**Agri-culture**	**Chem-ical**	**Auto-mobile**	**Others**
Karnataka	**16**	**2**	**7**	**2**	**0**	**4**	**1**
Bangalore	**16**	**2**	**7**	**2**	**0**	**4**	**1**
Maharashtra	**13**	**0**	**8**	**2**	**2**	**0**	**1**
Mumbai	**8**	**0**	**6**	**0**	**2**	**0**	**0**
Pune	**2**	**0**	**1**	**0**	**0**	**0**	**1**
Aurangabad	**2**	**0**	**0**	**2**	**0**	**0**	**0**
Goa	**1**	**0**	**1**	**0**	**0**	**0**	**0**

Andhra Pradesh	**5**	**1**	**1**	**3**	**0**	**0**	**0**
Karnool	**1**	**0**	**0**	**1**	**0**	**0**	**0**
Hyderabad	**4**	**1**	**1**	**2**	**0**	**0**	**0**
Delhi/NCR	**2**	**1**	**0**	**1**	**0**	**0**	**0**
Delhi	**2**	**1**	**0**	**1**	**0**	**0**	**0**
Gujrat	**1**	**0**	**0**	**0**	**1**	**0**	**0**
Vadodara	**1**	**0**	**0**	**0**	**1**	**0**	**0**
TOTAL	**37**	**4**	**16**	**8**	**3**	**4**	**2**

The 33 organisations in our sample have R&D centres in various other countries other than India. A look at the locations of the R&D centres may through some light on the importance of India as a R&D destination. Table 3.4(b) shows the locations of R&D centres, of the 33 organisations, situated outside India.

Table 3.4 (b)
Locations of R&D Centres Situated outside India

Agriculture			
Country of origin	**R&D Centre / Organisation in India**	**Location outside India**	
		Developed Countries	**Developing Countries**
Advanta Netherlands Holdings BV Netherlands	1. Advanta India Limited	Australia	Argentina, Chile, China, Thailand
Monsanto Company USA	2. Monsanto Research Centre	Australia, Austria, Belgium, Bulgaria, Canada, Croatia, Czech Rep. Denmark, France, Germany, Greece, Hungary, Italy, Japan, Poland, Romania, Russia, Slovakia, South Africa, Spain, Turkey, Ukraine, UK, USA	Argentina, Brazil, Chile, China, Columbia, Ecuador, Hong Kong, Indonesia, Kenya, Korea, Malawi, Malaysia, Mexico, Pakistan, Philippines, Senegal, Singapore, Taiwan, Tanzania, Thailand, Vietnam
Pioneer Hybrid International Seeds Limited USA	3. Pioneer Hybrid International Seeds India Limited	Austria, Australia, Japan, New Zealand, Canada, Czeck Republic, Dominian Republic, South Africa, Hungary, Turkey, Spain etc.	Indonesia, Pakistan, Chili, Phillipins, China, Thailand, Colombia, Egypt, Etheopia, Zimbabwe.
Pernod Richard France	4. Seagram R&D Centre, Seagram India Pvt Limited	Creteil Cedex, France	----
Seminis Incorporated USA	5. Semminis Vegetable Seeds India Limited	52 R&D Centres in 17 Countries	

Automobile			
Country of origin	**R&D Centre / Organisation in India**	**Location outside India**	
		Developed Countries	**Developing Countries**
Daimler – Chrysler Germany	1. Daimler Chrysler Research Centre India	Sacramento, USA	----
Delphi Corporation USA	2. Delphi Technical Centre India	Japan	Korea, Singapore
General Motors USA	3. General Motors India Science Laboratory	South East Michigan, USA	----
Toyota Motor Corporation Japan	4. Toyota – Kirloskar Motor Private Limited	California, USA	----

Biotechnology and Pharmaceuticals			
Country of origin	**R&D Centre / Organisation in India**	**Location outside India**	
		Developed Countries	**Developing Countries**
Astra Zeneca United Kingdom	1. Astra Zeneca R&D	Sweden, USA, Japan, Canada, France, UK	----
Gangagen Incorporated USA	2. Gangagen Biotechnologies Limited	Ontario - USA	----
iGate Clinical Research International USA	3. iGate Clinical Research India Limited	Pittsburg USA	----
Intervet International BV Holland	4. Intervet India Private Limited	USA (2), Germany (2), Netherlands, England, Norway, South Africa, Japan, Australia	Brazil, Singapore
CiVentiChem USA	5. Indus Bio Sciences Private Limited	(***CiventiChem***) North Carolina, USA	**----**
GE Healthcare Limited USA	6. John F Welch Technology Centre	Niskayuna - New York (US), Munich (Germany)	Sanghai (China)
Merck KgaA Germany	7. Merck Development Centre Private Limited	Boston (USA), Montreal (Canada), Essex (UK), Hoddesdon Herts (UK), Tokyo (Japan)	----
Millipore Corporation USA	8. R&D, Millipore India Limited	----	----
Novartis Pharmaceuticals Limited Switzerland	9. Novartis India Limited	New Jersey, Cambridge (Boston) Horsham (London), Basel (2) - Switverland, La Jolla -	Singapore

		California, Vienna, Japan	
Novo Nordisk Denmark	10. Novo Nordisk India Private Limited	Denmark	----
A/S PharmaNet Switzetrland	11. PharmaNet India Clinical Services Private Limited	US (8), Germany (2), Canada, Netherlands, UK, Spain, Russia, France, Sweden, Australia, Poland	Argentina
AG Glaxo SKB Croatia	12. Pliva Research India Private Limited	USA (New Jersey-),Spain (Madrid), UK (Hampshire), Netherlands (Amsterdam), Germany (Dresden), Switzerland (Zug), Italy (Milan), Czech Republic (Brno, Prague), Poland (Krakow), Russia (Moscow), Belarus, Lithuania, Latvia, Romania, Slovenia, Herzegovina	China (Beiging), Kazakstan, Ukraine
Quintiles Transnational USA	13. Quintiles India Limited	Canada, USA, South Africa, , Australia, Bulgaria, Czech Rep., Estonia, France, Greece, Ireland, Italy, Lithuania, Portugal, Russia, Spain, Switzerland, Turkey, UK, Belgium, Croatia, Denmark, Finland, Germany, Hungary, Israel, Latvia, Poland, Romania, Slovakia, Sweden, Netherlands, Ukraine.	
F. Hoffmann La Roche Limited Switzerland	14. Roche Scientific Company India Limited	Basel, Switzerland	----
Pfizer Incorporated USA	15. Warner Lambert Research And Development	***(PFIZER***) Toronto (Canada), Amboise (Franco), Nagoya (Japan), Tokyo (Japan), Sandwich (England), Michigan(USA), La Jolla – California (USA), New London & Groton – Connecticut (USA), Cambridge – Massachusetts (USA)	----

Chemical			
Country of origin	**R&D Centre / Organisation in India**	**Location outside India**	
		Developed Countries	**Developing Countries**
BASF – The Chemical Company USA	1. BASF India Limited	USA (8), Canada (2)	----
Unilever UK	2. The Hindustan Lever Research Centre	Port Sunlight, UK and many other around the world	
Saudi basic Industrial Corporation Saudi Arabia	3. Sabic Research and Technology Private limited	Texas - USA	Riyadh - Saudi Arabia

Computer Hardware and Software			
Country of origin	**R&D Centre / Organisation in India**	**Location outside India**	
		Developed Countries	**Developing Countries**
Bell Labs, Lucent Technologies USA	1. Bell Labs Research India	USA, Ireland,	China
International Business Machines Corporation USA	2. IBM India Research Lab	North America (3), Zurich-Switzerland, Haifa - Israel, Tokyo - Japan	Beiging - China
Texas Instruments USA	3. Texas Instruments India Private Limited	USA, Europe, Japan, Spain	Brazil, , China, Korea, Taiwan,
Xilinx Incorporated USA	4. Xilinx India Limited	Japan, Ireland, UK, Colorado in USA,	New Mexico, Singapore, Hong Kong

Others			
Country of origin	**R&D Centre / Organisation in India**	**Location outside India**	
		Developed Countries	**Developing Countries**
Sandvik AB Sweden	1. Sandvik Asia Limited	Sandviken, Sweeden	----
Sanyo Electronics Company limited Japan	2. Sanyo LSI Technology India Private limited	Germany, Japan, USA (California, New Jersey, Chicago)	China (Hong Kong, Shen Zhen, Sanghai, Qiangdao), Taipei, Phillipins, Malaysia, Singapore

An inspection of the Table 3.4(b) reveals the following:

1. The 28 countries that host R&D centres of organisations belonging to our sample are Brazil, China, Korea, Taiwan, New Mexico, Singapore, Hong Kong, Argentina, Chile, Peru, Mexico, Colombia, Ecuador, Indonesia, Kenya, Malawi, Malaysia, Pakistan, Philippines, Senegal, Tanzania, Thailand, Vietnam, Egypt, Ethiopia, Zimbabwe, Saudi Arabia, and Taipei. Among these countries China hosts 10 R&D centres of 8 organisations. Singapore hosts 6, Argentina, Brazil, Chile each hosts 4 and Korea, HK, Philippines, Thailand each hosts 3 R&D centres.

2. In case of the Biotechnology and Pharmaceutical Sector with 9 out of 15 companies choosing India as the only developing country R&D destination.

ii. Why was India chosen as a destination for setting up an R&D centre?

As for the reasons for setting up the R&D centre in India, the plausible reasons given were (a) political and social stability of India relative to the home country of the parent firm; (b) Availability of skilled manpower in India at an economical rate; (c) Proximity to the Indian market; (d) to avail Science & Technology infrastructure available in India; (e) Policy of the government of India that had been conducive to the establishment of the R&D centres in India, and the respondents were asked to choose the most important of the reason(s) applicable in their case. A further option of “any other reasons” was also included so as to bring out and accommodate the possibility of one or more additional reason for such establishment. Table 3.5 shows the reasons for choosing India as a R&D destination as reported by the 33 organisations in our sample.

Table 3.5

Primary Reasons for Choosing India as a R&D Destination

Biotechnology and Pharmaceutical Sector						
Name of the Company	Availability of skilled manpower	Proximity to Indian Market	To avail existing S&T infrastructure	Conducive govt. policy	Any other reason	Political and social stability
Astra Zeneca	■		■			
Gangagen					■	
iGate	■		■	■	■	
Intervet	■					
Indus Bio	■		■			
John F Welch	■			■		
Merck			■	■		
Millipore	■	■	■			
Novartis	■		■	■		
Novo Nordisk	■		■			
PharmaNet	■					
Pliva	■	■				
Quintiles	■	■	■	■	■	
Roche		■				
Warner Lambert		■		■		
Percentage of companies citing the reason	73%	33%	53%	40%	20%	0%

Agriculture						
Name of the Company	Availability of skilled manpower	Proximity to Indian Market	To avail existing S&T infrastructure	Conducive govt. policy	Any other reason	Political and social stability
Advanta	■	■	■	■		
Monsanto	■	■				
Pioneer	■	■				
Seagram	■	■				
Seminis		■				
Percentage of companies citing the reason	80%	100%	20%	20%	0%	0%

Computer Hardware and Software						
Name of the Company	Availability of skilled manpower	Proximity to Indian Market	To avail existing S&T infrastructure	Conducive govt. policy	Any other reason	Political and social stability
Bell Labs						
IBM						
Texas Instru.						
Xilinx						
Percentage of companies citing the reason	100%	75%	50%	0%	0%	0%

Chemical						
Name of the Company	Availability of skilled manpower	Proximity to Indian Market	To avail existing S&T infrastructure	Conducive govt. policy	Any other reason	Political and social stability
BASF						
Hindu. Lever						
SABIC						
Percentage of companies citing the reason	0%	100%	0%	0%	0%	0%

Automobile						
Name of the Company	Availability of skilled manpower	Proximity to Indian Market	To avail existing S&T infrastructure	Conducive govt. policy	Any other reason	Political and social stability
Daimler						
Delphi						
General Motors						
Toyota						
Percentage of companies citing the reason	100%	100%	0%	0%	0%	0%

Others						
Name of the Company	**Availability of skilled manpower**	**Proximity to Indian Market**	**To avail existing S&T infrastructure**	**Conducive govt. policy**	**Any other reason**	**Political and social stability**
Sanyo						
Sandvik						
Percentage of companies citing the reason	**100%**	**100%**	**50%**	**0%**	**0%**	**0%**
Percentage of companies citing the reason (all sectors)	**75%**	**67%**	**36%**	**21%**	**9%**	**0%**

[Notes:

1. "Conducive government policy" include –

(i) Commitment to the WTO TRIPS agreement

(ii) Indian Patent Law recognizing process patent since 1970

(iii) New Patent Bill 2005 encouraging CROs

(iv) Policy on Seed (December 1988) by GOI opening entry for research based MRTP / FERA companies of the seed sector

(v) Tax exemption on R&D expenses up to 150% in Agro-technology

2. Other reasons they Sited were-

(i) Well established corporate infrastructure

(ii) Growth in health and insurance sector

(iii) English speaking investigators

(iv) Huge literate patient base with commercially significant diseases (asthma, diabetes, HIV, Epilepsy, cancer, cardiac problems, Alzheimer disease, Hypertension, Schizophrenia)

(v) Heterogeneous population mix

(vi) Good patient compliance / retention

(vii) Less expensive clinical trials]

3.2. 2 Research Characteristics

AGRICULTURAL SECTOR

1 **Advanta India Limited**						
Area of Specialisation	Agriculture – superior hybrid seeds or crops of national importance					
Year of Establishment	1994					
Objective of the R&D centre	To provide research support to (1) the Indian unit and (2) to the R&D of the parent organisation.					
Major ongoing Projects	1. Development of suitable hybrid rice for southern imported paddy 2. Development of '00' quality suitable hybrid of Mustard, Brassica Juncea 3. Development of a CMS based hydrogenated system to develop hybrid of wheat 4. Development of moisture tolerant hybrid of sunflower 5. Development of coastal agro-eco system 6. Development of Superior hybrid of sorghum and pearl mullet					
Linkages and affiliations	1. Collaborative research and testing with Government of India – (1) Indian Council of Agricultural Research (ICAR), (2) DORR, Hyderabad, (3) DOR, Hyderabad. 2. Collaborative Research with private organisations in India – (1) Avesthagen (2) Discover (3) ITPC (4) Whitefield, Bangalore 3. Non Governmental Organisations India – ICRISAT, Hyderabad 4. Non Governmental Organisations International – CIMMYAT, IRRI Bangkojk and Phillipins 5. University of Mysore, University of Agricultural Sciences, Dharwan, Karnataka.					
R&D Expenditure	Year	Capital	Recurring	Total (in Rs. Lakhs)		
	2004-5	56.97	75.65	132.62		
	2003-4	41.94	57.40	99.34		
	2002-3	117.69	53.48	171.17		
	Total	216.60	186.53	403.13		
Employment		2005	2004	2003	2002	2001
	Doctoral level	5	6	6	6	6
	Master Degree	20	20	20	20	20
	Bachelors	10	9	9	9	9
	Technicians	2	2	2		
	Totals	37	37	37	35	35
Training Programs and courses	30 weeks course on Method of Plant Breeding at University of Agricultural Science, Bangalore Number of Participants – 1 Qualification – Ph. D. equivalent					

Infrastructural Facilities	Agricultural Research Station – Bangalore – 40 acres, Hyderabad – 22 acres, Aurangabad – 12 acres D4 lab – Bangalore Quality Lab - Karnool
Major Technologies Developed and Commercialised	1994-96: Development and commercialisation of moisture tolerant hybrid of sunflower for the drought prone areas of North Karnataka, Rayalseena – Andhra Pradesh, Marathwada region of Maharashtra 1998-2000: Development and commercialisation of hybrid rice for the impoverished coastal eco system of West Bengal, Bihar, Jharkhand, Chatisgarh and Orissa. 1999-2004: Development and commercialisation of 00 quality Brassica Hydla hybrids for the crop diversification programme of the government of Punjab.

