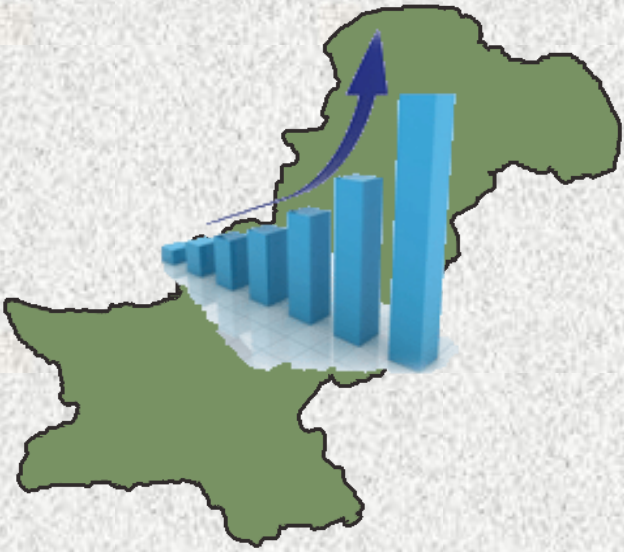
Pakistan

Science and Technology Data Book

2009



Pakistan Council for Science and Technology
Islamabad
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Science & Technology Data Book 2009

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FOREWORD

Pakistan Council of Science and Technology (PCST) is mandated to advise the Government on S&T policies and plans. It acts as a **Think Tank** by consulting experts in different S&T fields, and prepares state of the art reports on S&T issues. As the national repository for S&T statistics, PCST provides data to international and regional agencies such as UNESCO, SAARC etc. Periodically, the Council publishes reports on S&T indicators of Pakistan.

This is the second data book of the series and, like its predecessor, provides S&T Statistics as per UNESCO guidelines and covers all fields of science including social sciences and humanities. The S&T Data presented in this book is the result of a comprehensive survey conducted by the PCST during August – September 2008 giving figures for FY 2007-08. It covers 98% public sector Research Organizations (excluding the strategic organizations) and 89% of the higher education institutions in the public and private sector that respond to the survey. The information would be useful for S&T policy makers, researchers, scientists and technologists.

The efforts of **Dr. Shaikh Shahdin** Technical Expert, **Dr. Tariq Mahmood** Principal Research Officer, **Dr. Tariq Bashir** Principal Research Officer, **Mr. Muhammad Arshad** Senior Research Officer, **Mr. Abdullah Gaddani Baloch** Senior Research Officer, **Mrs. Sobia Sarwar** Senior Research Officer, **Mr. Muhammad Shahid** Research Officer, **Mr. Shiraz Khalid** Assistant Director, **Raja Mohsin Ali** Technical Assistant and **Mr. Tanzeel-ur-Rehman** Internee in conducting the survey and preparing the data book are highly appreciated.

(Dr. TARIQ-UR-RAHMAN)
CHAIRMAN

Abbreviations

AJK & NA	**Azad Jammu Kashmir and Northern Areas**
DAIs	**Degree Awarding Institutes**
Equi.	**Equivalent**
F	**Female**
FAEPM	**Federal Academy of Educational Planning and Management**
GDP	**Gross Domestic Product**
GNP	**Gross National Product**
HDI	**Human Development Index**
HEI	**Higher Education Institution**
IPO	**Intellectual Property Organization**
M	**Male**
MoIT	**Ministry of Information Technology**
MoST	**Ministry of Science & Technology**
PCST	**Pakistan Council for Science and Technology**
R&D	**Research and Development**
S&T	**Science and Technology**
T	**Total**
UNDP	**United Nation Development Program**


Part 1:
BASIC STATISTICS OF PAKISTAN

Table 1.1: Basic Statistics of Pakistan (2007-08)

General

- Population[1]: 161.10 million
- Population Growth Rate[1]: 1.8% (per annum)
- Geographical Area:
  - Total[2]: 803,940 sq km
  - Land[2]: 778,720 sq km
  - Water[2]: 25,220 sq km
- Roadways[1]: 264,853 km
- Railways[3]: 7,791 km

Source: [1]Pakistan Economic Survey 2007-08
[2] World Basic Facts (2008)
[3]M T D F 2005-10

Economy

- GDP[1,2]: $ 153.52 billion (Rs. 10,478.194 billion)
- GNP[1,2]: $ 156.95 billion (Rs. 10,712.18 billion)
- Per Capita Income[1,2]: $ 1085 (Rs.74051.25)
- Total Exports[1,2]: $ 19 billion (Rs. 1,296.75 billion)
- Total Imports[1,2]: $ 32.06 billion (Rs. 2188.095 billion)
- Foreign Direct Investment[1,2]: $3.6 billion (Rs. 245.7 billion)
- Natural Resources[3]: Natural Gas, Petroleum, Coal, Iron ores, Copper, Salt, Limestone.
- Major Exports[1]: Textile Products, Rice, Cotton, Fish, Carpets, Leather, Sports and Surgical Goods etc.
- Major Imports[1]: Petroleum and its Products, Edible Oils, Chemical Fertilizers, Machinery, Transport, Equipment, Medicines, Iron and Steel etc.

Source: [1]Pakistan Economic Survey 2007-08
[2] International Forex rate
[3] World Basic Facts (2008)

Education

- Literacy Rate[1]: 36%
- Male Literacy Rate[1]: 67%
- Female Literacy Rate[1]: 42%
- Primary Enrolment[2]: 24.585 million
- Middle Enrolment[2]: 5.369 million
- Secondary Enrolment[2]: 2.306 million
- University Enrolment[2]: 0.297 million

Information Technology

- Number of ISPs[3]: 62
- No. of Wireless Local Loop Subscribers[3]: 2.354 million
- No. of Land Line Users[3]: 4.546 million
- No. of Mobile Phone Users[3]: 90.407 million

Source: [1]Pakistan Economic Survey 2007-08
[2] Federal Bureaus of Statistics (2006-07)
[3]Pakistan Telecommunication Authority (2008)

Environment & Agriculture

- Forest Area[1]: 4.22 million hectares
- Agricultural Land[1]: 35.54 million hectares
- Water Available for Irrigation[2]: 135.7 million acre feet per year
- Population with Access to Clean Water[2]: 65%
- Energy Consumption[3]: 490 (kg of oil equivalent per capita)
- Electric Power Consumption[3]: 456 (kWh per capita)
- CO_2 Emissions[3]: 0.8 (metric tons per capita)

Source: [1]Federal Bureaus of Statistics (2006-07)
[2]M T D F 2005-10
[3]World Development Indicators Database (2007)


Part 2:
S&T ORGANIZATIONS AND HIGHER EDUCATION INSTITUTIONS

Table 2.1: Number of S&T Organizations and Higher Institutions

(Numbers)

Organization Type	No. of Organizations/ Institutions			Covered Under PCST Survey			
	Public	Private	Total	Public	Private	Total	(%)
Higher Education	67	57	124	62	48	110	89
R&D	85	-	85	83	-	83	98
Total	**152**	**57**	**209**	**145**	**48**	**193**	**92**

Source: (i) PCST Survey (2008-09)
(ii) HEC (2007-08)

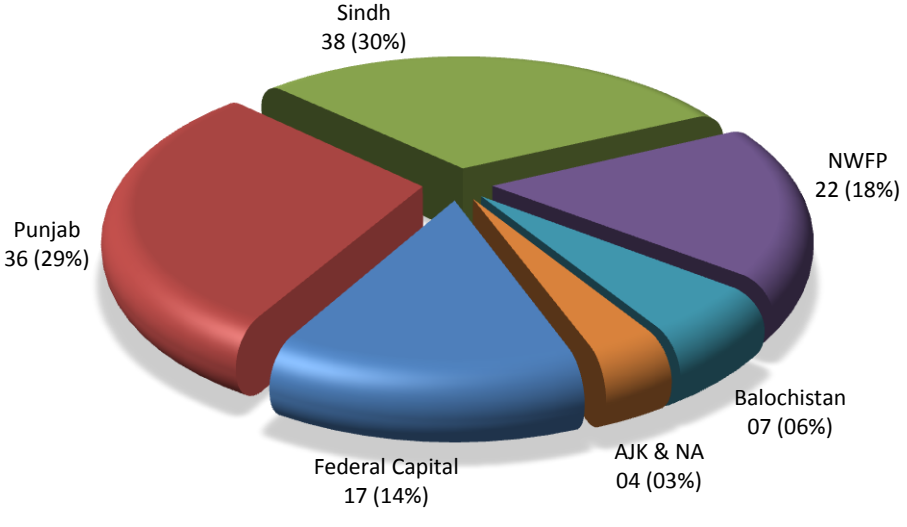
Table 2.2: Distribution of Higher Education Institutions by Sector and Location

(Numbers)

Region	Universities / DAIs		
	Public	Private	Total
AJK	1	2	3
Balochistan	6	1	7
Federal Capital	14	3	17
Northern Areas	1	-	1
NWFP	13	9	22
Punjab	20	16	36
Sindh	13	25	38
Total	**68**	**56**	**124**

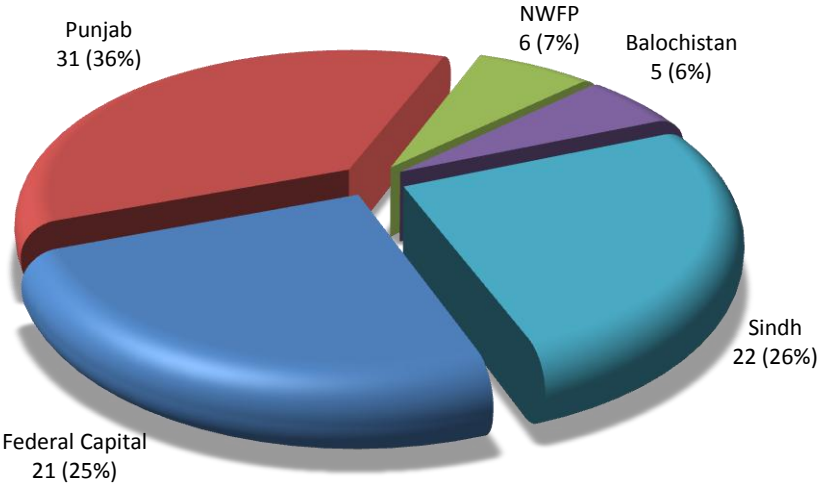
Source: HEC

Figure 2.1: Distribution of Higher Education Institutions by Location



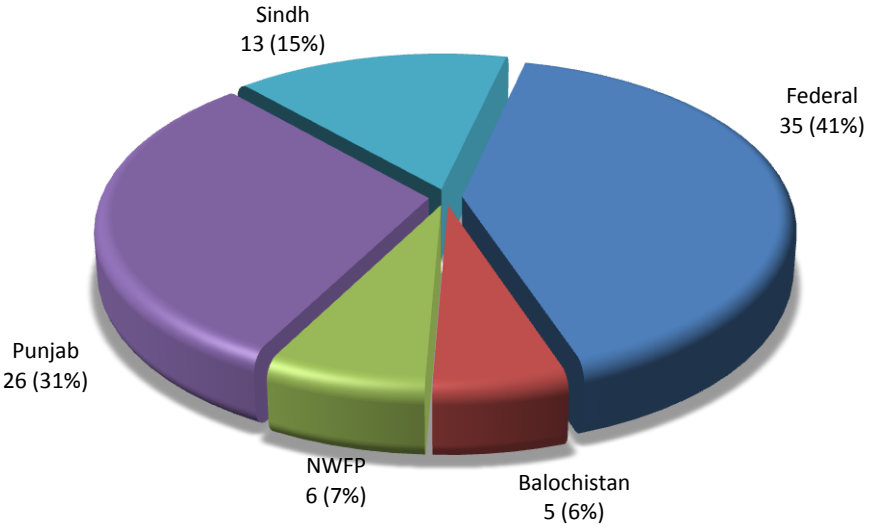
Source: PCST Survey (2008-09)

