Chapter 2

Council of Scientific & Industrial Research

2.0 The Council of Scientific and Industrial Research (CSIR) is one of the main organisations in India engaged in research and development in diverse fields of science and technology. At present, CSIR has a network of 38 laboratories / institutes and 80 extension / field / regional / polytechnology transfer centres spread all over India to undertake R&D in several disciplines. The areas of activity vary from molecular biology to leather, from seismicity to computer modelling, from aerospace to ocean sciences, from glass to steel, from micro-electronics to a range of test facilities and so on. The CSIR's role in the overall industrial development of the country, over the last six decades of its existence, has been in terms of providing technical know-how for upgrading existing technologies and generating fresh technologies in tune with the growing needs of the Indian industry.

CSIR laboratories have responded to the changes in the industrial, economic and trade policies introduced by the Government to successfully integrate the Indian economy in the global scene. Successful technology transfers have been achieved in various fields like drugs, agro-chemicals, petroleum refining, wood substitutes, waterproofing compounds and effluent treatment.

2.1 Overall Analysis

For analytical purposes as well as for meaningful comparison and consideration, the 38 CSIR labs were examined in 4 distinct groups as follows:

♦ BIOLOGICAL SCIENCES GROUP

1. Center for Cellular & Molecular Biology, Hyderabad
2. Institute for Genomics and Integrative Biology, New Delhi
3. Institute of Himalayan Bioresource Technology, Palampur
4. Indian Institute of Chemical Biology, Kolkata
5. Central Drug Research Institute, Lucknow
6. Central Institute of Medicinal and Aromatic Plants, Lucknow
7. National Botanical Research Institute, Lucknow
8. Institute of Microbial Technology, Chandigarh

9. Regional Research Laboratory, Jammu Tawi
10. Indian Toxicology Research Centre, Lucknow
11. Central Food Technology Research Institute, Mysore

♦ **CHEMICAL SCIENCES GROUP**

1. Central Electro Chemical Research Institute, Karaikudi
2. Central Salt and Marine Chemicals Research Institute, Bhavnagar
3. Central Leather Research Institute, Chennai
4. Indian Institute of Chemical Technology, Hyderabad
5. Indian Institute of Petroleum, Dehradun
6. National Chemical Laboratory, Pune
7. Regional Research Laboratory, Jorhat

♦ **PHYSICAL AND INFORMATION SCIENCES GROUP**

1. National Physical Laboratory, New Delhi
2. National Institute for Science, Technology And Development Studies, New Delhi
3. National Institute of Science Communication And Information Resources, New Delhi
4. National Institute Oceanography, Goa
5. National Geophysical Research Institute, Hyderabad
6. Central Scientific Instruments Organization, Chandigarh
7. Central Electronics & Electrical Engineering Research Institute, Pilani

♦ **ENGINEERING SCIENCES GROUP**

1. National Environmental Engineering Research Institute, Nagpur
2. National Metallurgy Laboratory, Jamshedpur
3. Regional Research Laboratory, Tiruvananthapuram
4. Regional Research Laboratory, Bhubaneshwar
5. Regional Research Laboratory, Bhopal
6. National Aerospace Laboratories, Bangalore
7. Structural Engineering Research Centre, Chennai
8. Central Road Research Institute, New Delhi
9. Central Mechanical Engineering Research Institute, Durgapur
10. Central Building Research Institute, Roorkee
11. Central Fuel Research Institute, Dhanbad
12. Central Glass and Ceramic Research Institute, Kolkata
13. Central Mining Research Institute, Dhanbad