2 **Monsanto Research Centre**	
Area of Specialisation	Agricultural Biotechnology – high yield crop varieties, hybrid crops such as corn, sunflower, cotton
Year of Establishment	March 1998
Objective of the R&D centre	To provide research support to the (1) R&D and (2) manufacturing unit of the parent organisation.
Employment	Over 50 scientists supported by consultants and software programmers
Major Technologies Developed and Commercialised	**Developed** 1. The first high lysine corn products that improve nutritional value of animal feed 2. improved soy beans and canola for healthier oils and proteins with low linolenic soy beans 3. increasing omega 3 content of soy bean oil (2003) 4. Ballgard Hybrid cotton seeds 5. pipe line includes crop plants with improved tolerance on environmental stress such as cold, drought, disease resistance, nitrogen efficiency **Commercialised** Maharashtra Hybrid (MAYCO) Seeds co. Ltd received regulatory approvals in March 2002. Mahyco Monsanto Biotech India Limited sold 72,000 acres of the approved ballgard hybrid cotton seeds in 2002, 230000 acres in 2003 and 2004 in 1.3 million. Ball gard was planted by 35000 farmers

3 **Pioneer Hybrid International Seeds India Limited**	
Area of Specialisation	Agriculture – crop genetics
Year of Establishment	1970

Objective of the R&D centre	To provide research support to the R&D and the manufacturing unit of the parent organisation
Major ongoing Projects	1. **Corn** / **Maize** – (1) develop hybrid with more than 5% yield performance advantage, (2) reduce crop losses, grower inputs costs and risk through genetically engineering insect, disease and herbicide resistance (3) create more value and new uses 2. **Pearl Mullet** – (1) Germ-plasm enhancement, (2) Inbred development and hybrid evaluation for yield stability and disease resistance. 3. **Rice** – (1) hybrid rice breeding in India since 1988 in Hyderabad with principal targets as yielding in predominantly irrigated regions of India. (2) Food quality enhancement, (3) strengthening of straw and (3) disease resistance. 4. **Sorghum** – (1) develop product and improve harvestable yield. (2) Incorporate getic traits to reduce crop losses disease, insects, lodging, drought and stress. (3) Improve grain quality. 5. **Sunflower** – (1) Improve harvestable yield. (2) Shorten product development cycle time. (3) Maintain competitive oil percentage advantage. (4) Incorporate disease and pest resistance as required by specific markets. (5) Value added oil profiles.
Major Technologies Developed	1. Hybrid Corn / Maize 2. Pearl Mullet 3. Hybrid rice 4. Improved harvestable Sorghum 5. Improved harvestable Sunflower

4 **Seagram R&D Centre, Seagram India Private Limited**	
Area of Specialisation	Product development, improvement of process and quality - Alcoholic Beverage
Year of Establishment	1997
Objective of the R&D centre	1. To provide support to the (1) manufacturing unit and (2) R&D unit of the parent organisation. 2. Optimizing quality of the product, processes and by products. Overseeing the quality systems advocated by Pernod Ricard. 3. Technical support to pan India units specially in terms of analytical techniques, microbiological techniques and consumer complaints investigation 4. Conducts pan India audits at manufacturing locations and distributors' warehouses to audit the quality of cased goods.
Major ongoing Projects	**PROCESSES:** 1. Standardising the fermentation proscess using alternate raw materials like Rice, Wheat, Bajra etc. 2. **Origin of alcohol project-** A collaborative programme with CRPR, Creteil, France to establish the botanical origin of alcohol. The database once developed would help identify alcohol from different botanical and geographical regions.

	3. **Contaminant Status**- To develop the contaminant status especially with respect to Aflatoxin levels in our raw materials (Sorghum) and by-poducts (DDGS) 4. **Pesticide Residue Analysis-** A third party analyses of our products for establishing PR levels. 5. **Bioconversion of fusel oil for flavour production-** A project in collaboration with NCL and sponsored by DBT. 6. **Shelf Life Extension and Alternate use of DDGS-** by product of alcohol industry DDGS is a product with high nutrition and calorific value. The centre is trying to develop • A new process for protease production using distillery by products like DDGS (Distillers Dried Grain and Soluble), syrup etc. • A new process for cellulose production using Distillery by products like DDGS, syrup etc. 7. **GC – FID Fingerprinting-** A project for mapping various brands of liquor by Seagram India across locations for consistency of products. 8. Develop wet cake as an alternative to DDGS. 9. Develop process for production of poultry probiotics using distillery waste. 10. Develop a lab scale process for Bioconversion of fusel oil for production of flavouring compounds utilising commercial lipases **SYSTEMS:** Implementation of integrated risk management system 1. ISO 9001:2000 2. ISO 14001:2004 3. OHSAS 4. HACCP
Linkages and affiliations	**Government of India –** 1. Department of Biotechnology DBT 2. National Chemical Laboratory NCL 3. Department of Scientific and Industrial Research DSIR 4. National Research Centre for Sorghum NRCS 5. International Crop Research Institute for Semi – Arid Tropics ICRISAT 6. State Excise Department 7. State Police **Private Organisations- India** 1. Testing Laboratories – Vimta Labs 2. Certification bodies – Det Norske Veritas (DNV), BVQI **Private Organisations- International** 1. Testing Laboratories – RSSL 2. Certification Bodies - Det Norske Veritas (DNV) **R&D Laboratory – International** 1. CRPR, Paris (Parent organosation) **University- India** 1. Vasant Dada Sagar University, Pune
R&D Expenditure	2002-3 : Rs. 23.68 Lakhs 2003-4: Rs. 23.10 Lakhs 2004-5: Rs. 15.93 Lakhs

<table>
<tr><td></td><td colspan="3">Total : Rs. 62.71 Lakhs</td></tr>
<tr><td>Employment</td><td colspan="3">2005 – Doctoral Level – 1, Masters Level – 3
2004 – Doctoral Level – 2, Masters Level – 3
2003 – Doctoral Level – 2, Masters Level – 2
2002 – Doctoral Level – 2, Masters Level – 1
2001 – Doctoral Level – 4, Masters Level – 2, Bachelors Level - 1</td></tr>
<tr><td rowspan="13">Training Programs and courses</td><td>Programmes</td><td>Number of participants</td><td>Qualification prior to training</td></tr>
<tr><td colspan="3">Abroad</td></tr>
<tr><td>Training on Qality Management Systems Development at CRPR, Paris. Total 3 Visits</td><td>1</td><td>Ph. D</td></tr>
<tr><td>Wine Training at Georgia (Earlier CIS State) for a period of 15 days</td><td>2</td><td>Ph. D and M. Sc.</td></tr>
<tr><td colspan="3">India</td></tr>
<tr><td>Lead Auditor Course (HACCP) from Det Norkse Veritas (DNV) a leading certification body world wide</td><td>2</td><td>Ph. D</td></tr>
<tr><td>Lead Auditor Course for ISO 14001</td><td>0</td><td>Nil</td></tr>
<tr><td>Lead Auditor Course for ISO 9001</td><td>1</td><td>Ph. D</td></tr>
<tr><td>Lead Auditor Course for ISO 14001</td><td>0</td><td>Nil</td></tr>
<tr><td>Internal Auditor Course from DNV</td><td>15</td><td>M. Sc, B. Sc, and SSC.</td></tr>
<tr><td>Enterprise Excellence through Six Sigma Management at IIT Mumbai</td><td>2</td><td>M. Sc.</td></tr>
<tr><td>Advanced Courses on fermentation technology – “Trends in Fermetation, Recovery and Purification of Molecules” at IMTECH, Chandigarh for a period of 15 days</td><td>2</td><td>M. Sc. & Ph. D.</td></tr>
<tr><td>Training on Gas Chromatography Application at Perkin Elmer</td><td>3</td><td>Ph. D. & M. Sc.</td></tr>
<tr><td>Infrastructural Facilities</td><td colspan="3">Complete facilities for carrying out basic as well as applied research in Fermentation Technology and allied fields.
Analytical Equipments like:
1. Gas Chromatograph with FID Detector (Perkin Elmer)
2. High Performance Liquid Chromatograph (Perkin Elmer) with UV – Vis detector and RI detector
3. Head Space Analyses (Perkin Elmer)
4. Rotary Evaporator (Buchi)
5. Glucose Analyser (Beckman)
6. Protein Analyser (Kjeltec)
7. Spectrophotometer (Hitachi)
8. Millipore Q Water Treatment System
9. Centrifuges (High speed, refrigerated, table top and Micro)
10. Colorimeter (Merck SQ 118)
11. Analytical Balances (Denver Instruments)
12. pH meter
13. Turbidity meter
A complete set up to carry out various simple and complex chemical analyses.</td></tr>
</table>

	Fermentation: 1. A 12 Litre capacity pilot fermentor which can be programmed as per the requirement. The state of art fermentor can be used to stimulate plant trails at lab / pilot scale. **Microbiological** A complete set up of microbiology to support our research work as well as support the manufacturing process requirement at the plant. 1. Laminar Air Flow 2. Autoclave 3. Incubators 4. Microscope (Olympus) **Testing Equipments like:** 1. Bursting Strength Tester 2. GSM Tester 3. Torque Tester for caps 4. Polariscope (for glass bottles) 5. Cobb tester (for Kraft paper) Facility to conduct basic tests on Packaging material.
Services offered	Training – Internal staff at factory level Collaborative Research – Pernod Ricard Group/National Chemical Laboraory/DSIR
Major Technologies Developed and Commercialised	1999 – A new process for protease production using DDGS, Syrup etc. 1999 – A new process for cellulose production using DDGS, Syrup etc. 2000 – process for production of pro-biotics using distillery by products like distillers solubles 2005 – A lab scale process of Bio conversion of Fusel oil to produce flavour components (Alcohol Acetates) by using commercial lipases.

Patents

Patent Number	Year	Title	Filed / Granted	Country
Indian Patent Application number 1009 / Del / 99	1999	A new process for protease production	Filed	India
Indian Patent Application number 844 / Del / 99	1999	A new process form cellulose production	Filed	India
Indian Patent Application number 80 / Del / 99	2000	A novel process for production of pro-biotic formulations	Filed	India

5 **Seminis Vegetable Seeds India Limited**	
Area of Specialisation	Agriculture – Plant breeding, Germ plasm development, pathology, vegetable quality research, biotechnology
Year of Establishment	1998
Objective of the R&D centre	To provide research support to the R&D of the parent organisation
Linkages and affiliations	Seminis World wide technology alliances with more than 100 public and private organisations including John Innes Institute (UK)

<table>
<tr><td></td><td colspan="6">Plant Research International (Netherlands)
Seoul National University (Korea)
Texas A & M (USA)
University of California, Davis (USA)
University of Florida (USA)
University of Wiskonsin (USA)</td></tr>
<tr><td>R&D Expenditure</td><td colspan="6">In 2002-3 - Rs. 165 Lakhs
In 2003-4 - Rs. 220 Lakhs
In 2004-5 - Rs. 265 Lakhs
Total – Rs 650 Lakhs</td></tr>
<tr><td rowspan="6">Employment</td><td>Qualification levels (Scientists and Engineers)</td><td>2005</td><td>2004</td><td>2003</td><td>2002</td><td>2001</td></tr>
<tr><td>Doctoral Degree</td><td>2</td><td>2</td><td>2</td><td>2</td><td>2</td></tr>
<tr><td>Master Degree</td><td>15</td><td>10</td><td>10</td><td>8</td><td>7</td></tr>
<tr><td>Bachelors</td><td>8</td><td>9</td><td>8</td><td>7</td><td>6</td></tr>
<tr><td>Technicians</td><td>1</td><td>2</td><td>2</td><td>2</td><td>9</td></tr>
<tr><td>Others</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>Major Technologies Developed and Commercialised</td><td colspan="6">1. Cosmopolitan Letuce
2. An ultra sweet charentais / cantaloupe hybrid
3. Blue mountain select
4. scarlet sweet corn
5. cancer fighting Broccoli
6. Mini personal water melon
7. the carrot that changed everything
8. the no heat hot-pepper
9. a virus protected squash
In 2001 – 10 improved varieties in Okra, Gourds, Eggplant and Onion were released for cultivation in India.
In 2002 – six improved varieties of Gourds, eggplant were released for cultivation in India
In 2003 - . six improved varieties of Gourds, eggplant, okra and onion were released for cultivation in India
In 2004 – nine improved varieties of coriander, palak, gourds, onion and eggplant were released for cultivation in India
In 2005 – five improved varieties of gourds and eggplant were released for cultivation in India</td></tr>
<tr><td>Training programmes</td><td colspan="6">1. Annual training program conducted in 2001; 15 participants; minimum qualification – bachelor degree
2. Training program on training conducted in 2002; 6 participants; minimum qualification – bachelor degree
3. Training program on product design conducted in 2004; 9 participants; minimum qualification – master degree
4. Training program on product development conducted in 2005; 30 participants; minimum qualification – bachelor degree</td></tr>
<tr><td>Infrastructural facilities</td><td colspan="6">1. Research station with 78 acres land at Aurangabad
2. Plant Pathology laboratory at Aurangabad
3. training stations at five locations</td></tr>
<tr><td>Patents</td><td colspan="6">Seminis owns, co-owns or has pending more than 140 patents. Also has more than 700 plant variety protection certificates issued or pending. Seminis India has not filed any patent so far.</td></tr>
</table>

AUTOMOBILE SECTOR

1 **Daimler Chrysler Research Centre India**	
Area of Specialisation	Automobile Technology
Year of Establishment	1996
Objective of the R&D centre	1. To perform research on a contract basis for organisations world wide. 2. Providing Techno support to Daimler Chrysler business units and related companies such as Mercedes Benz Passenger Cars, the technical computing centre in Alburn Hills, Evo Bus, Information Technology Management, Airbus, Exellsis. 3. To provide research support to the R&D of the parent organisation.
Major ongoing Projects / Core competency areas	1. Basic and applied research in area such as encryption image/ single processing and telematics (in collaboration with the other Daimler Chrysler Research Labs). 2. Engineering services in the areas of fine element modelling, CAD / CAM/ CAE and PDM 3. Software engineering and development using established and leading edge technologies (C++, J2EE, Websphere, Lotus Notes) 4. Management of Indian supplier outsourcing projects.
Major Technologies Developed	1. Encryption image/ single processing. 2. CAD / CAM/ CAE and PDM 3. Software engineering and development using established and leading edge technologies (C++, J2EE, Websphere)

