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Patents and Publications of HEIs & R&D Institutions in India

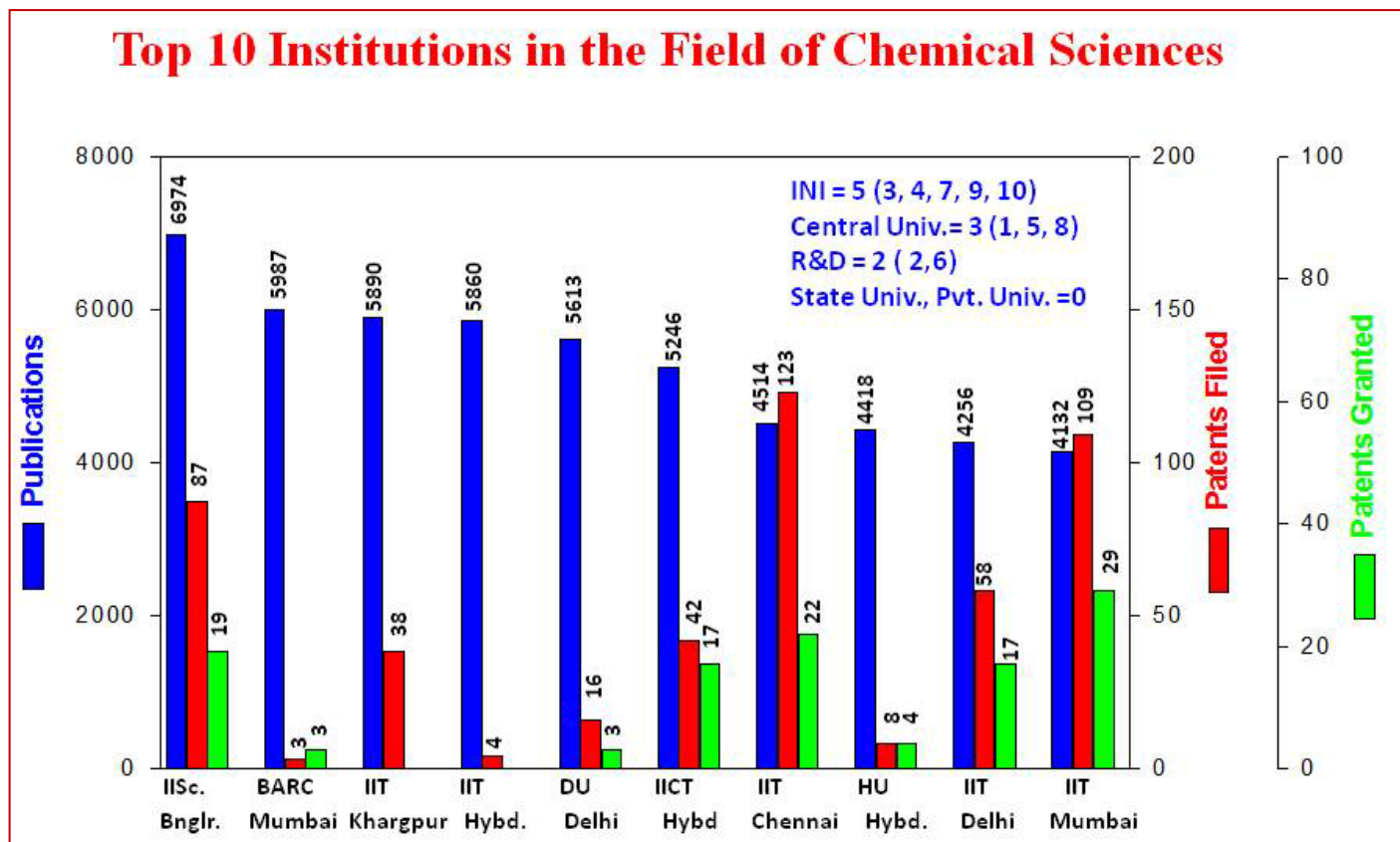
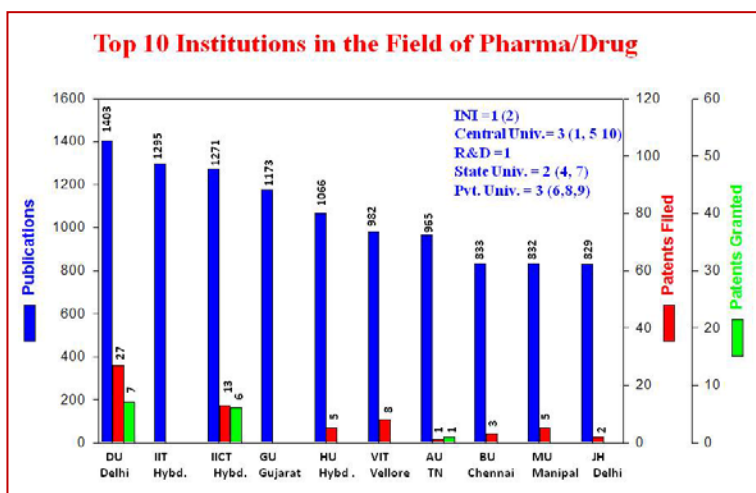
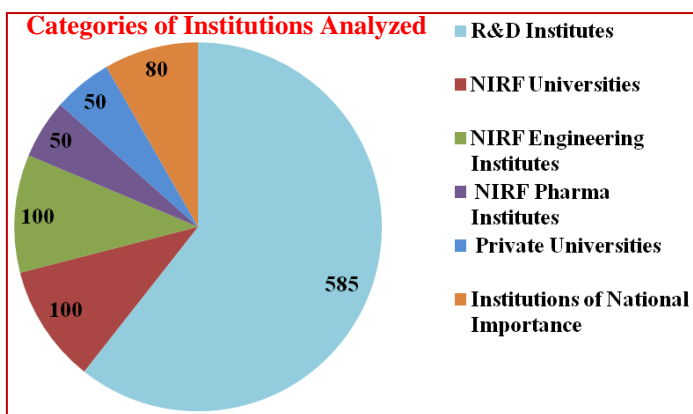


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Introduction

The knowledge-base of any society is its intellectual asset and it plays a strategic role in its overall progress and development. For this, availability of vibrant institutional framework and scientific temperament are essential ingredients. India is a very old and large democratic country and has its glorious past with inherent contradictions to generate and utilize knowledge but is still way behind the other countries.

In this era of knowledge and innovation, patents occupy a prominent position as global indicators for ranking of world economies. In general, there is a direct relation between the economy and the patent regime of a nation. India's dream of becoming a strong and developed nation cannot be fulfilled unless India improves its ranking in the domain of IPR. In order to achieve this, it is imperative that we understand the ecosystem of IPR, especially patents, existing in India. Keeping this in mind, DST-Govt. of India has given the objective "Adopt evidence based approach for identifying and promoting areas for generation of Intellectual Properties" to Centre for Policy Research (CPR) at Panjab University, Chandigarh. The DST-CPR undertook a responsibility to analyse the Indian patents profile and study about the stand of India on the global platform.

To achieve this objective, centre undertook a study for a total number of 914 institutions comprising of Institutions of National Importance (INI), top 100 National Institutional Ranking Framework (NIRF) universities, top 100 NIRF engineering institutes, top 50 NIRF Pharma institutes, top 50 private universities and 585 R&D institutes under various ministries (details in next pages). These 914 institutions have been analysed on the basis of research publications and patents filed/granted by them. This exercise was performed to figure out those institutes which are performing well in research publications, but lacking in converting their research into patents. Usually, in India, the reputation of any educational or R&D institutions is measured by quality and quantity of research publications by faculty, students, scientists and researchers of the institution. And it is being followed blindly in India, but there must be another measuring parameter for the reputation building which is patents filed or granted to an institution. This factor will facilitate not only institution as a whole, but also it will encourage scientists, researchers and faculty members as well, whether, it is financially or morally. In advanced countries like USA, Singapore, Finland, this parameter is very crucial for the institutional as well as economic development.

International Scenario

For this report, the stand of India in IPR ecosystem has been compiled from WIPO (World Intellectual Property Office (WIPO) annual reports and online database. WIPO is a specialized agency of United Nations (UN) and was set up in 1967 (originally known as BIRPI- Bureaux for the Protection of Intellectual Property) with an objective to promote and protect IP throughout the world. Currently, WIPO comprises of 188 member states. Till date, WIPO has administered 26 international treaties for practising IPRs all over the world. WIPO became a dedicated agency under UN in the year 1974 with a mandate to promote innovations and provide impetus to technology transfer, for improving the socio-economic as well as cultural/artistic levels of the developing economies. WIPO is working in three distinct fields a) protecting IP b) designing policies and c) development and global cooperation.

The table given below depicts the patents profile of top 10 countries for last 7 years (2010 onwards). China is leading in patents applications filing (World Intellectual Property Indicator, 2016) with a total number of 1, 101, 864 applications filed in the year 2016. Out of 1, 101, 846 applications 968, 252 are filed by the residents and 133, 612 applications are filed by non-residents only. The trend for top 10 countries is shown in table-1.

Table 1: Patents Applications by Top 10 National Patent Offices

Global Rank*	Country	2010	2011	2012	2013	2014	2015
1.	China	293,066 (98,111)	415,829 (110,583)	535,313 (117,464)	704,936 (120,200)	801,135 (127,042)	968,252 (133,612)
2.	USA	241,977 (248,249)	247,750 (255,832)	268,782 (274,033)	287,831 (283,781)	285,096 (293,706)	288,335 (301,075)
3.	Japan	290,081 (54,517)	287,580 (55,030)	287,013 (55,783)	271,731 (56,705)	265,959 (60,030)	258,839 (59,882)
4.	Republic of Korea	131,805 (38,296)	138,034 (40,890)	148,136 (40,779)	159,978 (44,611)	164,073 (46,219)	167,275 (46,419)
5.	European Patent Office**	n.a. (146,150)	71,898 (70,895)	73,014 (75,546)	73,503 (74,484)	75,496 (77,167)	76,131 (83,897)
6.	Germany	74,401	73,216	73,905	73,929	73,826	72,217

		(12,198)	(12,458)	(14,720)	(15,814)	(17,811)	19,509)
7.	India	8,853 (30,909)	8,841 (33,450)	9,553 (34,402)	10,669 (32,362)	12,040 (30,814)	12,579 (33,079)
8.	Russian Federation	29,022 (13,778)	26,879 (14,919)	29,174 (15,510)	29,120 (16,149)	24,370 (16,236)	29,567 (16,248)
9.	Canada	4,550 (30,899)	4,754 (30,357)	4,709 (30,533)	4,567 (30,174)	4,198 (31,283)	4,277 (32,687)
10.	Brazil	4,228 (20,771)	4,695 (23,954)	4,798 (25,637)	4,959 (25,925)	4,659 25,683	4,641 (25,578)

Source: WIPO Statistics Database (last updated may, 2017)

http://www.wipo.int/ipstats/en/statistics/country_profile/

**World Intellectual Property Indicators Reports (2010-16)

* World Intellectual Property Indicators Report (WIPO), Ranking 2016

The statistics are based on data collected from IP offices or extracted from the PATSTAT database (for statistics by field of technology). Data might be missing for some years and offices or may be incomplete for some origin. The numbers written with in the bracket are the patents filed by non-residents.

As far as Indian scenario is concerned, it has been ranked at 7th position on the basis of patents filing. In 2016, the total applications filed were 45, 658, out of which 12, 579 applications were filed by residents and 33, 079 applications were filed by non-residents (IPO Annual Report 2015-16). The percentage of patents filing by the resident is 27%, whereas, the %age of patents filed by non-residents is 73%. The percentage of non-residents filing comprises of patents filed through convention or through PCT filing.

Indian Scenario

The patent system administered in India is done by the office of the Controller General of Patents, Designs and Trademarks (CGPDTM) under the Department of Industrial Policy and Promotion, Ministry of Commerce and Industries. The jurisdiction of Indian patent system is divided geographically into four regions i.e. Northern Region (Patent Office, Delhi), Western Region (Patent Office, Mumbai), Southern Region (Patent Office, Chennai) and Eastern Region (Patent Office, Kolkata), which also houses national head office.

The amendments brought in 2005 have spurred tremendous growth in the patenting activities because before 2005 only process patents were protectable and after this amendment product patents are also protected. Indian patenting trend between 2010 and 2015 has given below in the tabular form, which has been compiled from annual reports of office of the CGPDTM. The trend for last seven years for patents filing in India is shown below in table-2.

Table 2: Patents Profile of India for last seven years (2010-16)

Year		2010	2011	2012	2013	2014	2015	2016
Filed	<i>Residents</i>	7044	8,312	8921	9,911	10,941	12017	13,066
	<i>Non-Residents</i>	27,243	31,088	34,276	33,763	32,010	30,746	33,838
Granted		6,168	7,589	4,381	4,126	4,227	5,978	6,326
Revenue Generated (crores)		142.61	158.78	164.40	170.47	188.27	374.00	398.40
Expenditure (crores)		21.87	24.02	25.69	25.33	26.82	25.32	55.91

Source: IPO Annual Reports, 2010-16

Last 10 years compilation of IPO data shows ups and downs of patent regime in India. During the financial year 2015-16, a total of 46, 904 patents applications were filed exhibiting about 10% growth in patents filing as compared to the financial year, 2014-15. The trend of last 7 years in respect of patents filed, granted, revenue generated and revenue expended are mention above in **table-2**. During the year 2015-16, the total revenue generated by patents only is ₹398. 40 crores and planed & non-planed revenue expenditure for the year was ₹55.91 Crores.

Scope of the Study

This report has been compiled on the basis of articles publications and patents filed and granted by various institutions. The main objective of this analysis is to figure out potential institutes which are having a great profile in publications as well as patents profile. In other words, the scope of this study is to provide a scholarly glimpse of Indian higher education institution and research labs on the basis of article publications from data base known as SCOPUS which is owned by Elsevier. Usually, the research output in the form of research articles emanates from academics and research establishments and is communicated mainly through journals.

The institutes and R&D labs considered for this study have been mentioned in **table 3**. These are the higher education institutes, which are mainly contributing to developing highly skilled and educated manpower in India. These institutes comprise of Research and Development (R&D) laboratories under 27 ministries. The labs considered for this study are only those, which were doing core research in the various streams of science and technology. Another category is top 100 universities, top 100 engineering institutes, top 50 pharma institutes, ranked by National Institutes ranking framework (NIRF), which is approved by Ministry of human resources and Development (MHRD).

The last category comprises of INI, which is a status conferred to a premier govt. higher education institution in India by an Act of Parliament, and "serves as a crucial player in developing highly skilled personnel within the specified region of the country/state". The breakup for all the institutes is given below in **table-3**.

Table 3: HEIs & R&D Labs Considered for the Analysis

S. No.	Name of Institute	No. of Institutions
1	R&D Institutes (under 27 ministries)	585
2	NIRF Universities (Public + Private)	100
3	NIRF Engineering Institutes	57*
4	Top 50 NIRF Pharma Institutes	50
5	Top 50 Private Universities	42**
6	Institutions of National Importance	80
	Total	914

* 43 institutes are included in Institutions of National Importance

** 8 universities are included in the list of top 100 NIRF universities

R&D Institutes

Research and development (R&D) is a prominent parameter of development and economic growth of a country. If there is a considerable growth in R&D, it has a direct impact on intellectual property regime in the country. The R&D status needs great emphasis which can be achieved by establishing world class infrastructure for R&D activities, encouraging technical institutions, national research labs and providing more financial aid to technologist and researchers. R&D enhancement is not the responsibility of the government of India; there should be the equal contribution of the private sector as well. The proportion of expenditure on R&D by the public and private sector is 3:1, so the creation of an environment to enhance private sector participation is much needed.