2.2 Manpower

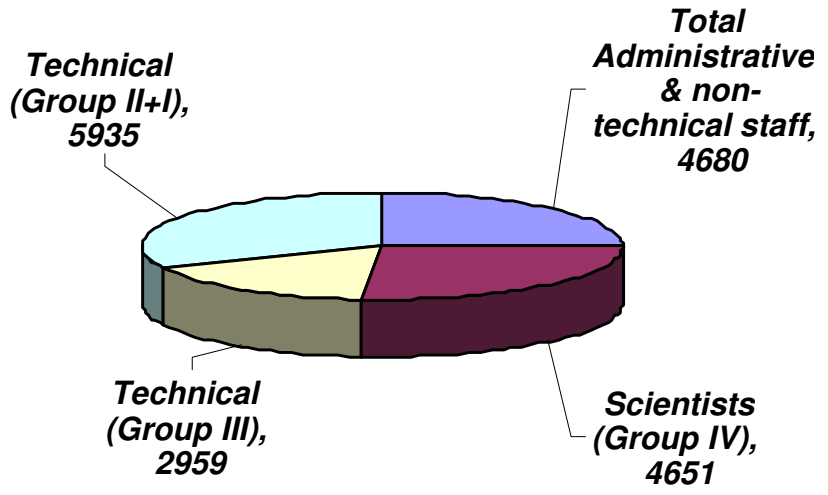
CSIR posses a large reservoir of R&D manpower numbering 13,545 scientists of finest calibre in the country who have demonstrated time and again their ability and skills in meeting challenges for the development of the country and have played a vital role in not merely making India self-reliant, but also a net exporter in the fields of drugs and pharmaceuticals, food, energy, housing, environment and rural development sectors.

2.2.1 Manpower Profile

The figure 2-1 below represents the Manpower profile of all the CSIR Laboratories as a whole, in terms of scientists, technicians and administrative staff:

Figure 2-1

CSIR MANPOWER RESOURCES



The details of the profile of manpower of CSIR laboratories are given in table 2-1below:

Table 2-1

S.No	TOTAL S&T STAFF	13,545
1.	SCIENTISTS (GROUP IV)	4651
	TECHNICAL (GROUP III)	2959
	TECHNICAL (GROUP II+I)	5935
2.	TOTAL ADMINISTRATIVE & NON-TECHNICAL STAFF	4680
	TOTAL STAFF	**18,225**

Source: CSIR Headquarters, 2005.

The Figure 2-2 and the accompanying Table2-2 gives indicative figures for group wise comparative analysis, of the manpower of the CSIR laboratories, in terms of scientists with PhD Degrees and those with postgraduate, qualifications, as well as engineers, technicians and supporting staff.