2 **Delphi Technical Centre India**	
Area of Specialisation	1. Software for Delphi's worldwide vehicle operations 2. Tools Development 3. Mechanical Analysis 4. Electrical Design 5. Analysis and Product Design 6. System Development 7. Manufacturing test software development 8. Mechanical Analysis 9. Medical Electronics 10. Electrical Analysis
Year of Establishment	2000
Objective of the R&D centre	To provide research support to the R&D of the parent organisation Perform contract research for organisations world wide (customers – Maruti Udyog Limited, General Motors India, Fiat Hindustan Motors, Volvo, Telco)
Major ongoing Projects /	**Mechanical Analysis** – (1) stress analysis (2) vibration and dynamics (3) injection and flow (4) thermal analysis

competency areas	**Structural Analysis** – (1) plastic snaps (2) circuit board deflection (3) solder joints **Electrical Design and Analysis** – (1) development, analysis and simulation of electrical Models for components, circuits (2) developing and deploying analysis tools and techniques for various product lines **Fuel Handling Product Engineering** – (1) design and development of fuel pump modules 2 and 4 wheelers (2) re-engineering and competitive analysis of fuel pump modules.
Linkages and affiliations	IISc Bangalore in areas of Mechanical Analysis, DSP etc. Some other new Institutions for students' projects in wireless (DSP, Speech recognition) web based technology operations and business process workflow areas.
Training Programs and courses	Training programme for software engineers.
Infrastructural Facilities	Laboratory to complement analysis work. Facilities include equipments like Vibration shaker, Microscope, Thermal Chamber, Thermal Imaging Camera, Strain Gauge System, UTM and perform tests for compliance with product reliability specifications. Considering the ever increasing demand for innovation and improvement TCI is aggressively pursuing opportunities in powertain mount application, Gas and diesel EMS application, ABS applications, electromagnetic analysis etc.
Major Technologies Developed and Commercialised	Embedded software for electronic control systems such as petrol and diesel engine controllers, anti lock breakers, radios, instrument clusters, mobile multimedia, fore warm systems, remote keyless entry, and air control systems. The centre plays a critical role in providing embedded software systems for many of Delphi's fastest growing product lines – (1) diesel common rail engine management systems and (2) advanced mobile multimedia systems

3 **General Motors India Science Laboratory**	
Area of Specialisation	Automobile technology – (1) Enterprise modelling and virtual manufacturing (2) Embedded control system (3) Automotive materials and chemical systems
Year of Establishment	2000
Objective of the R&D centre	To provide research support to the R&D of the parent organisation. The India Science Laboratory will focus on projects that complement the research programs ongoing in Warren and will also undertake new exploratory projects of high value to GM.
Infrastructural Facilities	**Vehicle Design Tools** 1. IFAD module and system development 2. Human modelling for crashworthiness prediction 3. Vehicle structures

	Enterprise Modelling & Virtual Manufacturing 1. Manufacturing enterprise modelling 2. Manufacturing operations 3. Virtual manufacturing 4. Manufacturing CAE 5. Knowledge systems **Embedded Control Systems Infrastructure** 1. Control software engineering methods 2. Control software engineering tools 3. Distributed system engineering process 4. Distributed system engineering tools 5. Mission-critical processes 6. Formal methods 7. V&V tools, artefacts 8. Standards 9. Libraries, including V&V **Automotive Materials and Chemical Systems** 1. Microstructure/property modelling. 2. Advanced joining including dissimilar materials. 3. Engineered surfaces. 4. Electrochemical systems and corrosion. 5. Lightweight metals and polymer composites. **Chemical reaction modelling group** 1. Chemical reaction engineering. 2. Emissions control systems. 3. Hydrogen storage systems. 4. Advanced batteries. 5. Atmospheric emissions impact modelling.

4 **Toyota – Kirloskar Motor Private Limited**	
Area of Specialisation	Automobile Technology
Year of Establishment	1997
Objective of the R&D centre	To provide research support to the R&D of the parent organisation
Major Technologies Developed and Commercialised	1. **Engine technology** – aimed at reducing emission / saving fuel. Important features – Variable Value Technology petrol engines, common rail turbo diesel, Toyota hybrid systems. 2. **Safety** – advanced steering, braking technologies and traction control technology.

BIOTECHNOLOGY and PHARMACEUTICAL SECTOR

1 **Astra Zeneca R&D**	
Area of Specialisation	Healthcare - Tuberculosis
Year of Establishment	1974 as ITC Zeneca and 2003 as Astra Zeneca
Objective of the R&D centre	To provide research support to the R&D of the parent organisation
Linkages and affiliations	1. Biocon R&D 2. Biogenomics and applied Materials R&D 3. Strand Genomics R&D 4. Sci Nova R&D 5. SysARRis R&D 6. Genotypic R&D 7. Xlyton R&D 8. Karnataka University 9. Bombay Pharmacy College 10. IIT Kanpur 11. IIT Delhi 12. University of Mysore 13. National Academy of Health Science, India 14. CSIR Units for R&D and information products
R&D Expenditure	US $ 3.5 Billion or Rs.1575000/- Lakhs per year on an average world wide
Employment	70 (include molecular biologists, genetic engineers and chemists)
Training Programs and courses	Astra Zeneca Workshop in Biomedical Sciences – a summer training for 12 weeks for post graduates (M. Tech or M.Sc)
Infrastructural Facilities	Nine specialist capabilities working globally – : (1)Structural Chemistry (2) Computational Chemistry (3) Compound management (4) Biological Chemistry (5) Genetics (6) Transgenic (7) Protein Science and supply (8) Imaging (9) Pathway Analysis
Research Grants	**List of projects funded** **Principal Investigator/Institute** — **Project** Dr. Laxmi Adhikary, Biocon R&D — Secondary Products of Myxobacteria Mr. Mukundan, SysARRis R&D — Virtual Screening based on chemical similarity Prof.H. Junjappa, BioOrganics & Applied Materials R&D — Diversity Oriented Synthesis of Organic Compounds Prof.H. Junjappa, BioOrganics & Applied Materials R&D — Total synthesis of Myxopyronin Dr. Kas Subramanian, Strand Genomics R&D — Prediction of Ligand binding cavities in Protein from Primary structure Mr. Rajeev Gangal, SciNova R&D — Prediction of Chemical Structure from NMR & MS data

	Dr. M.Raja, Genotypic R&D	Protein Sequence signatures and Ligand binding
	Dr. B.V. Ravi Kumar, XCyton R&D	Development of a Diagnostics for acute Bacterial meningitis
	Prof. M.V. Kulkarni, Karnatak University	Synthesis of Coumarin Analogues
	Prof. E. Coutinho, Bombay Pharmacy College	Structure determination of a 20mer peptide
	Prof. H. Ila, Indian Institute of Technology, Kanpur	1) Regioselective syntheses 2) Synthesis of 'Small Molecules Heterocycle' Libraries on Solid Support
	Dr. Jamuna Subramanian, Indian Institute of Technology, Kanpur	High-throughput for induction of P450 genes in *C.elegans*
	Dr. M.N. Gupta, Indian Institute of Technology, Delhi	Optimization of reaction conditions for Aldolase Catalyzed Reactions in non-aqueous solvents
	Dr. K.M. Loknath Rai, University of Mysore	Synthesis of new heterocycles via cycloadditions
	Dr. Ragini Macaden, St. John's National Academy of Health Sciences	Development of Treatment protocols for Infectious Diseases
	Dr. Raj Hirwani, CSIR Unit for Research and Development of Information Products, Pune	Database of Enzyme Inhibitors
Major Technologies Developed and Commercialised	**Cardiovascular**: Meronem (Meropenem) **Infection**: Meronem (Meropenem) **Neuro Science:** ▸ Diprivan (Propofol) ▸ Xylocaine Viscous (Lignocaine and adrenaline) ▸ Xylocaine Topical Solution (Lignocaine and adrenaline) ▸ Xylocaine Jelly (Lignocaine and adrenaline) ▸ Xylocaine Ointment (Lignocaine and adrenaline) ▸ Xylocaine Injection (Lignocaine and adrenaline) ▸ Xylocard Injection (Lignocaine and adrenaline) ▸ Sensorcaine Injection (Bupivacaine hydrochloride) ▸ Sensorcaine Heavy Injection (Bupivacaine hydrochloride) **Obestrics & Gynaecology:** Cerviprime (Dinoprostone) ▸ Primiprost (Dinoprostone) ▸ Prostodin (Carboprost) **Oncology:** ▸ Arimidex (Anastrozole) ▸ Nolvadex (Tamoxifen citrate) ▸ Zoladex (Goserelin) **Respiratory:** ▸ Bricanyl Tablets (Terbutaline Sulphate) ▸ Bricanyl Injection (Terbutaline Sulphate) ▸ Bricanyl Durules (Terbutaline Sulphate) ▸ Bricanyl Syrup (Terbutaline Sulphate) ▸ Bricanyl Inhaler (Terbutaline Sulphate) ▸ Bricanyl Nebulising Solution (Terbutaline Sulphate) ▸ Bricarex (Terbutaline/Guaifenesin) ▸ Linctus Codeinae (Codeinae)	

	▸ Pulmicort (Budesonide) ▸ Rhinocort (Budesonide) ▸ Symbicort (Budesonide/formoterol) ▸ Theobric (Turbutaline/Theophylline)
Patents	**16 Patents**. Some of them are - 1. A New Method for the Diagnosis of Virulent Bacteria. 2. DNA Probes Specific for Plasmodium Vivax. 3. A Novel Vector to Produce Biologically Important Peptides. 4. A Novel Procedure for the Detection of Pathogens Using DNA Probes. 5. Peptide-Carbohydrate Conjugates Generating T-Cell Immunity. 6. Ganglioside Analog. 7. Virulence-specific Bacterial DNA Sequence. 8. Novel Polypeptides. 9. A DNA Molecule for Expression of Bile Salt-Stimulated Lipase. 10. A method of identifying Ligands to RNA Polymerase Sigma 70 subunit. 11. A Scintillation Proximity Assay for the Detection of Peptidoglycan Synthesis.
Publications	1. Development of a DNA Diagnostic Probe for the Detection of the Human Malarial Parasite Plasmodium falciparum. V S Francis, Kayyanathan, P Bhat, H Srinivasa & G Padmanaban. Indian Journal of Biochemistry & Biophysics, 1988: 25, 537-541. 2. Congo red mediated regulation of membrane proteins of Shigella flexneri 2a.. K. Sankaran, Vasanthi Ramachandran, Yerramilli V.B.K. Subrahmanyam, Shantha Rajarathnam, Shanmugam Elango and Raman K. Roy. Infection and Immunity, 1989: 57, 2364-2371. 3. Cloning and hyperexpression of a gene encoding the heat-stable toxin of Escherichia coli. (Recombinant DNA; T7 and tac promoters; precursor protein; nucleotide sequence; transcription; processing). P. Dwarakanath, Sandhya S. Visweswariah, Y.V.B.K. Subrahmanyam, G. Shanthi, H.M. Jagannatha and T.S. Balganesh. Gene, 1989: 81, 219-226. 4. Proteinase-like activity in the cytotoxic factor produced by T cellsduring dengue virus infection. M.Khanna, U.C.Chaturvedi, B.R.Srinivasa, K.R.Swaminathan, A.Mathur, Immunology, 1989: 67, 32-37. 5. Astra Research Centre, India- a unique experiment in strategic collaboration. Kumud Sampath. BioSpectra, 1990. 6. The primary structure of xylanase from Thermoascus aurantiacus. B.R. Srinivasa, K.R. Swaminathan, Chitra Ganapathy, R.P. Roy, S.k. Murthy, and P.J. Vithayathil.. Protein Sequence & Data Analysis, 1991: 4, 15-20. 7. Strongly goal-oriented biomedical research-Astra Research Centre India. J. Ramachandran. Current Science, 1991: 60 No. 9&10, 533-536. 8. Identification of carbohydrate structures as receptors for lacalised adherent enteropathogenic Escherichia coli. H.M. Jagannatha, Umender

	K. Sharma, Tara Ramaseshan, A. Surolia and T.S. Balaganesh. Microbial Pathogenesis, 1991: 11, 259-268. 9. Interaction of heat-stable enterotoxins with human colonic (T84) cells: modulation of the activation of guanylyl cyclase. Sandhya S. Visweswariah, G. Shanthi and T.S. Balganesh. Microbial Pathogenesis, 1992: 12, 209-218. 10. Neuroanatomy of Cysticercus Cellulosae (Ceatode) as revealed by acetylcholinesterase and nonspecific esterase histochemistry. S. Vasantha, B.V. Ravi Kumar, S.D. Roopashree, Sarala Das, and S.K. Shankar. Parasitology Research, 1992: 78, 581-586. 11. Nucleic acids: the leading edge. K. Ayyanathan. Current Science, 1992: 62 No. 6, 443-444. 12. Software Report: Molecular Graphics Software-Mogra. N.V. Ramana and Indira Ghosh, Computer & Graphics, 1993: 17 No. 4, 415-416. 13. Hysteresis And Statistical Errors In Free Energy Perturbation L To D Amino Acid Conversion. Olle Edholm And Indira Ghosh, Molecular Simulation, 1993: 10 No. 2-6, 241-253. 14. Cloning of the triosephosphate isomerase gene of Plasmodium falciparum and expression in Escherichia coli. Jamuna Ranie, Vidya P. Kumar and Hemalatha Balaram, Molecular and Biochemical Parasitology, 1993: 61, 159-170. 15. Restriction and modification systems: Unrestricted frontiers. M. A. Mukund, Current Science, 1993: 65 No. 7, 509-510. 16. Insights into Plasmid biology. Umender K. Sharma, Current Science, 1993: 64 No. 5, 283-284. 17. The need for protection of intellectual property rights for indian inventions in biotechnology, S. Anand Kumar, Journal of Scientific and Industrial Research, 1993: 52, 304-307. 18. Designing a small peptide toxin using Molecular Dynamics. Indira Ghosh, Journal of Molecular Graphics, 1993: 11, 62. 19. Structural characterization of gelonin: Evidence for separate antigenic and cytotoxic domains. M.R. Sairam, B.R. Srinivasa and Jose Marcil, 1993: 31, 575-581. 20. Major histocompatibility complex class I-binding peptides are recycled to the cell surface after internalization. U.M. Abdel Motal, X. Zhou, A. Joki, A.R.Siddiqi, B.R.Srinivasa, K.Stenvall, J.Dahmen, M.Jondal, European Journal of Immunology, 1993: 23, 3224-3229. 21. Characterization and partial purification of the human receptor for the heat-stable enterotoxin. Sandhya S. Visweswariah, Vasanthi Ramachandran, Surabhi Ramamohan, Goutam Das And Janakiraman Ramachandran, Europena Journal of Biochemistry, 1994: 219, 727-736.

	22. Structure, function & therapeutic potential of omega conopeptides: Novel blockers of neuronal calcium channels. J Ramachandran, Proc. Indian Acad. Sci. (Chem. Sci.)., 1994: 106 No. 6, 1383-1387. 23. Analysis of E.coli promoter structures using neural networks. Indu Mahadevan and Indira Ghosh. Nucleic Acids Research, 1994: 22 No. 11, 2158-2165. 24. Molecular dynamics study of the binding of phenylalanine stereoisomers to thermolysin. Indira Ghosh and Olle Edlholm, Biochemical Chemistry, 1994: 50, 237 - 248. 25. Cloning and sequence of a cDNA encoding a novel hybrid proline-rich protein associated with cytokinin-induced haustoria formation in Cuscuta reflexa. K. Subramaniam, Jamuna Ranie, B.R. Srinivasa, Achyut M. Sinha and S. Mahadevan, Gene, 1994: 141, 207-210. 26. Untapped Potetential, Kumud Sampath, Pharmaceutical Visions, 1994: 2 No. 3. 27. Virulent Shigella codes for a soluble apyrase: Identification, characterization and cloning of the gene. Tishina Bhargava, Santanu Datta, Vasanthi Ramachandran, Ramesh Ramakrishnan, Raman K. Roy, Krishnan Sankaran and Yerramilli V. B. K. Subrahmanyam. Current Science, 1995: 68 No. 3, 293-300. 28. A Non-radioactive DNA diagnostic procedure for the detection of malarial infection: general application to genome with repetitive sequences. Kasirajan Ayyanathan and Santanu Datta. Molecular and Cellular Probes, 1995: 9, 83-89. 29. Development of specific DNA probes and their usage in the detection of Plasmodium vivax infection in blood. K. Ayyanathan, V.S.N.K. Francis, S. Datta and G. Padmanaban, Molecular and Cellular Probes, 1995: 9, 239-246. 30. Expression and Characterization of the ponA (ORF I) Gene of Haemophilus influenzae: Functional Complementation in a Heterologous System. Umender K. Sharma, P. Dwarakanath, Nabanita Banerjee, C. Town, And T.S. Balganesh, Journal Of Bacteriology, 1995: 177 No. 23, 6745-6750. 31. A CD4+ T cell line-secreted factor, growth promoting for normal and leukemic B cells identified as thioredixin. Anders Rosen, Pia Lundman, Mats Carlsson, Kasibhatla Bhavani, Bachally r. Srinivasa, Gunila Kjellstrom, Kenneth Nelsson and Arne Holmgren, 1995: 7, 625-633. 32. Alternative forms of the human thioredoxin mRNA: identification and characterization. Jayashree Hariharan, Pratibha Hebbar, Jamuna Ranie, Philomena, Achuyt Mohan Sinha and Santanu Datta, Gene, 1996: 173, 265-270. 33. Identification and characterization of a generic DNA probe capable of detecting plasmodial infections in blood. K. Ayyanathan and S. Datta, Molecular and Cellular Probes, 1996: 10, 273-278.