For the study 585, R&D institutions are covered by 27 ministries (out of 52) including two independent departments (Department of Space and Department of Atomic Energy). We have considered a total of 585 R&D labs, which comes under various ministries. The major R&D organization in India are Council of Scientific and Industrial research (CSIR), Indian Council of agricultural Research (ICAR), Indian Council for Medical research (ICMR), Defence Research and Development Organization (DRDO), Department of Science and Technology and Indian Space Research Organization (ISRO), etc. Most of the R&D labs are comprises of mainly these above-mentioned organisations. The main motive of these labs are doing the core research in various domains of science and to contribute to economic, social and environment benefits to the people of India. The number of labs and ministries considered for study are mentioned in **table-4**

Table 4: Ministries and Number of Labs Considered for the Study

S. No.	Name of Ministry	No. of Res. Labs
1	Ministry of Health and Family Welfare (mainly ICMR)	167
2	Ministry of Agriculture and Farmers Welfare (mainly ICAR)	92
3	Ministry of Science and Technology (DST, DSIR, DBT)	80
4	Ministry of Defence (mainly DRDO)	52
5	Department of Space	29
6	Ministry of Textiles	23
7	Ministry of Electronics and Information Technology	19

8	Ministry of Environment, Forest and Climate Change	17
9	Department of Atomic Energy	15
10	Ministry of Commerce and Industry	14
11	Ministry of Chemicals and Fertilizers	9
12	Ministry of Earth Sciences	9
13	Ministry of Petroleum and Natural Gas	9
14	Ministry of Communications	8
15	Ministry of AYUSH	5
16.	Ministry of Home Affairs	5
17.	Ministry of Micro, Small and Medium Enterprises	5
18.	Ministry of Human Resource Development	4
19.	Ministry of New and Renewable Energy	4
20.	Ministry of Water Resources, River Development and Ganga Rejuvenation	4
21.	Ministry of Food Processing Industries	3
22.	Ministry of Heavy Industries and Public Enterprises	3
23.	Ministry of Road Transport and Highways	3
24.	Ministry of Skill Development and Entrepreneurship	2
25.	Ministry of Steel	2
26.	Ministry of Rural Development	1
27.	Ministry of Urban Development	1
	Total Research Labs	585

National Institute Ranking Framework (NIRF), 2016

The National Institutional Ranking Framework (NIRF) was launched on 29th September 2015. This framework outlines a broad methodology to rank institutions across the country. The methodology for ranking universities and institutions has identified five broad parameters. Those are:

1. Teaching, Learning and Resources
2. Research and Professional Practices
3. Graduation Outcomes
4. Outreach and Inclusivity
5. Perception

Considering the fact that universities in India are essentially setup for postgraduate education and research, it was decided to assign higher percentage (40 per cent) weightage to “Research Productivity, Impact and IPR”, 30 per cent weightage to “Teaching, Learning and Resources”, 5 per cent weightage to “Graduation Outcomes”, 5 per cent weightage to “Outreach and Inclusivity” and 10% weightage to “Perception”. Weightages assigned for ranking of colleges were suitably modified. These five parameters further grouped into sub-categories. As mentioned above each broad category has an overall weight assigned to it, the sub-categories also have an appropriate weight distribution.

Pharma Institutes

The pharmaceutical industry discovers, develops, produces, and markets drugs or pharmaceutical drugs for use as medications. Pharmaceutical companies may deal in generic or brand medications and medical devices. They are subject to a variety of laws and regulations that govern the patenting, testing, safety, efficacy and marketing of drugs. For this study, we have selected top 50 pharma institutes ranked by NIRF, 2016.

Private Universities

In last three decades, the establishment of private universities has gained momentum, and their number as in 2016 is 349. A private university is a university established through a State/Central Act by a sponsoring body viz. A Society registered under the Societies Registration Act 1860, or any other corresponding law for the time being in force in a State or a Public Trust or a Company registered under Section 25 of the Companies Act, 1956. For this report, data has been extracted from ICI database to measure and evaluate the strengths and weaknesses of Private Universities. Here we are comparing the performance of private universities of the country based on their research papers in journals published from India. Based on research papers and citations received counts, a relative position of private universities have been computed and shown in Tables. The analysis reveals the relative position of a university among the comity of private universities. Based on this, all stakeholders can take a note to induct corrective and competitive measures. This report may not have names of few private universities due to the fact that either their contribution is not published in Indian journals or they are relatively new and yet to start scholarly activity. It has been observed that institute/university needs gestation period which may be in the range of 12 to 15 years to deliver expected scholarly output.

Institutions of National Importance (INI)

An Institute of National Importance, in India, is defined as one which serves as a pivotal player in developing highly skilled personnel within the specified region of the country/state. Only a chosen few institutes make it to this coveted list and are usually supported by the Government of India or even any other international institutes to develop centres of excellence in research, academics, and other such elite schools of education. In India, all of the IITs, NITs, AIIMS, NIPERs, ISI and some other institutes as Institutes of National Importance. It is also proposed to add to the list IIMs, IISERs, IESTs and the new AIIMS under Pradhan Mantri Swasthya Suraksha Yojana (**PMSSY Scheme**) of GOI once they are empowered by the Government of India by enacting an act in the Parliament. The institutions come under this category is mentioned below in **table 5**.

Table 5: Breakup for Institutions of National Importance

S. No.	Institutes	No. of Institutes
1.	IITs	23
2.	NITs	31
3.	NIPER	1
4.	AIIMS	7
5.	IISERs	5
6.	School of Planning & Architecture	3
7.	Other Institutes	10
	<u>Total</u>	<u>80</u>

Data Collection

A. Publications: SCOPUS owned by ELSEVIER- Annexure-1

B. Patents: Talwar & Talwar Consultants, Mohali by using various patents search tools like –Annexure-2

- *XLPAT owned by TT Consultants (www.xlpat.com)*
- *Orbit owned by Questel (www.questel.com)*

- *Thomson Innovation owned by Thomson Reuters (info.thomsoninnovation.com)*
- *InPASS of Govt. of India (ipindiaservices.gov.in)*

Time Span

For the purpose of this report, data for both articles publication and patents (filed and granted) have been taken from 2010 to 2016, i.e. 7 years period. The time span of 7 years has been considered enough to analyse trends on parameters of articles publications and patents of the institutes. By doing this exercise we can develop an evidence based approach to identify the gaps in patenting and research publication. It can also help in recognising those institutes, who are having magnificent patenting and research publication profile.

Methodology

The methodology of data extraction & retrieval has been used to search and retrieve relevant data of research publications from SCOPUS for the time period from 2010 to 2016. The data extraction for patents (filed/ granted) was outsourced to a private firm because it was a tedious task. It was not possible to fetch the validated data from one source. The firm used various software to retrieve, verified and validated data for patents and promised ~ 80-90 % accuracy in data retrieved by them. The time span may be little short of the process of patent filing is a very lengthy affair and it takes 3 to 5 years to grant a patent from the day of filing to a successful disposal, either a grant or a final refusal by the patent office. We have been successful in achieving our objective of identifying strong institutes in both parameters (publications and patents). Now, we can study the eco-system in these institutes for recommending the same for other institutes, having a large number of publications but producing less number of patents. We will write to these institutes and ask about their strengths and efforts they are doing and will seek assistance and suggestions to promote and adopt their model in other institutes.

Limitations

The data extraction for patents filed and granted has been done on the basis of “**name of the applicant**” not on “**name of the inventor**”, which means the patent has been assigned or granted to a particular institute. Data extraction by the name of the inventor was a very time-consuming task and to perform this task the Centre required a huge amount of money which, was not feasible to bear this much of expenses. Talwar & Talwar Consultants has assured ~ 80-90 % accuracy in data extracted by them regarding patents filed and granted. There are only 12402 total patents filed (national & international) by these 914 institutes under our study, out of which 9074 are in

application phase and 3328 have been granted to some institute or research lab. If any data error is found in the analysis, it could be due to errors in source data, typographical and computational, etc.

Literature

In the old Indian education system, teaching and learning process was confined to the personal domain and therefore, knowledge was not public property and neither was it treated as public good. The evolution path of the modern higher education system in India started with the establishment of Madras, Calcutta, and Bombay universities in 1857. After Independence, universal and compulsory education for all children in the age group of 6-14 was ensured by the government of India through *Article 45* of the Constitution.

Initially, teaching and learning were not the role of universities, they used to conduct examinations but now all is an integral part of the university system. Globally, now universities and research institutions are being assessed and evaluated based on their infrastructure, ecosystem and research productivity. Accordingly, the students/researchers are making their choice of study. The research output in terms of research papers, books, reports, patents, standards, etc. are measurable objects. For about 350 years, journals are the main and major source of research communication and over the period a concept of referred and high impact factor journals has evolved to monitor and maintain the quality standards of publications or research documents or research papers. In higher education and research establishments' publication counts in refereed journals and patents have become a globally recognized and accepted criterion. Therefore, the universities and research institutions are vigorously doing publications and creating patents out of that. Higher the counts of publications and patents received to them decides their relative superiority among the harmony of the academic world.

In the case of India, while measurement and evaluation are made for ranking purpose, that need to consider the fact, that in majority universities/institutes are teaching institutions and have a limited research mission or profile. Similar kind of situation seems true in the case of a global higher education system that is why only about a thousand or so out of the world's 18,000 universities or university level institutes find a place in so-called international rankings.

Factually, the measurement of academic and research productivity is not straight forward because the key function of teaching quality is seldom measured adequately. However, research productivity in terms of research papers is easier to measure than other kinds of academic work. National and global rankings count publications/research papers published in journals that are

indexed in nationally, globally visible and available indices – such as the Web of Science, Scopus, Indian Citation Index and equivalents of respective disciplines. These indices list only a small number of journals of the world and tend to favour English language publications.

Articles Publications

Research journals have been in existence for over 350 years and are scholars' lifeline for scholarly communication. Schaffner (1994) identified five distinct, though somewhat overlapping roles that journals play in scholarly communities.

1. Journals build a collective knowledge base. Journals form the most comprehensive, up-to-date, authoritative archive of information in a given subject field. This authoritative archive of journals can also serve as a tool to check duplication, etc.
2. Journals act as a carrier of knowledge to scholars working in a subject area. The advent and advancement of ICT have revolutionized the scholarly mode of communication.
3. Journals validate the quality of research in maintaining community standards through peer review mechanism.
4. Journals distribute rewards and publications in peer-reviewed journals are considered to be of more value/quality. The roots of this go all the way back to the publication in English the "Philosophical Transactions of the Royal Society, London" in 1665.
5. Journals finely network a scholarly community together in a number of ways. A hallmark of a discipline's coming of age is the establishment of a new journal: in essence, staking out the intellectual territory of the new field.

Research Publications in India

The first journal titled as 'Asiatick Researches' was published in 1788 in India. Since then, journal publication has come a long way and as of now, over 6,000 journals in various forms and styles are being published from India. Though it is there from the beginning of journal's publication but it has gained a hyped momentum for about last three decades, that the use of term 'International Journal' in publications is in vogue among academic and scholarly community particularly of developing and less developed countries.

By publishing in the journal, scientists/researchers/academicians can establish ownership and fulfil the role of documenting the paternity of Intellectual Property (IP). Sometimes they are

substantive and sometimes they extend to related areas such as the social implications of findings, funding, or training issues within the field. Journals also commonly serve as a forum for news such as new appointments to major positions or the passing of a well-known member of the scholarly community. While this role may be diminishing to some extent with the variety of communication options available, journals continue to play an important role in forming and maintaining scholarly communities. Four major reasons behind the exponential nature of growth of Indian papers are (a) Expansion of journals and Inclusion of Indian journals, (b) Increase in Institution involved in publishing activity (c) Increase in international collaboration (d) Activity in emerging research areas.

Patenting in India

Inventive activity is supposed to result in the invention, which further leads to technological advancement, economic welfare and industrial development. An old proverb says, 'Necessity is the Mother of Invention'. In the era of knowledge economy, this invention needs to be protected. The first major step taken in this regard was in 1970 when the government of India passed The Patent Act, 1970. In order to further fortify the inventions subsequent amendments too have been effected in the years 1999, 2002 and 2005. In 1994 India signed TRIPS agreement and on January 1, 2005, India became fully Trade-Related Aspects of Intellectual Property Rights (TRIPS)-compliant by bringing into effect its most important requirement of enforcing *product patents* in the fields of food, chemical substances, and pharmaceuticals.

Before TRIPS agreement, patents were exclusively governed by national jurisdiction, subject to local laws framed according to the national development goals and local needs. Another defining moment in patenting came in 1998 when India became a signatory of Patent Cooperation Treaty (PCT). As a result, inventors can now protect their inventions internationally through a single application. The Act protects the rights of inventor and encourages inventions. The amendments brought in 2005 have spurred tremendous growth in the patenting activities because before 2005 only process patents were protectable and after this amendment product patents are also protected. The patent is an exclusive and territorial right granted by regional or national government. Once granted, it remains valid for a maximum period of 20 years from the date of filing of the application, provided the periodic maintenance fees are duly paid during this period and the patent is not revoked or declared invalid by the court. The mandatory conditions required for protection of an invention are:

- i) It must be novel*
- ii) It relates to the process and product both*
- iii) It must involve an inventive step i.e. non-obvious to a person skilled in the related field of the technology*
- iv) It must be capable of industrial application and*
- v) It should not come under the Section 3 and Section 4 of The Patent Act 1970.*

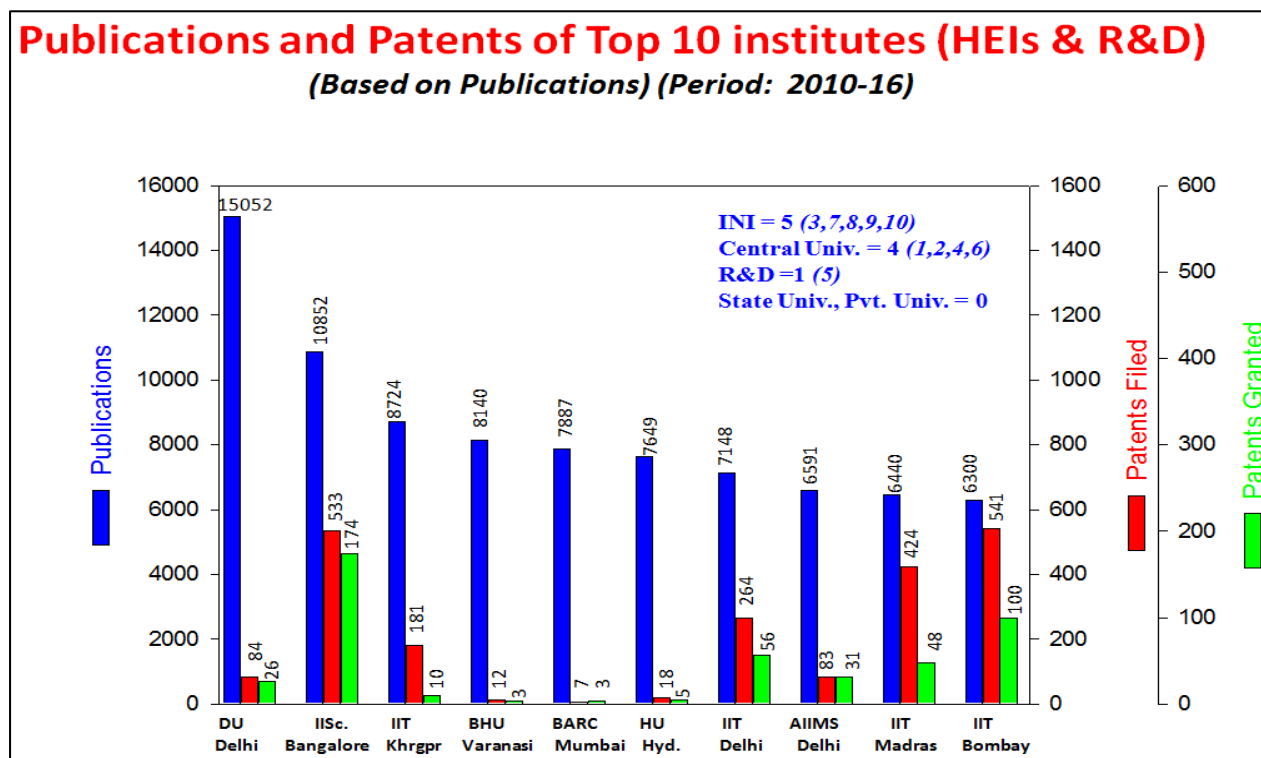
The patent system administered in India is done by the office of the Controller General of Patents, Designs and Trademarks under the Department of Industrial Policy and Promotion, Ministry of Commerce and Industries. The jurisdiction of Indian patent system is divided geographically into four regions i.e. Northern Region (Patent Office, Delhi), Western Region (Patent Office, Mumbai), Southern Region (Patent office, Chennai) and Eastern Region (Patent Office, Kolkata), which also houses national head office.

Analysis

The ranking is a natural thought process when plenty of things are available to do the same or similar things. In a globalised world, all have to compete in their area of activities to shine and sustain. The competition provides an opportunity to adjudge level of relative standing among the comity of stake holders and thus this relative standing is known as the rank of that particular competing stake holder and the procedure and system followed are known as a ranking system. Rankings generally spark competition and zeal to work more enthusiastically to compete with stakeholders. Rankings may have strengths and weaknesses; some may argue that competition indirectly improves overall quality in the higher education system; others may argue that the same competitive forces skew institutional policies in ways that might cause institute or university personnel to work against their own missions. Ranking of institutes/universities is a relative position based on defined parameters.

For this study, we are analysing a total of 914 institutions comprising of IITs, NITs, AIIMS, public & private universities, pharma & engineering institutes and research laboratories existing in India. Generally, the institutes with a greater number of research publications should also have a good number of patents. But that is not the case of India institutes. Indian academicians and researchers publish a large number of research papers, but they fail in converting their research in a patent, thus reducing chances of commercial exploitation of their innovative idea. As seen in **graph-1 & table-6**, (according to a number of articles publications) amongst the top 10 universities/ institutes University of Delhi, which is a central university, tops the list in publishing research papers, but fare poorly in getting it converted into a patent.

