DST-Centre for Policy Research
Panjab University, Chandigarh

Sanctioned by the Department of Science and Technology (DST)
(DST/PRC/CPR-03/2013, Dated 09/01/2014)

Report

on

Commercialization of Patents Granted to HEIs and NRLs of India

January 2010 – December 2017

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OBJECTIVES

Department of Science and Technology (DST), New Delhi sanctioned Centre for Policy Research (CPR) at Panjab University, Chandigarh in December 2013. The major objectives of this Center are:

- Development of a new country-specific model for the promotion of PPP for R&D
- Identify areas of policy gaps for stimulation of private sector investment in R&D and suggest changes in the policy environment
- Adopt evidence-based approaches for identifying and promoting areas for the generation of intellectual properties.

ADVISORY COMMITTEE FOR THE OBJECTIVE

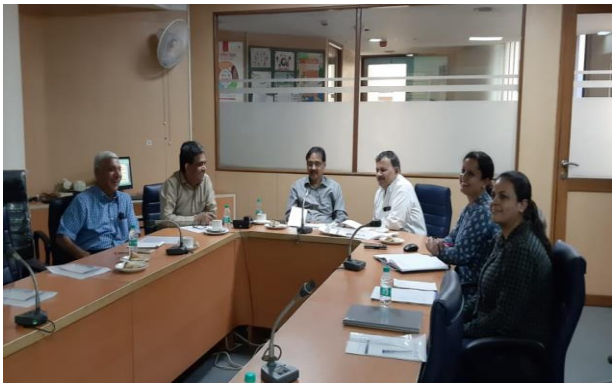
Adopt Evidence Based Approaches for Identifying and Promoting Areas for Generation of Intellectual Properties.

S. No.	Name	Address
1.	Dr. K. S. Kardam	Fmr. Senior Joint Controller of Patents & Designs Patent Office Delhi Boudhik Sampada Bhawan, Dwarka-14, New Delhi-110075
2.	Dr. Rajesh Dixit	Deputy Controller of Patents & Designs Patent Office Delhi Boudhik Sampada Bhawan, Dwarka-14, New Delhi-110075
3.	Dr. H. Purushotham	CMD, NRDC 20-22 Zamroodpur Community Centre, Kailash Colony Extn., New Delhi-110048
4.	Dr. Yashawant Dev Panwar	Scientist- E TIFAC, Vishwakarma Bhavan 'A' wing, Shaheed Jeet Sing Marg, New Delhi.-110016
5.	Shri Avinash Kumar	Fmr. Addl. Director (IPR), DRDO (HQ) Ministry of Defence, New Delhi -110004
6.	Mr. Siddhant Chouksey	Innovation Manager - Hero MotoCorp Ltd. Fmr. Assistant Manager CIPAM, DPIIT New Delhi - 110011
7.	Mr. Jitin Talwar	Attorney, Patent Agent, Founder XLPAT - TT Consultants-Talwar Advocates Mohali-160055

To fulfil the objective given to the Centre by DST, GoI, New Delhi, the Centre seeks time to time feedback and suggestions from the honorary advisory committee by organizing meetings and brainstorm sessions. The 4th Advisory Committee meeting was conducted on Saturday, July 13, 2018, at Meeting Hall, 4th floor, Technology Information Forecasting and Assessment Council (TIFAC), A' Wing, Vishwakarma Bhavan, Shaheed Jeet Singh Marg, New Delhi, 110016.

Agenda: Discussion regarding the study on 'Working' and 'Non-working' status of patents granted to National Research Laboratories (NRLs) and Higher Education Institutions (HEIs) of India and future IP related activities to be undertaken by DST-CPR, Panjab University (PU), Chandigarh.



Dr. Anita Aggarwal *(Scientist E, DST, New Delhi)* ; ***Prof. Rupinder Tewari*** *(Fmr. Coordinator, DST-CPR @ PU, Chd.)* ; ***Dr Yashawant Dev Panwar*** *(Scientist E, TIFAC);* ***Dr K. S. Kardam*** *(Fmr Sr. Controller General, IPO New Delhi);* ***Shri Avinash Kumar*** *(Fmr. Addl. Director (IPR), DRDO New Delhi);* ***Ms. Mamta Bhardwaj*** *(Sr. Scientist C, DST-CPR @ PU Chd.),* ***Ms. Amandeep Sandhu*** *(Fmr. Scientific Officer, DST-CPR @ PU*

Prof. Rupinder Tewari, then Coordinator, DST-CPR at PU, Chandigarh welcomed and introduced all the members of 'Advisory Committee (IP)'. Prof. Tewari briefly spoke about the 'Study on Working of patents in India' carried out by the Centre. A Summary of the Study had already been sent to all the members of the Advisory Committee on July 8th 2019.

Ms. Mamta Bhardwaj, in charge of the Study, apprised committee members with the activities executed by the Centre. Previously the Centre had analyzed 904 institutions pertaining to HEIs, universities and R&D laboratories in India under 27 various ministries. The data of institutions were analyzed based on research publications and patents granted to the respective institutes for the period 2010-17. The same has been published in the form of a book entitled **"Mapping Patents and Research Publications of Higher Education Institutes and National R&D Laboratories of India"** and research papers.

In the next phase, DST-Centre for Policy Research conducted the study on the patents granted to HEIs and NRLs of India, for the period 2010-17. This Study was presented before the 'Advisory Committee (IP)' in previous meeting i.e. on 8th September 2018. The presentation was followed by a healthy discussion on suggestions and feedback for the improvement on executed work by the Centre to achieve the objective **"Adopt evidence-based approaches for identifying and promoting areas for generation of intellectual property".** The inputs/ comments/ suggestions have been incorporated in the current study and the committee suggested the following activities to complete the study:

- Year wise data extraction of patents granted in India from InPASS.
- The data updation and changes as suggested by the 'Advisory Committee' shall be incorporated in the Study and the updated Study shall be shared with the Committee Members.
- Report and research papers based on the Study shall be prepared and thereafter published in peer-reviewed journals.

After incorporating all the suggestions by committee, DST-CPR was planning to conduct a meeting to present the updated data and analysis but due to CIVID-19 pandemic, this could not be possible. Therefore the complete study was communicated to all the members in the form of PowerPoint presentation in May 2020. The recommendations suggested by the committee are mention in the 'Recommendations' in later section.