Figure – 2-2

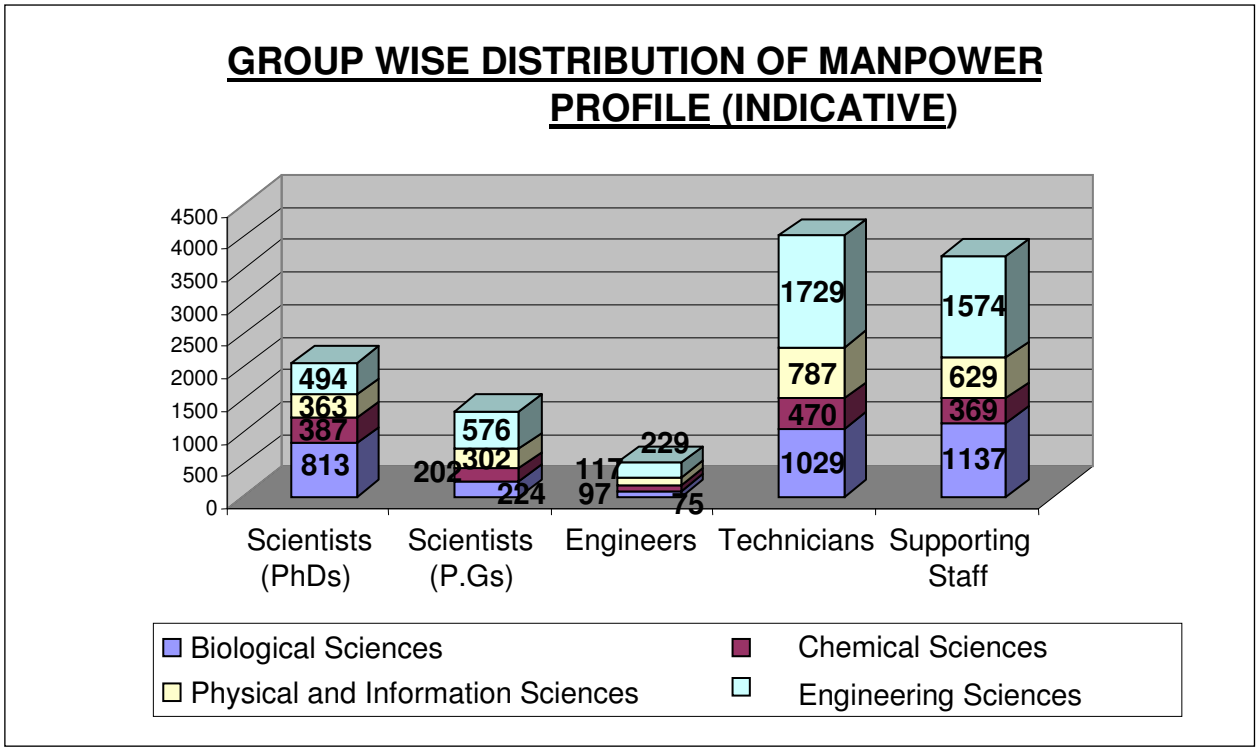


Table 2-2

Group-wise Distribution of Manpower Profile of CSIR labs (Indicative)

Groups	Scientists (PhDs)	Scientist (PGs)	Engineers	Technicians	Supporting Staff	Total
Biological Sciences	813	224	75	1029	1137	3278
Chemical Sciences	387	202	97	470	369	1525
Physical and Information Sciences	363	302	117	787	629	2198
Engineering Sciences	494	576	229	1729	1574	4602
Total	2057	1304	518	4015	3709	11603

The discrepancy in the total number of the staff in the above table as compared to the pictorial chart given on page 24 giving authentic data on date, is because many labs did not respond with data on staff on roll as per the categories asked. Nonetheless, the information collected on staff in terms of type and levels of qualifications totals to 11603, which is about 85.66% of the actual figure. The distribution of skills across the labs and their groups provides important insight.

As can be seen, the biological sciences group houses the largest number of Ph.D. scientists which account for 39.5% of the total Ph.D. scientists. The engineering sciences group has the largest number of P.G. scientists, engineers, technicians and supporting staff accounting for 44.17, 44.2, 43.06 and42.4% respectively of the total. The physical and information sciences group has the lowest number of Ph.D. scientists accounting for 17.6% of the total Ph.D. scientists. The chemical sciences group accounts for the lowest contribution in terms of P.G. scientists, technicians and supporting staff, with 15.5, 11.7 and 9.9% respectively of the total. The biological sciences group houses the lowest number of engineers, accounting for 18.7% of the total engineers in the CSIR system.