Publications and Patents of Top 10 institutes (HEIs & R&D) (Based on Publications) (Period: 2010-16)



Graph-1: Top 10 Institutes Based on Research Publications

These records show that IISc, Bangalore has a strong grip on innovation and has the considerable ability to convert its research into patents or commercial commodity. Apart from IISc, Bangalore there are other two institutes, which are performing good in above-mentioned parameters, those institutes are IIT(IIT), New Delhi and Indian Institute of Technology, Madras. IIT, Delhi has published 7148 research publications between, 2010-16 and has filed 261 patents, out of which 56 patents are granted to the institute. Its counterpart IIT, Madras has 6440 publications to its credit and has filed 424 patents out of which 48 have been granted to the institute. But they still need an overhaul and need to concentrate on, converting a research into a patent or commercial product or process instead of publishing it.

As already mentioned, the institutes are analysed on the basis of articles publications, but as shown in the **table-6** although IIT, Bombay is placed at eleventh position on the basis of a number of publications, but it is more prone to convert its research publications into patents. IIT Bombay has 6300 publications to its credit and it has filed 541 patents in the last seven years. Moreover, it has been granted 100 patents till 2016. It shows the average of converting its research into patents is better than its counterparts IIT, Delhi and IIT, Madras.

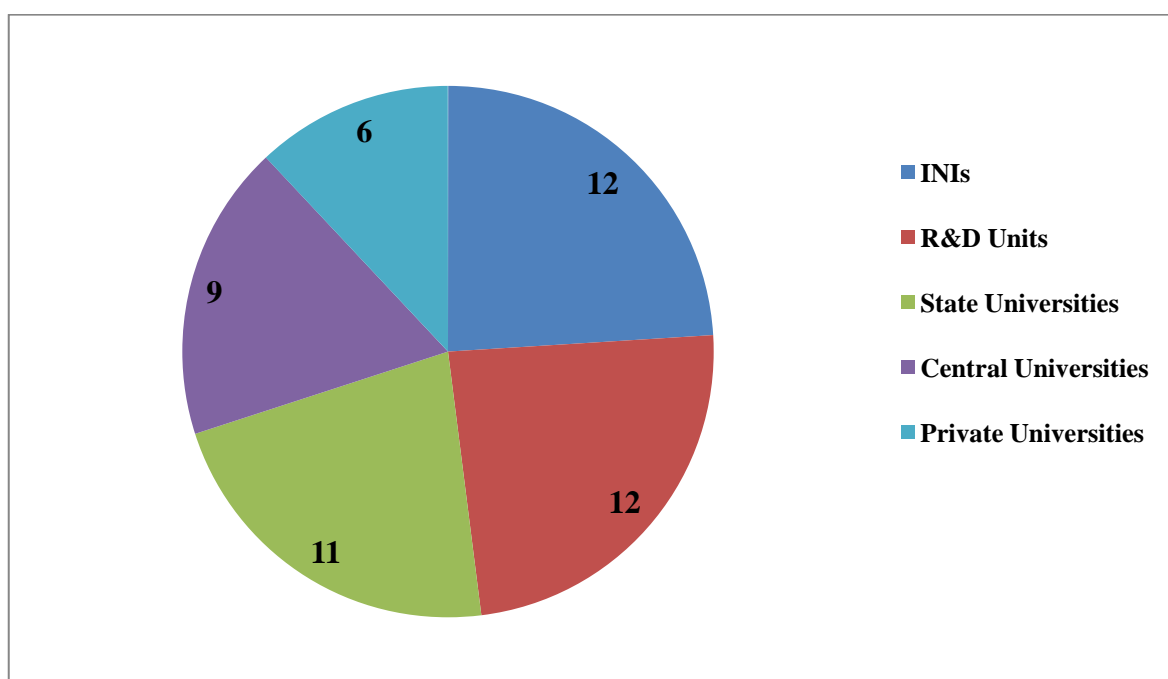
Table 6: Patents and Publications Profile of Top 50 Institutes* (HEIs & R&D) (2010-16)

S. No.	Institute	Status	Publications	Patents Filed	Patents Granted
1	University of Delhi, Delhi	Central Univ.	15052	84	26
2	IISc., Bangalore	Central Deemed Univ.	10852	533	174
3	IIT, Kharagpur	INI	8724	181	10
4	BHU, Varanasi	Central Univ.	8140	12	3
5	BARC, Mumbai	DAE	7887	7	3
6	University of Hyderabad, Hyderabad	Central Univ.	7649	18	5
7	IIT, New Delhi	INI	7148	264	56
8	AIIMs, Delhi	INI	6591	83	31
9	IIT, Chennai	INI	6440	424	48
10	IIT, Bombay	INI	6300	541	100
11	VIT University, Vellore	Pvt. Univ.	6267	54	3
12	IIT, Roorkee	INI	6028	26	1
13	IIT, Kanpur	INI	5622	296	44
14	Annamalai University, Tamil Nadu	State Univ.	5400	3	1
15	IIT, Hyderabad	INI	5398	28	2
16	PGIMER, Chandigarh	MHFW	5380	6	1
17	Gujarat University, Gujarat	State Univ.	4871	1	0
18	Panjab University, Chandigarh	State Univ.	4733	37	2
19	Aligarh Muslim University, Aligarh	Central Univ.	4588	7	2
20	Indian Institute of Chemical Technology, Hyderabad	CSIR	4534	76	32
21	Manipal University, Manipal	Pvt. Univ.	4444	56	13
22	IIT, Guwahati	INI	4205	23	0

23	Indian Agricultural Research Institute, New Delhi	ICAR	3934	7	2
24	S.R.M Institute of Science And Technology University, Chennai	Pvt. Univ.	3509	45	4
25	TIFR, Mumbai	DAE	3494	19	13
26	National Chemical Laboratory, Pune	CSIR	3232	4	3
27	Sathyabama University, Chennai	Pvt. Univ.	3211	8	0
28	Indian Association for the Cultivation of Science, Kolkata	DST	2961	21	2
29	Bharathiar University, Coimbatore	State Univ.	2948	1	0
30	Jawaharlal Nehru University, Delhi	Central Univ.	2739	19	6
31	Institute of Chemical Technology, Mumbai	State Univ.	2671	87	39
32	Saha Institute of Nuclear Physics, Kolkata	DAE	2543	2	2
33	Jammu University, Tawi	State Univ.	2524	0	0
34	Osmania University, Hyderabad	State Univ.	2467	7	0
35	National Physical Laboratory, New Delhi	CSIR	2378	0	0
36	Sri Venkateswara University, Tirupati	State Univ.	2344	1	0
37	IIT, Dhanbad	INI	2323	7	3
38	Jamia Millia Islamia, Delhi	Central Univ.	2320	10	0
39	NIT, Rourkela	INI	2275	6	0
40	Thapar University, Patiala	Pvt. Univ.	2269	10	0
41	Indira Gandhi Centre for Atomic Research, Tamil Nadu	DAE	2250	0	0
42	Indian Veterinary Research Institute, Izatnagar	ICAR	2242	4	2
43	Guru Nanak Dev University, Amritsar	State Univ.	2177	4	1
44	Pondicherry University, Puducherry	Central Univ.	2151	10	1

45	Central Drug Research Institute, Lucknow	CSIR	2125	3	2
46	University of Allahabad, Allahabad	Central Univ.	2109	3	0
47	Bharath University, Chennai	Pvt. Univ.	2082	111	0
48	Shivaji University, Kohlapur	State Univ.	2063	0	0
49	Indian Statistical Institute, Kolkata	INI	1886	41	13
50	Coimbatore Institute of Technology, Coimbatore	State Univ.	1854	2	0

*On the basis of Articles Publications



Graph 2: Categorization of Top 50 Ranked Institutes (HEIs + R&D Units)

Out of these top 50 institutions ranked according to number of publications, there are 12 institutions of national importance comprising of IITs, AIIMS, NIT and Indian Statistical Institute, Kolkata, nine central universities like Delhi University, which is on the top of the list, on basis of publications and 84 patents have been filed and 26 patents have been granted to its credit in last seven years, eleven State Universities, twelve R&D units under various ministries. Mainly institutions of national importance and research labs are dominating the ranking. But if we see the top 10 institutes (**graph-3**) based on research publications, the institutions like Banaras Hindu University (BHU), Bhabha Atomic Research Centre (BARC) and Hyderabad University (HU)

these are lacking in patents profile as their publication profile is very impressive. The institutes like IISc.at Bangalore, three IITs (Delhi, Madras, Bombay) and All India Institute of Medical Science (AIIMS), Delhi are performing equally good in both parameters vis a vis patents (filing/grant) and research publications. Here it is imperative to mention that the BARC institute, which, comes under Department of Atomic Energy (DAE), might have so many patentable inventions, but as per the **Atomic Energy Act, 1962** (<http://dae.nic.in/?q=node/153>), the inventions falling within Section 20 of the Act, are not patentable. The details of this section are as follows:

Section 20 of Atomic Energy Act, 1962: Special Provision as to Inventions

- i. As from the commencement of this Act, no patents shall be granted for inventions which in the opinion of the Central Government are useful for or relate to the production, control, use or disposal of atomic energy or the prospecting, mining, extraction, production, physical and chemical treatment, fabrication, enrichment, canning or use of any prescribed substance or radioactive substance or the ensuring of safety in atomic energy operations.*
- ii. The prohibition under sub-section (1) shall also apply to any invention of the nature specified in that sub-section in respect of which an application for the grant of a patent has been made to the Controller of Patents and Designs appointed under the Indian Patents and Designs Act, 1911, before the commencement of this Act and is pending with him at such commencement.*
- iii. The Central Government shall have the power to inspect at any time any pending patent application and specification before its acceptance and if it considers that the invention relates to atomic energy, to issue directions to the Controller of Patents and Designs to refuse the application on that ground.*
- iv. Any person, who has made an invention which he has reason to believe relates to atomic energy, shall communicate to the Central Government the nature and description of the invention.*
- v. Any person desiring to apply for a patent abroad for an invention relating to or which he has reason to believe relates to atomic energy shall obtain prior permission from the Central Government before making the application abroad or communicating the invention to any person abroad, unless three months have elapsed since his request for permission was made to the Central Government and no reply was received by him.*

- vi. *The Controller of Patents and Designs shall have the power to refer any application to the Central Government for direction as to whether the invention is one relating to atomic energy and the direction given by the Central Government shall be final.*
- vii. *Any invention in the field of atomic energy conceived whether in establishments controlled by the Central Government or under any contract, sub-contract, arrangement or other relationship with the Central Government shall be deemed to have been made or conceived by the Central Government, irrespective of whether such contract, sub-contract, arrangement or other relationship involves financial participation of or assistance from the Central Government.*
- viii. *Notwithstanding anything contained in the Indian Patents and Designs Act, 1911, the decision of the Central Government on points connected with or arising out of this section shall be final.*

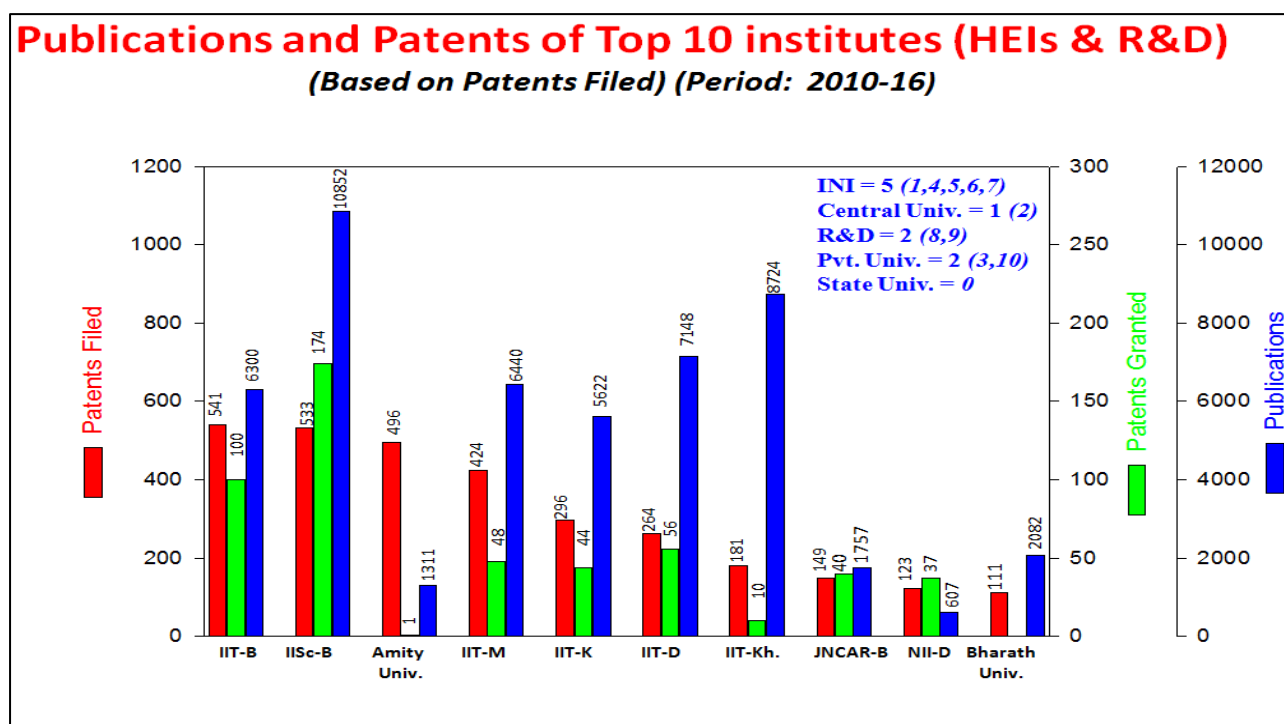
Role Models for other Institutions

There are some institutions in India, which are leading both in research publication and patenting as well. These institutes have been analysed by our centre and also approved by other national and international recognised reports and agencies as well. On the basis of the study, it appears that only IITs have taken responsibility in producing patents and presenting innovations before the world. They are actually justifying their name “Institutions of National Importance”. The reasons for this commendable performance of IITs (mainly first generation IITs) are they are very much IPR savvy, their incentivisation setup is very strong, they have dedicated IPR cells and technology transfer cells also which is missing in a maximum of the institutions in India. On the basis of this study, the centre has analysed those institutes which can act as role models for rest of the institutes which are doing good research but are unable or un aware about how they can exploit their research and can file a patent for the same. The top ten institutes which have been ranked on the basis of patents filed and patents granted are mentioned in next section (**graph 3 and graph 4**).

a. Top 10 Institutions Based on Patents Filed

The top 10 institutes, which are leading in patents filing are shown in Graph-2 with the no. of patents granted and research publications by them. The top 5 positions are occupied IITs namely IIT Bombay (1), IIT Madras (4), IIT Kanpur (5), IIT Delhi (6) and IIT Kharagpur (7). In addition to these IITs, other institutes which are filing a good number of patents are IISc Bangalore (2),

Amity University (3), Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore (8), National Institute of Immunology Delhi (9) and Bharath University Chennai (10). Some Universities are filing patents just for the sake of its reputation or brand building, whereas, their grant rate is zero. Here Amity University, Noida and Bharath University, Chennai are the suitable examples for this. As we can see in graph-2, for the period of 2010-16 Amity University has filed a total of 496 patents and they have only one patent granted to their credit for the same period. Apart from Amity University here is another private university which just believes in patents filing i.e. Bharath University situated in Chennai. Bharath University has filed a total of 111 patents for last seven years (2010-16) but their grant rate is nil. So the innovations by the students/scientist/researcher/faculty of any institute should be first evaluated at this institute level. For this purpose, every institution must have their dedicated IPR Policy, IPR Cell and Technology Transfer Cell etc. These cells will facilitate inventors by guiding them on how to protect their intellectual property or if their invention is protectable or not.