Figure 2.2: Distribution of Major S&T Organizations by Location



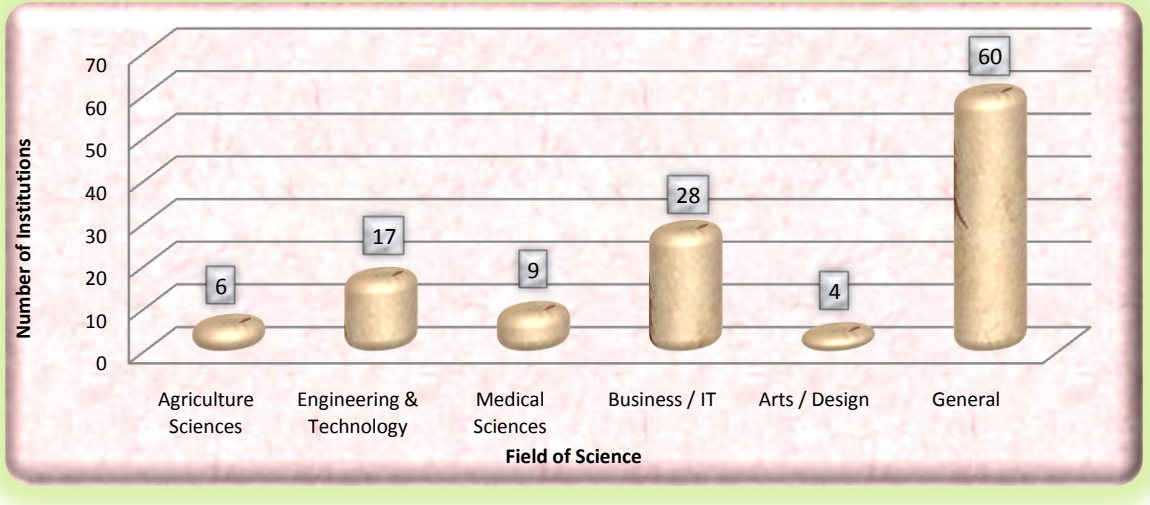
Source: PCST Survey (2008-09)

Figure 2.3: S&T Organizations by Administrative Control



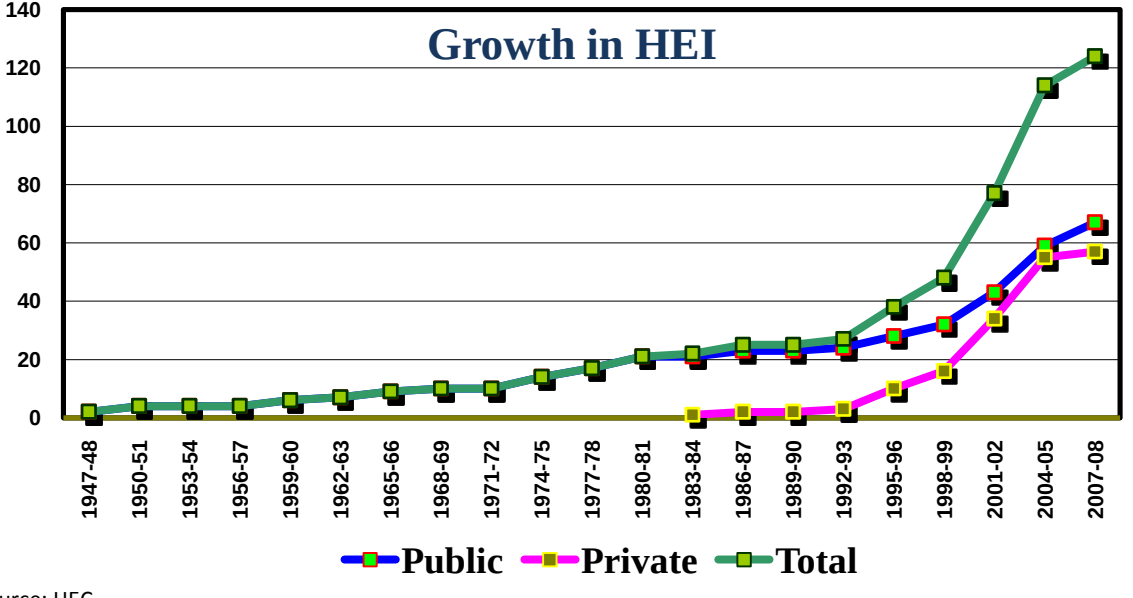
Source: PCST Survey (2008-09)

Figure 2.4: Number of Higher Education Institutions by Field of Science



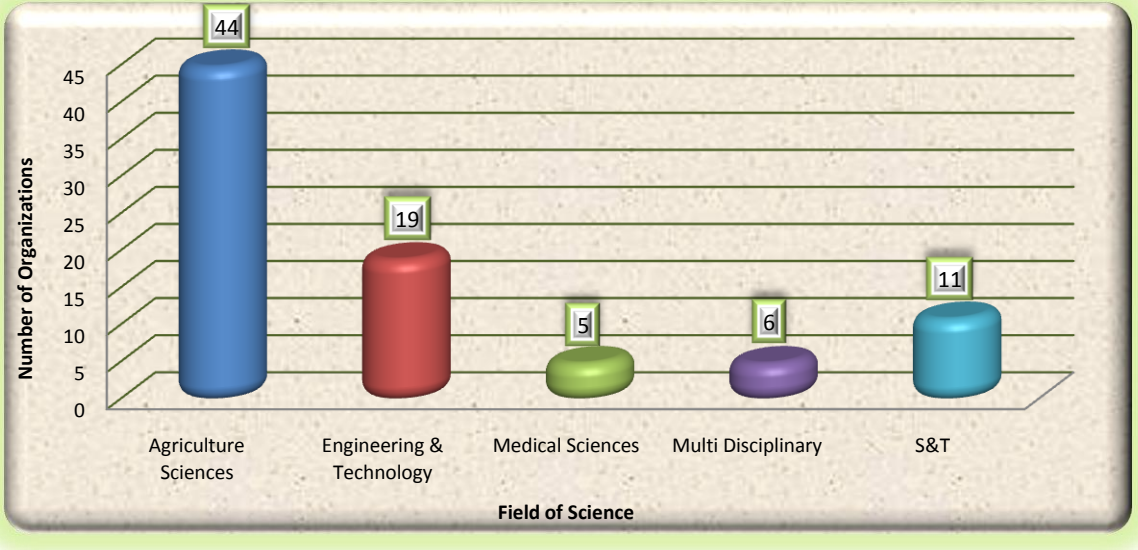
Sources: (i) PCST Survey (2008-09)
(ii) HEC

Figure 2.5: Growth in Higher Education Institutions



Source: HEC

Figure 2.6: Number of S&T Organizations by Field of Science



Source: PCST Survey (2008-09)


Part 3:
• S&T MANPOWER

Table 3.1: S&T Manpower (Head Count)

(Numbers)

Description	Researchers	Technicians	Support Staff	Total
Higher Education Institutions	44639	4583	34989	84211
R&D Organizations	8982	8736	27894	45612
Total	**53621**	**13319**	**62883**	**129823**

Source: PCST Survey (2008-09)

Table 3.2: S&T Manpower by Occupation – Full Time Equivalent (FTE)

(Numbers)

Sector	Occupation			
	Researchers	Technicians	Support Staff	Total
Higher Education Institutions*	17147	2295	5101	24543
R&D Organizations	8982	8736	27894	45612
Total	**26129**	**11031**	**32995**	**70155**

Source: PCST Survey (2008-09)

*For Calculation of FTE see Annexure-II.

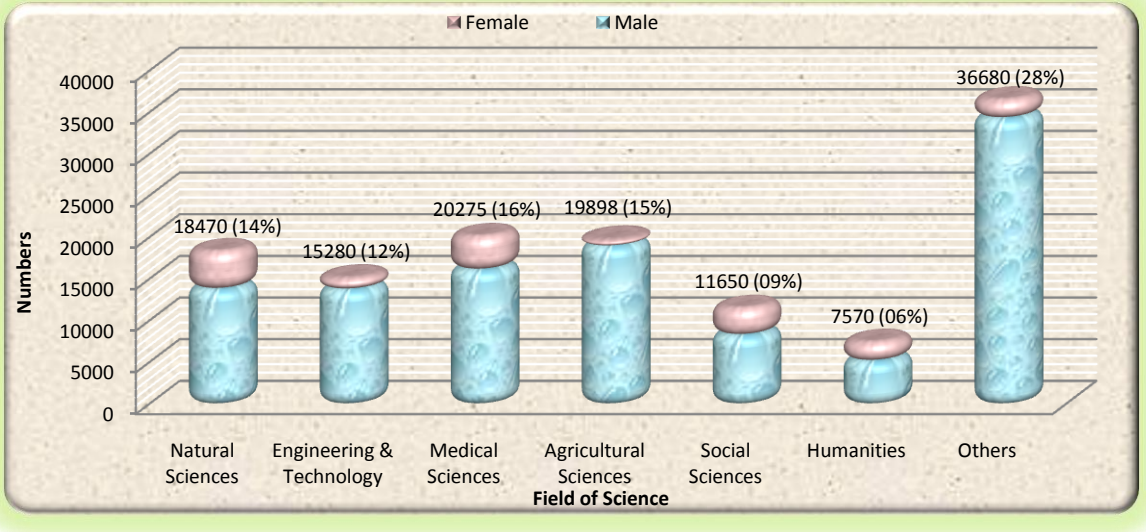
Table 3.3: S&T Manpower by Field of Science, Occupation and Sex (Head Count)

(Number)

Field	Researchers			Technicians			Support Staff			Total		
	M	F	Total	M	F	Total	M	F	Total	M	F	Total
Natural Sciences	8619	4311	12930	1232	54	1286	4006	248	4254	13857	4613	18470
Engineering & Technology	8632	1305	9937	2951	67	3018	2243	82	2325	13826	1454	15280
Medical Sciences	5514	3134	8648	2175	212	2387	8477	763	9240	16166	4109	20275
Agricultural Sciences	6627	669	7269	3021	69	3090	9397	115	9512	19045	853	19898
Social Sciences	4785	2722	7507	216	13	229	3324	590	3914	8325	3325	11650
Humanities	3103	2154	5257	444	57	501	1675	137	1812	5222	2348	7570
Others	1523	523	2046	2745	63	2808	30103	1723	31826	34371	2309	36680
Total	**38803**	**14818**	**53621**	**12784**	**535**	**13319**	**59225**	**3658**	**62883**	**110812**	**19011**	**129823**

Source: PCST Survey (2008-09)

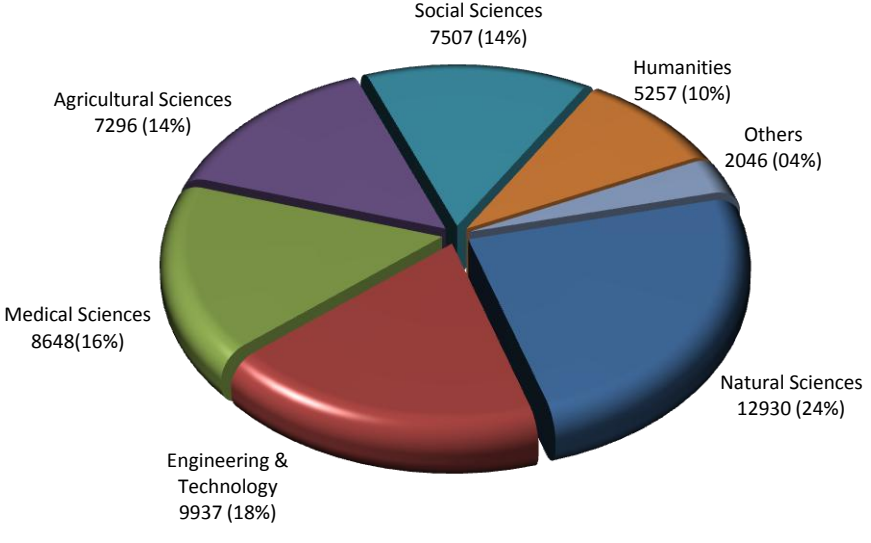
Figure 3.1: S&T Manpower by Field of Science (Head Count)