RESEARCH PUBLICATIONS

(from of this study)

1. Mamta Bhardwaj and Amandeep Sandhu. (2020). "**A Study on Working/Non-working Status of Patents Granted to HEIs and NRLs of India"** submitted for publication in "Current Science" (Communicated).

2. Mamta Bhardwaj and Amandeep Sandhu. (2020). **"Significance of Patents Licensing for Enhancing Translational Research Ecosystem in India" submitted** for publication in "Current Science" (Communicated).

3. Mamta Bhardwaj, Amandeep Sandhu and Navkiran Ghumman. (2020). **"Patent Commercialization Profile of Top Performing Indian HEIs"** submitted for publication in "Current Science" (Communicated).

4. Mamta Bhardwaj, Amandeep Sandhu and Rupinder Tewari. (2019). **Research Publications and Commercialization of Patents Generated by the Academic and Research Sectors in India** Proceedings of the 'International Conference on Innovation Driven Economic Growth in Asia Focusing on India.

DISCLAIMER

Earnest efforts have been made to make the information furnished in the Report as accurate & updated as possible based on available data, but the Authors or DST-CPR at Panjab University shall not be held responsible for any remaining inaccuracies or errors or omissions. All efforts were made to reference and credit the information/data used in the publication, and lapse, if any, is purely inadvertent and inconsequential.

INTRODUCTION

Universities and other higher education institutions (HEIs) are very prominent pillars for the economic development of a nation. A university is considered a successful institution if the knowledge being imparted to the students is converted into some tangible or intangible property. Policymakers and intellectual think tanks believe that the main focus of the universities and HEIs in India is to publish their research instead of securing it through the patents' rights given by the regional patent offices. As per the Scimago country ranking (https://www.scimagojr.com/countryrank.php?year=2018) India is at 5th position in the research publications, whereas, it is ranked at 52nd position in the indicator of 'Intellectual Property Rights' (https://www.internationalpropertyrightsindex.org/country/india).

India is a very crucial clog of the wheels of the education sector. After USA and China, India is having the largest education system. As per University Grants Commission (UGC-https://www.ugc.ac.in/oldpdf/Consolidated%20list%20of%20All%20Universities.pdf) there are 412 State Universities, 124 Deemed to be University, 52 Central Universities and 361 Private Universities, 94 Institutions of National Importance (INIs - https://mhrd.gov.in/institutions-national-importance) and around 600 research labs under various ministries and independent departments. The irony is entire academic fraternity focuses only on imparting knowledge to students but there is the least focus on converting that knowledge into a commercial commodity. This scenario can be attributed to some lacunas in governmental or institutional level policies and guidelines.

As far as other counterparts of India like China, Singapore, Japan, USA, South Korea, Germany, Canada and Australia, are concerned, their focus is more on converting knowledge into patents and technologies. As per WIPO Intellectual Property Statistics, 2019 (https://www.wipo.int/edocs/pubdocs/en/wipo_pub_941_2019.pdf) India is at 7th position in the patents applications filed at Indian patent office. But as shown below in table 1, the percentage of patents filed by residents and non-residents is 67.5% and 32.5% respectively. As per the annual report of The Office of the Controller General of Patents, Designs and Trade Marks (CGPDTM), 2018, USA files maximum patent applications in India followed by Japan, China, Germany, and the Netherlands respectively. The profile of patents filing by residents and non-residents of the top 20 nations are depicted below in a tabular form:

Table: 1 Patents Filing Profile by Residents and Non-Residents of Select Countries

S. No.	Country	Total	Non-Residents	%age	Residents	%age
1.	China	1,542,002	1,48,033	9.6	13,93,969	90.4
2.	United States of America	597,141	3,12,304	52.3	2,84,837	47.7
3.	Japan	313,567	59,892	19.1	2,53,675	80.9
4.	Republic of Korea	209,992	47,458	22.6	1,62,534	77.7
5.	EPO	174,397	92779	53.2	81618	46.8
6.	Germany	67,898	21252	31.3	46646	68.7
7.	**India**	**50,055**	**33787**	**67.5**	**16268**	**32.5**
8.	Russian Federation	37,957	13019	34.3	24937	65.7
9.	Canada	36,161	31822	88.0	4339	12
10.	Australia	29,957	27201	90.8	2756	9.2
11.	Brazil	24,857	19885	80.0	4971	20
12.	United Kingdom	20,941	8083	38.6	12857	61.4
13.	Mexico	16,424	14864	90.5	1560	9.5
14.	France	16,222	1914	11.8	14308	88.2
15.	Hong Kong	15,986	15666	98.0	320	2
16.	Iran	12,823	910	7.1	11913	92.9
17.	Singapore	11,845	10270	86.7	1575	13.3
18.	Italy	9,821	903	9.2	8917	90.8
19.	Indonesia	9,754	8349	85.6	1405	14.4
20.	Thailand	8,149	7244	88.9	905	11.1

Source: WIPO Intellectual Property Statistics, 2019

Another crucial issue which, needs to be addressed is patents and technology commercialization ecosystem in Indian universities and HEIs. The research being conducted in academic institutions is limited to publications only. This is happening despite the fact that there are enough possibilities of commercial exploitation of research. The worldwide percentage of patents commercialization is 5 to 7 per cent which is very low. To study the patents commercialization ecosystem in Indian academic institutions, a study on 904 [HEIs (351) + NRL (553)] was conducted by DST- Centre for Policy Research at Panjab University, Chandigarh.

The centre has compiled data on working and non-working status of patents granted to these institutions for the last 8 years (January 2010 - December 2017). The main purpose of the study was to identify the institutes having impressive patents commercialization ecosystem, and draw recommendation for rest of the institutions, which have granted patents to their credit but are not able to exploit them commercially.