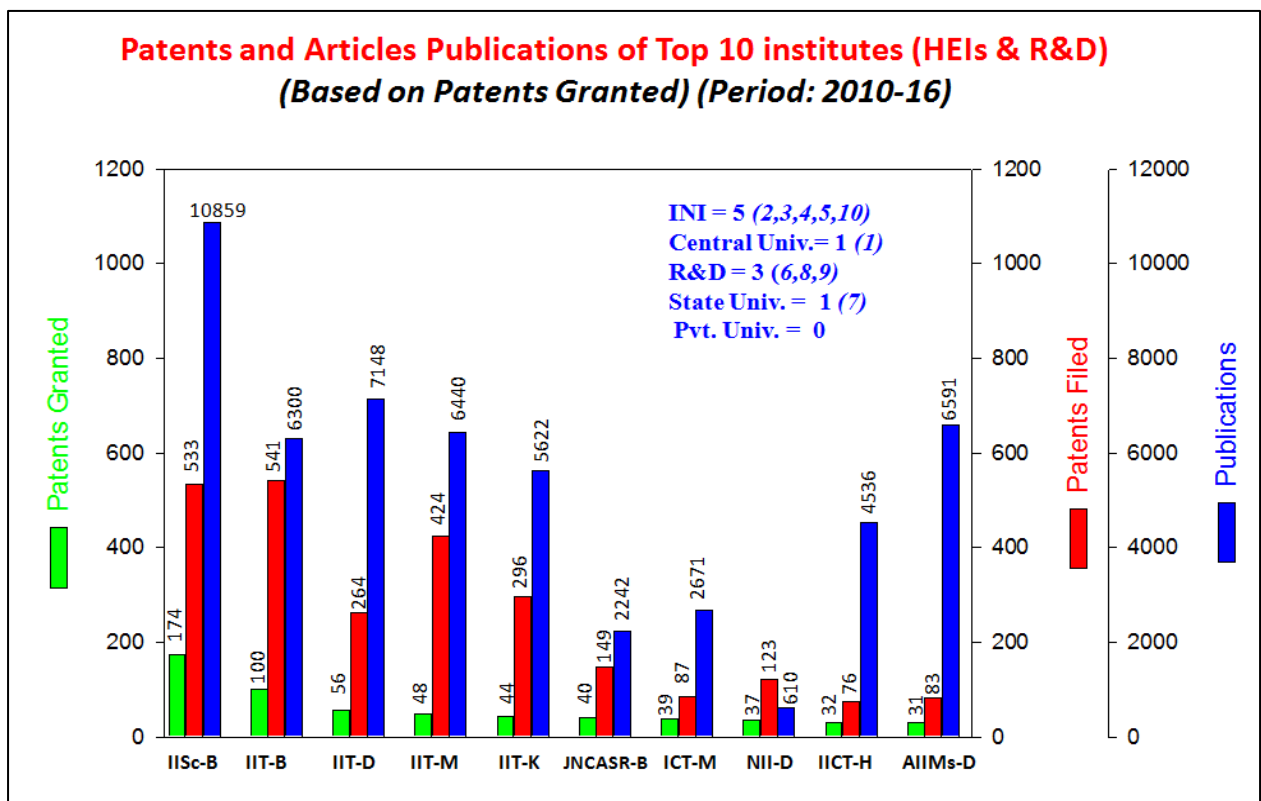


Graph-3: Top 10 Institutions Based on Patents Filing

b. Top 10 Institutions based on Patents Granted

In the ranking of top 10 institutes on the basis of patents granted between the years 2010 -16, there are five institutes belonging to the category of “Institutions of National Importance”, which is commendable. These five institutions are IIT Bombay, IIT Delhi, IIT Madras and IIT Kanpur.

Along with these five IITs, other institutes are Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore, ICT Mumbai, National Institute of Immunology New Delhi, Indian Institute of Chemical Technology, Hyderabad and All India Institute of Medical Science, Delhi. An institution having a well institutional setup and a good sense of the technologies exploitation, that institute, will always rise in all parameters related to science and technology. This statement is justified by selected institutes like IISc. Bangalore, IITs and some selected R&D institutes like Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore, ICT Mumbai, National Institute of Immunology, New Delhi. The IPR regime in these institutes is very - very strong as their patents grant rate is impressive. So we need to study models of these institutes. That model should be followed in other institutes too.



Graph-4: Top 10 Institutions Based on Patents Granted

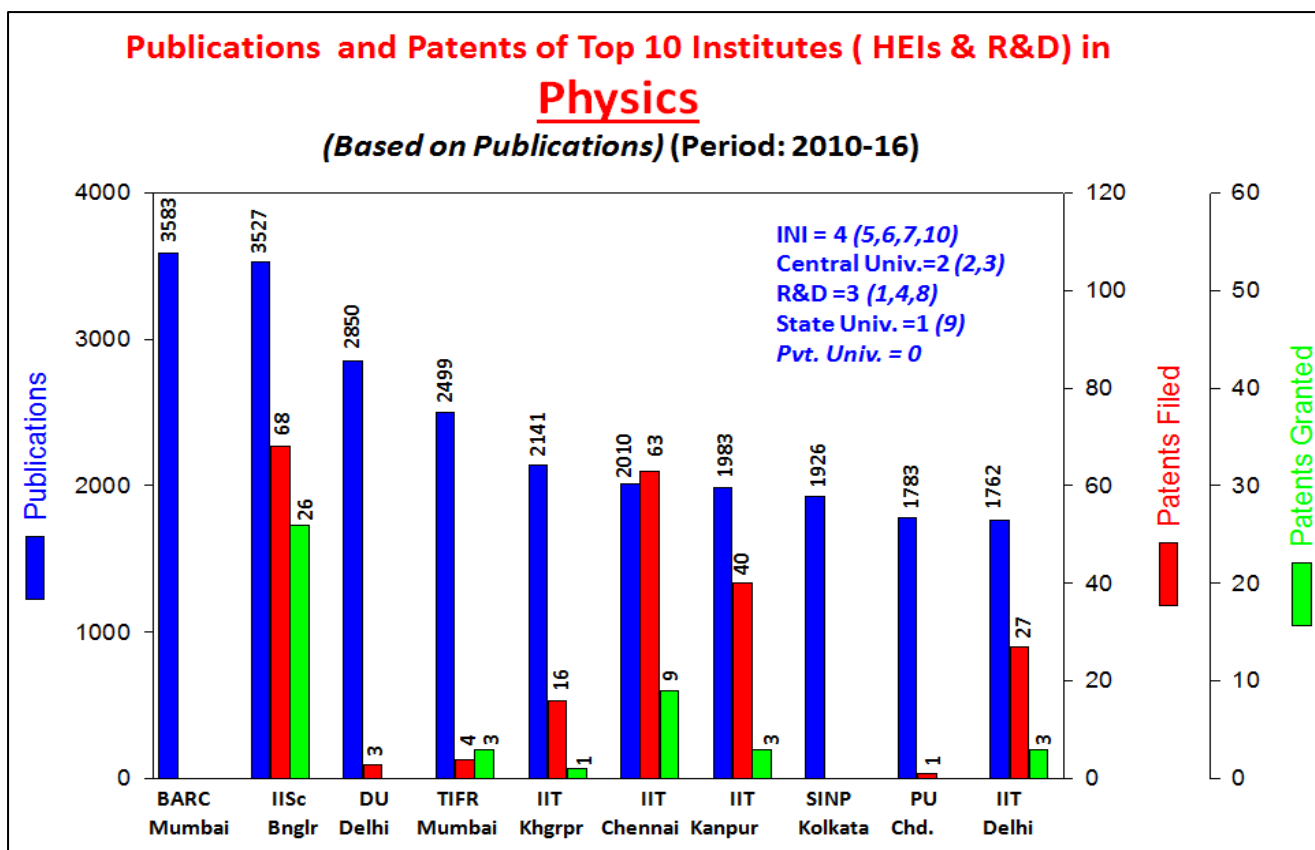
Field Wise Analysis of Institutions (914)

Academic institutions and universities are a storehouse of knowledge and knowledge givers, with new knowledge generated at these places on a continuous basis. Until recently the culture of protecting their inventive work legally through patents was almost nonexistent in these institutes, as most teachers felt that the knowledge should be shared freely through publications, seminars etc.

There are some institutes in India which are doing exceptionally good in patents and publications like IIT Madras, IIT Mumbai, IIT Delhi, IISc., Bangalore and CSIR. The reason behind their magnificent performance may be they are having IPR cells, dedicated IPR Policy, a Good incentivisation mechanism for academicians, researchers and scientists for patenting etc. Now we are in the process of sending proforma (**Annexure-3**) to these institutes and seek their involvement in promoting and identifying gaps between research publications and its conversion into patents and commercial asset. We have also analysed the data on the basis of six fields for all these institutions (914). By doing this exercise the Centre has figured out the stream wise performance of the institutes and can rope in them in strengthening the same in other institutes as well. The various fields are mentioned in **table 7**:

Table 7: Fields Categorization for Patents & Publications

S. No.	Patents Fields	Publications Fields
1	Physics	Physics & Astronomy
2	Chemical Engineering	<ul style="list-style-type: none"> • Chemistry • Chemical Engineering • Material Science
3	Pharma/Drug	Pharmacology, Toxicology and Pharmaceutics
4	Medical Science	<ul style="list-style-type: none"> • Medicine • Health Profession • Dentistry • Nursing • Neuroscience
5	<ul style="list-style-type: none"> • Mechanical Engineering • ECE • Electrical Engineering 	<ul style="list-style-type: none"> • Engineering • Computer Science
6	<ul style="list-style-type: none"> • Biotechnology/Biological Science • Food/Agriculture 	<ul style="list-style-type: none"> • Agricultural and Biological Sciences • Biochemistry and Genetics and Molecular Biology • Immunology & Microbiology • Environmental Sciences



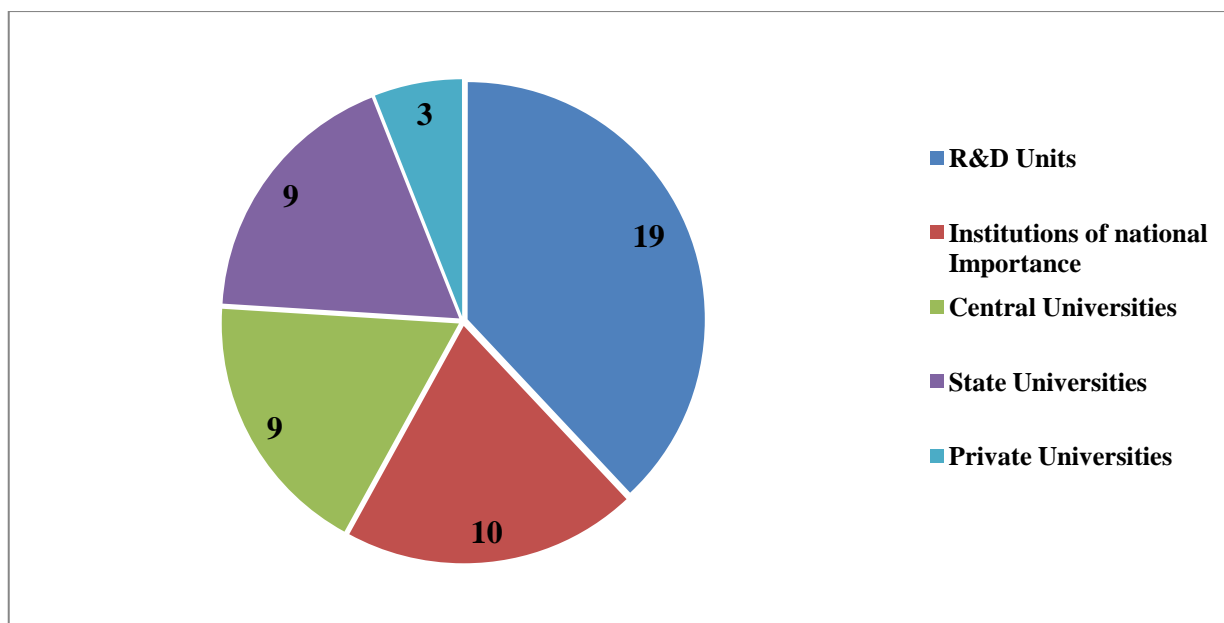
Graph-5: Top 10 Institutions in the Field of Physics

Table 8: Patents and Publications Profile of Top 50 Institutes based on Publications in Physics

S. No.	Institute	Status	Publications	Patents Filed	Patents Granted
1	Bhabha Atomic Research Centre, Mumbai	DAE	3583	0	0
2	Indian Institute of Science, Bangalore	Central Univ. (Deemed)	3527	68	26
3	University of Delhi, New Delhi	Central Univ.	2850	3	0
4	TIFR, Mumbai	DAE	2499	4	3
5	IIT , Kharagpur	INI	2141	16	1
6	IIT , Chennai	INI	2010	63	9
7	IIT, Kanpur	INI	1983	40	3
8	Saha Institute of Nuclear Physics, Kolkata	DAE	1926	0	0

9	Panjab University, Chandigarh	State Univ.	1783	1	0
10	IIT, New Delhi	INI	1762	27	3
11	IIT, Bombay	INI	1698	67	9
12	BHU, Varanasi	Central Univ.	1605	0	0
13	University of Hyderabad, Hyderabad	Central Univ.	1386	0	0
14	IIT , Roorkee	INI	1301	3	0
15	Indian Association for the Cultivation of Science, Kolkata	DST	1242	3	0
16	National Physical Laboratory, New Delhi	CSIR	1219	0	0
17	IIT, Guwahati	INI	1209	5	0
18	Indira Gandhi Centre for Atomic Research, Tamilnadu	DAE	1078	0	0
19	Institute for Plasma Research GIDC Bhat, Gandhinagar	DAE	866	2	1
20	Annamalai University, Tamilnadu	State Univ.	809	0	0
21	Institute of Physics, Bhubaneswar	DAE	778	0	0
22	Aligarh Muslim University, Aligarh	Central Univ.	759	0	0
23	Variable Energy Cyclotron Centre , kolkata	DAE	727	0	0
24	VIT University, Vellore	Pvt. Univ.	717	9	0
25	S.N. Bose National Centre for Basic Sciences, Kolkata	DST	714	4	4
26	Thapar University, Patiala	Pvt. Univ.	700	2	0
27	Physical Research Laboratory, Ahmedabad	DoS	687	0	0
28	Raja Ramanna Centre for Advanced Technology, Indore	DAE	681	0	0
29	Raman Research Institute, Bangalore	DST	669	9	3
30	Visva-Bharati University, West Bengal	Central Univ.	613	0	0

31	Indian Institute of Astrophysics, Bangalore	DAE	608	0	0
32	Gujarat University, Gujarat	State Univ.	597	0	0
33	Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore	DST	591	17	8
34	IIT, Hyderabad	INI	589	1	0
35	Harish Chandra Research Institute, Allahabad	DAE	587	0	0
36	Jamia Millia Islamia, New Delhi	Central Univ.	575	1	0
37	Bharathiar University, Coimbatore	State Univ.	568	0	0
38	Jammu University, Tawi	State Univ.	568	0	0
39	Sri Venkateswara University, Tripura	State Univ.	533	0	0
40	Central Glass Ceramic Research Institute, Kolkata	CSIR	530	0	0
41	IIT (Indian School of Mines), Dhanbad	INI	523	0	0
42	National Chemical Laboratory, Pune	CSIR	515	0	0
43	Shivaji University, Kolhapur	State Univ.	512	0	0
44	Guru Nanak Dev University, Amritsar	State Univ.	482	0	0
45	Cochin University of Science And Technology, Cochin	State Univ.	480	2	0
46	The Institute of Mathematical Sciences, Chennai	DAE	463	0	0
47	IISER, Pune	INI	455	1	0
48	Pondicherry University, Puducherry	Central Univ.	453	0	0
49	S.R.M Institute of Science And Technology University, Chennai	Pvt. Univ.	446	8	0
50	Tezpur University, Tezpur	Central Univ.	442	0	0



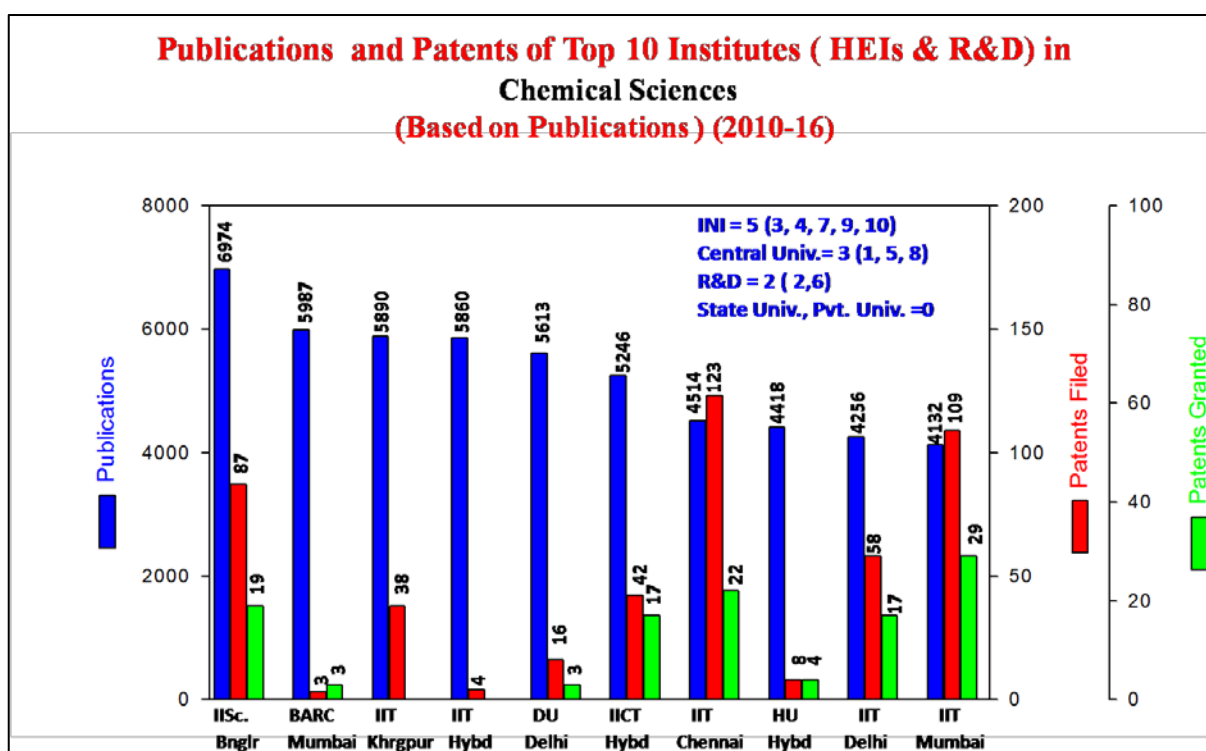
Graph 6: Categorization of Top 50 Ranked Institutes in the Field of Physics