34. Detection of virulent Shigella and enteroinvasive Escherichia coli by induction of the 43 kDa invasion plasmid antigen, ipaC. Rita Shamlal, Shantha Rajarathnam, Krishnan Shankaran, Vasanthi Ramachandran, Yerramilli V.B.K. Subrahmanyam, G. Balakrish Nair, Ragini Macaden, Raman K. Roy, FEMS Immunology and Medical Microbiology 1997: 17, 73-78.

35. Production of Recombinant Human Bile Salt Stimulated Lipase and Its Variant in Pichia pastoris. Anjali V. Sahasrabudhe, Suresh M. Solapure, Rajeev Khurana, Vepa Suryanarayan, Sudha Ravishankar, Sunitha M. DeSousa, and Goutam Das, Protein Expression And Purification, 1998: 14, 425-433.

36. Developmental selection of var gene expression in plasmodium falciparum. Qijun Chen, Victor Fernandez, Annika Sunstorm, Martha Schlichtherle, Santanu Datta. Per Hagblom and Mats Wahlgren, Nature, 1998: 394, 392-395.

37. Identification of Plasmodium falciparum erythrocyte membrane protein 1 (PfEMP1) as the rosetting ligand of the malaria parasite P.falciparum. Quijn Chen, Antonio Barragan, Victor Fernandez, Annika Sundstorm, Martha Schlichtherle, Anders Sahlen, Johan Carlson, Santanu Datta, amd Wats Wahlgren, Journal of Experimental Medicine, 1998: 187, 15-23.

38. Convergent synthesis of neoglycopeptides by coupling of 2-bromoethyl glycosides to cysteine and homocysteine residues in T cell stimulating peptides. Marita Bengtsson, Johan Broddefalk, Jan Dahmen, Krister Henriksson, Jan Kihlberg, Hans Lonn, B.R. Srinivasa and Kristina Stenvall, 1998: 15, 223-231.

39. Mechanism-Based Inhibitors: Development of a High Throughput Coupled Enzyme Assay to Screen for Novel Antimalarials. Jayashree Hariharan, Rajendra Rane, Kasirajan Ayyanathan, Philomena, Vidya Prasanna Kumar, Dwarakanath Prahlad and Santanu Datta, Journal of Biomolecular Screening, 1999: 4, 187-192.

40. Effect of mRNA secondary structure in the regulation of gene expression: Unfolding of stable loop causes the expression of Taq polymerase E.Coli. Mandyam Alasingachar Mukund, Tanmay Banerjee, Indira Ghosh and Santanu Datta, Current Science,1999: 76, 1486-1490.

41. Study of the interaction between Bacterphage T4 asiA and Eschercia Coli s70, using the Yeast two-hybrid system: Neutralization of asiA Toxicity to E.Coli cells by Coexpression of a Turncated s70 fragment, Umnder K. Sharma, Sudha Ravishankar, Radha Krishna Shandil, P.V.K. Praveen, and T.S. Balganesh, Journal of Bacteriology, 1999: 181, 5855-5859.

42. Rapid diagnosis of acute pyogenic meningitis by a combined PCR dot-blot assay, M.Balganesh, M. K. Lalitha and R. Nathaniel, Molecular and Cellular Probes (2000) 14, 61-69.

43. Novel Scintillation Proximity Assay for Measuring Membrane-

	Associated Steps of Peptidoglycan Biosynthesis in Escherchia Coli. B. Chandrakala, Bertha C. Elias, Upasana Mehra, N.S. Umapathy, P. Dwarakanath, T.S. Balganesh and Sunita M deSousa, Antimicrobial Agents and Chemotherapy, 2001: 45, 768-775 44. Use of variability in the stage-specific transcription levels of Plasmodium falciparum in the selection of target genes. Vidya Prasanna Kumar and Santanu Datta. Parasitology International 50 (2001) 165-173. 45. Proteins released during high toxin production in Clostridium difficile. Kakoli Mukherjee, Sture Karlsson, Lars G. Burman and Thomas Akerlund. Microbiology (2002), 148, 2245-2253. 46. Glycine and alanine dehydrogenase activities are catalyzed by the same protein in Mycobacterium smegmatis: upregulation of both activities under microaerophilic adaptation, Veeraraghavan Usha, Ramesh Jayaraman, Juan Carlos Toro, Sven E. Hoffner, and Kaveri S. Das. Can. J. Microbiol. 48: 7-13 (2002) 47. Mutational analysis of bacteriophage T4 AsiA: involvement of N- and C-terminal regions in binding to 70 of *Escherichia coli in vivo*, Umender K. Sharma, P. V. K. Praveen and T. S. Balganesh. Gene, 295(1):125-134 (2002) 48. Pharmacokinetics-pharmacodynamics of rifampin in an aerosol infection model of tuberculosis. R. Jayaram, S. Gaonkar, Parvinder Kaur, B.L. Suresh, B.N. Mahesh, R.Jayashree, Vrinda Nandi, Sowmya Bharat, R.K. Shandil, E.Kantharaj, V.Balasubramanian. Antimicrob Agents Chemother. 47(7):2118-2124. (2003) 49. High-Throughput Screen for Inhibitors of Transglycosylase and/or Transpeptidase Activities of Escherichia coli Penicillin Binding Protein 1b, B. Chandrakala, Radha K. Shandil, Upasana Mehra, Sudha Ravishankar, Parvinder Kaur, Veeraraghavan Usha, Bina Joe, and Sunita M. deSousa. Antimicrobial Agents and Chemotherapy. 48 (1): 30-40 (2004) 50. Drug discovery for tuberculosis: Bottlenecks and path forward. T.S. Balganesh, V. Balasubramanian and S. Anand Kumar. Current Science. 86(1):167-176 (2004). 51. Isoniazid Pharmacokinetics-Pharmacodynamics in an Aerosol Infection Model of Tuberculosis. Ramesh Jayaram, Radha. K. Shandil, Sheshagiri Gaonkar, Parvinder Kaur, B. L. Suresh, B. N. Mahesh, R. Jayashree, Vrinda Nandi, Sowmya Bharath, E. Kantharaj, and V. Balasubramanian. Antimicrobail Agents and Chemotherapy, 48(8): 2951-2957 (2004) 52. Biochemical characterization of Plasmodium falciparum hypoxanthine-guanine-xanthine phosphorybosyltransferase: Role of histidine residue in substrate selectivity. Dhiman Sarkar, Indira Ghosh, Santanu Datta. Molecular & Biochemical Parasitology. (2004) *In press*

2 **Gangagen Biotechnologies Limited**	
Area of Specialisation	Biotechnology – Phage Therapy - development of therapies against antibiotic-resistant bacterial infection, for medical, veterinary, agricultural and environmental applications. Gangagen's strategy is to pursue specific human initially topical applications where there is an opportunity to shorten the long product development timeline by focusing on those indications that require shorter clinical trials and enable faster regulatory approvals.
Year of Establishment	December 2001
Objective of the R&D centre	To provide research support to the R&D of the parent organisation
Major ongoing Projects	1. Development of proprietary bacterio-phage based products for preventions and treatment of bacterial infections. 2. Management of recurrent urinal tract infection in women. 3. Pre clinical development of potent phages targeting stophylocus aureus including antibiotic resistant straints.
Major Technologies Developed and Commercialised	Already built a library of over 400 bacteriophages which kill a variety of bacteria present in over 1100 clinical isolates obtained from patients suffering from infections caused by burns and wounds The Company has made significant progress in the preclinical development of potent phages targeting staphylococcus aureus including antibiotic-resistant strains(MRSA) and plans to seek approval for clinical evaluation in the near future.

3 **iGate Clinical Research India Limited**	
Area of Specialisation	Clinical trials support services for conducting Phase II-IV clinical trials in India. Research Areas: 1. Allergy 2. Bioavailability and Bio equivalence 3. Endocrinology including diabetes 4. Gastroentrology 5. Oncology 6. Infectious diseases including vaccines 7. Cardio-vascular diseases 8. Metabolic and growth disorders 9. Central nervous system 10. Psychiatry 11. Dermatology 12. Respiratory 13. Respiratory Infectious diseases 14. Vaccines
Year of Establishment	1997 as Diagnosearch Centrallab and 2003 as iGate Clinical Research International
Objective of the R&D centre	1. To perform research on a contract basis for pharmaceutical companies worldwide.

	2. Conducting ICH-GCP compliant work in clinical research
Clients	Eli Lilly & Co. , Bayer, SmithKline Beacham, Cybele, Pfizer Lupin Laboratories, CVCL, Metacure, Serum Institute of India, Pharmacia, Roche, Cardiome, Eisai, MVO and WHO-Path, Emisphere, Sun Pharma, Shasun, Novum, Acebiomed, Cipla, Altana, Clinigene/ Biocon, CliniRx etc.
Major ongoing Projects	iGate Clinical Research International has conducted more than 65 clinical trials in a broad range of therapeutic areas over the past 9 years.
Services offered	1. Clinical operations and monitoring 2. Project management 3. Data management 4. Central Laboratory services 5. Bio Statistical Services 6. Medical report writing 7. Quality assurance 8. Regulatory affairs 9. Specific Consultancy services

4 **Intervet India Private Limited**	
Area of Specialisation	Animal Health - Poultry Vaccines, Canine Products and Fertility Hormones.
Year of Establishment	1997
Objective of the R&D centre	To provide support to the R&D and manufacturing unit of the parent organisation.
Major Technologies Developed and Commercialised	**Fertility Hormones** **Products** — **Description** Chorulon® — Each vial contains human Chorionic Gonadotrophin (hCG) as a white freeze dried crystalline powder (1500 I.U.). Crestar® — Oestrus control in both cyclic & non cyclic cattle (Heifers & cows) Folligon® — Each vial contains Pregnant Mare Serum Gonadotrophin (PMSG) as a white freeze dried crystalline powder (1000 I.U.) Iliren® — Each ml Iliren contains 0.196 mg tiaprost trometamol, equivalent to 0.150 mg tiaprost, & chlorocresol as an antimicrobial agent 2mg Receptal® — Highly effective & safe GnRH analogue for the treatment of hormonal infertility **Poultry Vaccines** **Products** — **Description** AE-POX VACCINE NOBILIS — Combined live vaccine against Avian Encephalomyelitis and Fowl pox/diphtheria in chickens

	Nobilis® I.B. Vaccine, Strain H-120	Live, freeze-dried vaccine against Infectious Bronchitis in chickens
	Nobilis® IB+ND, Ma5+Clone 30	Live, freeze-dried vaccine against Infectious Bronchitis and Newcastle Disease in chickens
	Nobilis® ND Lasota	Live, freeze-dried vaccine against Newcastle disease in chickens
	Nobilis® REO 1133	The vaccine is intended for the prevention of Tenosynovitis (viral arthritis) in chickens of 7 days or older
	Nobivac® Coryza	Vaccination against Haemophilus paragallinarum infections in chickens

Canine Products

Products	Description
Tetracycline	Broad spectrum antibiotic powder for the treatment of Gram positive and Gram negative bacterial infections in livestock and poultry.
Tonophosphan® Vet	Injection phosphorus preparation for improving metabolism, milk production and fertility in livestock.
Amnovit®	Amnovit is a scientifically balanced formulation of vitamins and amino acids as a non antibiotic growth promoter for poultry, livestock and fish
Avil® & Pheniramine Maleate	For quick relief from allergic manifestations. Noteworthy for its potent, rapid and prolonged antihistaminic action as well as for its excellent tolerence
Berenil®	Chemotherapeutic agent for treatment and prophylaxis of Babesiosis. Trypanosomiasis and mixed haemoprotozoal infections in livestock.
Berenil® RTU	For treatment and control Therapy of Babesiosis, Trypanosomiasis, Theileriosis and Pyrexia of unknown origin
Butox®	A new generation ectoparasiticide. Highly effective and safe. Ideally suited for control of ticks, mites, Lice and flies of livestock, poultry, dogs and farm houses.
Chorulon®	Each vial contains human Chorionic Gonadotrophin (hCG) as a white freeze dried crystalline powder (1500 I.U.).

	Floxidin®	True broad-spectrum bactericidal agent, effective against Gram positive, Gram negative and mycoplasmal infections in livestock and poultry
	Nobivac® Corona	Against canine corona virus & can be administered to healthy susceptible pups as early as 6 weeks of age
	Nobivac® DHPPi	Vaccination against CDV, CAV2, CPV and CPi. Besides providing protection against CAV2 disease entities such as respiratory tract infections. The vaccine also protects against infectious canine hepatitis (ICH) caused by CAV1.
	Nobivac® Lepto	Active immunisation against Leptospirosis caused by L.icterohaemorrhagiae and L.canicola of Leptospira interrrogans.
	Nobivac® Puppy DP	For active immunization of young puppies against Canine distemper & Parvo virus disease
	Nobivac® Rabies	For the active immunization against rabies
	Panacur®	Broad spectrum anthelmintic for use in cattle, sheep, goats, horse, pigs and dogs
	Prednisolone Acetate	Crystalline injectable suspension for systemic and local therapy in acetonemia and inflammatory conditions
	Taktic® 5%	Broad spectrum ectoparasiticide against ticks, mites, lice and keds.

5 **Indus Bio Sciences Private Limited**	
Area of Specialisation	CRO providing pre clinical drug delivery research
Year of Establishment	2001
Objective of the R&D centre	To perform research on a contract basis for organisations in India and worldwide
Services Offered	Primary objective - to fulfil customer needs by synthesizing complex organic molecules and fine chemical intermediates in quantities from milligrams to kilograms. 1. Contract Research 2. Custom Synthesis – synthesize milligram to multi-kilogram quantities of complex organic compounds.