Institutions considered for the study are HEIs (351) and all national R&D institutions (553). The HEIs comprise of Institutions of National Importance (INIs), universities, engineering institutes, pharma institutes and private universities, based on the national rankings released in 2016. The national R&D labs, included in this study, have been established under 27 ministries of Govt. of India and 2 independent departments under the Prime Minister's office**.** The breakup of 904 institutes, considered in this study, is depicted in the chart below (Figure 1):

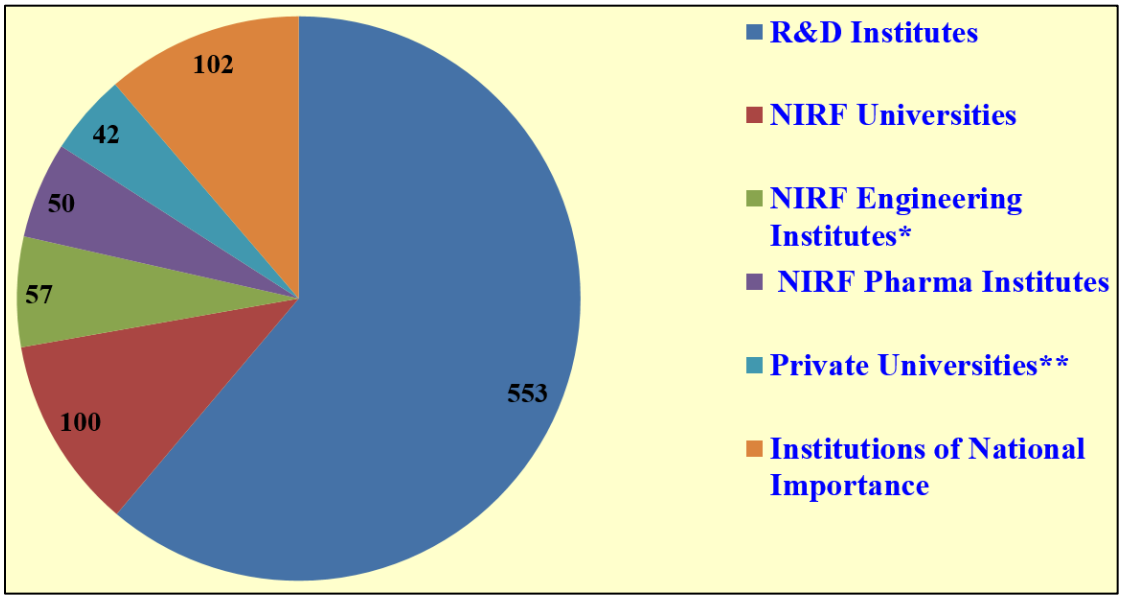


Figure 1: Breakup for 904 Institutions Studied

NIRF – National Institute Ranking Framework (2016)

** 43 institutes are included in Institutions of national Importance*

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

SOURCES USED DATA COLLECTION FOR PATENTS

The raw data for patents (published & granted) of INIs was procured from a well-reputed private firm, Talwar & Talwar (TT) Consultants (http://ttconsultants.com/xlpat-patent-search-tool.php)

located in Mohali, Punjab, India. Data extraction has been done using the following patents' search tools.

- XLPAT owned by TT Consultants (http://ttconsultants.com/xlpat-patent-search-tool.php)
- InPASS of Govt. of India (http://ipindiaservices.gov.in/publicsearch)
- Orbit owned by Questel (https://www.questel.com/)
- Dervent Innovation owned by Clarivate Analytics (https://clarivate.com/products/derwent-innovation/)

PLAN OF THE STUDY

In the previous exercise, the DST-CPR had conducted a study on research articles publications and patents (granted & filed) status of above mentioned 904 institutions. The study can be accessed from the official website of the centre. (http://cpr.puchd.ac.in/wp-content/uploads/2016/09/Book-2-PDF-min.pdf). Further, it was advised by the 'Advisory Committee (IP)' to conduct a study on the commercialization status of patents granted to the Indian HEIs and NRLs. To achieve this, the centre collected information regarding working and non-working status, revenue generated after commercialization, licensees, reasons mentioned for not working of patent, etc. from the official website of Indian Patent Office and analyzed the collected patent information.

Here it is pertinent to mention that for every patentee it is mandatory to file the Form-27 with information regarding working and non-working status of the patent. During the research, it was found that almost all of the patentees (considered for the study) has filed Form-27 after 2013. Before 2013, filing of Form-27 was not a regular practice there were a handful of patentees who filed the Form-27 in the patent office. A very renowned case 'Natco V. Bayer' was the sparking case in this regard (http://lobis.nic.in/ddir/dhc/SRB/judgement/24-04-2019/SRB22042019LPA3592017.pdf).

In 2012, India granted a compulsory license to a Hyderabad based drug maker firm NATCO. This was a landmark decision in the history of Indian Patent regime. Delhi High Court gave the decision in the favour of NATCO to make and sell a similar version of an advanced kidney cancer drug by Bayer's Nexavar. The Judge imposed just a condition on the NATCO Company to pay Bayer royalty of 6% of net sales, every quarter. After this case, Indian applicants might have taken on a serious note and came out to furnish the information in the Form-27.

The timeline and steps followed by the centre to complete the study are as follows:

- Patent Information sought from TT Consultants, Mohali for the period: January 2010-December 2017.
- The Firm provides the list of patents with patent numbers, application numbers, publication date, grant date, etc.
- Patents commercialization information extracted from InPASS, GoI for:
  - ✓ Status (Ceased/In Force/Under Extension Period)
  - ✓ Form-27 scrutinised for the information mentioned below:
    - *Working/Non-working status*
    - *Reasons for not working of patents*
    - *Revenue generated through working patents*
    - *Patent licensees*
    - *Single or multiple institutions involved*
- Preparation of Excel Sheets of the data collected
- Data Analysis

FORM-27

As per the Section 146 (2) of the Indian Patent Act, 1970 (http://www.ipindia.nic.in/writereaddata/Portal/IPOAct/1_31_1_patent-act-1970-11march2015.pdf), after the grant of a patent, it is mandatory for the applicant to file the working (commercially exploited) statement of the patent before 31st march of every financial year**.** The information provided in these submissions is the basis of which, the Controller General of Patents, Designs & Trade Marks (CGPDTM) decides on granting a compulsory license to the interested party. In the case against a particular patent the patentee has failed to furnish working information in Form-27, or in case the patentee submits but the Controller on examination feels that requirements of Section 146/ Rule 131 are not met, he may pass an order to grant a compulsory license under Section 84.