Table 9: Top 10 Institutes on the basis of Patents Filed in Physics

S. No.	Institute	Patents Granted	Patents Filed	Publications
1.	IISc., Bangalore	26	68	3527
2	IIT, Mumbai	9	67	1698
3	IIT, Madras	9	63	2010
4	IIT, Kanpur	3	40	1983
5	Amity University, Noida	0	30	237
6	IIT, New Delhi	3	27	1762
7	Amrita Viswa Vidyapeetham, Coimbatore	3	17	119
8	Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore	8	17	591
9	IIT, Kharagpur	1	16	2141
10	Bharath University, Chennai	0	15	27

Table 10: Patents and Publications Profile of Top 10 Institutes in Physics (Based on Patents Granted) (Period: 2010-16)

S. No.	Institute	Patents Granted	Patents Filed	Publications
1.	IISc.Bangalore	26	68	3527
2	IIT Chennai	9	63	2010
3	IIT Bombay	9	67	1698
4	Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore	8	17	591
5	S.N. Bose National Centre for Basic Sciences, Kolkata	4	4	714
6	IIT Kanpur	3	40	1983
7	IIT New Delhi	3	27	1762
8	Indian Statistical Institute, Kolkata	3	6	304
9	Amrita Vishwa Vidyapeetham Coimbatore	3	17	122
10	Raman Research Institute, Bangalore	3	9	669



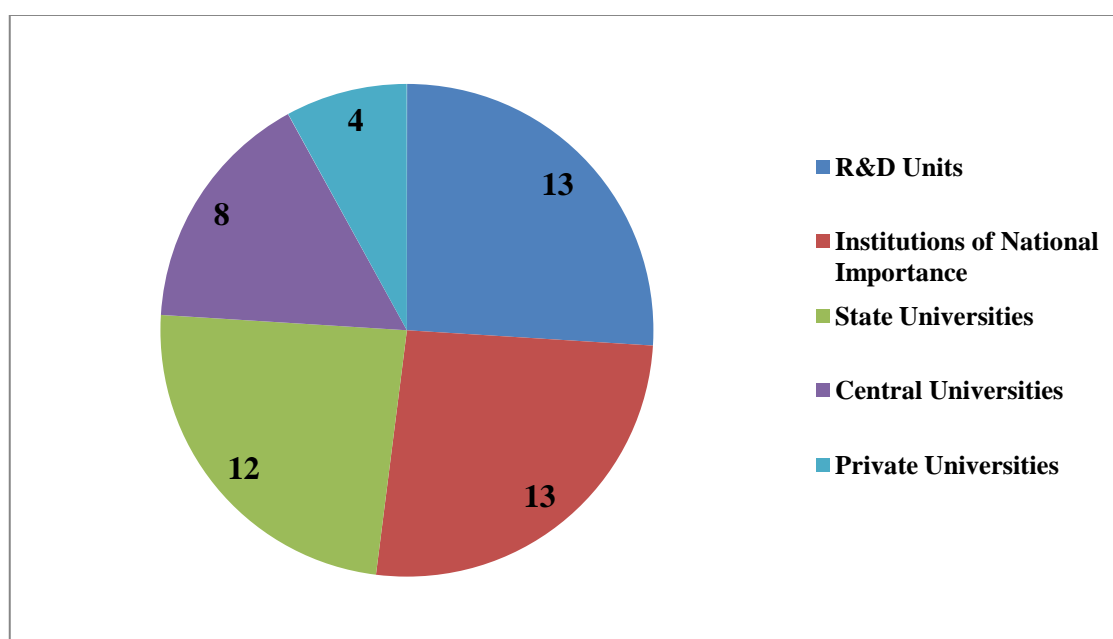
Graph: 7 Top 10 Institutions in the Field of Chemical Sciences

Table 11: Patents and Publications Profile of Top 50 Institutes based on Publications in Chemical Sciences

S. No.	Institute	Status	Publications	Patents Filed	Patents Granted
1	IISc., Bangalore	Central Univ. (Deemed)	6974	87	19
2	BARC, Mumbai	DAE	5987	3	3
3	IIT, Kharagpur	INI	5890	38	0
4	IIT , Hyderabad	INI	5860	4	0
5	University of Delhi, Delhi	Central Univ.	5613	16	3
6	Indian Institute of Chemical Technology, Hyderabad	CSIR	5246	42	17
7	IIT, Chennai	INI	4514	123	22
8	University of Hyderabad, Hyderabad	Central Univ.	4418	8	4
9	IIT, New Delhi	INI	4256	58	17
10	IIT, Bombay	INI	4132	109	29
11	IIT, Kanpur	INI	4060	86	17
12	National Chemical Laboratory, Pune	CSIR	4045	1	1
13	Banaras Hindu University, Varanasi	Central Univ.	3863	5	1
14	IIT, Roorkee	INI	3612	15	1
15	Indian Association for the Cultivation of Science, Kolkata	DST	3532	9	1
16	IIT , Guwahati	INI	3067	4	0
17	Institute of Chemical Technology, Mumbai	State Univ.	2917	47	20
18	VIT University, Vellore	Pvt. Univ.	2712	12	2
19	Gujarat University, Gujarat	State Univ.	2680	1	0
20	Annamalai University, Tamilnadu	State Univ.	2380	0	0

21	National Physical Laboratory, New Delhi	CSIR	2293	0	0
22	Indira Gandhi Centre for Atomic Research, Tamilnadu	DAE	2083	0	0
23	Aligarh Muslim University, Aligarh	Central Univ.	1974	5	2
24	Central Leather Research Institute, Chennai	CSIR	1754	0	0
25	Shivaji University, Kolhapur	State Univ.	1749	0	0
26	Panjab University, Chandigarh	State Univ.	1690	6	0
27	Bharathiar University, Tamilnadu	State Univ.	1651	0	0
28	Central Electrochemical Research Institute, Karaikudi	CSIR	1636	0	0
29	Central Salt Marine Chemicals Research Institute, Bhavnagar	CSIR	1584	0	0
30	Guru Nanak Dev University, Amritsar	State Univ.	1558	1	0
31	Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore	DST	1539	52	16
32	National Institute For Interdisciplinary Science and Technology ,Thiruvananthapuram	CSIR	1463	0	0
33	Sri Venkateswara University, Tirupati	State Univ.	1448	0	0
34	NIT, Rourkela,	INI	1361	1	0
35	S.R.M Institute Of Science And Technology, Chennai	Pvt.	1356	2	1
36	Tezpur University, Tezpur	Central Univ.	1345	4	0
37	Thapar University, Patiala	Pvt. Univ.	1326	5	0
38	Jamia Millia Islamia , New Delhi	Central Univ.	1260	3	0
39	IIT (Indian School of Mines), Dhanbad	INI	1247	2	0
40	Osmania University, Hyderabad	State Univ.	1216	3	0
41	Alagappa University	State Univ.	1197	0	0

42	Central Glass Ceramic Research Institute, Kolkata	CSIR	1174	0	0
43	Central Drug Research Institute, Lucknow	CSIR	1156	3	2
44	Pondicherry University, Puducherry	Central Univ.	1153	5	1
45	IIT (BHU), Varanasi	INI	1146	0	0
46	NIT, Karnataka	INI	1131	0	0
47	IISc.Education & Research (IISER), Kolkata	INI	1095	0	0
48	Kalyani University, West Bengal	State Univ.	1074	0	0
49	Birla Institute of Technology & Science, Pilani	Pvt.	1064	0	0
50	Cochin University of Science And Technology, Cochin	State Univ.	1015	0	



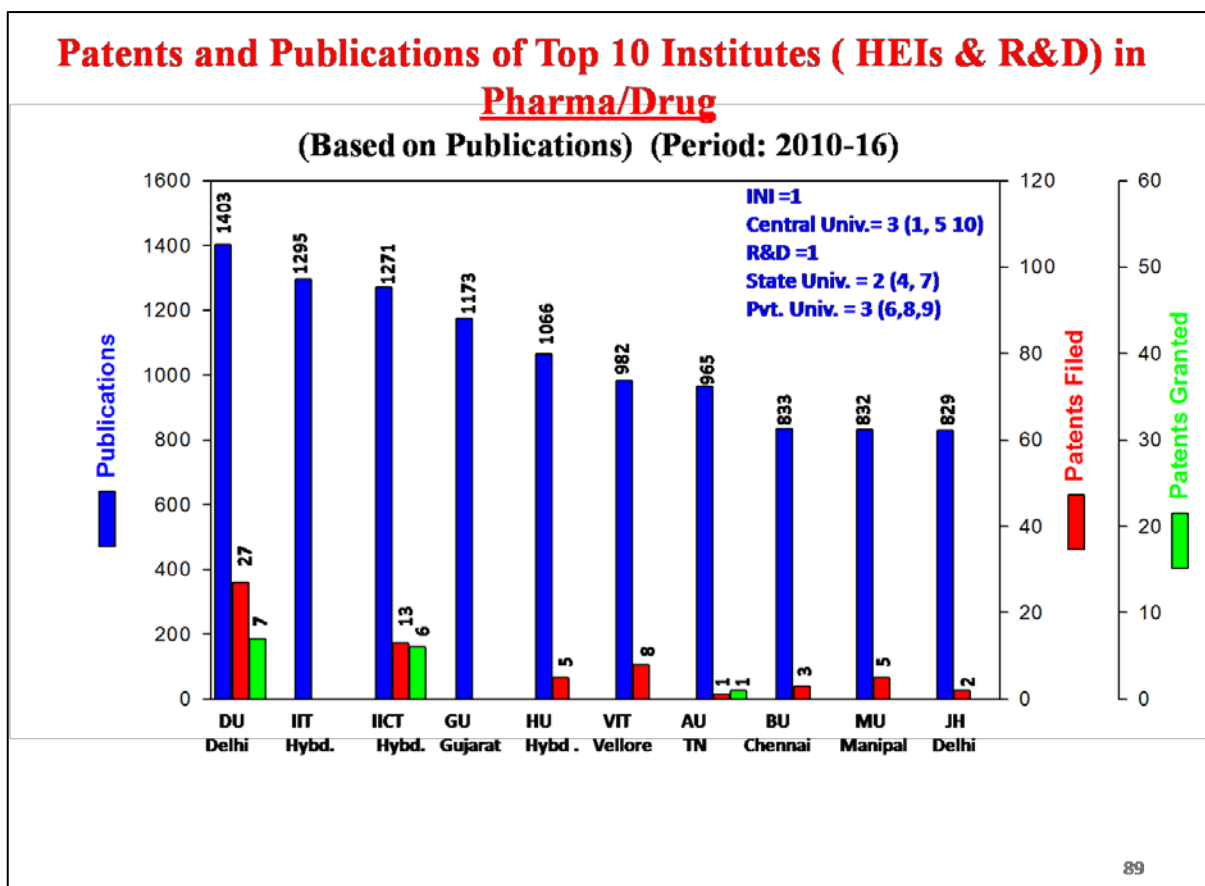
Graph 8: Categorization of Top 50 Ranked Institutes in the Field of Chemical Sciences

Table 12: Top 10 Institutes on the basis of Patents Filed in Chemical Sciences

S. No.	Institute	Patents Granted	Patents Filed	Publications
1.	Indian Institute of Technology, Chennai	22	123	4514
2	Indian Institute of Technology, Mumbai	29	109	4132
3	Amity University, Noida	0	105	496
4	Indian Institute of Science, Bangalore	19	87	6974
5	Indian Institute of Technology, Kanpur	17	86	4060
6	Indian Institute of Technology, New Delhi	17	58	4256
7	International Advanced Research Centre for Powder Metallurgy & New Materials, Hyderabad	6	52	383
8	Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore	16	52	1539
9	Institute of Chemical Technology	20	47	107
10	National Institute of Pharmaceutical, Educational and Research, Mohali	8	46	254

Table 13: Patents and Publications Profile of Top 10 Institutes in Chemical Sciences (Based on Patents Granted) (Period: 2010-16)

S. No.	Institute	Patents Granted	Patents Filed	Publications
1.	IIT, Mumbai	29	109	4132
2	IIT, Chennai	22	123	4514
3	Institute of Chemical Technology, Mumbai	20	47	2917
4	IISc., Bangalore	19	87	6974
5	IIT, Kanpur	17	86	4060
6	IIT, New Delhi	17	58	4256
7	Indian Institute of Chemical Technology, Hyderabad	17	42	5246
8	Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore	16	52	1539
9	NIPER Mohali, Punjab	8	46	252
10	Central Institute of Research on Cotton Technology, Mumbai	6	9	9



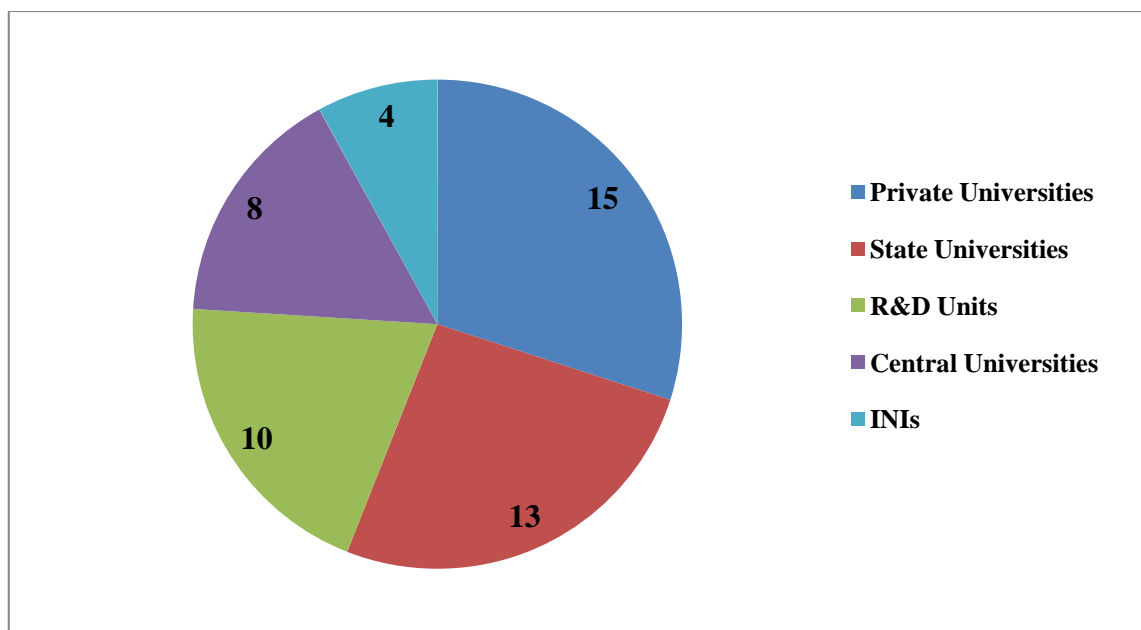
Graph: 9 Top 10 institutions in the Field of Pharma/Drug

Table 13: Patents and Publications profile of Top 50 Institutes based on Publications in Pharma/Drug

S. No.	Institute	Status	Publications	Patents Filed	Patents Granted
1	University of Delhi, New Delhi	Central Univ.	1403	27	7
2	IIT, Hyderabad	INI	1295	0	0
3	Indian Institute of Chemical Technology, Hyderabad	CSIR	1271	13	6
4	Gujarat University, Gujarat	State Univ.	1173	0	0
5	University Of Hyderabad, Hyderabad	Central Univ.	1066	5	0
6	VIT University, Vellore	Pvt. Univ.	982	8	0
7	Annamalai University, Tamilnadu	State Univ.	965	1	1
8	Bharath University, Chennai	Pvt. Univ.	833	3	0

9	Manipal University, Manipal	Pvt. Univ.	832	5	0
10	Jamia Hamdard, New Delhi	Central Univ.	829	2	0
11	Central Drug Research Institute, Lucknow	CSIR	802	0	0
12	Banaras Hindu University, Varanasi	Central Univ.	761	4	1
13	Sathyabama University, Chennai	Pvt. Univ.	723	0	0
14	S.R.M Institute of Science And Technology, Chennai	Pvt. Univ.	602	10	1
15	Panjab University, Chandigarh	State Univ.	591	27	2
16	Jawaharlal Nehru Technological University, Hyderabad	State Univ.	476	0	0
17	Osmania University, Hyderabad	State Univ.	472	0	0
18	Sri Venkateswara University, Tirupati	State Univ.	418	0	0
19	Manipal College of Pharmaceutical Sciences, Manipal	Pvt. Univ.	389	2	0
20	University Institute of Pharmaceutical Sciences, Chandigarh (Panjab Univ.)	State Univ.	385	4	0
21	Indian Institute of Integrative Medicine, Jammu	CSIR	346	11	7
22	Bharati Vidyapeeth, Pune	Pvt. Univ.	330	2	0
23	Bharathiar University, Coimbatore	State Univ.	329	0	0
24	Indian Institute of Toxicology Research, Lucknow	CSIR	327	0	0
25	Birla Institute of Technology & Science, Pilani	Pvt. Univ.	322	3	0
26	All India Institute of Medical Sciences, New Delhi	INI	320	24	9
27	Birla Institute of Technology, Ranchi	Pvt. Univ.	308	3	0
28	Karpagam University, Coimbatore	Pvt. Univ.	305	10	0
29	Poona College of Pharmacy Pune	Pvt. Univ.	298	0	0