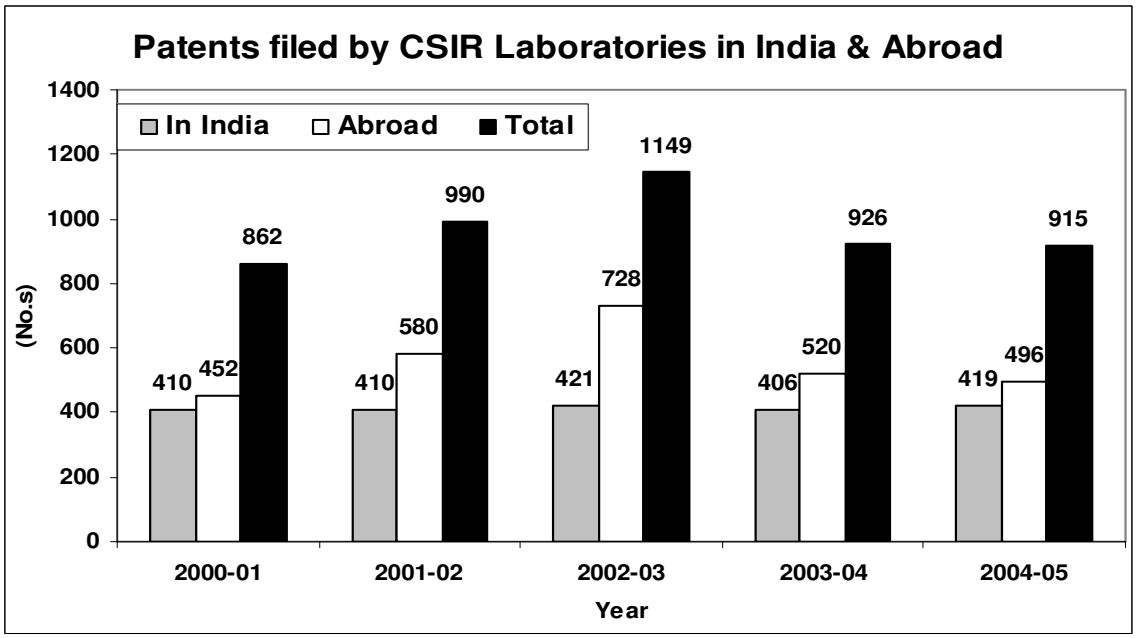
2.3 Patents

CSIR file highest number of patents not only in India but also abroad by any Indian entity. During the period 2000-01 to 2004-05 CSIR filed a total of 4842 patents (2066 patents within the country and 2776 patents abroad). Total number of Indian and foreign patents granted to CSIR during the period 2000-01 to 2004-05 were 1901(1075 Indian and 826 foreign). The utilization of patents of CSIR is more than 7 %, which is much higher as compared to the global average of less than 5 %. Some of the CSIR laboratories have also joined hands with several multinationals and world renowned business houses like Parke Davis, DuPont of America and Mitsui of Japan. In the domestic market, CSIR laboratories work closely with Indian industry and provide comprehensive solutions to their problems, technology packages and turnkey plants.

2.3.1 Patent Analysis

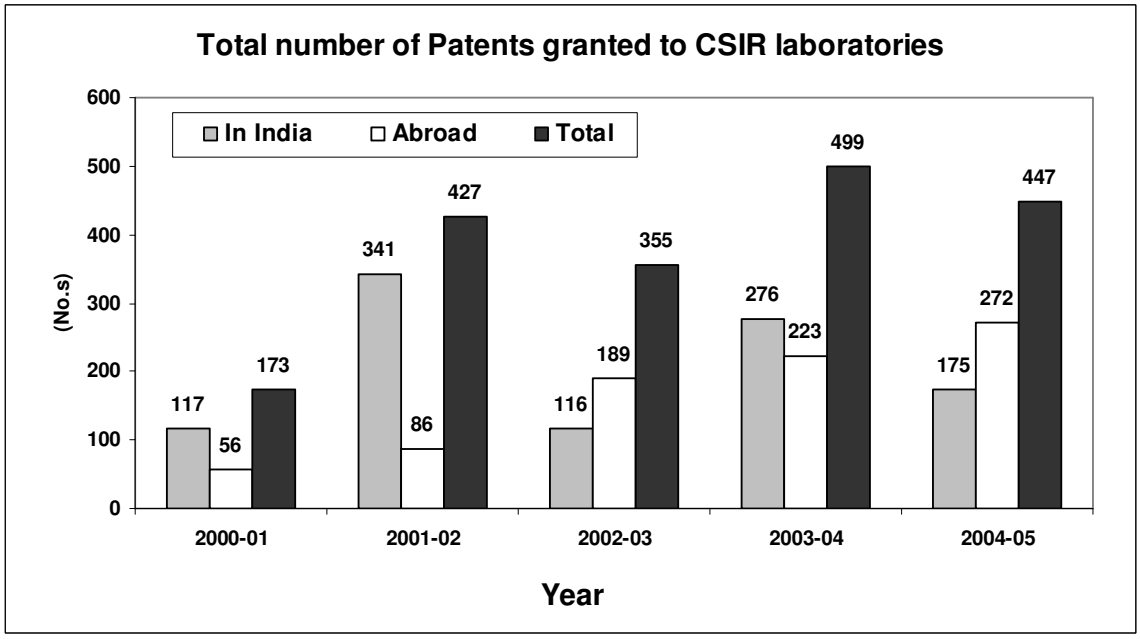
a. The following figure 2-3 represents the cumulative number of Patents applied by CISR laboratories in India and abroad from 2000-01 to 2004-05.