Punishment for not furnishing the Information: U/s 122, the punitive measures for non-compliance with Section 146 is punishable with fine which may extend to ten lakh rupees and 6

months imprisonment. Furnishing wrong information will be punishable with imprisonment with fine, or with both. The sample for the form is given below:

Sample of Form-27

FORM- 27
THE PATENTS ACT, 1970
(39 of 1970)
&
THE PATENTS RULES, 2003
STATEMENT REGARDING THE WORKING OF THE PATENTED INVENTION ON COMMERCIAL SCALE IN INDIA
[See section 146 (2) and rule 131 (1)]
In the matter of Patent No. _____of _____

I/We

The patentee(s) or licensee(s) under Patent No. _____ hereby furnish the following statement regarding the working of the patented invention referred to above on a commercial scale in India for the year_____.

(i) The patented invention:
[ ] Worked [ ] Not worked
(a) if not worked: reasons for not working and steps being taken for working of the invention.
(b) If worked: quantum and value (in Rupees), of the patented product: _____
(i) manufactured in India – Yes/No
(ii) imported from other countries. (give country wise details)

(ii) the licences and sub-licenses granted during the year; - Yes/No
(iii) state whether public requirement has been met partly/adequately/to the fullest extent at reasonable price.

The facts and matters stated above are true to the best of my/our knowledge, information and belief.

Dated this ____day of _____, 20

For
Signature _____

To:
The Controller of Patents,
The Patent Office, at _____.

Source: http://www.ipindia.nic.in/writereaddata/Portal/IPOFormUpload/1_39_1/form-27.pdf

DEFINITIONS

Some definitions for the terms mentioned in Form-27 and terms used in the study are as follows:

In force: A patent is in force if the applicant is paying the annuity (renewal fee) for the patent in order to maintain it, subject to the 20 years from the date of the patent filed.

Ceased: A patent is subjected to be ceased by Controller General if the applicant stops paying annuity (renewal fee) to maintain the patent.

Worked: A patent falls under the category of 'worked' if it has been licensed/ transferred or is being exploited commercially by the patentee or licensee.

Non-worked: If the patent is not commercialized or not licensed to any other party it falls under the non-worked category.

Compulsory License: Compulsory licenses are generally defined as "authorizations permitting a third party to make, use, or sell a patented invention without the patent owner's consent if it is not commercialized after the 3 years of its grant.

Under Extension Period: If the applicant fails to pay the annuity (renewal fee) for the maintenance of the patent, the patent office provides him a 6 months extension period to pay the fee, wherein the status of the patent is under extension period

Dead (expired) Patents: The patents which have completed their life term of 20 years from filing date or priority date (whichever comes first) of the patent.

Alive Patents: The patent which has not yet completed the life term of 20 years from filing date or priority date (whichever comes first) of the patent.

ANALYSIS CARRIED OUT

The total number of patents (published & granted) of HEIs and NRLs (904) of India was around 14,000 during the period: Jan 2010 – Dec 2017. It is pertinent to mention that the data extraction for the institutions has been performed as per the name of the applicant, not as inventors. The extracted data includes the patents which are filed in India and abroad (through convention or PCT). As per Section 39 of the Patent Act, 1970 "Residents not to apply for patents outside India without prior permission". Any Indian applicant, interested in filing a patent in PCT countries or directly to a convention member country, he/she has to file it first in Indian Patent Office. Ordinarily, under the following circumstances, it is not necessary to obtain prior permission from the Patent Office to file patent application abroad (http://www.ipindia.nic.in/writereaddata/Portal/Images/pdf/Final_FREQUENTLY_ASKED_QUESTIONS_-PATENT.pdf):

a. *Applicant is not Indian resident and invention is originated abroad about*
b. *If the applicant is Indian resident and filed patent application has been in India before filing the application outside India and six weeks period is over from that date*
c. *The invention does not belong to Atomic Energy or defence purpose*

If an applicant wants to file a patent directly in a convention country, he has to request for the permission through Form 25 from the Controller General of Patent Office. Residents of India require prior permission to apply for patents outside India under section 39 of the Patents Act, 1970 under the following circumstances.

a. The applicant or inventor is an Indian resident.
b. The applicant does not wish to file a patent application in India before filing outside India.
c. If the applicant is an Indian resident, a patent application has been filed in India and six weeks period is not yet over from that date
d. The invention relates to atomic energy or defence purpose. However if the invention is relevant for Defence or Atomic Energy purpose, no permission shall be granted without the consent of Central Government.

Out of the Total patents, there were 9,841 patents in the application phase and 4,159 were granted. The granted patents are divided as patents granted in India (1961) and patents granted outside India (2,198). The study is executed only for the patents granted in India (1961). This is because the working details of the patents granted are extracted from the Form-27. The provision of filing such form is only available in India. The centre will study the details of the patents granted outside India (2198) in Phase-2 of the study after analyzing the possibility of details available in the public domain. The block diagram for the breakup of patents information is depicted below:

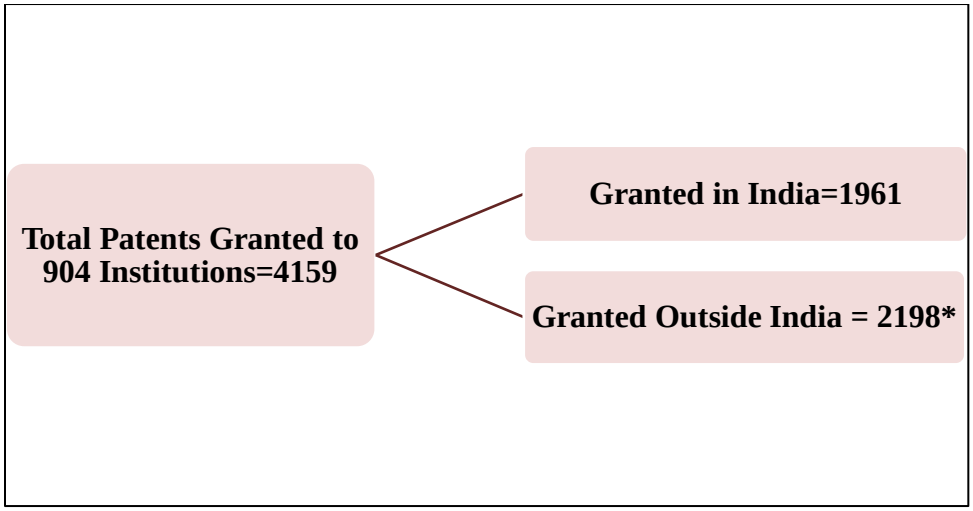


Figure 2: Breakup of Patents Information Granted to the Institutions (Jan. 2010-Dec. 2017)