30	Aligarh Muslim University, Aligarh	Central Univ.	286	2	0
31	JSS University, Mysore	Pvt. Univ.	271	5	0
32	JSS College of Pharmacy, Mysore	Pvt. Univ.	263	0	0
33	National Chemical Laboratory, Pune	CSIR	263	4	3
34	Guru Nanak Dev University, Amritsar	State Univ.	263	3	1
35	Indian Institute of Chemical Biology, Kolkata	CSIR	257	5	0
36	Periyar University, Tamilnadu	State Univ.	254	0	0
37	University College of Pharmaceutical Sciences, Warangal	State Univ.	226	0	0
38	Department Of Pharmaceutical Sciences, (Dibrugarh Univ.), Dibrugarh	State Univ.	226	2	0
39	University of Allahabad, Allahabad	Central Univ.	218	0	0
40	SRM University, Chennai	Pvt. Univ.	217	10	1
41	PGIMER, Chandigarh	ICMR	208	2	0
42	Central Institute of Medicinal Aromatic Plants, Lucknow	CSIR	204	0	0
43	Pondicherry University, Pudicherry	Central Univ.	201	0	0
44	IIT, Kharagpur	INI	200	5	0
45	NIPER Mohali, Punjab	INI	195	50	10
46	BARC, Mumbai	DAE	195	0	0
47	Nirma University, Ahmedabad	Pvt. Univ.	191	3	0
48	Jamia Millia Islamia, New Delhi	Central Univ.	185	0	0
49	Institute of Nuclear Medicine & Allied Sciences, Delhi	DRDO	177	0	0
50	Guru Jambheshwar University of Science & Technology, Hisar	State Univ.	172	2	0



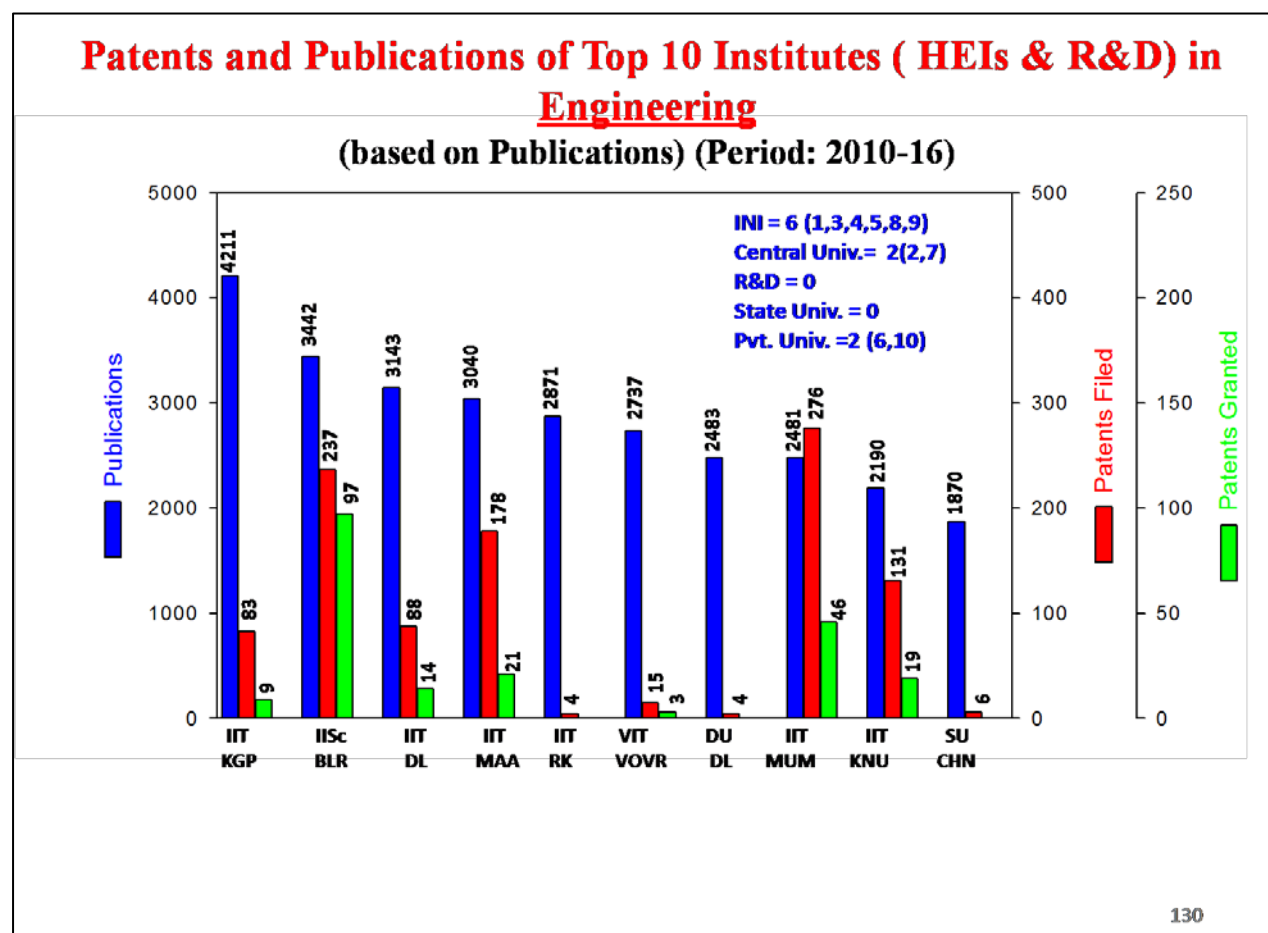
Graph 10: Categorization of Top 50 Ranked Institutes in the Field of Pharma/Drug

Table 14: Top 10 Institutes on the basis of Patents Filed in Pharma/Drug

S. No.	Institute	Patents Granted	Patents Filed	Publications
1.	Amity University, Noida	0	158	156
2	NII, New Delhi	25	76	71
3	IISc., Bangalore	18	58	256
4	Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore	13	54	33
5	NIPER Mohali, Punjab	10	50	195
6	IIT, Mumbai	14	41	140
7	Amrita Viswa Vidyapeetham, Amrita Nagar	5	33	162
8	University of Delhi, New Delhi	7	27	1403
9	Panjab University, Chandigarh	2	27	591
10	AIIMS, New Delhi	9	24	320

Table 15: Patents and Publications Profile of Top 10 Institutes in Pharma/Drug (Based on Patents Granted) (Period: 2010-16)

S. No.	Institute	Patents Granted	Patents Filed	Publications
1.	NII, New Delhi	25	76	71
2	IISc., Bangalore	18	58	256
3	IIT, Mumbai	14	41	140
4	Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore	13	54	33
5	NIPER Mohali, Punjab	10	50	129
6	AIIMS, New Delhi	9	24	320
7	University of Delhi, New Delhi	7	27	1403
8	Indian Institute of Integrative Medicine, Jammu	7	11	346
9	National Centre for Cell Science, Pune	7	8	34
10	Jamia Hamdard, New Delhi	6	23	829



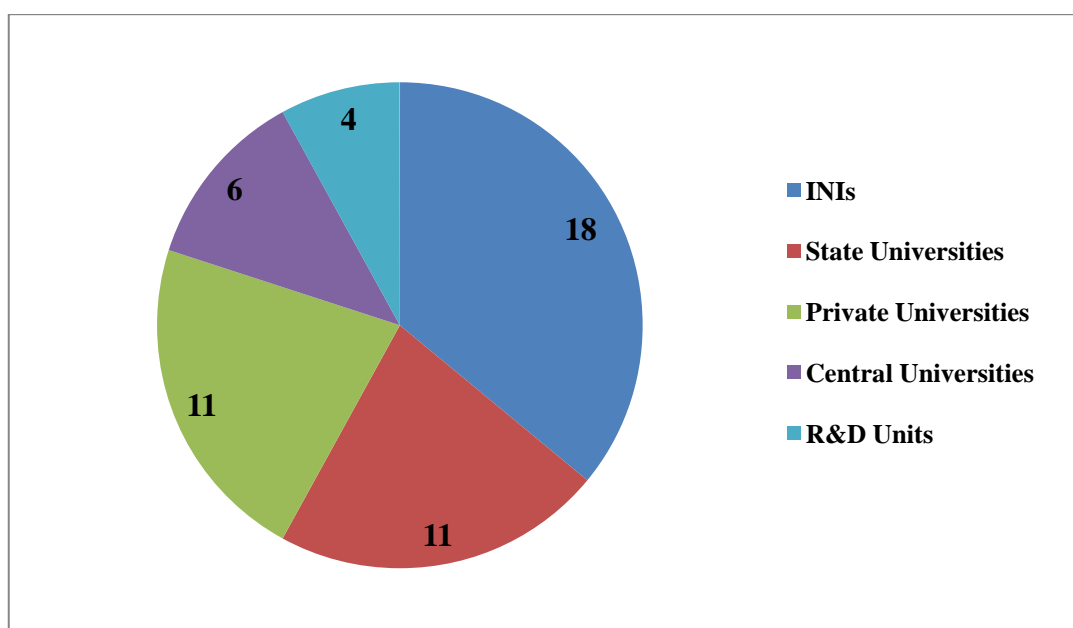
Graph-11: Top 10 Institutions in the Field of Engineering

Table 16: Patents and Publications Profile of Top 50 Institutes based on Publications in Engineering

S. No.	Institute	Status	Publications	Patents Filed	Patents Granted
1	IIT, Kharagpur	INI	4211	83	9
2	IISc., Bangalore	Central Univ. (Deemed)	3442	237	97
3	IIT, New Delhi	Central Univ.	3143	88	14
4	IIT, Chennai	INI	3040	178	21
5	IIT, Roorkee	INI	2871	4	0
6	VIT University, Vellore	Pvt. Univ.	2737	15	3
7	University of Delhi, New Delhi	Central Univ.	2483	4	0
8	IIT, Bombay	INI	2481	276	46
9	IIT, Kanpur	INI	2190	131	19
10	Sathyabama University, Chennai	Pvt. Univ.	1670	6	0
11	S.R.M Institute of Science And Technology, Chennai	Pvt. Univ.	1545	20	2
12	IIT , Guwahati	INI	1501	6	0
13	Bhabha Atomic Research Centre, Mumbai	DAE	1379	0	0
14	Coimbatore Institute of Technology-Coimbatore	State Univ.	1344	1	0
15	NIT, Rourkela,	INI	1298	2	0
16	Thapar University, Patiala	Pvt. Univ.	1285	1	0
17	University of Hyderabad, Hyderabad	Central Univ.	1235	1	0
18	Annamalai University, Tamilnadu	State Univ.	1233	1	0
19	BHU, Varanasi	Central Univ.	1225	2	0
20	IIT (Indian School of Mines), Dhanbad	INI	1055	2	1

21	PSG College Of Technology, Coimbatore	Pvt. Univ.	980	11	1
22	Amrita Viswa Vidyapeetham, Amrita Nagar	Pvt. Univ.	920	36	2
23	Bharathiar University, Coimbatore	State Univ.	870	0	0
24	Indira Gandhi Centre for Atomic Research	DAE	869	0	0
25	SRM University, Chennai	Pvt. Univ.	860	20	2
26	Indian Statistical Institute, Kolkata	INI	824	26	9
27	NIT, Durgapur	INI	794	1	0
28	Thiagarajar College of Engineering, Madurai (Anna Univ.)	State Univ.	767	10	5
29	IIT, Hyderabad	INI	744	20	2
30	NIT, Karnataka,	INI	705	0	0
31	Jamia Millia Islamia, New Delhi	Central Univ.	703	5	0
32	National Physical Laboratory, New Delhi	CSIR	662	0	0
33	Panjab University, Chandigarh	State Univ.	647	1	0
34	Aligarh Muslim University, Aligarh	Central Univ.	633	0	0
35	NIT, Calicut	INI	596	6	0
36	Motilal Nehru Institute of Technology, Allahabad	INI	596	2	0
37	Birla Institute of Technology, Ranchi	Pvt. Univ.	582	6	3
38	Institute of Chemical Technology, Mumbai	State Univ.	576	5	1
39	Shivaji University, Kolhapur	State Univ.	575	0	0
40	IIT (BHU), Varanasi	INI	563	0	0
41	NIT, Warangal	INI	557	0	0
42	Gujarat University, Gujarat	State Univ.	555	0	0

43	BITS, Pilani	Pvt. Univ.	533	0	0
44	Sri Venkateswara University, Tripura	State Univ.	512	0	0
45	Karunya University, Coimbatore	Pvt. Univ.	510	0	0
46	NIT, Kurukshetra	INI	498	1	0
47	Bharath University, Chennai	Pvt. Univ.	498	45	0
48	College of Engineering, Pune	State Univ.	497	7	0
49	Defence Metallurgical Research Laboratory, Hyderabad	DRDO	484	0	0
50	Cochin University Of Science And Technology, Cochin	State Univ.	473	2	0



Graph 12: Categorization of Top 50 Ranked Institutes in the Field of Engineering

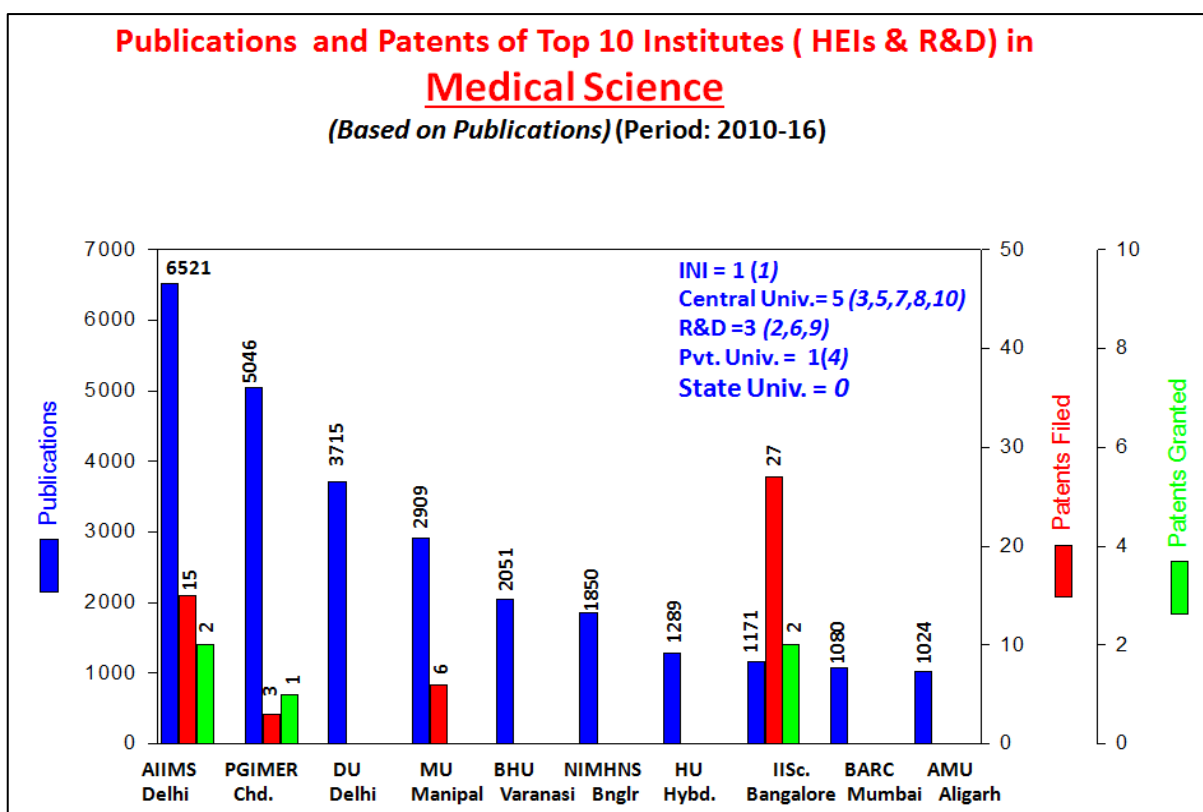
Table 17: Top 10 Institutions on the basis of Patents Filed in Engineering