Source: PCST Survey (2008-09)

Total Manpower=129,823

Figure 3.2: Distribution of Researchers by field of Science (Head Count)



Source: PCST Survey (2008-09)

Total Researchers=53,621

Table 3.4: S&T Manpower by Level of Qualification, Occupation and Sex (Head Count)

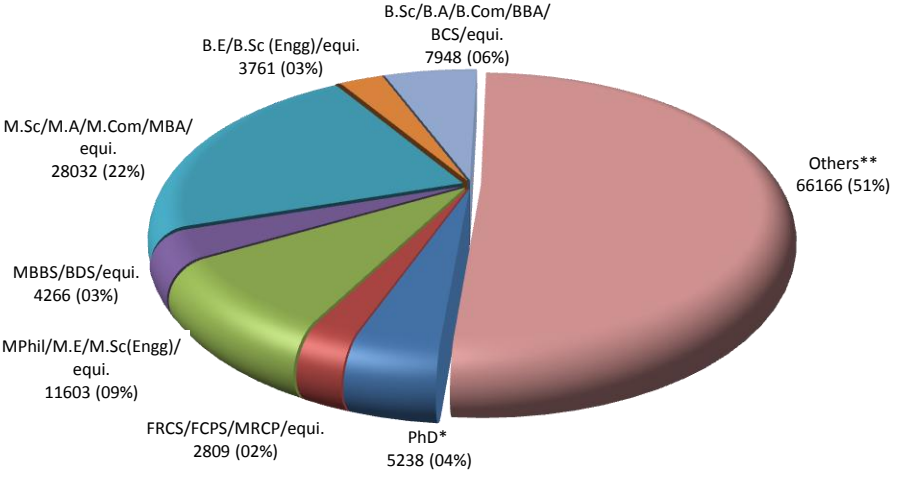
(Numbers)

Combined	Researchers			Technicians			Support Staff			Total		
	M	F	Total	M	F	Total	M	F	Total	M	F	Total
PhD	4370	835	5205	0	0	0	30	3	33	4400	838	5238
FRCS/FCPS/MRCP/equi.	2131	608	2739	2	1	3	41	26	67	2174	635	2809
MPhil/M.E/M.Sc(Engg)/ equi.¥	8446	2873	11319	29	10	39	199	46	245	8674	2929	11603
MBBS/BDS/equi.	2105	1349	3454	120	49	169	514	129	643	2739	1527	4266
M.Sc/M.A/M.Com/MBA/ equi.£	17047	7666	24713	617	70	687	2165	467	2632	19829	8203	28032
B.E/B.Sc(Engg)/equi.	2260	767	3027	176	16	192	396	146	542	2832	929	3761
B.Sc/B.A/B.Com/BBA/ BCS/ equi.#	1202	290	1492	1236	117	1353	4454	649	5103	6892	1056	7948
Others* (Not Specified)	1242	430	1672	10604	272	10876	51426	2192	53618	63272	2894	66166
Total	**38803**	**14818**	**53621**	**12784**	**535**	**13319**	**59225**	**3658**	**62883**	**110812**	**19011**	**129823**

¥6 years education after F.Sc. £4 years education after F.Sc. #2-3 years education after F.Sc. *F. A/F.Sc/Diploma and below.

Source: PCST Survey (2008-09)

Figure 3.3: S&T Manpower by Level of Qualification (Head Count)



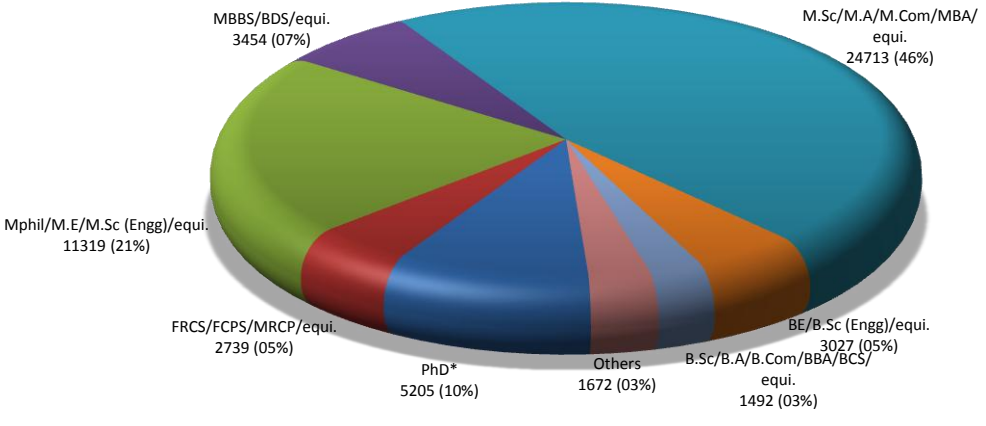
*See Table 3.4

**FA/F.Sc/Diploma and below.

Source: PCST Survey (2008-09)

Total Manpower=129,823

Figure 3.4: Researchers by Level of Qualification (Head Count)

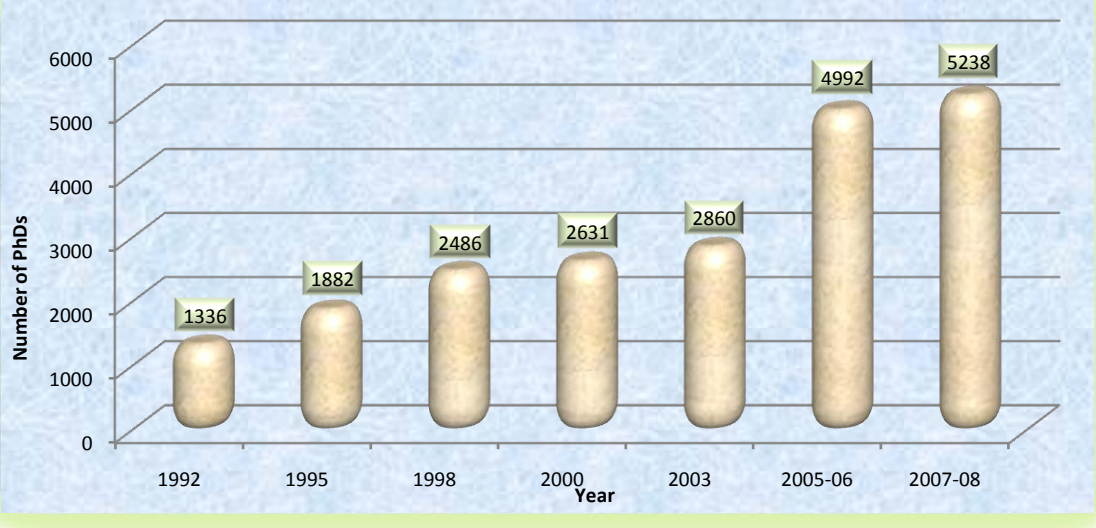


*See Table 3.4

Source: PCST Survey (2008-09)

Total Researchers=53,621

Figure 3.5: Growth in Number of PhDs



Source: PCST Survey (2008-09)

Table 3.5: S&T Manpower in Higher Education Institutions by Field of Science, Occupation and Sex (Head Count)

(Numbers)

Field	Researchers			Technicians			Supporting Staff			Total		
	M	F	Total	M	F	Total	M	F	Total	M	F	Total
Natural Sciences	7516	3951	11467	627	49	676	3687	242	3929	11830	4242	16072
Engineering & Technology	7068	1167	8235	1020	58	1078	1757	81	1838	9845	1306	11151
Medical Sciences	5173	2789	7962	923	135	1058	6209	698	6907	12305	3622	15927
Agricultural Sciences	2660	448	3108	85	6	91	425	4	429	3170	458	3628
Social Sciences	4536	2707	7243	175	12	187	3048	577	3625	7759	3296	11055
Humanities	2891	2143	5034	156	7	163	1227	116	1343	4274	2266	6540
Others (Not Specified)	1082	508	1590	1278	52	1330	15484	1434	16918	17844	1994	19838
Total	**30926**	**13713**	**44639**	**4264**	**319**	**4583**	**31837**	**3152**	**34989**	**67027**	**17184**	**84211**

Source: PCST Survey (2008-09)

Table 3.6: Faculty of Higher Education Institutions by Field of Science, Designation and Sex (Head Count)

(Numbers)

Field	Professors			Associate Professors			Assistant Professors			Lecturers			Total		
	M	F	Total	M	F	Total	M	F	Total	M	F	Total	M	F	Total
Natural Sciences	567	92	659	350	104	454	988	292	1280	1674	1065	2739	3579	1553	5132
Engineering Technology	470	15	485	319	18	337	1217	115	1332	2108	595	2703	4114	743	4857
Medical Sciences	876	234	1110	606	175	781	1456	567	2023	1646	1318	2964	4584	2294	6878
Agricultural Sciences	168	4	172	119	7	126	214	26	240	300	70	370	801	107	908
Social Sciences	407	95	502	210	101	311	832	333	1165	1162	1050	2212	2611	1579	4190
Humanities	182	53	235	163	80	243	376	279	655	797	949	1746	1518	1361	2879
Others (Not Specified)	107	14	121	93	12	105	226	68	294	322	197	519	748	291	1039
Total	2777	507	3284	1860	497	2357	5309	1680	6989	8009	5244	13253	17955	7928	25883

Source: PCST Survey (2008-09)

Table 3.7: Faculty of Higher Education Institutions by Qualification, Designation and Sex (Head Count)

(Numbers)

Field	Professors			Associate Professors			Assistant Professors			Lecturers			Total		
	M	F	Total	M	F	Total	M	F	Total	M	F	Total	M	F	Total
PhD	1788	245	2033	726	131	857	1049	292	1341	127	55	182	3690	723	4413
FRCS/FCPS/MRCP /equi.	530	110	640	408	95	503	1071	337	1408	97	48	145	2106	590	2696
MPhil/M.E/M.Sc (Engg)/equi.	216	65	281	285	96	381	1351	361	1712	1639	743	2382	3491	1265	4756
MBBS/BDS/equi.	54	36	90	53	22	75	153	71	224	1400	1163	2563	1660	1292	2952
M.Sc/M.A/M.Com /MBA/equi.	158	45	203	302	126	428	1282	479	1761	2878	2229	5107	4620	2879	7499
B.E/B.Sc(Engg)/ equi.	8	4	12	48	16	64	317	91	408	1260	637	1897	1633	748	2381
B.Sc/B.A/B.Com /BBA/BCS/equi.	3	2	5	12	1	13	38	15	53	403	211	614	456	229	685
Others (Not Specified)	20	0	20	26	10	36	48	34	82	205	158	363	299	202	501
Total	**2777**	**507**	**3284**	**1860**	**497**	**2357**	**5309**	**1680**	**6989**	**8009**	**5244**	**13253**	**17955**	**7928**	**25883**

Source: PCST Survey (2008-09)

Table 3.8: Research Students (Enrollment) (Head Count)

(Numbers)

Field	Ph. D Students			M. Phil Students		
	M	F	Total	M	F	Total
Natural Sciences	1219	702	1921	2718	1696	4414
Engineering & Technology	501	54	555	2453	370	2823
Medical Sciences	202	104	306	387	391	778
Agricultural Sciences	838	109	947	1021	232	1253
Social Sciences	493	209	702	1432	919	2351
Humanities	400	241	641	973	541	1514
Others (Not Specified)	59	33	92	275	184	459
Total	**3712**	**1452**	**5164**	**9259**	**4333**	**13592**