	3. Process Development 4. Synthesis of Complex Organic Molecules 5. FTE Chemists – provide talented chemists on FTE basis in RTP, North Carolina and in Hyderabad, India. 6. cGMP Capabilities – to aid customers in drug development. 7. Consulting – in the areas of market research, technology transfer, strategic planning and outsourcing in the Asia Pacific Region.
Major ongoing Projects	1. Novel Building Blocks 2. Process Development of Pharma Intermediaries 3. Reference Standards – several products involving multiple synthesis 4. Proprietary Building Blocks and Small Molecules – Several Pyrazoles and Isoxazoles
Linkages and affiliations	1. Indian Institute of Chemical Technology (IICT) Hyderabad 2. Centre for cellular and Molecular Biology (CCMB) 3. Osmania University (Hyderabad)
Capabilities	Halogenations Organometallics – alkyl lithium, gringard reaction Phosgenerations Friedel craft reactions Suzuki and Buchwald couplings Asymetric Synthesis Milligram to Kilogram synthesis of complex organic molecules
Infrastructural Facilities	1. Modern laboratory with 30 fume hoods, four walk-in hoods, a kilo lab and all the necessary equipment. 2. Miligram to multi-kilogram scale quantities of complex organic molecules, pharmaceutical intermediates and APIs. 3. Access to large scale manufacturing 4. Autoclave for high pressure and high temperature reactions 5. Low and High Temperature chemistry 6. Own analytical equipment – HPLC/GC/LC-MS 7. NMR facilities
Major Technologies Developed and Commercialised	1. CarboHydrate Derivatives 2. Heterocyclic Building Blocks 3. Reagents and Building Blocks 4. Chiral Agents and Building Blocks 5. Nitriles, Acids and Amidines 6. Pyridines, Piperidines, Pyrimidines & Indazoles

6 **John F Welch Technology Centre (GE)**	
Area of Specialisation	At JFWTC, technology teams from GE Global Research, GE Advanced Materials, GE Consumer & Industrial, GE Energy, GE Transportation (Air Craft Engines and Rail) and GE HealthCare work with teams. Research Areas include - 1. Electromagnetic Analytics 2. Composite Material Design 3. Colour Technology 4. Additive Technology 5. Non destructive Evaluation 6. Corrosion Technology

	7. MEMS 8. Molecular Modelling 9. Power Electronics 10. Analysis Technologies 11. Computational Fluid Dynamics 12. Engineering Analysis
Year of Establishment	September 2000
Objective of the R&D centre	To provide support to the (1) R&D and (2) manufacturing Units of the Parent Organisation.
Linkages and affiliations	1. Jamnalal Bajaj Institute of Management Studies (Bombay) 2. Itnstitute of International Education (for training purposes) 3. IIT – Chennai 4. IIT – Bombay 5. IIT – Delhi 6. IIT – Kanpur 7. IIT – Kharagpur 8. Delhi School of Economics 9. IIM Calcutta 10. IIM Indore 11. IIM Kozhikode
R&D Expenditure	US $ 80 Million or Rs. 3600 Lakhs worldwide
Employment	Over 2200 scientists, researchers and engineers
Training Programs and courses	1. Leadership programme 2. Edison Engineering Development programme 3. Management Development programmes with Universities and Management Institutes (see Linkages and Affiliations) 4. Diversity Programs 5. In India GE has launched a Rs. 6.7 million scholarship program for students pursuing graduation, post graduation in engineering, science and management courses in leading education institutes. Till now 63 students at 25 institutes have received this scholarship.
Infrastructural Facilities	1. Spread over 50 acres of land, the US $80 million, 545,000 square feet, John F. Welch Technology Centre houses state-of-the-art laboratories and facilities. 2. The Centre has specialized equipment like Moisture and Oxygen permeation through thin films testing facilities, JTest & JProbe, an - Energy storage and characterization lab, Furnaces, Several reactors, Advanced software tools for analytics, a Full-fledged Synthesis Laboratory and Chromatographs for molecular separation and identification. 3. State-of-the-art technology and e-Engineering tools facilitate real-time global interaction with GE's businesses and the other GE Global Research teams at Niskayuna (USA), Shanghai (China) and Munich (Germany). 4. The Knowledge Centre at the campus is fully integrated with facilities to access and disseminate technical knowledge globally, to accelerate competitive technology developments for the benefit of GE's customers. 5. The facilities at the Centre include a training center, employee recreational centre, amphitheater, fitness center, and a cafeteria.

Major Technologies Developed and Commercialised	1. More Efficient Refrigerators 2. Energy Efficient Motors That Last Longer 3. Locomotives That Perform Better With Improved Fuel Efficiency 4. Un-frosted Head Lamps for Automobiles 5. Quieter Machines and Appliances 6. Injection Moldable Magnetic Products 7. Improved Diagnostic and Treatment Protocols 8. Advanced Risk Dashboards 9. Automobiles That Help Conserve Fossil Fuel 10. New Colors 11. Better Patient Care 12. NDE Imaging Lab 13. NDE Modelling Lab 14. Polymer and Synthetic Materials 15. Information and Design Technologies 16. Micro and nano-structure technologies 17. Electronic and Photonic Technologies 18. Advanced Mechanical Technologies
Patents	200 patents in year 2000

7 **Merck Development Centre Private Limited**	
Area of Specialisation	Pharmaceuticals – process research and development of bulk drugs and intermediates.
Year of Establishment	1967
Objective of the R&D centre	1. To perform research on a contract basis for organisations in India 2. To provide research support to the manufacturing unit of the parent organisation
Major Technologies Developed and Commercialised	Products covering various therapeutic segments spread as they are across anti biotics, anti malarials, cardiologicals, cough and cold formulations, dermetologicals, haematinics, neurologicals, ORS, and non-steroidial anti inflammatory drugs.
Publications	Neo natal drug dosage guidelines

8 **Millipore India Limited, R&D**	
Area of Specialisation	Membrane Validation and Protein Research
Year of Establishment	2002
Objective of the R&D centre	1. To perform research on a contract basis for organisations in India and world wide 2. To provide research support to the R&D unit and Manufacturing unit of the Parent organisation
Major ongoing Projects	Millipore is a bioscience service providing company, manufacturer of membrane which is used in varying applications. R&D centre supports

	in providing validation and evaluation. Standardising of western blotting and detecting agents Protein fractionation and purification using ultra filtration
Employment	2005 : Doctoral level -2, Masters Level – 2 2004 : Doctoral level -1, Masters Level – 2 2003 : Doctoral level -2 2002 : Doctoral level -2
Training Programs and courses	1. Basic training at Millipore, Danvers, MA, USA (Number of participants–1, Qualification – Ph. D. Microbiology) 2. Training on Membrane validation, Bedford, MA, USA (Number of participants – 1, Qualification – Ph. D. Microbiology)
Difficulties	Customs clearance is a major challenge especially for work on micro organisms specified in Pharmacopoeia. A common lab commodity is held for clearance for weeks.

9 **Novartis India Limited**	
Area of Specialisation	Pharmaceuticals – Alzheimer disease, epilepsy, musculo-skeleton system, central nervous system, ophthalmology, cardiovascular system, transplantation, immunology, oncology, gynaecology, respiratory system.
Year of Establishment	October 1997
Objective of the R&D centre	To provide research support to the R&D of the parent organisation.
Linkages and affiliations	**Alliances in India** Dr Reddy, Hyderabad, India for Diabetes Synegene – chemistry collaboration **Alliances Abroad** Idenix Pharmaceuticals, Cambridge, USA for Antiviral Elan, Dublin, Ireland for Drug delivery Emisphere Technologies, Tarrytown, USA for Drug delivery SkyePharma, London, UK for Drug delivery Lohmann, Andernach, DE for Drug delivery Noven, Miami, USA for Drug delivery Biosite, Täby, Sweden for Bioassay Speedel, Basel, Switzerland for Cardiovascular, hypertension Sibia, USA/Merck for Nervous system, epilepsy Celgene, Warren, USA for Nervous system, ADHD Orion, Espoo, Finland for Nervous system, Parkinson's disease Dainippon, Osaka, Japan for Nervous system, anxiety Genentech/Tanox, San Francisco, USA for Allergy, asthma Schering AG, Berlin, Germany for Oncology, angiogenesis Ajinomoto, Japan for Diabetes QLT, Vancouver, Canada for Ophthalmology and oncology
Major Technologies Developed and Commercialised	**Arthritis and bone metabolism –** rheumatoid arthritis, osteoarthritis and osteoporosis. Researchers also capitalize on scientific opportunities that emerge from primary research focus, including the development of novel therapies for tumor-induced hypercalcaemia and fracture repair. Some research may also provide benefit in other

	inflammatory conditions such as asthma, dermatitis and autoimmune diseases. **Cardiovascular and metabolic diseases –**type 2 diabetes and related metabolic disorders, hypertension and congestive heart failure. Major **achievements** have included angiotensin II receptor antagonists and angiotensin-converting enzyme (Diovan, CoDiovan, Lotensin, and Lotrel for the treatment of hypertension and congestive heart failure), HMGCoA reductase inhibitors (Lescol and Lescol XL for the treatment of hypercholesterolemia), and insulinotropic agents (Starlix for the treatment of type 2 diabetes). More recently, Novartis has moved to the forefront of diabetes drug discovery with its dipeptidyl peptidase IV inhibitors (LAF237 and DPP728, presently in Phase II clinical testing). **Dermatology/Immunopathology –** allergic and inflammatory skin diseases with a high medical need such as atopic dermatitis and psoriasis. Other research programs in this arena focus on the discovery of novel drugs for the treatment of inflammatory bowel disease, multiple sclerosis and systemic lupus erythematosis (SLE). In addition to the marketed drugs Lamisil (for the treatment of onychomycosis) and Elidel (for atopic dermatitis), Dermatology/Immunopathology has generated a series of innovative compounds that are in earlier stages of development. **Infectious disease -** In order to overcome the increasing problems of microbial resistance, the efforts are focused on developing drugs against completely new functional targets and targets of unknown functions essential for bacterial growth or pathogenicity. Antifungal studies is also a focus of our preclinical research. **Nervous system disorders –** The research focuses on four main indications: Alzheimer's disease, anxiety/depression, schizophrenia, chronic pain. In addition, other indications are followed opportunistically, e.g. bipolar disorders, epilepsy, and spinal cord injury. In order to find new disease-modifying therapies for Alzheimer's disease, all key pathogenic mechanisms are addressed. In addition, there are ongoing efforts on multiple receptor subtypes such as GABA-B or glutamate receptors. **Oncology –**major forms of solid tumors (lung, breast, colorectal, prostate), which cause about 50% of all cancer deaths, and on leukemias. Smaller cancer indications (glioblastoma, melanoma, ovarian, leukemias, lymphomas, sarcomas) are pursued if a major patient benefit is probable, or if major indications are also part of the compound's efficacy profile. Major **achievements** have included aromatase inhibitors (Femara for the treatment of breast cancer), bisphosphonates (Aredia and Zometa for the treatment of hypercalcemia and bone metastasis) and somatostatins (Sandostatin for the treatment of acromegaly). More recently Novartis has moved to the forefront of cancer research based on advances in the area of kinase inhibitors. One result of this research effort is Glivec/Gleevec, a completely new treatment of chronic myelogenic leukemia, noted as a major breakthrough. **Ophthalmics –** Novel research directions for the identification of development candidates in the most important ophthalmics indications such as glaucoma, retinal degenerations, myopia are pursued. Novartis Ophthalmics already holds number of successful drugs on the market. The most recent example is Visudyne, for the exsudative form of age-related macular degeneration (AMD), the leading cause of

	blindness in elderly people. **Transplantation -** improved immuno-suppression, chronic rejection and induction of tolerance. Cell-based therapies are pursued as long-term opportunities, with considerable spin-off from primary indication transplantation to autoimmune disease areas. Novartis has the largest-in-industry, dedicated research unit addressing major medical needs in transplantation, thereby building strong synergies with other in-house research units addressing autoimmune diseases. Our portfolio of marketed products (Neoral, Sandimmun, Simulect) is strong. Our new products Certican and Myfortic already gained approval in some countries.

10 **Novo Nordisk India Private Limited**	
Area of Specialisation	Pharmaceuticals – Insulin and insulin delivery systems, – Growth hormone therapy and Haemostatis management
Year of Establishment	1994
Objective of the R&D centre	1. To perform research on a contract basis for organisations in India 2. To provide research support to the R&D of the parent organisation
Linkages and affiliations	1. Torrent Pharmaceuticals Limited 2. Abot India Limited 3. Med India
Training Programs and courses	Novo Nordisk incorporated NOVO NORDISK EDUCATION FOUNDATION. This is an independent non-profit trust with a mission to enhance healthcare by facilitating awareness and education. The foundation proposes to become the most credible resource centre for information on diabetes and other endocrine diseases.
Infrastructural Facilities	Infrastructure to carry out research in (1) gene and cell technology, (2) protein science, (3) biology and pharmacology, (4) medicinal chemistry, (5) pharmaceutical development, (6) device development, (7) quality assurance.
Major Technologies Developed and Commercialised	1. 2 Insulin analogues – Novomix 30 and Novo Rapid (in 2003) 2. Insulin Delivery device – Novolet 3. A third generation durable insulin delivery device – Novopen

11 **PharmaNet India Clinical Services Private Limited**	
Area of Specialisation	1.Drug Development and Clinical Research – Neuroscience, Pediatrics, Women's Health, Oncology, Infectious diseases, Dermatology, Opthalmology, Cardiavascular and general medicine. 2.Biostatistics
Employment	More than 1500 professionals world wide
Services offered	PharmaNet offers a comprehensive range of clinical development and consulting services to the bio pharmaceutical industry. PharmaNet India
Year of Establishment	2002

Objective of the R&D centre	1.To perform research on a contract basis for organisations world wide 2.Consulting
Major ongoing Projects & Technology developed	Combination-product categories : 1. Drug-eluting stents 2. Implantable drug/device delivery systems 3. Catheter-based drug-delivery technologies 4. Co-packaged combination products

	centre offers bio statistical services as a speciality, which include 1. Protocol development, including sample size and power calculations 2. Randomization schedules 3. Statistical analysis plans 4. Statistical programming in SAS® 5. Interpretation and reporting of data for clinical trial reports and publications 6. Regulatory representation Other services include data management, Global Safety Pharma-co-vigilance, Medical writing, Project Management, Protocol/CRF design, Quality Control and assurance, regulatory affairs, site management, strategic planning, study monitoring.
Services offered & Infrastructure Facilities	PharmaNet offers a globally integrated database management system that can operate multiple software applications from a variety of venders, thereby providing flexibility for our clients in conducting largescale clinical trials in multiple international markets. We also offer biostatistical and programming services, employing state of the art software technologies and innovative strategies to facilitate data processing, analysis and reporting of results. Additionally, the company's information technology division PharmaSoft provides a single web based platform containing all products and services needed to conduct electronic trials, including an easy to use system for clinical data management and electronic capture.