Figure 2-3



b. The following figure 2-4 represents the cumulative number of Patents granted to CISR laboratories in India and abroad from 2000-01 to 2004-05.

Figure 2-4



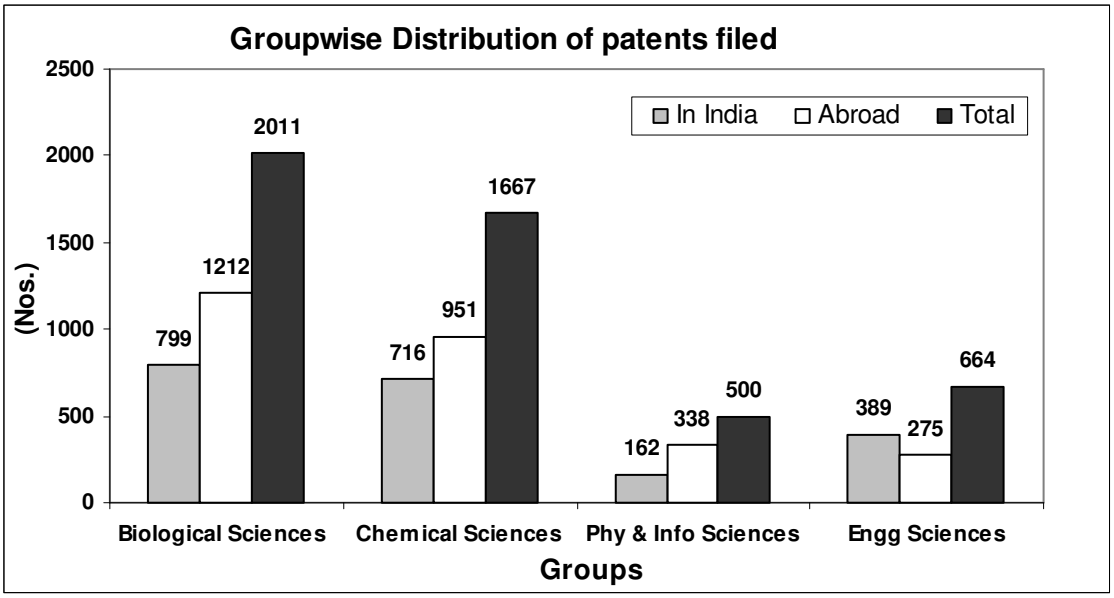
It is observed that the total number of Indian & foreign patents applied by the CSIR system has increased from 862 in the year 2001 to 1149 in the year 2002-03 and have decreased from there to 926 in 2003-04 and decreased further to 915 in the year 2004-05.

The number of foreign patents applied for shows an increase of 28.3% from 452 in the year 2000-01 to 580 in 2001-02 and further by 25.5% to 728 in the year 2002-03; however there is a decreasing trend from there to 520 in 2003-04 and 496 in the year 2004-05.