Source: PCST Survey (2008-09)

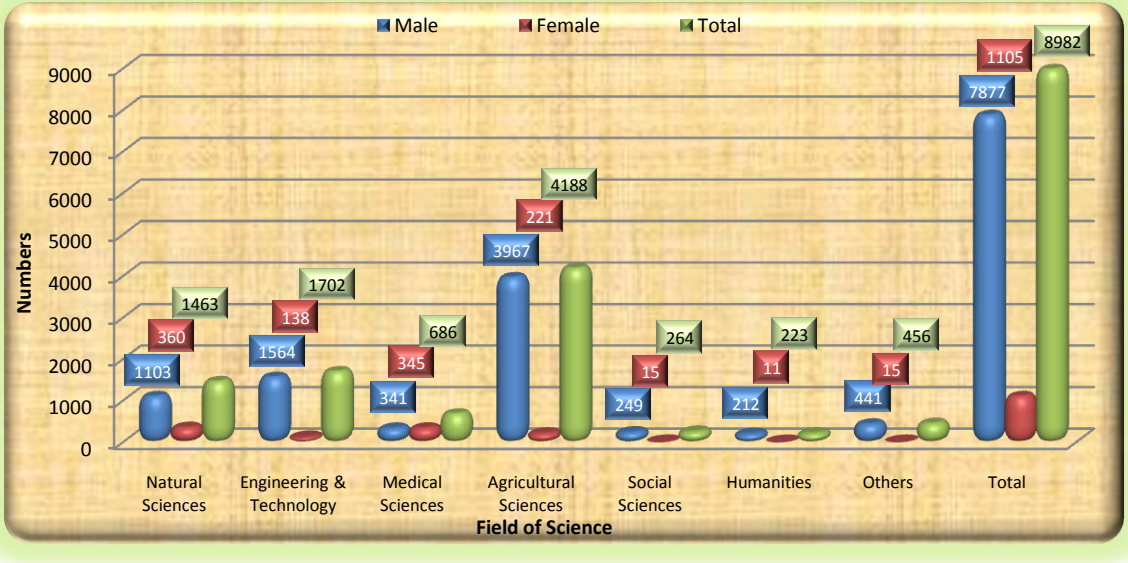
Table 3.9: Manpower in S&T Organizations by Field of Science, Occupation and Sex (Head Count)

(Numbers)

Field	Researchers			Technicians			Supporting Staff			Total		
	M	F	Total	M	F	Total	M	F	Total	M	F	Total
Natural Sciences	1103	360	1463	605	5	610	319	6	325	2027	371	2398
Engineering & Technology	1564	138	1702	1931	9	1940	486	1	487	3981	148	4129
Medical Sciences	341	345	686	1252	77	1329	2268	65	2333	3861	487	4348
Agricultural Sciences	3967	221	4188	2936	63	2999	8972	111	9083	15875	395	16270
Social Sciences	249	15	264	41	1	42	276	13	289	566	29	595
Humanities	212	11	223	288	50	338	448	21	469	948	82	1030
Others (Not Specified)	441	15	456	1467	11	1478	14619	289	14908	16527	315	16842
Total	**7877**	**1105**	**8982**	**8520**	**216**	**8736**	**27388**	**506**	**27894**	**43785**	**1827**	**45612**

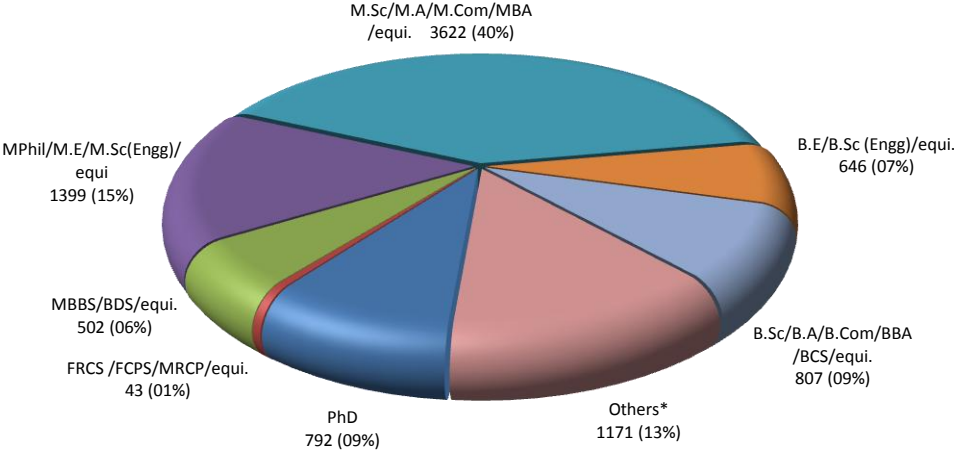
Source: PCST Survey (2008-09)

Figure 3.6: Researchers by Field of Science in S&T Organizations (Head Count)



Source: PCST Survey (2008-09)

Figure 3.7: Researchers in S&T Organizations by Qualification (Head Count)



*FA/F. Sc/Diploma and below.

Total Researchers=8,982

Source: PCST Survey (2008-09)


Part 4:
S&T / R&D EXPENDITURE

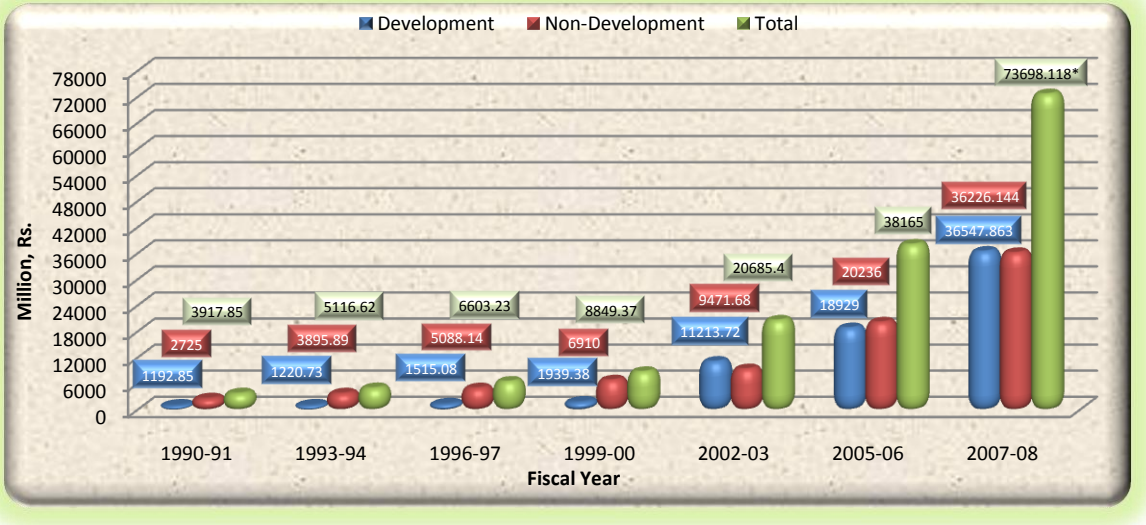
Table 4.1: S&T Expenditure by Type of Organization

(Million, Rs.)

Field	S&T Organizations (Nos.)	Expenditure
Agricultural Sciences	50	8909.599
Arts / Design	04	429.246
Business / IT	23	4065.189
Engineering & Technology	32	10,815.954
Medical Sciences	13	23,126.271
Multi Discipline	60	59,123.476
S&T Services	11	3229.691
Total	**193**	**109699.426**

Source: PCST Survey (2008-09)

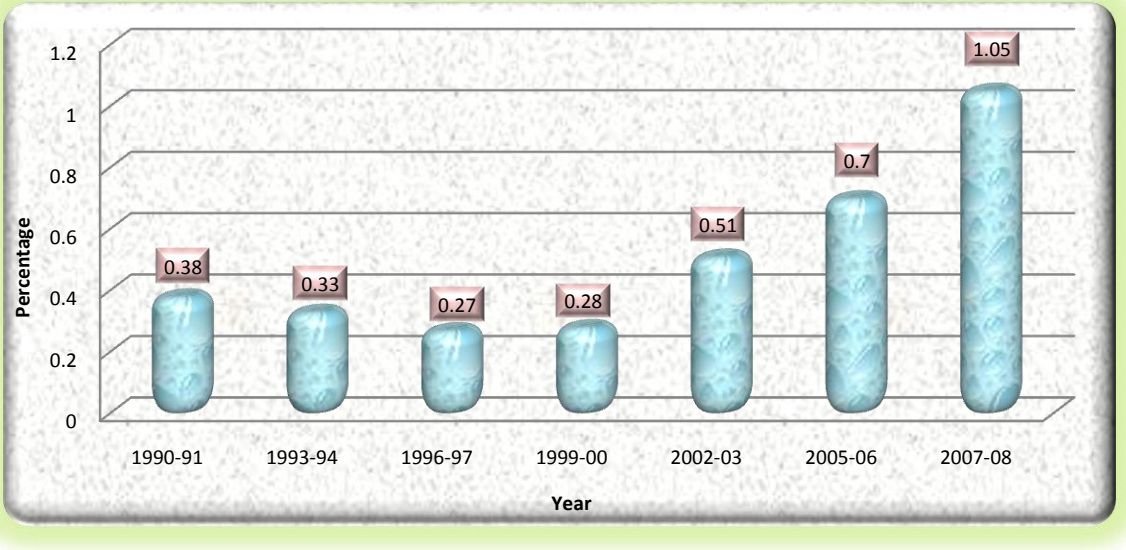
Figure 4.1: Growth in Government Expenditure on S&T



* Total includes development, non-development & donations/endowments by the government.

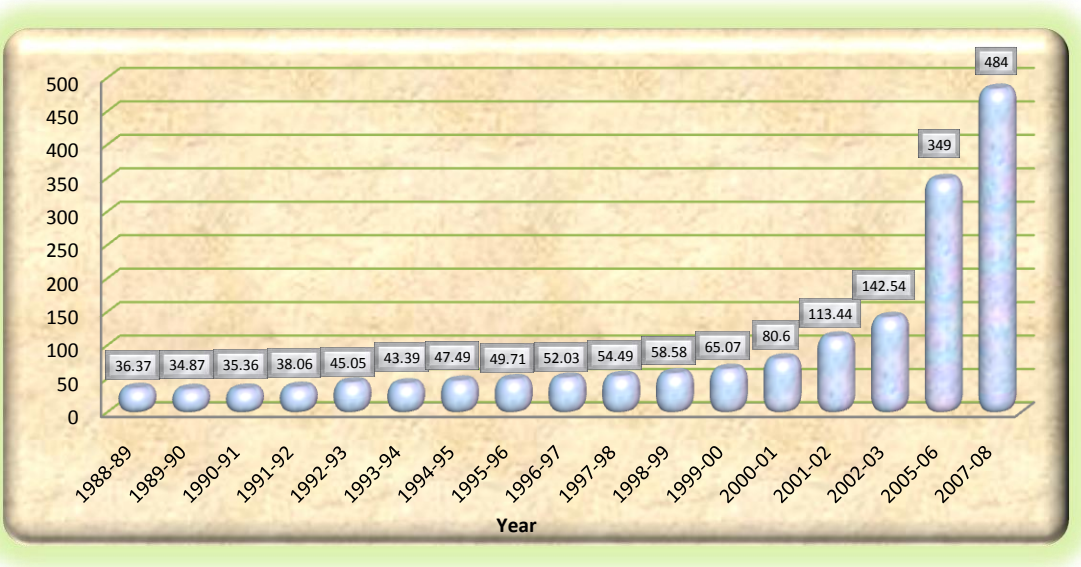
Source: PCST Survey (2008-09)

Figure 4.2: S&T Expenditure as Percentage of GDP



Source: PCST Survey (2008-09)

Figure 4.3: Per Capita S&T Expenditure



Source: PCST Survey (2008-09)

Table 4.2: Total S&T Expenditure by Source of Funding

(Million, Rs.)