S. No.	Institute	Patents Granted	Patents Filed	Publications
1.	IIT, Bombay	46	276	2481
2	IISc., Bangalore	97	237	3442

3	IIT, Chennai	21	178	3040
4	IIT, Kanpur	19	131	2190
5	IIT, New Delhi	14	88	3143
6	IIT, Kharagpur	9	83	4211
7	Amity University, Noida	0	79	403
8	Bharath University, Chennai	0	45	498
9	Centre for Development of Telemetric, Delhi	6	40	7
10	Amrita Viswa Vidyapeetham, Amrita Nagar	2	36	920

Table 18: Patents and Publications Profile of Top 10 Institutes in Engineering (Based on Patents Granted) (Period: 2010-16)

S. No.	Institute	Patents Granted	Patents Filed	Publications
1.	IISc., Bangalore	97	237	3442
2	IIT, Mumbai	46	276	2481
3	IIT, Chennai	21	178	3040
4	IIT, Kanpur	19	131	2190
5	IIT, New Delhi	14	88	3143
6	Manipal University, Manipal	11		442
7	IIT, kharagpur	9	83	4211
8	Indian Statistical Institute, Kolkata	9	26	824
9	Central Institute of Research on Cotton Technology, Mumbai	9	28	2
10	Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore	9	32	185



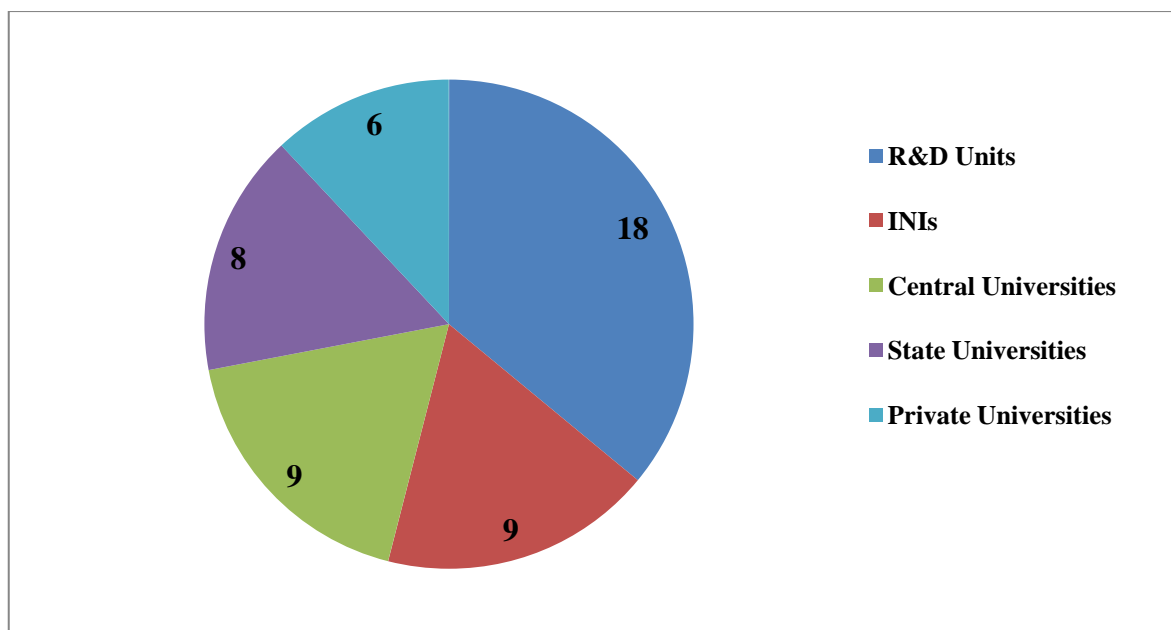
Graph 13: Top 10 Institutions in the Field of Medical Sciences

Table 19: Patents and Publications Profile of Top 50 Institutes based on Publications in Medical Sciences

S. No.	Institute	Status	Publications	Patents Filed	Patents Granted
1	AIIMS, New Delhi	INI	6521	15	2
2	PGIMER, Chandigarh	ICMR	5046	3	1
3	University of Delhi, New Delhi	Central Univ.	3715	0	0
4	Manipal University, Manipal	Pvt. Univ.	2909	6	0
5	BHU, Varanasi	Central Univ.	2051	0	0
6	National Institute of Mental Health & Neuro Sciences, Bangalore	MHFW	1850	0	0
7	University of Hyderabad, Hyderabad	Central Univ.	1289	0	0
8	IISc., Bangalore	Central Univ. (Deemed)	1171	27	2
9	BARC, Mumbai	DAE	1080	0	0

10	Aligarh Muslim University, Aligarh	Central Univ.	1024	0	0
11	Panjab University, Chandigarh	State Univ.	952	3	0
12	King George Medical University Lucknow	State Univ.	912	1	0
13	Annamalai University, Tamilnadu	State Univ.	901	1	0
14	Central Drug Research Institute, Lucknow	CSIR	882	0	0
15	Sree Chitra Tirunal Institute for Medical Sciences and Tech., Thiruvananthapuram	Pvt. Univ.	832	36	1
16	Gujarat University, Gujarat	State Univ.	716	0	0
17	VIT University, Vellore	Pvt. Univ.	671	2	0
18	Jamia Hamdard, New Delhi	Central Univ.	654	2	0
19	Jawaharlal Nehru University, New Delhi	Central Univ.	640	0	0
20	IIT, Kharagpur	INI	575	13	0
21	Institute of Genomics and Integrative Biology, Delhi	CSIR	558	0	0
22	Indian Institute of Chemical Biology, Kolkata	CSIR	544	0	0
23	Armed Forces Medical College, Pune	Indian Armed Forces	498	0	0
24	Centre for Cellular Molecular Biology, Hyderabad	CSIR	492	0	0
25	Indian Veterinary Research Institute, Izatnagar	ICAR	489	0	0
26	IIT , Hyderabad	INI	486	2	0
27	Bharathiar University, Coimbatore	State Univ.	483	0	0
28	Osmania University, Hyderabad	State Univ.	467	0	0
29	Institute of Post Graduate Medical Education and Research, Kolkata	ICMR	450	0	0
30	S.R.M Institute Of Science And Technology, Chennai	Pvt. Univ.	448	0	2
31	IIT, New Delhi	INI	444	1	19

32	Bharati Vidyapeeth, Pune	Pvt. Univ.	438	0	0
33	Indian Institute of Chemical Technology, Hyderabad	CSIR	435	0	0
34	IIT Chennai	INI	433	1	27
35	Jamia Millia Islamia, New Delhi	Central Univ.	426	0	0
36	Indian Institute of Toxicology Research, Lucknow	CSIR	386	0	0
37	Bose Institute, Kolkata	DST	373	0	0
38	Guru Nanak Dev University, Amritsar	State Univ.	358	1	0
39	Institute of Nuclear Medicine & Allied Sciences, Delhi	DRDO	343	0	0
40	IIT Bombay	INI	339	36	3
41	Medical Council of India, New Delhi	ICMR	338	0	0
42	IIT, Kanpur	INI	336	14	1
43	IIT, Guwahati	INI	334	5	0
44	IIT , Roorkee	INI	332	1	0
45	JSS University, Mysore	Pvt. Univ.	331	0	0
46	Central Food Technological Research Institute, Mysore	CSIR	319	0	0
47	National Institute of Immunology, New Delhi	DBT	313	10	3
48	Jammu University, Tawi	State Univ.	311	0	0
49	University of Allahabad, Allahabad	Central Univ.	302	0	0
50	NCL, Pune	CSIR	295	0	0



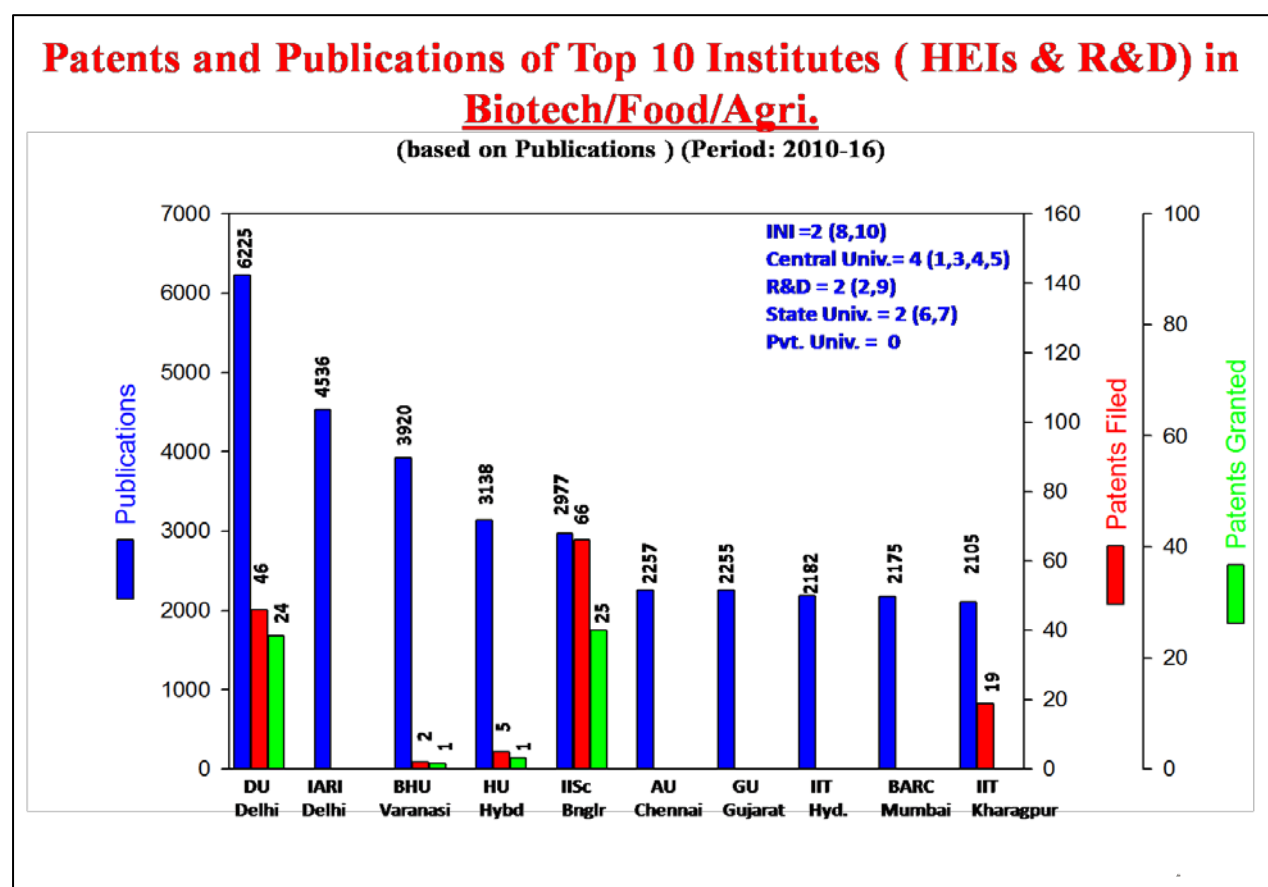
Graph 14: Categorization of Top 50 Ranked Institutes in the Field of Medical Sciences

Table 20: Top on the basis of Patents Filed in Medical Sciences

S. No.	Institute	Patents Granted	Patents Filed	Publications
1.	Sree Chitra Tirumal Institute for Medical Sciences and Technology, Thiruvananthapuram	1	36	832
2	IIT, Mumbai	3	36	339
3	IIT, Chennai	1	28	433
4	IISc., Bangalore	2	27	1171
5	IIT, New Delhi	1	20	444
6	AIIMS, New Delhi	2	15	6521
7	IIT, Kanpur	1	14	336
8	IIT, Kharagpur	0	13	575
9	Bharath University, Chennai	0	12	130
10	Amity University, Noida	0	11	225

Table 21: Patents and Publications Profile of Top 10 Institutes in Medical Sciences (Based on Patents Granted) (Period: 2010-16)

S. No.	Institute	Patents Granted	Patents Filed	Publications
1.	IIT, Mumbai	3	36	339
2	Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore	3	6	240
3	NII, New Delhi	3	10	313
4	Institute of Life Sciences, Bhubaneswar	3	7	151
5	AIIMS, New Delhi	2	15	6521
6	IISc., Bangalore	2	27	1171
7	IIT, Chennai	1	28	433
8	IIT, Kanpur	1	14	336
9	IIT, New Delhi	1	20	444
10	Sree Chitra Tirunal Institute for Medical Sciences & Technology, Thiruvananthapuram	1	36	214



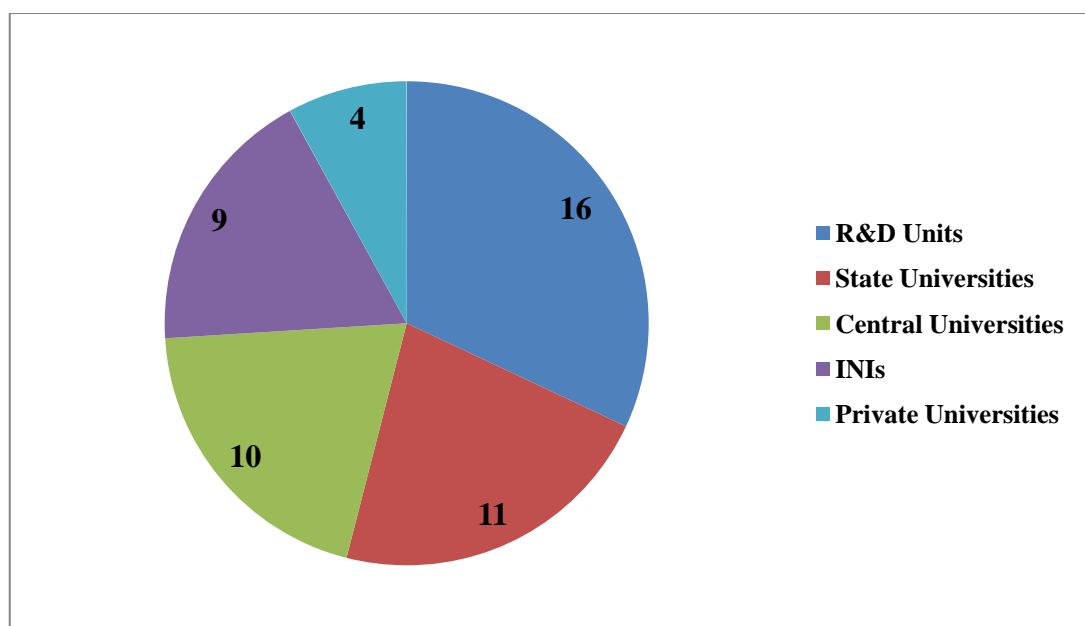
Graph: 15 Top 10 Institutions in the Field of Biotech./Food/Agri.

Table 22: Patents and Publications Profile of Top 50 Institutes based on Publications in the Field of Biotech/Food./Agri.

S. No.	Institute	Status	Publications	Patents Filed	Patents Granted
1	University of Delhi, Delhi	Central Univ.	6225	46	24
2	Indian Agricultural Research Institute, New Delhi	ICAR	4536	7	2
3	Banaras Hindu University, Varanasi	Central Univ.	3920	2	1
4	University of Hyderabad, Hyderabad	Central Univ.	3138	5	2
5	IISc, Bangalore	Central Univ. (Deemed)	2977	66	25
6	Annamalai University, Tamilnadu	State Univ.	2257	0	0
7	Gujarat University, Gujarat	State Univ.	2255	0	0
8	IIT, Hyderabad	INI	2182	0	0
9	BARC, Mumbai	DAE	2175	0	0
10	IIT, Kharagpur	INI	2105	19	0
11	Indian Institute of Chemical Technology, Hyderabad	CSIR	2066	17	8
12	IIT, New Delhi	INI	2029	26	5
13	Indian Veterinary Research Institute, Izatnagar	ICAR	1929	2	0
14	Aligarh Muslim University, Aligarh	Central Univ.	1908	1	1
15	VIT University, Vellore	Pvt. Univ.	1868	8	0
16	AIIMS, New Delhi	INI	1784	37	20
17	Manipal University, Manipal	Pvt. Univ.	1666	2	0
18	JNU, New Delhi	Central Univ.	1625	15	5
19	IIT, Roorkee	INI	1492	1	0
20	Panjab University, Chandigarh	State Univ.	1472	0	0

21	Central Drug Research Institute, Lucknow	CSIR	1442	0	0
22	Central Food Technological Research Institute, Mysore	CSIR	1436	0	0
23	National Dairy Research Institute, Karnal	ICAR	1422	0	0
24	IIT, Bombay	INI	1357	44	9
25	Jammu University, Tawi	State Univ.	1352	0	0
26	IIT , Guwahati	INI	1294	2	0
27	National Chemical Laboratory, Pune	CSIR	1220	0	0
28	IIT, Chennai	INI	1161	27	5
29	PGIMER, Chandigarh	ICMR	1118	1	0
30	Osmania University	State Univ.	1113	6	0
31	Bharathiar University, Coimbatore	State Univ.	1098	1	0
32	Institute of Genomics and Integrative Biology, New Delhi	CSIR	1079	0	0
33	Institute of Chemical Technology, Mumbai	State Univ.	1053	24	12
34	Centre for Cellular Molecular Biology, Hyderabad	CSIR	1030	2	0
35	National Botanical Research Institute, Lucknow	CSIR	1025	0	0
36	S.R.M Institute Of Science And Technology, Chennai	Pvt. Univ.	1018	2	0
37	Sathyabama University, Chennai	Pvt. Univ.	1004	0	0
38	Indian Institute of Chemical Biology, Kolkata	CSIR	955	2	0
39	Pondicherry University, Puducherry	Central Univ.	927	2	0
40	Jamia Hamdard, New Delhi	Central Univ.	924	1	0
41	University of Allahabad, Allahabad	Central Univ.	924	1	0
42	Bose Institute, Kolkata	DST	909	7	4

43	Sri Venkateswara University, Tripura	State Univ.	899	1	0
44	Institute of Microbial Technology, Chandigarh	CSIR	888	1	0
45	IIT, Kanpur	INI	881	21	4
46	Shivaji University, Kilhapur	State Univ.	877	0	0
47	Guru Nanak Dev University, Amritsar	State Univ.	872	0	0
48	Central Institute of Medicinal Aromatic Plants, Lucknow	CSIR	848	0	0
49	Jamia Millia Islamia, New Delhi	Central Univ.	847	0	0
50	Kalyani University, West Bangal	State Univ.	746	0	



Graph 16: Categorization of Top 50 Ranked Institutes in the Field of Biotech/Food./Agri.