c. Group-wise Patents Analysis

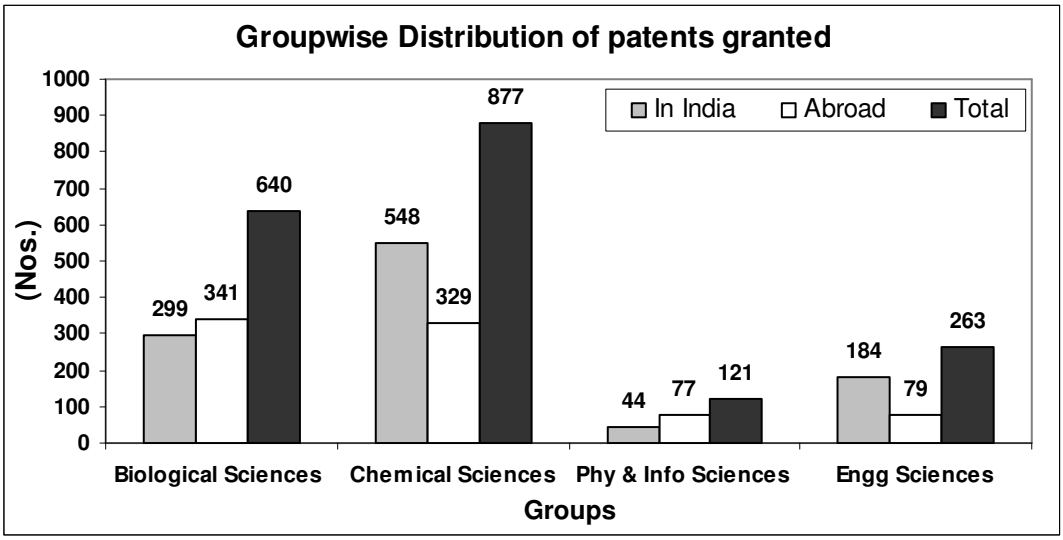
The group-wise analysis of the patents filed figure 2-5 shows that Biological sciences group has filed a total of 2011 patents in India and abroad followed by Chemical sciences group with 1667, Engineering sciences with 664 and Physical and Information sciences group 500 during the period 2000-01 to 2004-05.

Figure 2-5



However, the Chemical sciences group has been granted the maximum numbers of patents totaling 877 in India and abroad, followed by Biological sciences group with 640, Engineering sciences group 263 and Physical and Information science group with 121 during the period 2000-01 to 2004-05.(Figure 2-6)