Source	S&T/R&D Organizations	Higher Education Institutions	Total
	Expenditure	Expenditure	Expenditure
Government Grant (Development)	25630.286	10917.577	36547.863
Government Grant (Non-Development)	15332.979	20893.165	36226.144
Self Generated Funds	1770.029	10595.925	12365.954
Tuition Fees	0.000	14955.688	14955.688
International Research Grants	125.709	429.781	555.490
Donations / Endowments (Government)	166.366	757.745	924.111
Donations / Endowments (Private)	3.099	4519.156	4522.255
Others	10.620	3591.301	3601.921
Total	**43039.088**	**66660.338**	**109699.426**

Source: PCST Survey (2007-2008)

Table 4.3: S&T Expenditure by Type of University

(Million, Rs.)

Field	Higher Education Institutions (Nos.)	Expenditure
Agricultural Sciences	6	2826.144
Arts / Design	4	429.246
Business / IT	23	4065.189
Engineering & Technology	15	9656.235
Medical Sciences	8	22549.147
Multi Discipline	54	27134.377
Total	**110**	**66660.338**

Source: PCST Survey (2008-09)

Table 4.4: Province Wise S&T Expenditure

(Million, Rs.)

Source	Expenditure
Federal	74668.653
Punjab	7874.723
Sindh	2402.224
NWFP	948.828
Baluchistan	415.075
Private	23389.923
Total	**109699.426**

Source: PCST Survey (2008-09)

Table 4.5: Research Expenditure by Type of S&T/R&D Organization

(Million, Rs.)

Field	No of Organizations	Expenditure
Agriculture Sciences	44	6083.455
Engineering & Technology	17	1159.718
Medical Sciences	5	577.124
Multi Discipline	6	31989.099
S&T Services	11	3229.691
Total	**83**	**43039.088**

Source: PCST Survey (2008-09)

Table 4.6: R&D Expenditure by Sector of Performance

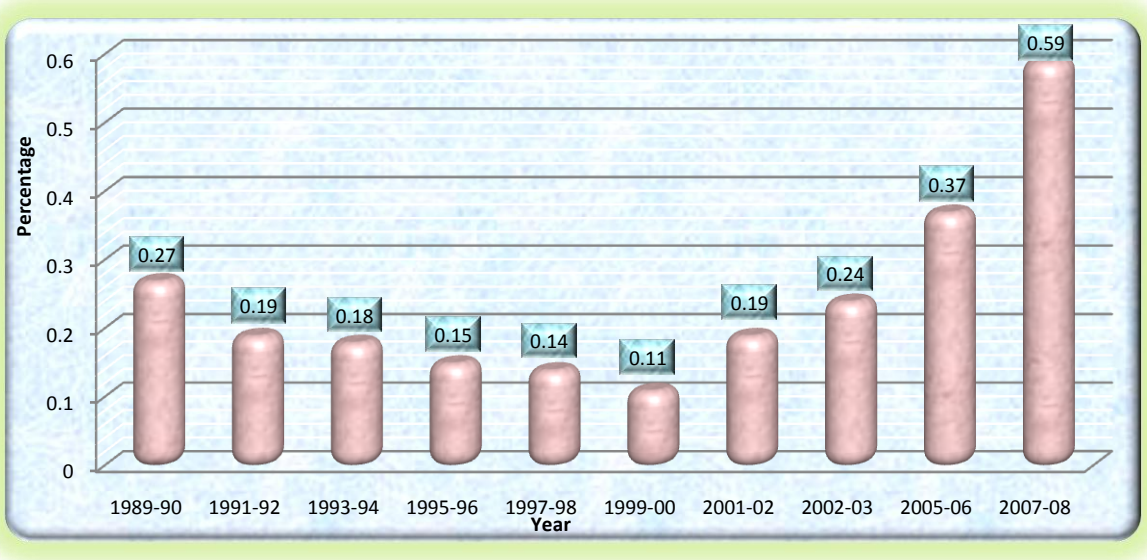
(Million, Rs.)

Sector of Performance	Expenditure
Government / S&T Organizations	43039.087
Higher Education*	15533.838
Total	**58572.925**

*Research Expenditure was calculated proportionate to the full time equivalent factor (Details at Annexure-II)
Source: PCST Survey (2008-09)

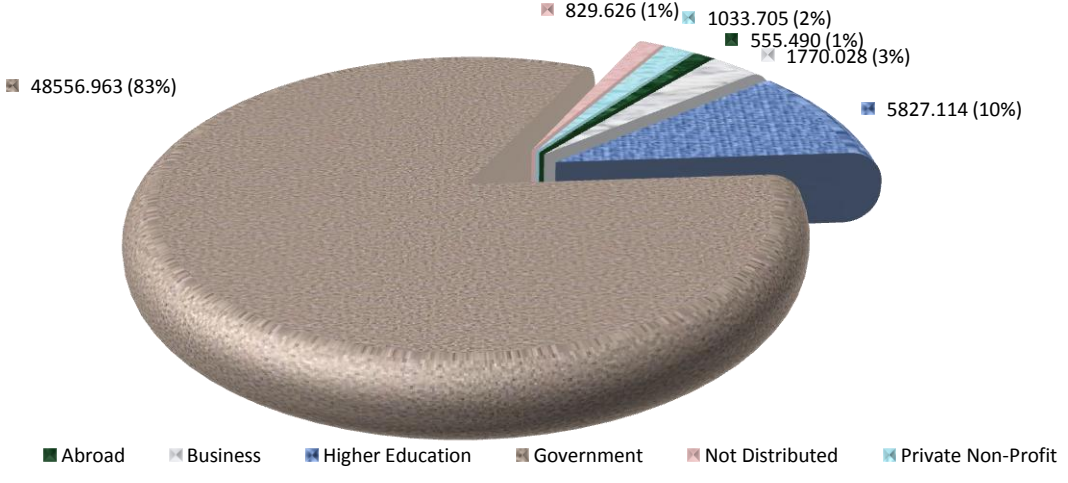
Total R&D Expenditure as % of GDP=0.59

Figure 4.4: R&D Expenditure as Percentage of GDP



Source: PCST Survey (2008-09)

Figure 4.5: Distribution of Gross Domestic Expenditure on Research and Development by source of funds



Total R&D Expenditure= 58,572.925


Part 5:
• S&T INDICATORS IN COMPARISON WITH SELECTED COUNTRIES

Table 5.1: S&T Indicators of Pakistan in Comparison with Selected Countries

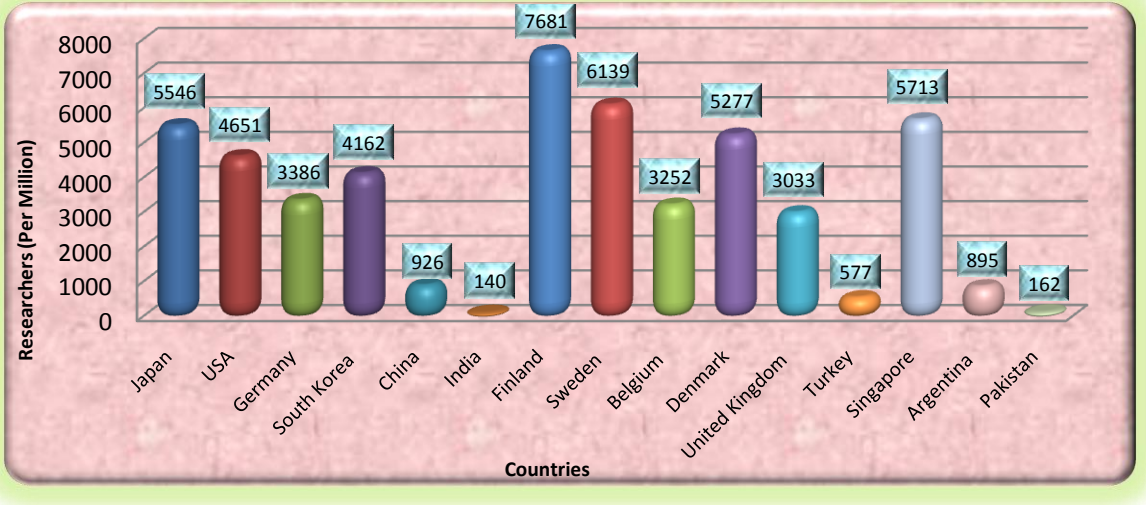
Country	Year	R&D Expenditure (% of GDP)	Researchers* (Per Million)
Japan	2006	3.40	5546
USA	2006	2.60	4651
Germany	2006	2.50	3386
South Korea	2006	3.20	4162
China	2006	1.40	926
India	2006	0.88	140
Finland	2006	3.40	7681
Sweden	2006	3.80	6139
Belgium	2006	1.80	3252
Denmark	2006	2.40	5277
UK	2006	1.80	3033
Turkey	2006	0.80	577
Singapore	2006	2.40	5713
Argentina	2006	0.50	895
Pakistan	2007	0.59	162

Sources: (i) PCST Survey (2008-09) *FTE

(ii) UNESCO Institute of Statistics, www.uis.unesco.org

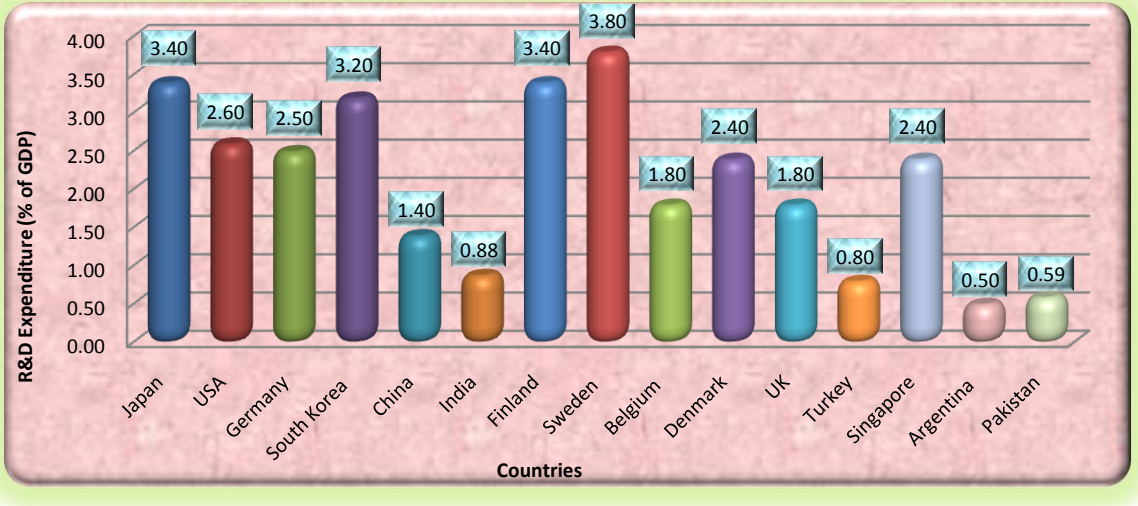
(iii) MoST, India www.dst.gov.in

Figure 5.1: Researchers in Comparison with Selected Countries (FTE)



Sources: (i) PCST Survey (2008-09)
(ii) UNESCO Institute of Statistics, www.uis.unesco.org

Figure 5.2: R&D Expenditure in Comparison with Selected Countries



Sources: (i) PCST Survey (2008-09)
(ii) UNESCO Institute of Statistics, www.uis.unesco.org