12 **Pliva Research India Private Limited**	
Area of Specialisation	Medicine - oncology
Year of Establishment	November 2003
Objective of the R&D centre	To perform research on a contract basis for organisations worldwide To provide research support to the R&D and the manufacturing unit of the parent company
Major Technologies / products Developed and Commercialised	**ANTIINFECTIVES:** azithromycin dihydrate, oxytetracycline dihydrate, oxytetracycline hydrochloride, mupirocin, sulfisoxazole (sulfafurazole), sulfisoxazole acetyl **CYTOSTATICS:** carboplatin, cisplatin, dacarbazine, oxaliplatin **DIURETICS:** chlorothiazide, chlorthalidone, hydrochlorothiazide, torsemide (torasemide N) **VARIOUS API:** acetazolamide, mesalzine, warfarin sodium salt clathrate, ondansetron hydrochoride dihydrate **NUTRACEUTICALS:** SAMe **INTERMEDIATES:** 5-acetylsalicylamide, monoacetoneglucose, diacetoneglucose, diacetonefructose, 3,4-dimethyl-5-amino-isoxazole, p-tert-butylbenzene sulfonamide.
Linkages and affiliations	Dr. Reddy's Laboratory

13

Quintiles India Limited	
Area of Specialisation	Clinical Biology – therapeutic expertise in (1) oncology, (2) psychiatry, (3) Neurology, (4) Anti Infection, (5) Endocrinology, (6) Gastroenterology, (7) Ophthalmology, (8) Cardiology
Year of Establishment	1997
Objective of the R&D centre	1. To provide research support to the R&D (clinical) of the parent organisation 2. To perform research on a contract basis (data management) for organisations world wide
Services provided	**Data management** – 33 projects with 20 customers The data management unit I Bangalore provides customised solutions to pharmaceutical, biotech and medical devices companies including CRF design, data base design, query management, double data entry, coding and quality control. **Clinical** – 104 projects with 52 pharmaceutical and biotech companies **ECG services** – 115 projects with 25 customers This service is in place since 2002. This sservice include digital ECG analysis, paper digitisation, 3 and 12 head halters, medical and statistical report writing **Quality Assurance –** Quintiles India adheres to Quintiles Global Standard operating procedures and conduct studies that conform to ICH GCP requirements. All the studies conducted by QT are for US FDA or European regulatory bodies.
Major ongoing Projects	Ongoing projects are in the following areas 1. Monitoring 2. Drug safety 3. Site management 4. Quality assurance 5. Data management 6. Project management 7. Regulatory management 8. Protocol development 9. Training 10. ECG analysis

14 Roche Scientific Company India Limited	
Area of Specialisation	Pharmaceuticals – Transplantation, oncology, Non – Hodgkin's Lymphoma, Breast Cancer, Hepatitis, HIV
Year of Establishment	April 1994
Objective of the R&D centre	1. To provide research support to the (1) R&D and (2) the manufacturing unit of the parent organisation 2. Ensure registrations of new products and obtain amendments to registrations. 3. Initiate and monitor clinical trials with new chemical entities for generation of data for international use and for registration with Drug Controller General of India. 4. Monitor and ensure adherence of International Federation of Pharmaceutical Manufacturers' Association (IFPMA) guidelines

	in respect of F. Hoffmann - La Roche products. 5. Sponsor R & D projects for process developments for new bulk drugs in India. 6. Provide support in conducting programmes for continuous Medical Education, assist in protocol studies, hands on experience with new therapies in new therapy management and dissemination of updated scientific and technical information in fields of Oncology, Virology, and Nephrology.
Major Technologies Developed and Commercialised	**Transplantation** - Roche has developed three innovative therapies that improve graft and post – transplant health; Cellcept is the cornerstone of low toxicity immunosuppressant therapies. Cellcept is the largest selling branded immunosuppressive in North America, offers both physicians and patients the possibility of an effective long term immunosuppressive regimen with low toxicity, Zenapax prevents the acute rejection of the newly transplanted organ, and Cymevene/Cytovene/Valcyte has been developed for the prevention and treatment of cytomegalovirus, a dangerous viral infection associated with transplantation. **Oncology -** Roche has developed and introduced a number of targeted novel medicines to treat different forms of cancer, providing longer survival and new treatment options for cancer patients worldwide. **Hepatitis** –The first interferon introduced by Roche to treat hepatitis C was Roferon ®-A (Interferon alfa-2a) which in combination with Ribavirin has been shown to increase the response rate to therapy. One of the newest advances in this disease area is Pegasys ® (Pegylated Interferon-alfa 2a) which shows an excellent response to therapy especially when combined with Ribavirin . With regard to hepatitis B, trials with Pegasys ® (Pegylated Interferon alfa-2a) have confirmed that this molecule is superior to the standard medicines currently prescribed for this disease. **HIV -** Saquinavir with ritonavir (1000/100 mg twice daily) has shown encouraging results in the MaxCmin 1 trial with high efficacy and an excellent safety and tolerability profile. Saquinavir/r was approved in the EU in August 2002. Viracept (nelfinavir), another PI is supplied by Roche outside the US and Canada. In first- line HIV therapy, Viracept delivers consistent long-term efficacy and safety. When used first line, Viracept also allows the subsequent use of both NNRTIs and other PIs for most patients due to its unique resistance pattern. The viral load measurements in the clinical trials for Fuzeon were performed using the AMPLICOR HIV-1 MONITOR version 1.5 assay. This test from Roche Diagnostics is considered to be a highly sensitive measurement of the amount of HIV circulating in a patient's blood ("viral load").
Publications	Updated Oncology Review and Education Literature Consultant Series: 1. Hodgkin's Disease 2. Non Hodgkin's Lymphoma 3. Advanced Ovarian Cancer 4. Breast Cancer

	5. Myeloid Malignancies 6. The importance of dose in cancer chemotherapy 7. Peripheral blood progenitor cell rescue 8. Acute Myeloid Leukemia 9. Allogenic peripheral blood progenitor cell transplantation 10. Autologous peripheral blood progenitor cell mobilization & transplantation Education booklets: 1. The importance of dose in cancer chemotherapy 2. Potential of new chemotherapeutic approaches to improve outcome in Small Cell Lung Cancer 3. Potential of new chemotherapeutic approaches to improve outcome in Advanced Ovarian Cancer 4. The integral role of filgrastim in chemotherapy regimens for aggressive lymphomas 5. Filgrastim: A cost effective approach to decrease chemotherapy morbidity in Acute Myeloid Leukemia 6. Clinical Applications of filgrastim to intensify chemotherapy for high risk Breast Cancer 7. Potential of new chemotherapeutic approaches to improve outcome in Primary Breast cancer 8. Small Cell Lung Cancer: HGF protocol series 9. Non- Small Cell Lung Cancer: HGF protocol series 10. Clinical Applications of filgrastim in advanced HIV infection to decrease Neutropenia & infection 11. Clinical benefits of filgrastim in advanced HIV infection to improve Neutrophil function 12. Clinical benefits of intensified chemotherapy in poor risk testicular cancer 13. Breast cancer: Guide for patients

15 **Warner Lambert Research And Development**	
Area of Specialisation	Pharmaceuticals and Clinical Research – (1) Infectious diseases including Malaria, Typhoid Fever, (2) Oncology – Breast cancer, (3) Cardiovasculor Diseases – hypertension, heart failure, (4) Psychiatry, (5) Respiratory Diseases (Asthma, Brncitis), (6) Metabolic Diseases – osteoporosis)
Year of Establishment	1995
Objective of the R&D centre	To provide research support to the R&D of the parent organisation
Linkages and affiliations	1. Bombay College of Pharmacy and Suven Pharma (for Training Initiative Academy of Clinical Excellence (ACE) – PGRD). ACE is a training centre for clinical research offering training and certification of various clinical research professionals towards raising the standards of conduct of clinical research in India. 2. A new Initiative - Medical Research Specialists – The MRS function seeks to replicate the regionally based research function (Regional Medical and Research Specialists – RMRS)

	established in the USA, UK and Canada. The MRS will identify and collaborate with frontline clinicians and institutions in initiating and conducting leading edge medical research. The MRS will also partner with patient support groups and NGOs to develop and deploy programmes of relevance to national health care needs. Operationally MRS will receive support from and collaborate with Pfizer's established Clinical Research and Medical Affairs Function.
Training Programs and courses	1. Training more than 1500 investigators, ethics committee members, CROs and other professionals in clinical research technologies and good clinical practices 2. Professional training to investigators and other clinical research personnel in India – PGRD – in collaboration with Bombay College of Pharmacy) 3. Quality Standards and Training – The QS&T team is responsible for identifying training needs for MRD individuals and co-ordinating training activities, apart from quality assurance activities.
Infrastructural Facilities	1. The clinical research group comprises of 4 organisational segments – (1) Clinical Development, (2) Study Management Services, (3) Indian Regional Monitoring Group and (4) Clinical Alliance and Out sourcing. 2. One half of the clinical research portfolio relates to phase II and Phase III studies executed on behalf of Pfizer Global R&D world wide development teams, while the ret are phase III, phase IV comparative, post marketing surveillance, epidemiology, drug utilisation and bio pharmaceutical studies to support local registration, launch and marketing. 3. Through clinical research studies placed at various hospitals, investments have been made in upgrading research infrastructure in India. Notable amongst these are the establishment of Osteoporosis Research Centres at 6 major healthcare facilities in India with donations of diagnostic equipment like DXA (bone densitometry) at the cost of $6000000. 4. Initiatives to evolve clinical research environment in the country, such as, contribution to revision in schedule y, India GCP guidelines etc.

CHEMICAL SECTOR

1 **BASF India Limited**	
Area of Specialisation	Speciality Chemicals for leather, textile and paper. Catalyst Agrochemicals. Other speciality chemicals like flame retardants.
Year of Establishment	BASF India Limited was established in 1943. BASF R&D Centre was established in 1978.
Objective of the R&D centre	1. To provide support to the manufacturing unit of the parent company 2. To provide support to the manufacturing units of BASF India 3. To do basic research in the above areas of specialisation. 4. To provide support to the global R&D Centre of the parent company.
Infrastructural Facilities	1. Well equipped R&D laboratories, which cater to the product and process improvement studies and technical support to customers and the manufacturing plants. The R&D laboratories of BASF in India work in close co-ordination with various R&D laboratories of BASF group. 2. 3000 MHz NMR 3. GCMS,LCMS 4. Several HPLCs, preparativr HPLC 5. Several GLCs, GLC with headspace 6. Several Instruments related to textile applications 7. Several Instruments related to leather applications 8. GPC 9. Fully equipped pilot plant with vessels ranging from 30 Ltrs. to 3000 ltrs.
Major Technologies Developed and Commercialised	1. Several leather chemicals 2. Several textile chemicals 3. Several paper chemicals 4. Several agrochemicals 5. Backward integration 6. Import substitutions of several chemicals **Speciality Chemical Research** 1. Strobilurins – From natural substance to crop protectant 2. Synthesis of the carotenoid astaxanthin 3. Contract manufacturing of pharmaceutical chemicals 4. Low-foam surfactants 5. Leather dyes 6. Lumogen® fluorescent dyes 7. Variocrom® effect pigments 8. Anti-aging systems **Chemical Research and Engineering** From the cracker product to the crop protection agent **Polymer Research** Thermoplastics Polyurethanes / polymer foams Emulsion polymers Solution polymers Polymer physics

2 **Hindustan Lever Research Centre**	
Area of Specialisation	Chemical
Year of Establishment	1958
Objective of the R&D centre	To provide research support to the R&D and the manufacturing unit of the parent organisation
Linkages and affiliations	University of Bombay for Ph. D. Program for employees
Employment	Over 200 scientists and technologists many with post doctoral experience acquired from US and Europe. 350 (Source : "Globalisation of R&D and its impact on industrial R&D in India" - Thesis by Raj Kumar R. Hirwani)
Training Programs and courses	1. Ph. D. Program in University of Bombay 2. Exchange Program for Scientists
Major Technologies Developed and Commercialised	**PRODUCT** **Saving Water:** In a typical Indian home, at least 20% of the water consumed goes behind washing of clothes. HLL's scientists have innovated a path-breaking technology – it reduces water consumption and time taken for rinsing by 50%. **Safe Water Technology:** HLL's scientists have developed a breakthrough device, which purifies water as safe as boiled water, providing 100% protection from all water-borne diseases; it also protects from pesticides and harmful metals, like lead. Its operation does not require electricity, running tap water and plumbing or expensive maintenance. It thus provides water at a cost of just Re.1 for every six litres – or less than 20 paise a litre. **Iodine Protector:** Iodised salt is a well-accepted mode of ensuring appropriate iodine intake. HLL scientists have developed a patented breakthrough technology to stabilise iodine in salt, following work on the stability of iodine under Indian conditions of storage and cooking. The technology has made it possible to actually realise the purpose of iodised salt – that people get appropriate iodine intake through the food they eat. **Cool Cart** One of the most fascinating inventions from the research centre has been the world's first totally safe, non-corrosive, Eutectic coolant that keeps ice creams at -18^{o} C even under the most aggressive climatic conditions. **PROCESS** **In-house machine development:**

	The company has the capability to design and manufacture machines in-house. This enables the company to set up plants at half the cost of others. Such technological developments have also led to significant improvement in productivity. **Energy conservation:** The latest technology to produce Distilled Fatty Acid for soap making and the resultant plant capacity expansion has drastically brought down specific energy consumption while improving distillation yields. The evolution of continuous soap processing technology has also reduced energy consumption.
Patents	Over 380 process patents. For example – (1) In house machine development (2) Energy Conservation (3) technology to stabilise Iodine in salt

3 **SABIC Research and Technology Private Limited**	
Area of Specialisation	Chemical and polymer research
Year of Establishment	2002
Objective of the R&D centre	1. To provide research support to the R&D and the manufacturing unit of the parent organisation 2. To perform research on a contract basis 3. To reduce plant operation costs by improving license technologies used by its affiliates and to provide technical support to SABICS customers. SABIC's long term goal is to develop a new technological base enabling SABIC to diversify within its core business sectors.
Linkages and affiliations	1. International private organisation – Linda AG, Germany 2. SABIC research and technology has several joint programmes with local universities and other business and academic institutions outside the kingdom of Saudi Arabia.
Employment	550 people including all R&T centres
Training Programs and courses	1. Scholarships to employees to pursue higher education 2. Co-operation program with universities and colleges to teach final year graduate students 3. On the job training
Major Technologies Developed and Commercialised	**Technologies developed (SABIC – VADODARA)** 1. CO2 treatment technology with environmental benefits 2. Improved EPS technology resulting in improved quality of SABIC's polysterene products 3. Butane -1 technology 4. SABCAT – 1 – a new catalyst to produce Butane 1 which reduces production costs and improves quality 5. Acetic Acid technology 6. Linear Alpha Olefin process in partnership with Linda AG, Germany

	Technologies commercialised (all R&T centres)

Product	**Technology Licensed to**
PE (Polyethylene)	Union Carbide – Exxon
PP (Polypropylene)Ethylene Glycol	Union Carbide
Ethylene Glycol	Scientific Design - Shell
PVC/VCM (PolyVinyl Chyloride/ VinylChloride Monomer)	Oxyvinyl
Polystyrene	Fina Huntsman
Polyester	Zimmer
Methanol	Mitsubishi
Direct Reduction Process (Steel)	Midrex - HYL
Melamine	DSM
MTBE (methyl tertiary butyl ether)	CDTECH - Snamprogetti
Aromatics	UOP
PTA (Purified Terephthalic Acid)	Tecnimont
Butene-1	**IFP**
2-Ethyl Hexanol (2-EH)	KPT/UCC

COMPUTER SOFTWARE AND HARDWARE SECTOR

1 **Lucent Technologies India Private Limited**	
Area of Specialisation	Computer Science and Networking Research 1. Algorithms 2. Networking 3. Network management 4. Data management 5. Distributed computing
Year of Establishment	October 2004
Objective of the R&D centre	To provide support to the R&D of the parent organisation.
Major ongoing Projects	1. **Algorithms:** This includes complexity theory, approximation algorithms, graph algorithms, linear programming, game theory. 2. **Networking:** This includes switch architectures for routing packets at high speeds, and protocol design for data, optical and wireless networks. low cost networking technologies for providing broad band connectivity to remote areas and rural villages. 3. **Network management:** This includes software for configuring network parameters to improve resource utilization, monitoring end-to-end performance, isolating the root cause of faults, and detecting security violations. Network management software research for VOIP networks. 4. **Data management:** This includes software for integrating data from diverse sources, reconciling discrepancies among the data, and mining/analyzing massive network data streams. 5. **Distributed computing:** This includes peer-to-peer systems, publish/subscribe systems, distributed agreement, and communications middleware.
R&D Expenditure	US $ 1 Million or Rs. 450 Lakhs in 2004 - 5
Employment	9 (includes researchers at the Masters level are (3) and PhD level (6)). Lab members have diverse backgrounds (majority of them have obtained advanced degrees from US universities, while others pursued higher studies in India and Europe).
Training Programs and courses	**Joint research programs:** joint research agreements with faculty at a number of Indian educational institutions like Indian Institute of Science (IISc), and the Indian Institutes of Technology (IITs) to do collaborative research in the areas of (1) Efficient network monitoring, (2) Mining network performance data to find anomalies, (3) Algorithms for optimizing network performance, (4) Caching and replication in peer-to-peer networks, and (5) Using WiFi/WiMax to provide low-cost internet connectivity to remote areas and rural villages. **Summer intern program:** a summer intern program where students at all levels (Bachelors, Masters and PhD) get to spend 10-12 weeks working with Bell Labs researchers on cutting-edge research problems.