** A single patent can be filed in many countries, so most of the patents are common in both the categories.*

The patents granted (1961) in India to HEIs and NRLs considered for the study are analyzed based on the parameters mentioned below:

- Field wise categorisation of patents granted
- Applicant wise categorisation of patents granted
- Collaborative patents granted
- Reasons for patents not worked
- Institutes good in patent commercialization
- Suggestions for enhancing patent commercialization

The Report is compiled in Various Sections as Follows:

- **Working/Non-working status of Patents Granted**
  - *Composite Analysis of Patents Granted*
  - *Categorization of Total Patents Granted*
  - *Top Institutions (Applicants) having Patents Granted*
  - *Categorization of Working Patents*
  - *Leading Applicants*
  - *Field Wise Trend of Granted Patents*
  - *Working Patents in Various Fields*
  - *Yearly Trend of working and Non-working Patents in Various Fields*
  - *Collaborative Patents*
  - *Reasons for Non-Working of Patents*
- **Recommendations for enhancing patent commercialization**

COMPOSITE ANALYSIS OF PATENTS GRANTED (1961)

The total number of patents granted to HEIs and NRLs (904) of India was 4159 during the period: Jan. 2010 – Dec. 2017. This includes the patents which are granted in abroad too. Out of 4159 patents, 2198 patents have been granted outside India, whereas, 1961 patents were granted in India only to the institutions mentioned in the figure. 3. The current study is conducted on these 1961 patents granted by the Indian Patent Office. Of the 904 institutes, only 186 institutions had granted patents to their credit for the time period studied, from Jan 2010 to Dec 2017. These institutions have been categorized as HEIs, NRLs and Others

(Industry/PSU/Board/Council/Hospital). The count of institutions in each category has been illustrated below:

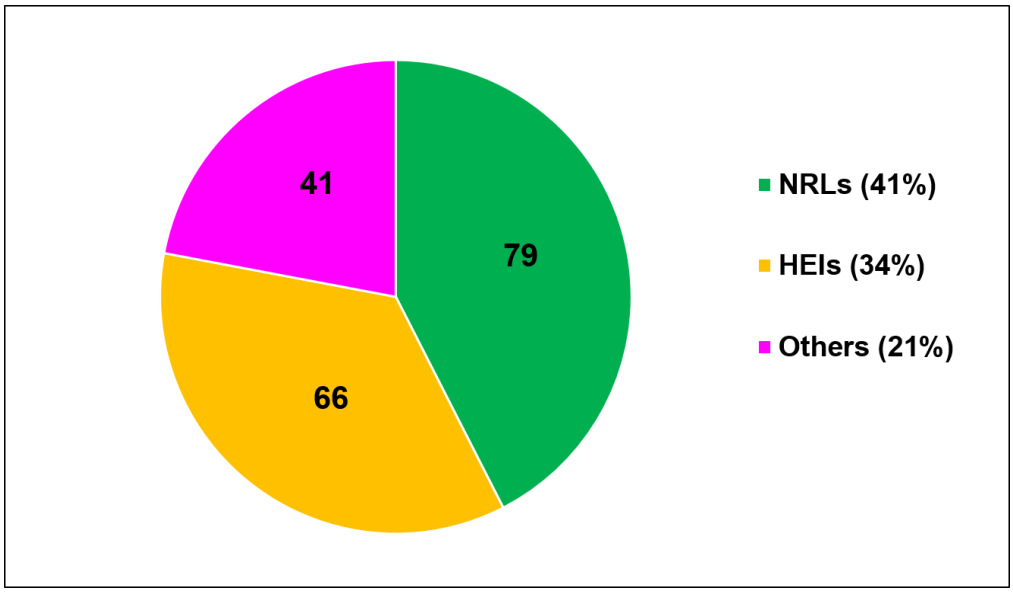


Figure 3: Applicants Wise Categorization (Percentage)

Table2: Applicants Wise Categorization (HEIs, NRLs) of Patents Granted (>1)

S. No.	Applicants	Total Patents Granted	Parent Organization/ Status	Working Patents
1.	CSIR, New Delhi	863	Ministry of S&T	112
2.	DRDO, New Delhi	308	Ministry of Defence	117
3.	IIT, Bombay	76	MHRD (INI)	5
4.	ISRO, Bangalore	74	Department of Space	62
5.	ICAR, New Delhi	61	Ministry of Agriculture & Farmers Welfare	14
6.	DBT, New Delhi	58	Ministry of S&T	10
7.	IISc, Bangalore	47	MHRD (Autonomous)	2
8.	IIT, Kanpur	46	MHRD (INI)	2
9.	IIT, Madras	44	MHRD (INI)	14
10.	IIT, New Delhi	44	MHRD (INI)	3
11.	NIPER, Mohali	38	Ministry of Chemicals and Fertilizers	0
12.	IIT, Kharagpur	23	MHRD (INI)	1
13.	DAE, Mumbai	22	Department of Atomic Energy	2

14.	ICMR, New Delhi	19	Ministry of Health & Family Welfare	9
15.	DIT, New Delhi	16	Ministry of Electronics and Information Technology	9
16.	DST, New Delhi	15	Ministry of S&T	1
17.	DU, New Delhi	14	Central University	3
18.	C-DAC (Collective)	13	Ministry of Electronics and Information Technology	7
19.	AIIMS, New Delhi	11	ICMR (INI)	0
20.	International Advanced Research Centre for Powder Metallurgy & New Materials, Gurugram	10	Department of S&T (DST)	1
21.	ICT, Mumbai	9	State University	0
22.	Central Council for Research in Unani Medicine, New Delhi	9	Ministry of AYUSH	9
23.	Jamia Hamdard, New Delhi	8	Deemed to be University	0
24.	Rajiv Gandhi Centre for Biotechnology, Thiruvananthapuram	8	DBT	0
25.	Central Institute For Research on Cotton Technology, Mumbai	7	ICAR	0
26.	National Institute of Research on Jute & Allied Fibre Technology Indian Council Of Agricultural Research, Kolkata	7	ICAR	0
27.	Central Power Research Institute, Bangalore	6	ICAR	0
28.	Raman Research Institute, Bangalore	6	DST	0
29.	S N Bose National Centre For Basic Sciences, Kolkata	6	DST	0
30.	National Institute of Immunology, New Delhi	5	DBT	1
31.	Birla Institute of Technology, Ranchi	5	Private University	0
32.	Cochin University of Science & Technology, Kochi	5	State University	1
33.	Central Sericulture Research & Training Institute, Mysore	5	Ministry of Textiles	0
34.	Centre for Development of Telematics, New Delhi	5	Ministry of S&T (DSIR)	1
35.	Centre for Materials for Electronics Technology, New Delhi	5	MeitY	2
36.	National Research Development Corporation, New Delhi	5	DST	0
37.	Petroleum Conservation Research Association, New Delhi	5	Ministry of Petroleum & Natural Gas	1