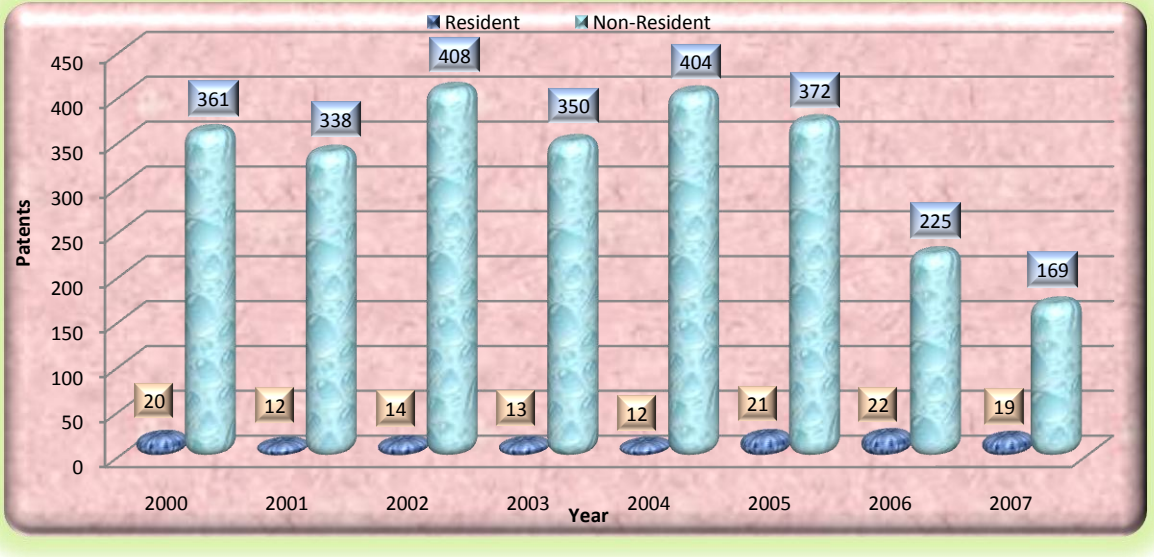

Part 6:
PATENTS

Table 6.1: Number of Patents Registered with Pakistan Patent Office

Year	Patents Granted		
	Local	Foreign	Total
2000	20	361	381
2001	12	338	350
2002	14	408	422
2003	13	350	363
2004	12	404	416
2005	21	372	393
2006	22	225	247
2007	19	169	188

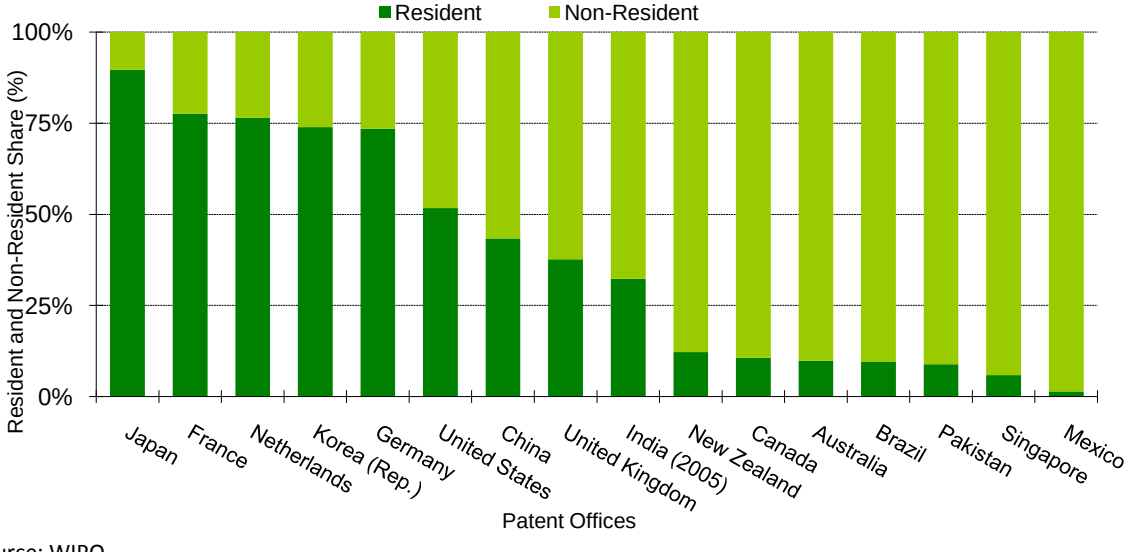
Source: IPO-Pakistan

Figure 6.1: Number of Patents Registered



Source: IPO-Pakistan

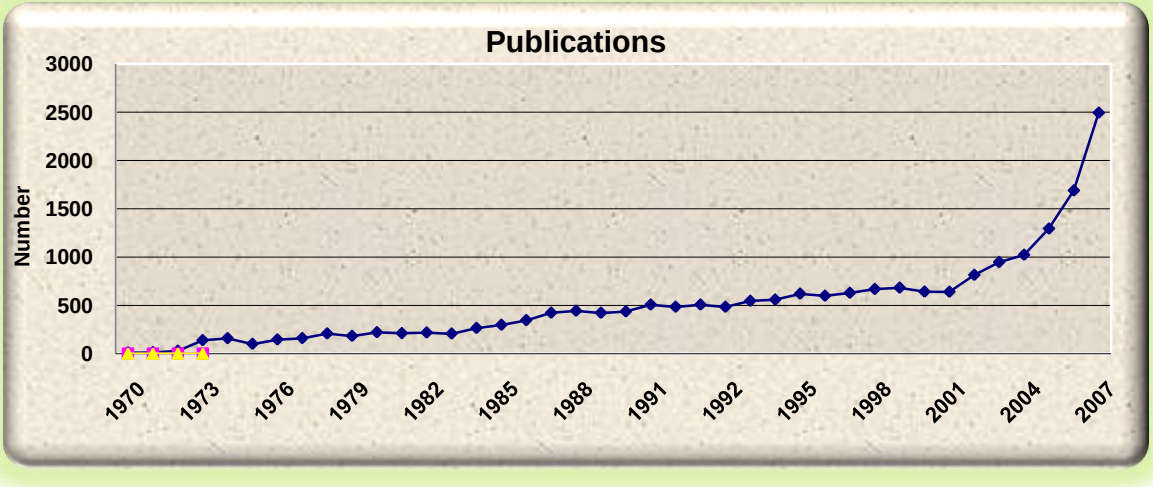
Figure 6.2: Distribution of resident and non-resident patent grants in comparison with selected countries (2006)



Source: WIPO


Part 7:
• RESEARCH PUBLICATIONS

Figure 7.1: Annual Publications by Pakistani Scientists in International Journals (1970-2008)



Source: ISI, Web of Science

Total Publication during 2007: 2494

Table 7.1: Discipline-wise Total Publications* by Pakistani Scientists (up to 2008)

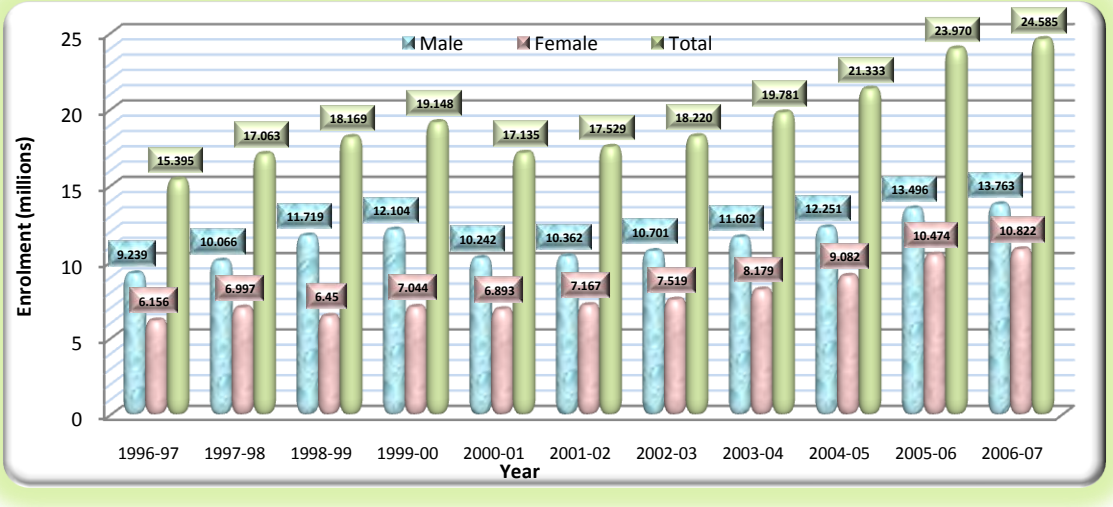
Discipline	No. of Publications
Agriculture Science	1814
Biological Science	5136
Chemistry	9095
Computer Science	38
Earth Science	270
Engineering Sciences	708
Environmental Sciences	77
Health Sciences	532
Mathematics	793
Pharmaceutical Sciences	514
Physics	4739
Statistics	36
Total	**23752**

*in journals with impact factor only

Source: PCST Database of Scientist for the Award of RPA (2008-09)