Table 24: Top 10 Institutes on the basis of Patents Filed in Biotech/Food/Agri.

S. No.	Institute	Patents Granted	Patents Filed	Publications
1.	Amity University, Noida	1	97	592
2	IISc.Bangalore	25	66	592

3	University of Delhi, New Delhi	24	46	6225
4	IITMumbai	9	44	2182
5	All India Institute of Medical Sciences, Delhi	20	37	1784
6	National Institute of Immunology, New Delhi	11	35	598
7	Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore	9	32	560
8	IITChennai	5	27	1161
9	IITNew Delhi	5	26	2029
10	Institute of Chemical Technology, Mumbai	12	24	1053

Table 25: Patents and Publications Profile of Top 10 Institutes in Biotech/Food./Agri. (Based on Patents Granted) (Period: 2010-16)

S. No.	Institute	Patents Granted	Patents Filed	Publications
1.	IISc.Bangalore	25	66	2977
2	University of Delhi	24	46	6225
3	All India Institute of Medical Sciences, New Delhi	20	37	1784
4	Institute Of Chemical Technology	12	24	1053
5	National Centre for Cell Science, Pune	12	17	543
6	National Institute of Plant Genome Research, New Delhi	12	21	721
7	DBT -National Institute of Immunology, New Delhi	11	35	598
8	IIT Mumbai	9	44	1357
9	Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore	9	9	560
10	Indian Institute of Chemical Technology, Hyderabad	8	17	2088

Conclusion

Academic institutions place emphasis on research publication because it is being considered as an indicator of excellence in its faculty/ researchers/ scientists. Usual parameters for evaluating the research output of institutions are citations and papers in reputed journals. We aimed to fill the gap between research publications and their conversion into patents. The academic institutions that have been able to raise their patent filing have initiated foreign collaborations, have special cells for relations with industry, and have some operational mechanisms to ensure patents filings. Teaching institutions face similar problems of the public sector in general regarding raising patent activity. A number of patents filed by universities is low as compared to IITs. One reason behind this trend is that universities have very little funds or no funds for carrying out R&D. In India, most of the R&D funding comes from government ministries. The University Grant Commission (UGC) also provides funds to various universities/ academic institutions on the condition that the outcome is patented (WIPO, 2007). Their funding is not comparable to the funds received by R&D institutions which are meant to carry out R&D. Similarly, infrastructure support available to universities is also limited. Most academicians have to imbibe the fact that they should not publish their research work without first filing patent applications. One of the reasons for the increase in patent filing by academic and teaching institutions of India is that many Government departments have instituted systems for helping universities to protect their inventive work.

As mentioned before academic institutions in India are more research oriented but to convert this research into patents and the commercial product and process is the need of the hour. The poor patent regime in India is the result of lack of awareness among inventors/researchers and gaps in IPR policies and also the absence of an institutional framework for ensuring the protection of IP rights. Most important is the lack of awareness and those who are aware, they are hesitant in patent filing as the process of patent filing is very time consuming and costly too for an individual person. So first intervention should be the time and process of filing of patents needed to be streamlined. As of awareness about IPR, there should be at least an introductory chapter about IPR at the school level. It is also suggested that five universities, each located in a northern, southern, western, eastern and central part of India, be designated as nodal centres for IPRs, which will run short term 'Certificate', 'Diploma' and 'Advanced' courses on IPR, open for public and private sector both.

Patents are of no value unless the commercial worth of the product or technology is demonstrated and exploited. Many patentable inventions have failed not because they didn't work, but because

the inventor was unable to exploit them commercially. So there is a need for policy in India on this. If an institution or an individual is unable to utilize and commercialize the patent, they should entrust their patent to a specialized agency for its management, utilization or disposal. Also, the government should set up technology transfer offices in research labs, research centric universities and institutes.

Patent litigation is another area of concern. It is a sensitive and expensive issue. The academician/researcher/scientist may not be aware of how to deal with legal issues related to IPR. So to avoid wastage of time on IPR issues, there must be a dedicated chamber in courts to take care of IPR issues. So, if infringement is proved, damages may be awarded to the owner on time. It will prove a deterrent to those who infringe other's inventions. The government is trying for the dissemination of IPR related issues, The National IPR Policy-2016 of India stresses upon making Indian researchers and scientists IPR savvy. To achieve this goal, DIPP has created a special body, Cell for IPR Promotion and Management, with the mandate of creating awareness about IPRs amongst the students and scientists of the country by delivering lectures at various places i.e. schools, colleges, universities and R&D institutes.

Academic institutions and universities are a storehouse of knowledge and knowledge givers, with new knowledge generated at these places on the continuous basis. Until recently the culture of protecting their inventive work legally through patents was almost nonexistent in these institutes, as most teachers felt that the knowledge should be shared freely through publications, seminars etc. There are some institutes in India which are doing exceptionally good in patents and publications like IIT Madras, IIT Mumbai, IIT Delhi, IISc., Bangalore and CSIR. The reason behind their magnificent performance may be they are having IPR cells, dedicated IPR Policy, a good incentivisation mechanism for academicians, researchers, and scientists for patenting etc. Now we are in the process of sending proforma (**Annexure-3**) to these institutes and seek their involvement in promoting and identifying gaps between research publications and its conversion into patents and commercial asset. We are also analysing data on the basis of fields for all these institutions. By doing this exercise we can analyse the stream wise performance of the institutes and can rope in them in strengthening the same in other institutes. The fields are shown in table-14.

Recommendations

As patents publications and research publications are two main means to bring technical and scientific knowledge to the public. Usually, educational institutions concentrate on basic research and applied science is usually being carried out in industries only. But this scenario needs to be changed. DST-CPR has drowned some recommendations to enhance technology transfer and patent regime in India.

- IP cells in higher education and R&D institutions are very - very crucial and these cells should be fully supported by institute's administration.
- The industry-academia interaction is a very important factor for patent commercialization. Whatever research is being undertaken in the labs should be communicated to the industry and should concentrate on industry based research. If a patent is not commercialised there is no use of patenting. In most of the developed economies, I-A interactions are the main parameter for IP commercialization.
- The role of IP cells in any R&D /Academic Institutes is extremely important for promotion of IPR culture as well as for increasing IPR Filings.
- There ought to be mechanism in every educational institution and R&D units that every research publication being carried out in institute should first go to the IP cell before publication to check for patentability of the research work. This screening before publication will surely increase the IPR filing rates.
- In any research partnership, there should be an emphasis on product development /deliverables from the very beginning of the research activities.
- One of the reason institutes like IISc., Bangalore and IIT, Mumbai have very good record of both publications and patents is that they have IP setup within the institute premises. So, other universities should also set up IP cells to match up publication and patenting numbers.
- Enough work has been done for IPR dissemination. There should be dedicated awareness programmes on IPR filing and commercialization.
- A condition must be incorporated for Ph. D. Students, that they should have at least one patent filed to their credit to complete their Ph. D.
- Every HEI and R&D units must have a robust IPR Policy in place to guide and educate researchers.

- IPR cells and technology transfer cells should be clubbed since they need to work in close association.
- There should be knowledge sharing between academia and industry, so that they can exploit each other's innovation and knowledge.
- Each institute should not only concentrate on IPR cells within the institutes, but also promote technology transfer and business incubator simultaneously.
- IPR cell, technology transfer cells and business incubators should work in tandem. This model has been implemented by many developed countries and need to be adopted in India as well.
- For making students IPR savvy, there should be at least introductory chapter at school level so that they have knowledge about IPR and get to know how to exploit their ideas and innovations.
- There should be a separate IP commercialization cell along with IP protection cell which can reach out to industry with available technologies/patents for commercialization. It should be considered as an independent business unit with sufficient autonomy to take decision. Reaching out to industry will not only enable relation development, faster commercialization, avoidance of duplication but will also be helpful in need based research in academia.
- Include students also in IPR related activities; it will inculcate the IPR knowledge to students and make them IPR savvy.
- Some Universities are filing patents just for the sake of its reputation or brand building, whereas, their grant rate is zero. So technologies and innovations must be evaluated before filing patent. By doing this other processes such as examination will be faster.
- All the technical institutes should collaborate with the local Patent Information Cell (PIC) established by TIFAC (DST) in 20 states (<http://pfc.org.in/index.htm>) and all PICs should be actively participate in IPR dissemination and help them in all IPR activities and commercialization being carried out in those institutes.
- The incentivisation set up in HEIs and R&D labs except IITs is very weak so there is a scope of improvement in rest of the institutions.

Future Activities to be Undertaken

- Patents classification on the basis of International Patents Classification (IPC) codes from WIPO and also classification of the patents information on the basis of institutes.
- Analyse the research publications viz-a-viz a number of PhD scholars for all institutes.
- Analysis of institutes on the basis of patents granted/filed and patents licensed.
- Conduct Case studied on the institutes which, are having strong hold on both parameters i.e. publications and patents.
- Designing of the questionnaires with the consultation of ‘Advisory Committee’ for case studies on these institutes.
- Study the correlation between funding amount given by public funding agencies to HEIs and R&D labs and revenues they are getting in return by commercializing technologies.
- Upload the classified patents data on centre’s website.
- For IPR generation or dissemination, link the website or sources of all schemes, facilities and programmes of ministries and other public and private agencies on centre’s webpage.
- Collaborative research/ technology transfer/IP commercialization data by classifying the patents list available with the centre.
- Data collection of SMEs pertaining to IPR which can be find from 32 IPFCs and also technologies transferred to them by academia.
- Patents landscaping for industries and analysis of data on the basis of collaborative research by industry and academia.
- **Study IPR Policies of**
 - I. Developed Countries: UK, USA, Germany etc
 - II. Asian Countries: S. Korea, China and Japan etc
- **Case Studies on:**
 - Top 5 Scientists in filing patents
 - Top 5 industries in PCT applications
 - Top 5 R&D units
 - Top 5 HEIs

Annexure-1

Scopus

Scopus is the largest abstract and citation database of peer-reviewed literature: scientific journals, books and conference proceedings. Delivering a comprehensive overview of the world's research output in the fields of science, technology, medicine, social sciences, and arts and humanities, Scopus features smart tools to track, analyse and visualize research. The Scopus covers 17,000 journals in natural and social sciences including humanities.

As research becomes increasingly global, interdisciplinary and collaborative, you can make sure that critical research from around the world is not missed when you choose Scopus.

To keep track of what's happening in your research world, turn to Scopus. Across all research fields—science, mathematics, engineering, technology, health and medicine, social sciences, and arts and humanities—Scopus delivers a broad overview of global, interdisciplinary scientific information that researchers, teachers and students need to stay informed.

Features of Scopus:

Document search: Search directly from the homepage and use detailed search options to ensure you find the document(s) you want

Author search: Search for a specific author by name or by ORCID (Open Research and Contributor Identifier) ID

Affiliation search: Identify and assess an affiliation's scholarly output, collaborating institutions and top authors.

Language Interface: The Scopus interface is available in Chinese and Japanese. Content is not localized, but you can switch the interface to one of these language options (and switch back to English, the default language) at the bottom of any Scopus page. Note: By default, Scopus will appear in the language selected in your browser settings, unless your institution has specified otherwise or the language is not supported by Scopus (in which case, the interface will be in English).

Field Wise (Fields Covered)

- Physics and Astronomy
- Medicine
- Biochemistry, Genetics and Molecular Biology
- Chemistry
- Engineering
- Pharmacology, Toxicology and Pharmaceutics
- Materials Science
- Computer Science
- Chemical Engineering
- Agricultural and Biological Sciences
- Business management and Accounting
- Social Sciences
- Economics, Econometrics and Finance
- Immunology and Microbiology
- Arts and Humanities
- Earth and Planetary Sciences
- Mathematics
- Environmental Sciences
- Multidisciplinary
- Decision Science

Documents Coverage:

- Book
- Book Chapter
- Conference Paper
- Conference Review
- Articles
- Review
- Article in Press
- Editorial
- Short Survey
- Business Article

Search Options:

- Authors
- First Author
- Source Title
- Article Title
- Abstract
- Keywords
- Affiliation Name
- Affiliation City
- Affiliation Country
- References
- Chemical Name
- Language
- ISSN
- Conference

Annexure-2

Talwar and Talwar Consultants

TT Consultants is an Intellectual Property service provider established in the year 2006. TT Consultants is consistently serving many of the Fortune 1000 companies, start-ups, incubators, investors and law firms from the last ten years by providing insights on technology intelligence, assisting in strategic alliances, and managing intellectual property assets.

TT Consultants primarily provides solutions that cover the complete technology/product life cycle, from conception till commercialization. These solutions include R&D / Innovation Management, In-licensing Support, Go-to-market Strategy, Out-licensing, Product Development Support, Competitive Intelligence, Due-Diligence, Deal-Structuring & Negotiation, Opportunity Assessment, Business Plan Review, Patent & Trademark Prosecution, Portfolio Optimization, Litigation Support, and Prior-art Search.

As a company, TT Consultants strive toward providing excellence to its customers. Therefore, the company's efforts till date are aligned with a vision to innovate for proliferating innovation. XLPAT solution, an automated solution applying artificial intelligence on unstructured patent data, is one of the most critical innovation of TT Consultants.

XLPAT solution has also received multiple accolades such as Best Product of the Year 2013 by STPI, START TELAVIV 2015, IBM Smart Camp 2015. XLPAT solutions extract its intelligence by implementing technologies like Natural Language Processing, Artificial Intelligence, Watson, Search Intelligence, Image Recognition and knowledge from our 10 years of experience in IPR.

TT Consultants has its global presence in sales and all the projects are delivered through three operation centres - situated in India, the US and Taiwan. To date, the company has demonstrated its expertise to clients in more than 30 major geographies.

Annexure-3

Proforma

DST- Centre for Policy Research

at

PANJAB UNIVERSITY, CHANDIGARH-160 014 (INDIA)

(Estt. Under the Panjab University Act VII 1947 enacted by the Govt. of India)

The filled up Questionnaire can either be emailed at dstprc2014@pu.ac.in or a hard copy may be sent to

Prof. Rupinder Tewari

Coordinator

DST – Centre for Policy Research

Panjab University

Sector-14, Chandigarh-160014.

Name of the Institute:		
Complete Postal Address:		
E-Mail Address		
Contact Number:		
	Does the Institute have a dedicated “IPR Cell” or its equivalent?	
	Does the Institute have a dedicated “IPR Policy” or its equivalent?	
	<i>Does institute provide courses/ training to faculty/students related to IPR?</i>	
	Does the Institute hold workshops/ conferences/ seminars on IPR	
	<i>No. of Faculty members completed course on IPR</i>	
	<i>Does institute have research collaborations with industries?</i>	
	<i>Does institute have research collaborations with other academic institutions?</i>	

	Is there any Industry sponsored research fellowship in the Institute?	
	<i>Exchange Programmes (National/international)</i>	
	Are there any special incentives for faculty members/researchers who have obtained patents/ transferred technology?	
	Does the Institute have an IPR Cell/ Entrepreneurship Cell/ Placement Cell/ Technology transfer Cell/ any other (pl. mention)?	
	<p>Please fill in the appropriate details relevant to the Institute (Till now)</p> <p>(a) Number of Patents</p> <p>(i) Granted..... (ii) Filed.....</p> <p>(b) Number of Technology transfers</p> <p>(i) Commercialized..... (ii) Under process.....</p> <p>(c) Number of MoU with the Industries</p> <p>(i) Signed..... (ii) Under process.....</p>	

FEEDBACK & SUGGESTIONS:

Name

Designation

Signature

For query: Ms. Mamta Bhardwaj, Email: mamtab@pu.ac.in; dstprc2014@pu.ac.in.