	Bell Labs Fellowship Awards: To encourage more students to pursue doctorate degrees, we have instituted Bell Labs Fellowship Awards at a number of Indian universities (IISc, IITs). As part of the fellowship, we offer a stipend to a select group of students who are enrolled in the PhD program, and have a strong academic/research track record.
Major Technologies Developed and Commercialised	**Network Management Software for Next-Generation IP Networks:** Lucent is building monitoring and management platforms that will enable service providers to offer *carrier-grade* services (VoIP, IPTV) over best-effort IP and wireless networks. (1) **Design and planning :** This involves traffic engineering of the MPLS core network, and determining optimal locations for VoIP elements like softswitches and media gateways so that the network can scale to handle large call volumes. (2) **Provisioning :** This involves configuring diffserv policies on routers to ensure QoS for voice traffic. (3) **Monitoring :** Next-generation networks require fine-grained, real time monitoring solutions to assure service quality to each and every subscriber. Lucent is developing active and passive probes to monitor network performance continuously and identify service impairments in real time. (4) **Service quality metrics:** Lucent is devising novel metrics, beyond delay, loss and jitter that accurately estimate the user perceived quality of VoIP and IP video services. (5) **Security:** Lucent is developing data analysis techniques for detecting DoS attacks and abnormal calling patterns in real time. Techniques include data streaming algorithms that minimize computation, storage and communication overheads. **WiCAT: Wireless Coverage and Assurance Tool:** Subscriber churn is a serious problem for Wireless service providers (WISP) who are also looking for ways to distinguish their networks from competitors. Currently, WISPs have very limited information about the individual user experience, and characteristics and capabilities of mobile devices. Software agents on mobile handsets are a novel and scalable method for acquiring such critical information. Lucent is developing software agents that run on mobile handsets, and collect a wide range of statistics at the RF level (like signal strength), and at the application level (like server response times and frequently accessed web pages). The agent technology can be used in a variety of applications; GPS-enabled mobile phones can provide location information coupled with signal strength to obtain real time coverage maps. These agents can also be used by the WISP to initiate remote tests, acquire performance statistics, and thus more accurately diagnose connectivity problems. **Next-Generation Naming Services**: The current Domain Name System (DNS), due to its hierarchical structure, imposes a disproportionate amount of load on nodes close to the root, and is thus not very scalable. We are working on a naming system based on a distributed peer-to-peer architecture for applications like video, RFID, etc. Due to better load balancing, peer-to-peer systems are more scalable and resilient to DoS attacks compared to today's hierarchical DNS architecture. We are studying novel caching and replication schemes to improve the performance of peer-to-peer naming services.

	Lucent is also working on improvements to the caching algorithm of current DNS (based on BIND9) that can significantly reduce query response times. **Low-Cost Networking for Rural Areas:** Developing countries like India have low broadband penetration rates (India has only 20-30 million Internet users) and limited ability to pay (30% of the Indian population is below the poverty line). Our goal is to leverage WiFi and WiMax to provide broadband wireless access to remote areas and rural villages. Specifically, we're focusing on MAC and networking layer innovations to WiFi and WiMax so that they can be deployed in an outdoor setting in a mesh topology with long-distance link transmissions.
Publications	3 publications in 5 period, 2005 conference by Rajeev Rastogi 1 Publication in ULDB, 2005 conference by Rajeev Rastogi 2 publications in INFOCOM 2006 conference by Sharad jaiswal

2 **IBM India Research Laboratory**	
Area of Specialisation	Information Technology – Services, Sciences, Information Management, User Interaction technologies, e commerce, Life Sciences, Distributed Computing and Software Engineering
Year of Establishment	1998
Objective of the R&D centre	1. To perform contract research for organisation world wide 2. To perform contract research for organisation in India 3. To provide research support to the R&D of the parent organisation
Major ongoing Projects	**Solutions & Services** Business Finder: Enabling On Demand Business in a Mobile Marketplace Eclipse-based eGovernance Framework End-to-End Multi-Provider Pervasive Solutions On Demand Innovation Services **Information Management** Policy Infrastructure for Data Management Search Essence BUSTER Web Content Monitoring Web Fountain **User Interaction Technologies** Speech Technologies Reusable Dialogue Components **e Commerce** Ease of Deployment Multi-channel Information Fusion Online Marketing Research **Life Sciences** Biological Knowledge Discovery Infrastructure Functional Magnetic Resonance Imaging **Distributed Computing** Decentralized Orchestration of Composite Web Services

	High Performance Computing Fault tolerance in massively parallel systems Performance analysis of parallel programs **Software Engineering** Legacy Transformation Multi-site Software Development On-demand Data Centre Services (ODCS): Porting
Linkages and affiliations	**University Linkages:** IBM India Research Lab (IRL) has an active University Relations program. IBM offers a host of grants, internship opportunities and awards for faculty and students from leading institutions in India. The various programs that IBM IRL currently has are: 1. **Faculty Travel Program**, open to faculty from the Indian Institutes of Technology (IITs) located at Chennai (Madras), Delhi, Kanpur, Kharagpur and Mumbai (Bombay) and the Indian Institute of Science (IISc) at Bangalore. 2. **Student Travel Program**, open to students pursuing their graduate degrees at the six institutions mentioned above. 3. **Awards for outstanding PhD students**, apart from the six institutions mentioned above, students from TIFR, Mumbai (Bombay), are also eligible for these awards. 4. **One Year Project Training at IRL**, open to students from the Indian Institutes of Technology Bombay, Delhi, Guwahati, Kanpur, Kharagpur and Madras. 5. **Summer Internship Program**, open to students pursuing B.Tech/M.Tech/PhD from all Indian Institutes of Technology and students pursuing M.Tech/PhD from Indian Institute of Science, Bangalore and PhD students from select Universities abroad. The Faculty and Student travel grants mentioned above are provided to enable presentation of papers at select international conferences. 6. **Shared University Relations Program:** In this program, IBM awards equipment to universities in order to promote research in areas of mutual interest, and strives to connect the research and researchers at the university with personnel who are interested in the research from the IBM research, development and solutions provider communities. The SUR program at any given institution is well suited to initiate and/or to support a strong ongoing relationship that benefits both the university as well as IBM. There are about 50-60 awards per year world-wide. **7. Eclipse Innovation Grants:** IBM's Eclipse Innovation Grant program provides funding for faculty members and researchers who lead projects that use the Eclipse open source code base for teaching or research, or to actively promote the growth of Eclipse user communities. Award recipients are also encouraged to share their infrastructure with the Eclipse community via the Eclipse open source project. In its second year, the IBM Eclipse Innovation Grants awards program has attracted a record number of high-quality proposals from around the world.

	Eclipse is an open-source community that creates technology and an open universal platform for tools integration. Eclipse based tools give developers freedom of choice in a multi-language, multi-platform, multi-vendor supported environment. Eclipse delivers a plug-in based framework that makes it easier to create, integrate and use software tools, saving time and money. By collaborating and sharing core integration technology, tool producers can concentrate on their areas of expertise and the creation of new development technology. The Eclipse Platform is written in the Java language, and comes with extensive plug-in construction toolkits and examples. It has already been deployed on a range of development workstations including HP-UX, Solaris, AIX, Linux, MAC OS X, QNX and Windows based systems. Eclipse also offers significant value to researchers and educators, by providing an industrial-strength infrastructure for conducting research and developing curricula in many areas of computer science and computer engineering, with particular relevance to programming languages, development tools, collaboration and programming environments. **<u>Government Linkages:</u>** 1. IBM works with a few State governments of India on their e-governance initiatives. 2. Conducted survey on improvising India's Healthcare and Education Systems through IT in 2004-5, presented to the President of India in March 2005 3. Similar linkages with governments worldwide. 4. Work closely with industry bodies like NASSCOM and CII.
R&D Expenditure	US $ 5.5 billion or Rs. 2475000 Lakhs worldwide
Employment	More than 100
Training Programs and courses	See "University Linkages" in "Linkages and Affiliations" Apart from that IBM offers on the job training to their staff time to time as per requirements.
Patents	120 by Indian entity (Source: Business Today-Evalueserve)
Publications	Various Journal publications, Conference publications, Whitepapers and Tutorials

3 **Texas Instruments India Private Limited**	
Area of Specialisation	Silicon design and embedded software
Year of Establishment	1985
Objective of the R&D centre	To provide support to the R&D of the parent organisation
Linkages and affiliations	Texas Instruments India works with universities to achieve **multiple objectives** 1. Promotion of TI company image amongst faculty and students

	on campus 2. Seeding of TI technology skills amongst large numbers of future technology industry engineers 3. Support of faculty / research staff in the outsourcing of industry R&D to universities on TI platforms 4. Support of campus product incubators that are building innovative products on TI platforms **University Distributor in India** Cranes Software is Texas Instruments' university distributor in India, with a distinct delivery model specifically designed to meet educational and training needs across the country. Cranes has setup over 450 TI DSP labs at universities in India, works with several state education committees in defining DSP syllabi, annually conducts over 300 small and large TI DSP workshops in India, and annually trains over 2000 faculty, researchers and technology industry professionals on TI DSP technologies. Cranes provides universities with: 1. Pre-sales guidance 2. Sales 3. Installation 4. Training workshops 5. Technical support 6. Teaching products 7. Course structure definitions related to TI DSPs **University Third Parties** TI's has several third parties in India, some of whom provide TI-DSP-based products and services to engineering schools in India. These partners include: Epsilon Control, Gill Instruments, I Micro Systems, Mistral Software Sands India **MSP430, High Performance Analog and VLSI Design Education at Universities** From 2005-06, TI has been actively promoting MSP430, High Performance Analog and VLSI Design education at universities in India. TI is actively working with state universities across India to strengthen the VLSI (Digital and Mixed Signal) Design ciricculum available to faculty and students across a large number of engineering colleges. This effort is being undertaken through select channels to achieve a goal of 10,000 annual VLSI-specialized graduates and 2,000 experienced VLSI faculty in India by 2008. **TI has Linkages with the following educational institutions**: Indian Institute of Science, Bangalore Indian Institute of Technology, Mumbai Indian Institute of Technology, Chennai Indian Institute of Technology, Kharagpur Indian Institute of Technology, Delhi Indian Institute of Technology, Kanpur Indian Institute of Technology, Guwahati Indian Institute of Information Technology, Bangalore Birla Institute of Technology & Science, Pilani

	Birla Institute of Technology, Mesra National Institute of Technology, Calicut National Institute of Technology, Karnataka National Institute of Technology, Tiruchirappalli National Institute of Technology, Warangal Dhirubhai Ambani Institute of Information and Communication Technology, Gandhinagar
Employment	1200 Engineers
Training Programs and courses	Training is provided in the following areas 1. Business and customer 2. Leadership and management 3. Engineering 4. Quality 5. Product training 6. Project and program management 7. Personal growth Training is imparted through various delivery methods such as: (1) Instructor-led (2) Web cast (3) Video and (4) e-learning
Major Technologies Developed and Commercialised	**Products developed** 1. Amplifiers & Linear 2. Digital Signal Processors 3. Data Converters 4. Interface 5. Logic 6. Micro Controllers 7. Power Management
Patents	225 by Indian entity (Source: Business Today-Evalueserve)

4 **Xilinx India Limited**	
Area of Specialisation	Software – Logic Solutions
Year of Establishment	2004
Objective of the R&D centre	To provide support to the R&D and the manufacturing unit of the parent organisation.
Major ongoing Projects & Technologies development	1. Developing programmable gate array (FPGA) solutions targeted at high growth markets such as consumer electronics, automotive and communications 2. Xilinx programmable silicon platform (90nm devices)
Employment	30 employees (to grow to 300 in Hyderabad centre)

SECTOR: OTHERS

1 SANDVIK ASIA LIMITED, R&D Centre	
Area of Specialisation	Engineering and Materials Technology
Year of Establishment	1980
Objective of the R&D centre	1. To perform research on a contract basis for organisations world wide 2. To provide research support to the manufacturing unit of the parent organisation 3. To provide research support to the R&D of the parent organisation
Major ongoing Projects	
R&D Expenditure	2002-3 – Rs. 126 Lakhs 2003-4 – Rs. 136 Lakhs Total- Rs. 262 Lakhs
Employment	Doctoral level – 3, Masters degree – 7, Bachelors degree – 7, Technicians - 9
Infrastructural Facilities	1. CAD – CAM systems 2. Chemical, metallurgical and analytical facilities 3. JICS – Fixtures and Instruments
Major Technologies Developed and Commercialised	1. Recovery of tungsten from hard metal - 1982 2. Recovery of cobalt from hard metal crap and similar other resources and manufacture of extra fine cobalt powder- 1983 3. SALTUN – tungsten base EDM Electrodes, heavy duty arcing contacts for circuit breakers, tap changers – 1984 4. Salpunite – Guide rolls for use in steel wires rolling mills – 1985 5. Salface – hard facing electrodes and rods – 1986 6. Gamma – Alumina coated grades for cutting tools – 1986 7. (TiW)C – Titanium / Tungsten Carbide powder – 1987 8. Special purpose machines and equipments – 1989 9. Extruded cemented carbide rods / flats – 1991 10. Special carbide grade for railway wheel turning and other heavy duty applications – 1991 11. Development of cheap breaker geometries and press too plungers for some using CAD / CAM – 1992 12. Development of carbide cutting edge for motor graders – 1990 13. Development of fine grained carbide grades for watch industry etc. – 1992 14. Manufacture of ultra fine cobalt powder – 1992 15. Cobalt oxide powder – 1993 16. Gradient cintered grades – 1994 17. diffusion bonded electrical contacts – 1995 18. New generation coated tool grades – 1996 19. Inserts for cast iron milling – 1997 20. Speial geometries for rail cross milling inserts – 1997 21. FMS tooling packages for earth movers – 1997 22. Face milling tools for steel plants – 1998 23. Tooling for differential case for automobiles – 1998

	24. High speed boring bars for 2 wheelers - 1998 25. Recycling system in CVD coating – 1999 26. development for new resource for cobalt - 1999 27. 6" DTH Hammer – 2000 28. New cutting heads and cartridges – 2001 29. Cobalt grade for gang saw blades – 2002 30. Process monitoring system - 2002