38.	Centre for High Technology, NOIDA	4	Ministry of Petroleum and Natural Gas	0
39.	Nano Cutting Edge Technology Pvt, Mumbai	4	Pvt. Industry	0
40.	National Dairy Development Board, Anand	4	Board	0
41.	Banaras Hindu University, Varanasi	4	Central University	0
42.	Indian Institute of Technology, Roorkee	4	INI	0
43.	Jawaharlal Nehru University, New Delhi	4	Central University	0
44.	North Maharashtra University, Jalgaon	4	State University	0
45.	Panjab University, Chandigarh	4	State University	0
46.	Central Silk Technological Research Institute, Bangalore	4	Ministry of Textile	1
47.	Institute for Plasma Research, Gandhinagar	4	DST	1
48.	Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore	4	DST	0
49.	National Centre for Cell Science, Pune	4	DBT	0
50.	South India Textile Research Association, Coimbatore	4	Ministry of Textile	0
51.	G B Pant University of Agriculture & Technology, Uttarakhand	3	State University	0
52.	FDC Ltd., Nalagarh	3	Pvt. Industry	0
53.	Amity University, Noida	3	Private University	0
54.	Centre of Excellence Wireless Technology (IIT-Madras)	3	INI	0
55.	Indian Institute of Technology, Guwahati	3	INI	0
56.	Tamil Nadu Agricultural University, Coimbatore	3	State University	0
57.	University of Hyderabad, Hyderabad	3	Central University	0
58.	Ahemdabad Textile Industry's Research Association, Ahmedabad	3	Ministry of Textile	0
59.	Automotive Research Association of India, Pune	3	Ministry of Heavy Industries and Public Enterprises	0
60.	Central Tasar Research & Training Institute, Jharkhand	3	Ministry of Textiles	0
61.	National Council for Cement & Building Materials, Ballabgarh	3	Ministry of Commerce & Industry	1
62.	National Institute of Health & Family Welfare, Mohali	3	Ministry of Health & Family Welfare	3
63.	National Institute of Ocean Technology, Chennai	3	Ministry of Earth Sciences	0
64.	Society for Applied Microwave Electronics Engineering & Research, Mumbai	3	DST	1

65.	Tata Institute of Fundamental Research, Mumbai	3	Department of Atomic Energy	0
66.	Guru Jambheshwar University of Science & Technology, Haryana	2	State University	0
67.	Indian Institute of Horticultural Research, Bangalore	2	ICAR	0
68.	National Institute of Animal Nutrition & Physiology, Bangalore	2	ICAR	0
69.	Godfrey Philips India Ltd., New Delhi	2	Pvt. Industry	0
70.	Indian Oil, New Delhi	2	Public sector undertakings	0
71.	Madras Institute of Nephrology, Chennai	2	Hospital	0
72.	NTPC Limited, New Delhi	2	PSU	0
73.	Samtel Color, New Delhi	2	Pvt. Industry	0
74.	Babasaheb Ambedkar Marathwada University, Aurangabad	2	State University	0
75.	Indian Association for the Cultivation of Science, Kolkata	2	DST	0
76.	Industrial Research & Development, New Delhi (IIT, Delhi)	2	MHRD (INI)	0
77.	Jadavpur University, Kolkata	2	State University	0
78.	National Institute of Technology, Rourkela	2	MHRD (INI)	0
79.	Poona District Education Association S Seth Govind Raghunath Sable College of Pharmacy, Pune	2	Private University	0
80.	Punjab Agricultural University, Ludhiana	2	Central University	1
81.	Shree S K Patel College of Pharmaceutical Education & Research, Gujarat	2	Private University	0
82.	Shri Ramdeobaba Kamla Nehru Engineering College Nagpur	2	Private University	0
83.	University of Allahabad, Allahabad	2	Central University	0
84.	Agharkar Research Institute, Pune	2	DST	0
85.	Bose Institute, Kolkata	2	DST	0
86.	Central Coir Research Institute, Kerala	2	Ministry of S&T	2
87.	Central Pulp And Paper Research Institute, Saharanpur	2	Ministry of Commerce & Industry	0
88.	Indian Agricultural Research Institute, New Delhi	2	ICAR	2
89.	Institute of Forest Genetics & Tree Breeding, Coimbatore	2	Ministry of Environment, Forest and Climate Change	1
90.	International Center for Genetic Engineering & Biotechnology, New Delhi	2	Autonomous under UNIDO	1

91.	National Bureau of Plant Genetic Resources	2	ICAR	0
94 applicants are having single patent to each (NRLs = 29, HEIs = 32, Others = 33) (Appendix)				

Blue: HEIs, **Black:** NRLs, **Red:** Others*

**PSU, Trust, Contract Research Organization, Intergovernmental Organisation, Board, Corporation, Foundation, Individual*

CATEGORIZATION OF TOTAL PATENTS GRANTED

The Patents (1961) are granted to only 186 institutions out of which 41% share goes to the NRLs, 34% to HEIs and 21% is credited to others. The other institutes are comprising of industries, Public Sector Undertakings (PSU), trusts, boards, corporation, hospitals, etc.