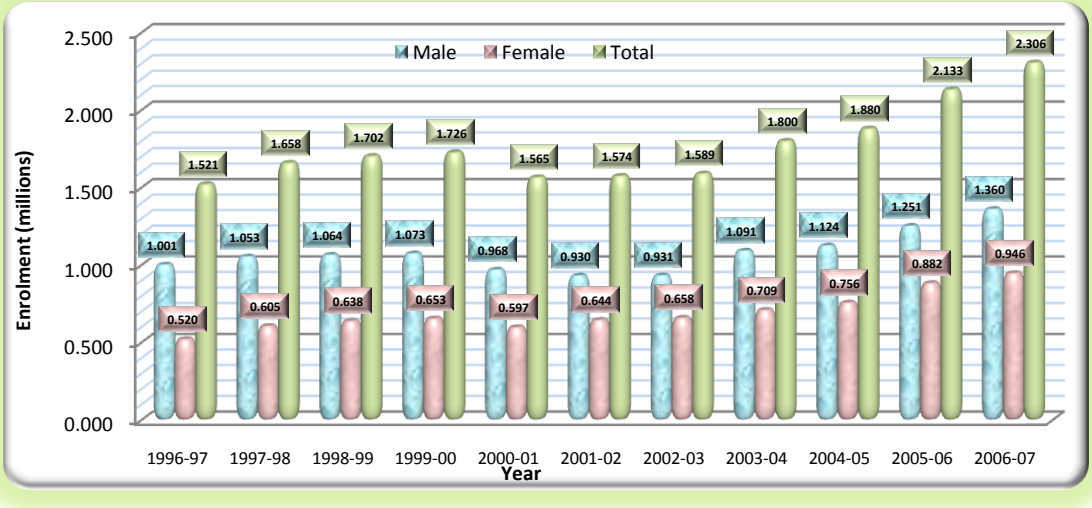

Part 8:
EDUCATION

Figure 8.1: Enrolment in Primary Schools



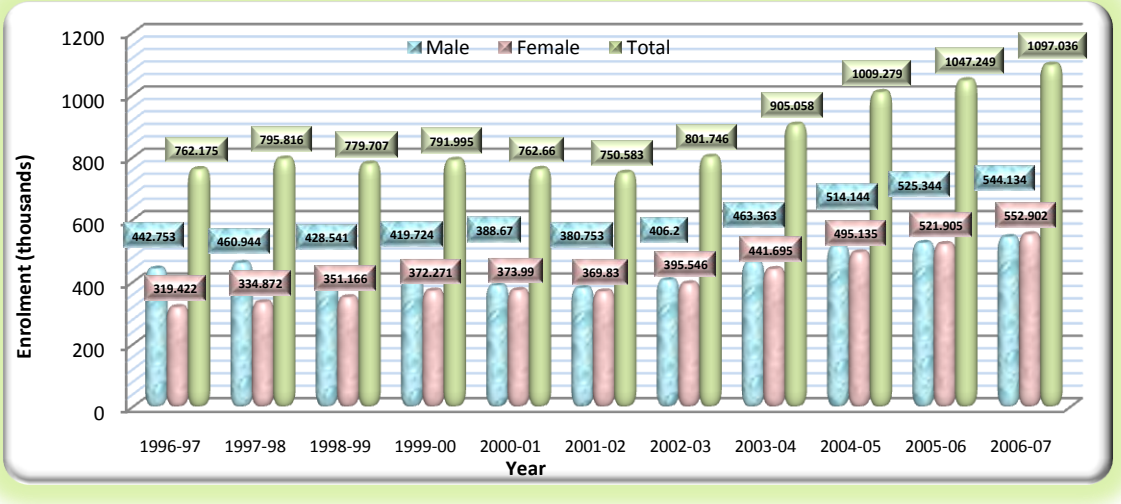
Source: FAEPM

Figure 8.2: Enrolment in High Schools



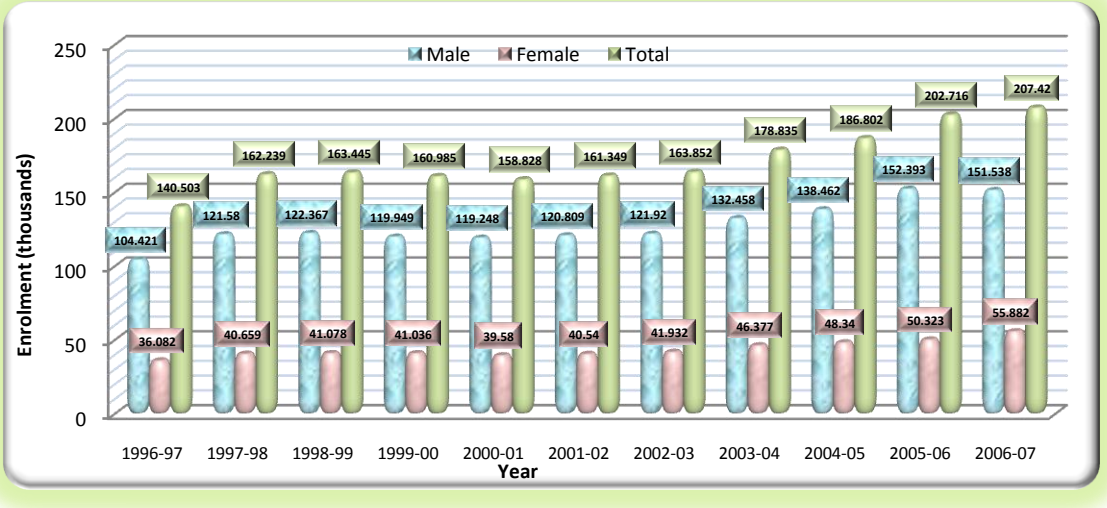
Source: FAEPM

Figure 8.3: Enrolment in Arts & Science Colleges



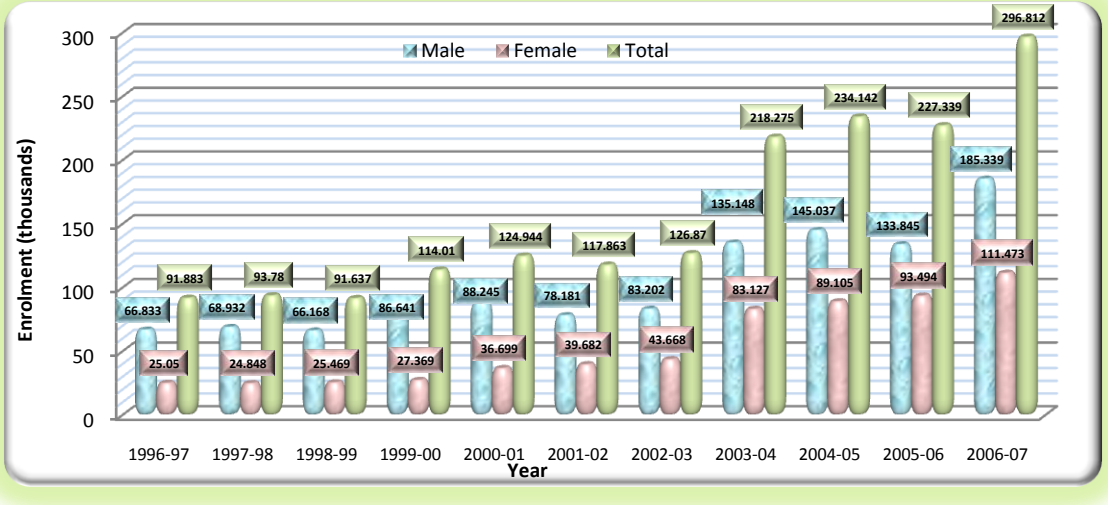
Source: FAEPM

Figure 8.4: Enrolment in Professional Colleges



Source: FAEPM

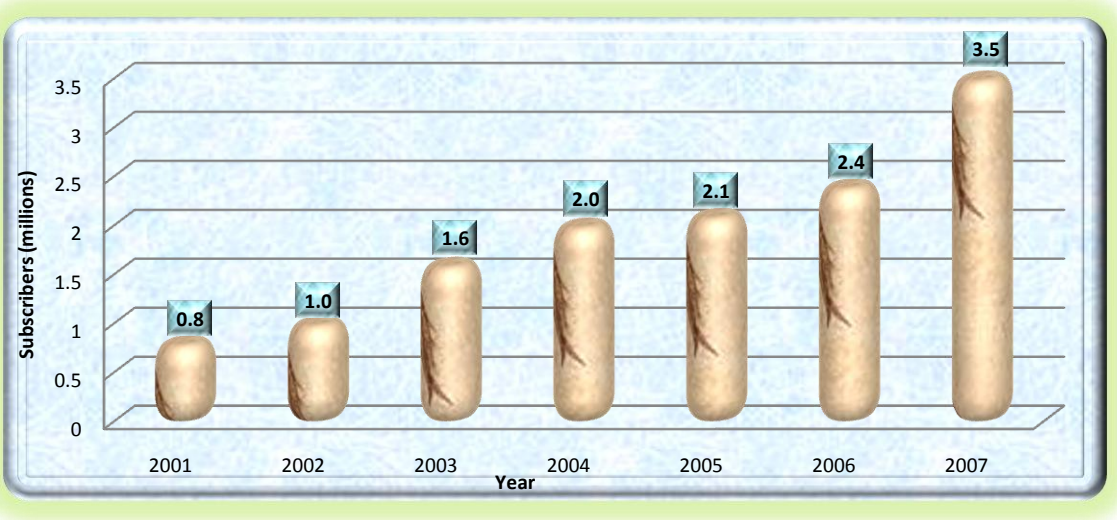
Figure 8.5: Enrolment in Universities



Source: FAEPM

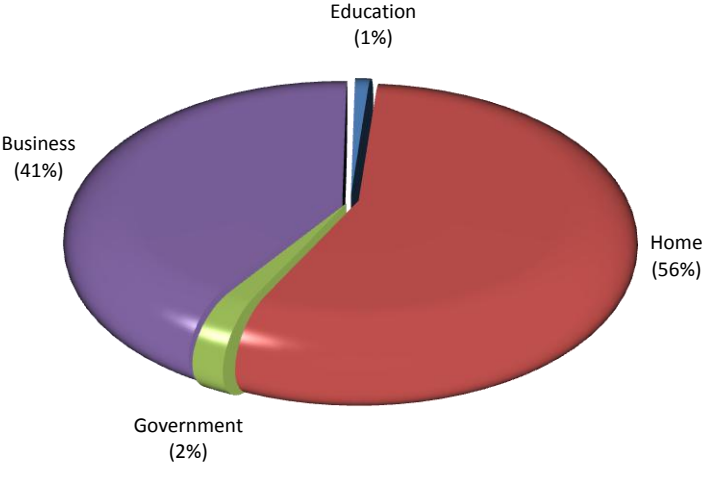

Part 9:
• INFORMATION AND COMMUNCIATION TECHNOLOGIES

Figure 9.1: Pakistan Internet Subscribers



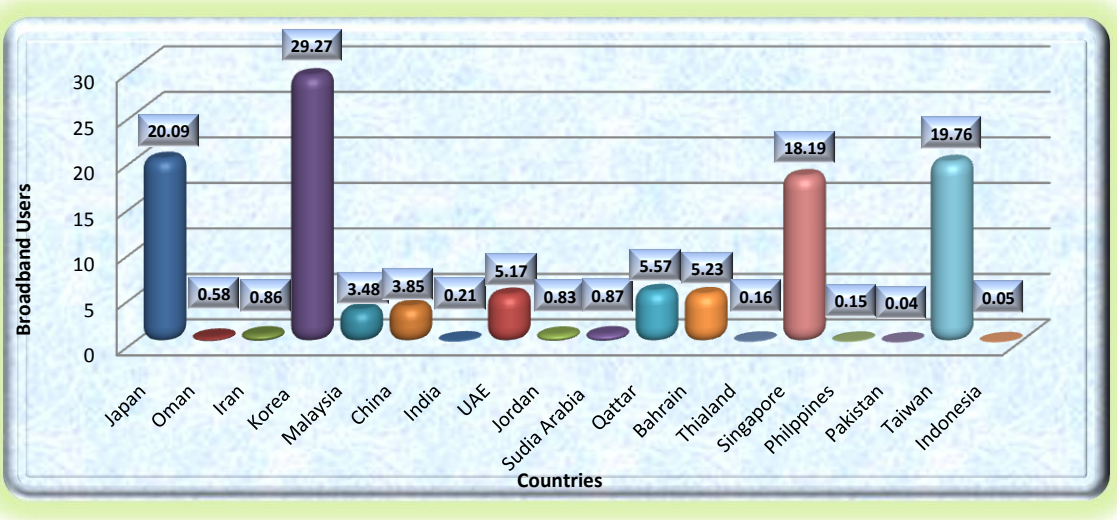
Source: MoIT

Figure 9.2: Pakistan Broadband Subscribers by Profession



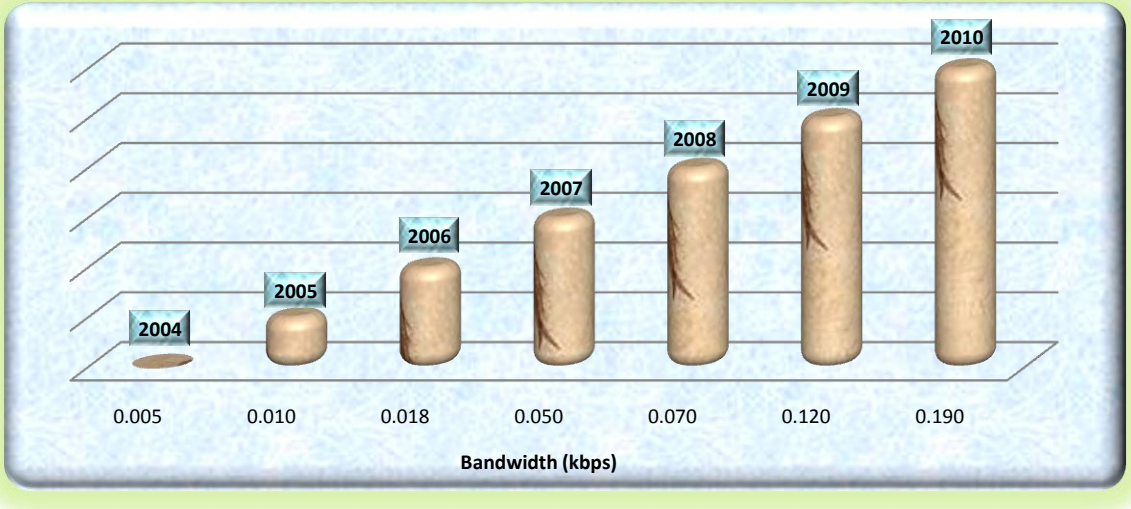
Source: MoIT
(Figures for 2006-07)