Figure 2-6

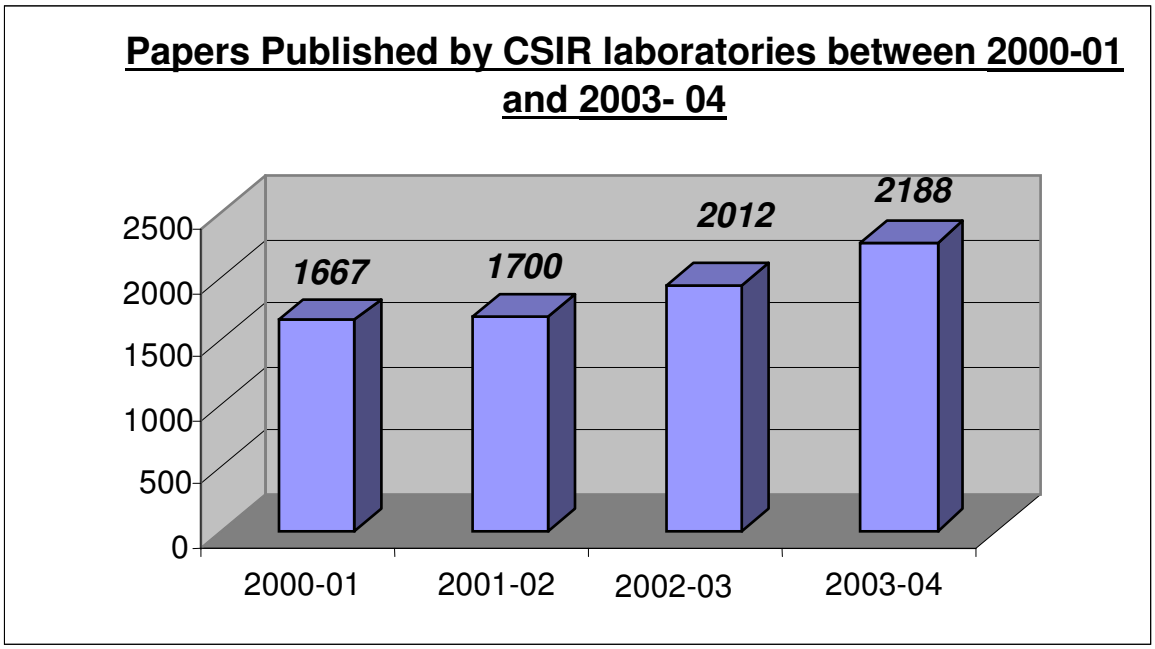


The preliminary analysis of patent data demonstrated that CSIR labs are fairly advanced in developing new knowledge and protecting them through patents in all the four groups studied. A strong patent regime and awareness is a necessary condition for attracting business and industry for seeking know-how and R&D services. A detailed analysis of patent portfolios possessed by CSIR labs to ascertain their strength in specific areas with regard to technology transfer and R&D services was beyond the scope of this study. This may, however, be taken up subsequently to identify specific areas of R&D services for focused attention.

2.4 Papers

The following figure 2-7 represents the total number of publications, for the CSIR Laboratories as a whole for 2000-01 to 2003-04:

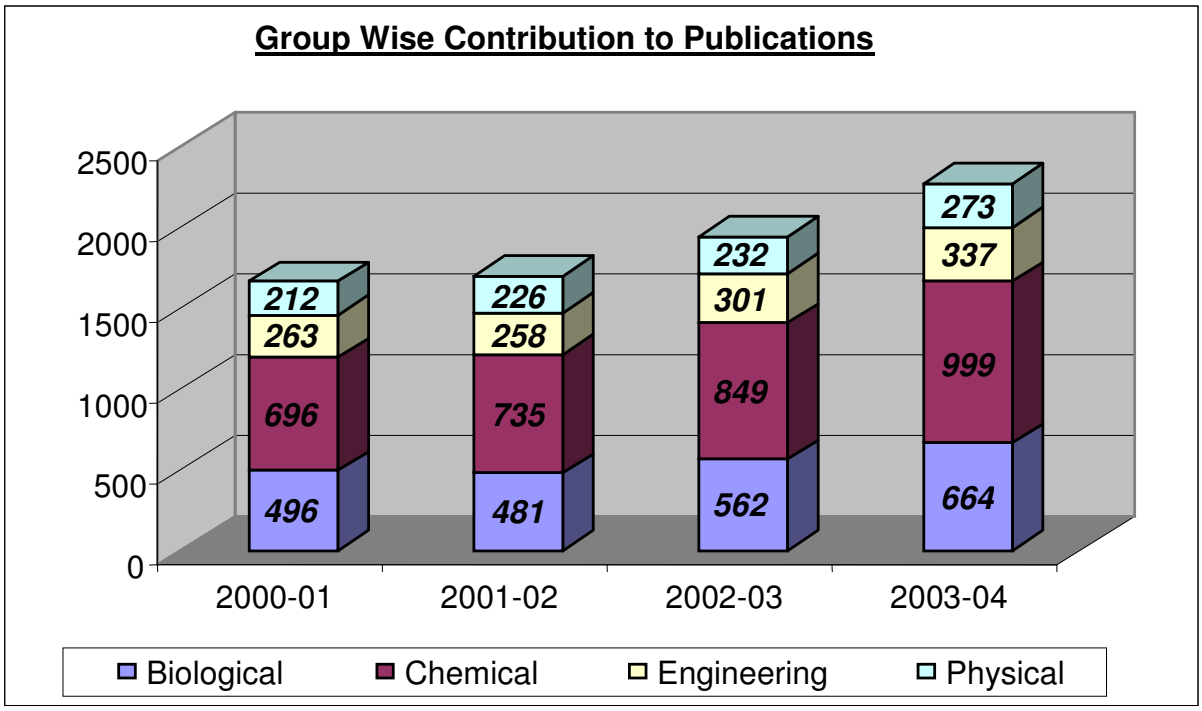
Figure 2-7



As is observed, there is a steady increase in the number of papers published from 2000-01 to 2003-04. Although there is only about 2% increase in the number of papers published from 2000-01 to 2001-02, the number of papers published increased by 18.35% from 2001-02 to 2002-03, and by 8.7% from 2002-03 to 2003-04 for the CSIR system as a whole.