The trend depicted in figure 4 shows that, in 2010, a total of 473 patents were 'In force' (active patents). Out of 473 patents, the working/non-working statement in Form-27 was filed only for 19 patents. Till 2012 the statistics indicated the increase in the number of patents 'In force' whereas, the patents for which the Form-27 was filed was almost stagnant. After the year 2013, the trend of the patents for which Form-27 was being filed started increasing. A very renowned case 'Natco Vs Bayer' was the sparking case in this regard. In 2012, India granted a compulsory license to a Hyderabad based drug maker firm NATCO. This was a landmark decision in the history of the Indian patent regime.

TOP INSTITUTIONS (APPLICANTS) HAVING PATENTS GRANTED

Top institutes which are having maximum patents granted to their credit for the year 2010-17 are depicted below in figure 4 Council of Scientific and Industrial Research (CSIR), an autonomous and publically funded research organization, is the leading applicant having a total of 863 patents granted (in India only). Only CSIR is sharing 44% of total patents granted in the duration 2010-17. Here it is pertinent to mention that, as a policy matter the patents granted to the research labs under CSIR are assigned to the parent organization (CSIR). Defence Research and Development Organization (DRDO), dedicated to the research for the military under Ministry of Defence secures the 2nd position with 308 patents. The third position is occupied by an Institution of National importance, Indian Institute of Technology (IIT), Bombay with 76 patents granted in the time period 2010-17. Rest applicants, which has secured the position among top 10 institutes at 4th, 5th and 6th position respectively are three govt. research organizations (Indian Space

Research Organization (ISRO), Bangalore; Indian Council for Agricultural Research (ICAR), New Delhi and Department of Biotechnology (DBT), New Delhi. Seventh, 8th, 9th and 10th position is occupied by Indian Institute of Science (IISc), Bangalore and IIT, Kanpur; IIT, Madras and IIT, Delhi respectively. There are 1961 patents granted to 904 institutions.

Out of the total patents granted (1961), 82% share goes to these top 10 applicants furthermore 59% share is contributed by only top 2 applicants i.e. CSIR, New Delhi and DRDO, New Delhi. The rest institutes (Figure 5) having patents granted for this period are such as NIPER, Mohali (38); IIT, Kharagpur (23); DAE, Mumbai (22); ICMR, New Delhi (19); DIT, New Delhi (16); DST, New Delhi (15); DU, New Delhi (14); C-DAC, Trivandrum (13), AIIMS, New Delhi (11). Rest of the applicants are having patent less than 10 and 94 applicants have single patent (granted) to their credit for the period Jan. 2010 – Dec. 17.

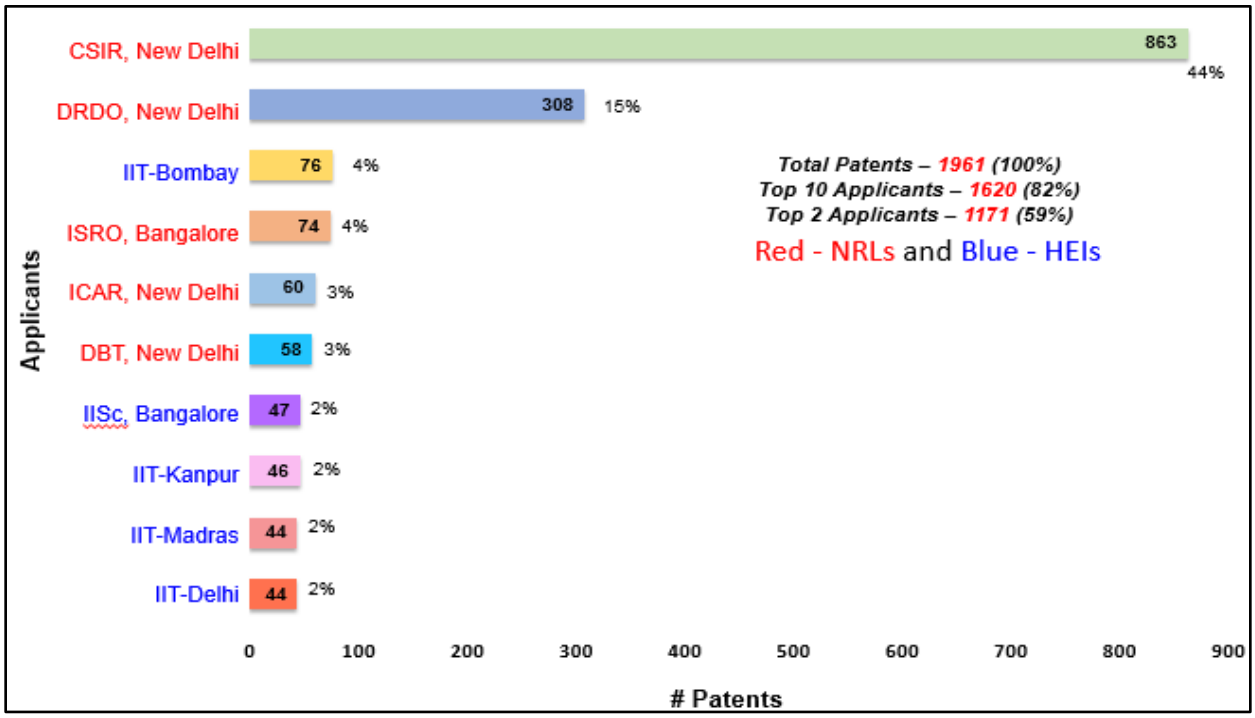


Figure 4: Top 10 Applicants based on Total #Granted Patents (1961) (Jan 2010-Dec 2017)