Figure 9.3: Broadband Users in Asia (Per 100 Inhabitants)



Source: MoIT

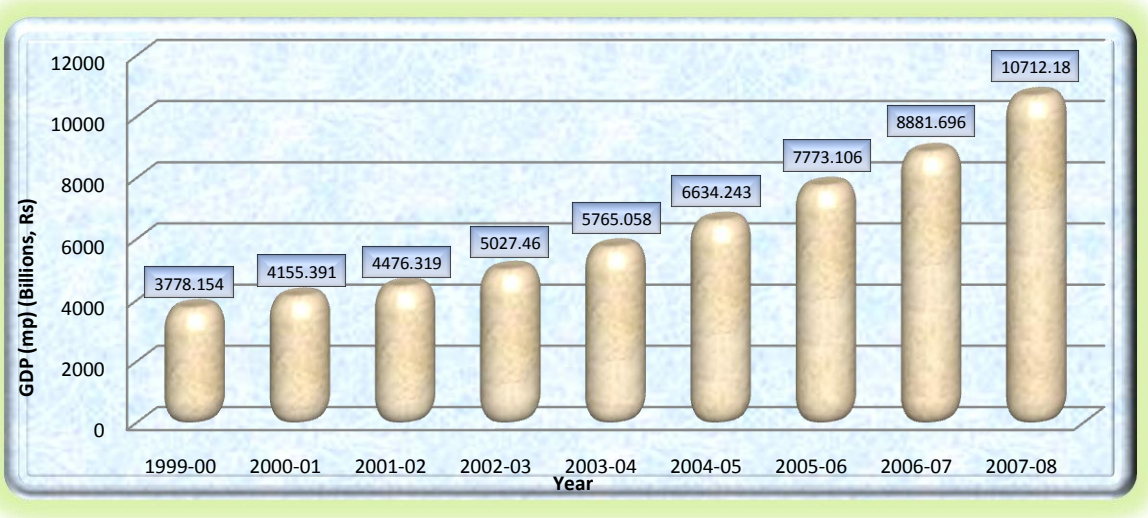
Figure 9.4: Projected IP Broadband Consumption/Inhabitant (kbps)



Source: MoIT

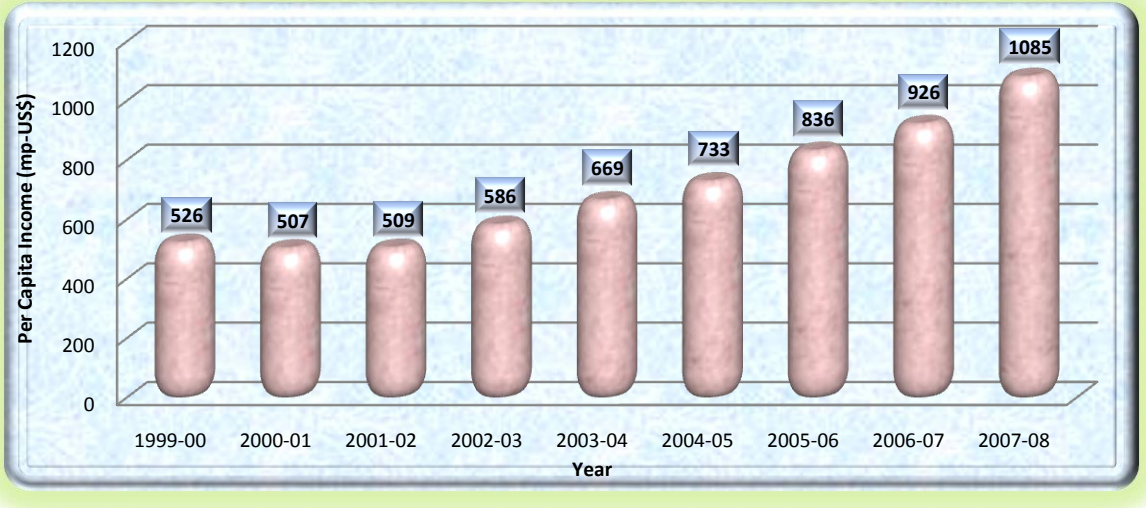

Part 10:
ECONOMY

Figure 10.1: Gross Domestic Product at Current Factor Cost



Source: Economic Survey of Pakistan 2007-08

Figure 10.2: Per Capita Income (mp-US$)



Source: Economic Survey of Pakistan 2007-08

Annexure-I

Definitions

1. Research & Experimental Development (R&D)

Research & Experimental Development (R&D): Creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of humanity, culture and society, and the use of this stock of knowledge to devise new applications. The term R&D covers three activities: basic research, applied research and experimental development.

Basic Research: Experimental or theoretical work undertaken primarily to acquire new knowledge of the underlying foundation of phenomena and observable facts, without any particular application or use in view.

Applied Research: Original investigation undertaken in order to acquire new knowledge. It is, however, directed primarily towards a specific practical aim or objective.

(Contd....)

Experimental Development: Systematic work, drawing on existing knowledge gained from research and/or practical experience, which is directed to producing new materials, products or devices, to installing new processes, systems and services, or to improving substantially those already produced or installed. R&D covers both formal R&D in R&D units and informal or occasional R&D in other units.

2. R&D Occupations

Researchers: Professionals engaged in the conception or creation of new knowledge, products, processes, methods and systems and also in the management of projects concerned. Postgraduate students at the PhD level engaged in R&D should be considered as researchers.

Technicians and Equivalent Staff: Persons whose main tasks require technical knowledge experience in one or more fields of engineering, physical and life sciences (technicians) or social sciences and humanities (equivalent staff). They participate in R&D by performing scientific and technical tasks involving the application of concepts and operational methods, normally under the supervision of researchers.

(Contd….)

Other Supporting Staff: Include skilled and unskilled craftsmen, secretarial and clerical staff participating in R&D projects or directly associated with (or providing services to researchers involved in) such projects.

Head Count: The total number of persons employed in R&D, independently from their dedication. These data allow links to be made with other data series, such as education and employment data, or the results of population censuses. They are also the base for calculating indicators analyzing the characteristics of R&D workforce with respect to age, gender or national origin.

Full Time Equivalent: May be thought of as one person-year. Thus, a person who normally spends 30% of his/her time on R&D and the rest on other activities (such as teaching, university administration and students counseling) should be considered as 0.3 FTE. Similarly, if a full-time R&D worker is employed at an R&D unit for only six months, this results in an FTE of 0.5. However, for reporting purposes, the total sum of FTEs should be rounded to the next integer, avoiding the reporting of decimals.

(Contd….)

3. Fields of Science and Technology (by UNESCO)

Natural Sciences:

- Mathematics and computer science [mathematics and allied fields; computer sciences and other allied subjects (software development only)]
- Physical sciences (astronomy and space sciences, physics and allied subjects)
- Chemical sciences (chemistry, other allied subjects)
- Earth and related environmental sciences (geology, geophysics, mineralogy, physical geography & other geosciences, meteorology / atmospheric sciences including climatic research, oceanography, volcanologist, palaeoecology).
- Biological sciences (biology, botany, bacteriology, microbiology, zoology, entomology, genetics, biochemistry, biophysics, other allied sciences, excluding clinical & veterinary sciences)

Engineering and Technology:

- Civil engineering (architecture engineering, building sciences and engineering, construction engineering, municipal and structural engineering and other allied subjects)

(Contd….)

- Electrical engineering, electronics [electrical engineering, electronics, communication engineering and systems, computer engineering (hardware only) and other allied subjects]
- Other engineering sciences (such as chemical, aeronautical and space, mechanical, metallurgical and materials engineering, and their specialized subdivisions; forest products; applied sciences such as geodesy, industrial chemistry, etc.; the science and technology of food production; specialized technologies of interdisciplinary fields, e.g. system analysis, metallurgy, mining, textile technology and other allied subjects).

Medical Sciences:

- Basic medicine (anatomy, cytology, physiology, genetics, pharmacy, pharmacology, toxicology, immunology and immunohaematology, clinical chemistry, clinical microbiology, pathology)
- Clinical medicine (anesthesiology, pediatrics, obstetrics and gynecology, internal medicine, surgery, dentistry, neurology, psychiatry, radiology, therapeutics, otorhinolaryngology, ophthalmology)
- Health sciences (public health services, social medicine, hygiene, nursing, epidemiology)

(Contd….)

Annexure-I

Agricultural Sciences:

- Agriculture, forestry, fisheries and allied sciences (agronomy, animal husbandry, fisheries, horticulture, other allied subjects)
- Veterinary medicine

Social Sciences:

- Psychology
- Economics
- Educational sciences (education and training and other allied subjects)
- Other allied subjects [anthropology (social and cultural) and ethnology, demography, geography (human, economics and social), town and country planning, management, law, linguistics, political sciences, sociology, organization and methods, miscellaneous social sciences and interdisciplinary, methodological and historical S&T activities relating to subjects in this group.
  "Physical anthropology, physical geography and psychophysiology should normally be classified with the natural sciences".

(Contd....)

Humanities:

- History (history, prehistory, together with auxiliary historical disciplines such as archaeology, numismatics, paleography, genealogy, etc.)
- Language and literature (ancient and modern)
- Other humanities [philosophy (including the history of science and technology), arts, history of arts, art criticism, painting, sculpture, musicology, dramatic arts excluding artistic "research" of any kind, religion, theology, other fields and subject pertaining to the humanities, methodological, historical and other S&T activities relating to the subjects in this group]

Annexure-II

Criteria for Calculation of Full Time Equivalent (FTE)

1: Calculation of Full Time Equivalent (FTE)

R&D Organizations:	All researchers, technicians and support staff of S&T organizations are considered full-time Researchers.
Higher Education Institutions:	FTE for higher education institutions has been calculated based on estimated percentage of total time spent on research activities as per following:
Researchers and Support Staff:	30% of total time for Natural Sciences, Engineering & Technology and Agricultural Sciences. 20% of total time for Social Sciences. 10% of total time for Medical Sciences, Humanities and others (Not Specified).
Technicians:	50% of the total time for all fields.
M. Phil/MS/ME students:	50% of the total time.
PhD students:	Considered as full-time Researchers.

2: Calculation of Research Expenditure in Higher Education Institutions (HEIs):

Total HEI Manpower (FTE)	=	24543
Researchers	=	17147
Supporting Staff	=	5101
Technicians	=	2295

a. Ratio of Researchers & Supporting Staff in total Manpower (FTE) of HEIs =
[(17147 + 5101) / 24543] * 100 = 90.65%

b. Ratio of Technicians in total Manpower (FTE) of HEIs =
[2295 / 24543] * 100 = 9.35%

c. Weighted Average %age of total Time Spent on Research by researchers for seven fields of sciences used for FTE calculation = [(0.3 ×3) + (0.2×1) + (0.1×3)] / 7 = 0.20

d. Total time spent on Research by technicians for all field of science = 0.50

Research Expenditure of HEIs

e. Expenditure on Researchers & Supporting Staff
= [(a × c) × (Total HEIs expenditure excluding International Research Grant)]
= 0.9065 × 0.20 × 66230.56 = Rs. 12007.60 million

f. Expenditure on Technicians
= [(b × d) × (Total HEIs expenditure excluding International Research Grant)]
= 0.0935 × 0.50 × 66230.56 = Rs. 3096.28 million

g. International Research Grant = Rs. 429.78 million

Total Expenditure (e+f+g) = Rs. 15533 million

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