An indicative representation of the number of papers published according to the different groups (figure 2-8) shows that the chemical sciences group contributed to the maximum number of papers published in all the years under review. The biological sciences group contributed to the maximum number of papers published in the year 2003-04. The chemical sciences group contributed to 41.7, 43.2, 42.2 and 45.6 % of the total papers published in the years 2000-01, 2001-02 , 2002-03 and 2003-04 respectively.

Figure 2-8



The biological sciences group contributed to 29.7, 28.3, 28 and 30.4% in the years 2000-01, 2001-02, 2002-03 and 2003-04 respectively. However, the group experienced a drop in the number of publications in the year 2001-02. The engineering sciences group contributed 15.7, 15.2, 14.9 and 15.4% in the years 2000-01, 2001-02, 2002-03 and 2003-04 respectively. However, the group experienced a drop in the number of publications in the year 2001-02. The physical and information sciences group contributed 12.7, 13.4, 11.5 and 12.5% in the years 2000-01, 2001-02, 2002-03 and 2003-04 respectively.

The analysis of publication profile of CSIR labs was considered essential to throw light on the areas of strength in relation to possible R&D services being offered by CSIR labs. A direct correlation between the two could not however be derived. But it is evident that a good publication record is a reflection of productivity of CSIR labs. An increase of publications over time shows that productivity of CSIR labs has been on the rise in recent times. It was also learnt that the average impact factor of CSIR paper publications in SCI journals has also increased from 1.552 in 2000-01 to 1.749 in 2003-04 implying thereby that the value of CSIR papers has also gone up along with their increased number.

2.5 Expertise

Some of the CSIR laboratories, over the years have acquired expertise and recognition for providing a range of R&D services which meet international standards. A few of the significant ones are coal resource surveys; maintaining databases in the areas of drugs, toxicology, leather, food, chemicals etc; primary standards and calibration; environmental impact assessment; product evaluation etc. Specialised major facilities include wind tunnel, acoustic test facility and tower testing facilities among others. CSIR also has collaborative agreements for bilateral cooperation in R&D with 47 agencies in 42 countries. A list of these 42 countries is given is Annexure 3.

2.6 Major Core Competencies

Towards a first step of identification of exportable R&D services from the CSIR system, key areas of core competencies in each CSIR lab were identified followed by potential exportable R&D services that could be related to one or more core competencies.

Group wise core competencies of the laboratories and exportable R&D services along with delivery modes of R&D services are given in annexure 1. However, major core competencies identified in the four groups of the CSIR laboratories are as given below:

Biological Sciences Group: There are 11 laboratories in this group. The main core competencies identified in this group of labs are biotechnology, bioinformatics, cell biology, environmental biology, tea sciences, floriculture, drug design and development and food biotechnology etc.

Chemical Sciences Group: There are seven laboratories in this group. The main areas of competency in this group are – process design and engineering, membrane science & technology, specialty chemicals: organic synthesis, catalysis, polymer, arid zone plantations, electrochemical and electrochemical metallurgy etc.

Engineering Sciences Group: There are 13 laboratories in this group. The main areas of core competencies in this group are environment impact assessment, waste water treatment, refractory and advanced ceramics including

bio-ceramics electro-ceramics and non-oxide ceramics, mineral beneficiation, extractive metallurgy, characterization and synthesis of composites, wind tunnel modeling & testing, transmission line towers, road research and highway design, rapid prototyping and tooling, disaster mitigation and earth quake resistant structures, coal liquefaction and gasification and mining technology etc.

Physical and Information Sciences Group: This group comprises of 7 laboratories, the main areas of competency are – material science and characterization, radio & atmospheric science, superconductivity, cryogenics, ecosystems, marine technology assessment of mineral, underground water and hydrocarbon along with their exploration & management, instrumentation, power electronics and studies on various important subjects.