2 **Sanyo LSI Technology India Private Limited**	
Area of Specialisation	SLTI has domain expertise in the following areas of work: Multimedia, DSP Hardware & Software in the areas of Audio & Video Compression, chipsets for display systems and IP blocks in communication systems for parent company SANYO Japan.
Year of Establishment	1998
Objective of the R&D centre	The objective of SLTI is to work in close co-ordination with **SANYO Semiconductor Business Headquarters** in Japan to provide strong development support in the area of LSI design and embedded software which are the key components that go into the present day consumer electronic equipment.
Major ongoing Projects	Co-operative Development with Japan R&D Product Design for Asian Market. **Macro cell:** Macrocell group in SLTI has professional design skills in SRAMs, basic analog cells such as operational amplifiers, comparators and complex analog designs like ADCs and DACs. **Flash Memory:** Sanyo is developing NOR type Flash memory that is superior for random accessing and direct programming with split gate technology. SLTI is actively involved in designing embedded as well as standalone Flash that involves the full custom IC design flow from specification to testing on silicon. The design challenges include generating and dealing with higher voltages, accurate current sensing at low power supplies, etc. **Micro & RISC Hardware Group:** In Micro and RISC hardware group SLTI engages in LSI/VLSI front-end design. The design includes the peripheral blocks development for micro controllers like ARM, 8051 and Sanyo's own micro controllers. Some of the peripheral, which we have already designed, are OSD controllers for TV, IIC controller, IRDA controller etc. SLTI also carries out stand-alone designs like USB Hub, MP3 decoders etc. SLTI is also involved in projects, which are executed in Japan. **Micro Software:** SLTI works on Analog TV features development for Indian and south east Asian countries customer. This development involves pure embedded programming on SANYO's 8-bit microcontrollers. We also work in areas of Inverter /motor control and energy meter applications. **DSC Software:** SLTI works on developing embedded software for

	Digital still Camera, the platform is based on SANYO's DSC solution. We have a qualified Bluetooth stack, which was qualified on microItron RTOS. **Software Quality Assurance:** SLTI is in the process of implementing SEI-CMM level 2 / 3 for their software development to create a professional software development environment to produce quality software. It is expected that future digital products are going to demand 70% – 80% software development effort and we are working towards building a strong embedded software development team as well as systems which can produce high quality, high performance software. **RISC Software Group:** This group main focus is on bringing up Linux OS on embedded systems (like Sanyo's custom boards based on ARM/ PPC). The domain expertise of this group includes writing device drivers, network protocol stacks, middleware and Wireless technologies.
R&D Expenditure	US $ 5 Million or Rs. 2250 Lakhs world wide
Infrastructural Facilities	1. State-of-Art System for Design (CAD) & Communication 2. SANYO LSI Technology India Private Limited has 11,000 Sq. ft. State-of-the-art design facility. The work station area comprises of modular furniture with flexibility for reconfiguration. The facility has a conference hall and the discussion rooms are well equipped for the modern day meetings. Hardware labs facilitate to the need for the hardware activities required for various projects. Added to these are the 30 KVA and the 10 KVA UPS systems as a 100% back up for the heart of the facility the Server Room. 3. The facility also has an additional 8,000 Sq. ft. area adjoining the present set up for future expansion. 4. SANYO LSI Technology India Private Limited is situated in the International Tech Park which is one of the best incubation facilities in Bangalore. The Park caters to all the other requirements like Dedicated Power Plant for un-interrupted power supply, Excellent Telecommunication services, efficient Transport facility, ample Parking area, central Air-conditioning, good water supply and beautiful landscape. 5. Effective Safety and security which is one of the most important aspects of the modern day business is addressed to its best in the Park
Major Technologies Developed and Commercialised	**Software IP optimized for ARM9** 1. H.264 encoder and decoder 2. GSM-AMR encoder and decoder 3. MP3 encoder and decoder

3.3 A Sector-wise Summary of the Findings on the locational and research characteristics

SECTOR	Agriculture
Number of centres contacted	12
Number of centres data available for	5
Situation	Bangalore (2), Ayrangabad (2), Hyderabad (2), Karnool (1), NCR (1).
Country of origin	USA (3), France (1), Netherlands (1)
Primary Objective of the R&D centres	1. Support R&D activities of the parent organisation **2.** Support manufacturing activities of the parent organisation

SECTOR	Automobile
Number of centres contacted	12
Number of centres data available for	4
Situation	Bangalore (all 4)
Country of origin	USA (2), Germany (1), Japan (1)
Primary Objective of the R&D centres	1. Support R&D activities of the parent organisation 2. Contract research for organisations world wide 3. Support manufacturing activities of the parent organisation

SECTOR	Biotechnology and Pharmaceuticals
Number of centres contacted	47
Number of centres data available for	15
Situation	Bnagalore (7), Mumbai (6), Pune (1), Goa (1), Hyderabad (1)
Country of origin	USA (7), Switzerland (3), Croatia (1), Denmark (1), Germany (1), Holland (1), UK (1)
Primary Objective of the R&D centres	1. Support R&D activities of the parent organisation 2. Contract research for organisations world wide 3. Contract research for organisations in India 4. support manufacturing activities of the parent organisation 5. Consulting

SECTOR	Chemical
Number of centres contacted	17
Number of centres data available for	3

Situation	Mumbai (2), Vadodara (1)
Country of origin	USA (1), UK (1), Saudi Arabia (1)
Primary Objective of the R&D centres	1. Support R&D activities of the parent organisation 2. support manufacturing activities of the parent organisation 3. Contract research for organisations world wide 4. Contract research for organisations in India

SECTOR	**Computer Software and Hardware**
Number of centres contacted	24
Number of centres data available for	4
Situation	Bangalore (2), Hyderabad (1), New Delhi (1)
Country of origin	USA (4)
Primary Objective of the R&D centres	1. Support R&D activities of the parent organisation 2. Contract research for organisations world wide 3. Contract research for organisations in India

SECTOR	**Others**
Number of centres contacted	8
Number of centres data available for	2
Situation	Bangalore (1), Pune (1).
Country of origin	Japan (1), Sweden (1)
Primary Objective of the R&D centres	1. Support R&D activities of the parent organisation 2. Support manufacturing activities of the parent organisation 3. Contract research for organisations world wide

3.4 Summary of findings on the locational and research characteristics for all sectors combined

SECTOR	ALL
Number of firms contacted	119
Number of centres data available for	37
Situation	Bangalore (16), Mumbai (8), Hyderabad (4), NCR (2), Pune (2), Aurangabad (2), Vadodara (1), Goa (1), Karnool(1)
Country of origin	USA (17), Switzerland (3), Germany (2), UK (2), Japan (2), Croatia (1), Denmark (1), Holland (1), Saudi Arabia (1), France (1), Netherlands (1), Sweden (1)
Primary Reasons for choosing India as a destination (Ranking)	1. Availability of skilled manpower. 2. Proximity to Indian Market. 3. Availing existing S&T infrastructure. 4. Conducive government policy. 5. Availability of mass of diseased yet literate people for clinical research. 6. political stability.
Primary Objective of the R&D centres (Ranking)	1. Support R&D activities of the parent organisation. 2. support manufacturing activities of the parent organisation. 3. Contract research for organisations world wide. 4. Contract research for organisations in India. 5. Consulting.

3.5 ANALYSIS OF CONTRIBUTION TO CAPACITY BUILDING IN INDIAN INDUSTRIES

Name of the R&D Centre	R&D to support manufacturing unit in India	Contract research for organizations in India	Contract research for organizations worldwide	Any Other – collaboration, consultancy	Training programme for employees	Collaborative research with Indian Universities /Firms
Agricultural Sector						
Advanta	■			■	■	■
Monsanto	■					
Pioneer	■					
Seagram	■			■	■	■
Semminis	■					
Automobile Sector						
Daimler	■		■			
Delphi				■	■	
General Motors	■					
Toyota	■					
Biotechnology and Pharmaceuticals Sector						
Astra Zeneca	■			■	■	
Gangagen	■					
iGate		■	■	■		
Indus Bio Sciences		■	■			■
Intenvet	■					
J F Welch	■				■	■
Merck	■	■	■			
Millipore	■	■			■	
Novartis						
Novo Nordisk	■	■			■	
PharmaNet		■	■			
Pliva		■	■			
Quintiles		■				
Roche	■					
W. Lambert	■				■	
Chemical Sector						
BASF	■					
Hindutan Lever	■				■	
SABIC	■				■	
Computer Hardware and Software Sector						
Bell Labs	■				■	
IBM	■	■	■	■	■	■
Texas Instru		■	■		■	
Xilinx India	■					
Others						
Sandvik	■		■			
Sanyo	■					

Contribution to the capacity building in Indian industries can be measured in various ways, namely (1) Contract Research with Indian clients (2) Collaborative research with Indian Universities / Firms (3) Supporting own manufacturing unit in India and (4) Training Programs for Employees.

Contract Research:-

1. The number of firms engage in contract research with Indian clients in Biotechnology & pharmaceutical are 8 out of the 15 firms and the corresponding numbers in the Computer Software & Hardware Sector is 2 out of the 4 firms.

2. Firms in Agricultural, Automobile, Chemical and 'Other' sectors do not engage in such activities.

Collaborative research with Indian Universities / Firms:-

The number of firms engage in collaborative research with Indian universities/firms are given below sector-wise:-

1. Agricultural	2 (out of 5) firms
2. Automobile	0 (out of 4) firms
3. Biotechnology & pharmaceutical	2 (out of 15) firms
4. Chemical	0 (out of 3) firms
5. Computer hardware and software	1 (out of 4) firms
6. Others	0 (out of 2) firms

R&D to support manufacturing unit in India :–

The number of firms supporting manufacturing units in India are given below sector-wise:-

1. Agricultural	5 (out of 5) firms
2. Automobile	3 (out of 4) firms
3. Biotechnology & pharmaceutical	9 (out of 15) firms
4. Chemical	3 (out of 3) firms
5. Computer software and hardware	3 (out of 4) firms
6. Others	2 (out of 2) firms

Training Programs for Employees: –

The number of firms engage in training programs are given below:-

1. Agricultural	2 (out of 5) firms
2. Automobile	1 (out of 4) firms
3. Biotechnology & pharmaceutical	5 (out of 15) firms
4. Chemical	2 (out of 3) firms
5. Computer software and hardware	3 (out of 4) firms
6. Others	0 (out of 2) firms

APPENDIX I TO CHAPTER III

LIST OF 119 R&D CENTRES CONTACTED

Sector: AGRICULTURE

1. **Advanta India Limited, Karnool**
2. **Advanta India Limited Bangalore,**
3. **Advanta India Limited, Aurangabad**
4. **Advanta India Limited, Hyderabad**
5. Hybrid rice International Limited
6. Isagro (Asia) Agrochemicals Private Limited
7. **Monsanto Holdings Private Limited**
8. **Pioneer Overseas Corporation**
9. **Seagram India Private Limited**
10. **Seminis Vegetable Seeds India Limited**
11. Seagate Singapore International Headquarters Private Limited
12. Seed works India Private Limited.

Sector: AUTOMOBILE

1. **Delphi Automotive Systems Private Limited**
2. **Daimler Benz Research Centre India**
3. Eicher Goodearth Limited
4. Fiat India Private Limited
5. **General Motors – India Science laboratory**
6. Honeywell Technology Solutions Limited
7. Hyundai Motors India Limited
8. Honda Technical Centre Private Limited
9. Mico Bosch India Limited
10. **Toyota Kirloskar Motor Ltd.**
11. Visteon Technical and Services Center – India Private Limited
12. Volvo India Private Limited

Sector: BIOTECHNOLOGY AND PHARMACEUTICALS

1. Abbott India Limited
2. Albert David India Limited

3. **Astra Zeneca India Limited**
4. Avestha Gengrain Technologies Private Limited
5. AVL Bio Chemical Private Limited
6. Bio Ved Inc.
7. Boehringer Mannheim India Limited
8. Brantford Chemicals Private Limited
9. Brown and Burk Pharmacutcals Private Limited
10. Centre for Medical Innovations (India) Private Limited
11. Diagnostic Systems Lab India Private Limited
12. Emcure Biotech Limited
13. Ferrings Pharmaceuticals Limited
14. Flemming Laboratories Limited
15. Frost and Sullivan India Limited
16. Fulford India Limited
17. **Gangagen Biotechnologies Limited**
18. **iGate Clinical Research International Private Limited**
19. Haat Incinerators India Private Limited
20. **Indus Bio Sciences**
21. Instruments de' Medicine Veterinaire (IMV)
22. **Intervet India Private Limited**
23. Ivax International (GmbH)
24. **John F Welch Technology Centre, GE Health Care**
25. Lark Laboratories India Limited
26. **Merck Development Centre (I) Private Ltd**
27. Metahelix Life Sciences Limited
28. **Millipore India Private Limited**
29. Morepen Biotech
30. Muller & Phipps India Limited
31. **Novartis Enterprises Private Limited**
32. **Novo Nordisk India Private Limited**
33. Otira Pharmaceuticals Private Limited
34. Pharmacia and Upjohn India Private Limited
35. **PharmaNet Clinical Services Private Limited**
36. **Pliva Research (India) Private limited**
37. **Quintiles Research (India) Private Limited (Mumbai)**

38. **Quintiles Research (India) Private Limited (Bangalore)**
39. Reckitt Benckiser India Limited
40. **Roche Scientific Company (India) Private Limited**
41. UCB SA
42. WISEC Global Ltd.,
43. W. S. Atkins India Private Limited
44. **Warner Lambert India Private Limited; Pfizer Centre**
45. Wyeth Lederle Ltd
46. Zydus Altana Healthcare Private Limited

Sector: CHEMICALS

1. **BASF India Limited**
2. Amylum Europe NV
3. Kimani Establishment (Germany) in collaboration with Orchid Chemicals and Pharmaceuticals Ltd
4. **Sabic India Private Ltd**
5. Byk Lomberg Chemische FabriK GMBH
6. Fosroc Chemicals (I) Ltd
7. Hindustan Dorr Oliver Ltd
8. **Hindustan Lever**
9. Wockhardt Ltd [Joint Venture with Rhein Biotech GMBH]
10. Airliquid India Holdings Private Limited
11. Locitite India Private Limited [joint venture with Henkel
12. Vanavil Dyes and Chemicals Ltd
13. Colgate-Palmolive (India) Limited
14. Ciba Specialty Chemicals (India) Ltd
15. Engelhard Asia Pacific (I) Private Limited
16. Polaroid India Private Limited
17. Indian Oil [joint venture with Xytel Corporation]

Sector: COMPUTER HARDWARE AND SOFTWARE

1. Microsoft India (R&D) Private Limited
2. Siemens Ltd.
3. **IBM India Research Lab**
4. Intel India Development Centre

5. **Texas Instruments (India) Private Limited**
6. Robert Bosch India Limited
7. Google
8. **Xilinx India Limited**
9. Symantec Corporation (India)
10. Nvidia (India)
11. Oracle India Private Limited
12. Cisco Systems (R&D)
13. BMC Software India Private Limited
14. Cadence Designs Systems (I) Private Limited
15. IC Semiconductors
16. ST Microelectronics Private Limited
17. Adobe Systems India Private Limited
18. Alliance Semiconductor (India) Private Limited
19. Dell Computers India Private Limited
20. Infineon Technologies India Private Limited
21. Interra Software India Private Limited
22. **Lucent Technologies India**
23. Sun Microsystems India Private Limited
24. Advanced Micro Devices Far East Lmited

Sector: OTHERS

1. Badische Stahl Engineering India Private Limited
2. **Sandvik Asia Limited**
3. Elgi Tyre and Tread Limited
4. Alfa Laval India
5. Caterpillar India Private Limited
6. Fischer India Innovative Fixing Technologies Private Limited
7. Philips India Limited
8. **Sanyo LSI Technology India Private Limited**