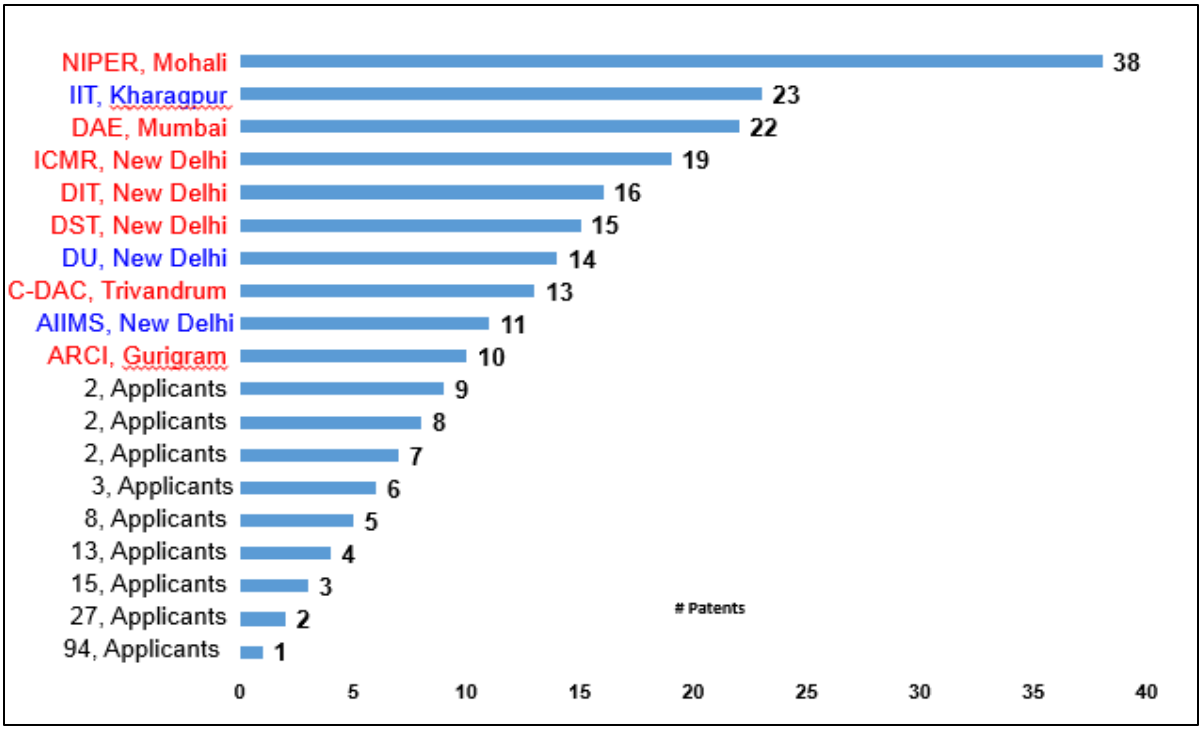


Figure 5: Remaining Applicants having Patents Granted (184) (Jan 2010 – Dec 2017)

CATEGORIZATION OF WORKING PATENTS

In 'The Patent Act, 1970', a very clear statement is given that by granting 'monopoly' to an individual or the group is not just to facilitate the applicant with exclusive rights on the innovation but he has to ensure that the invention recognized by the system must be commercialized to the fullest for the benefits of society at large as required. Section 146 of the Patent Act, 1970 and Rule 131 of the Patents Rules makes it mandatory for all the patent holders to submit a commercial statement of the patent, by furnishing information regarding the working and non-working status of the patent. The same information has been extracted to accomplish the patents commercialization ecosystem of Indian HEIs and NRLs. The graph (Figure 7) shown below depicts the trend of the last 8 years for the indicators patents In force, patents for which Form-27 was filed, working patents, etc. Working profile of the total patents granted to HEIs and NRLs of India is represented in figure 6:

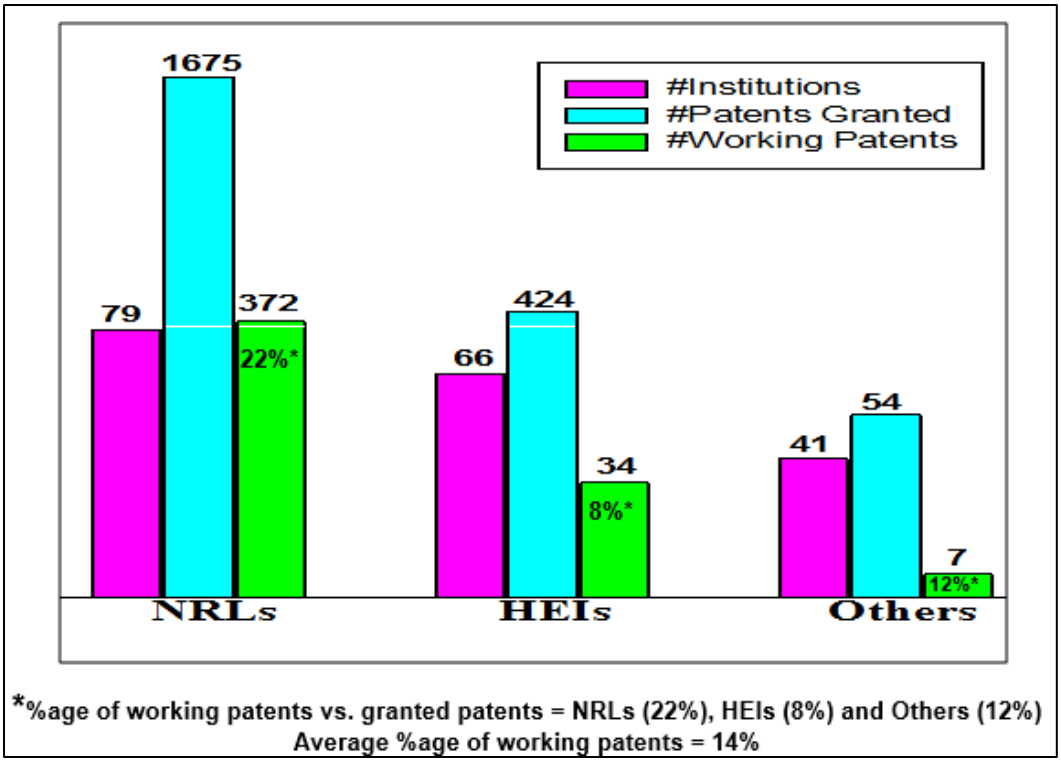


Figure 6: Breakup Patents Granted and working Patents of the Institutions

The statistic indicates that in 2010 the number of patents in force was 473, whereas, only for 19 patents Form-27 was filed indicating 7 patents as working patents. As shown in figure 7, the percentage of worked patents against the patents for which Form-27 was filed is 37% (blue line). In the year 2011, and 2012 the percentage of working patents is very poor but in the year 2013 the number of patents raised for which the working/non-working statement was filed in Form-27. Although the percentage of working patents with respect to the patents for which the form was filed is only 15%. The graph for the indicators patents In force and patents for which Form-27 was filed from 2013 to 2017 is showing the gradual increase whereas, the percentage of working patents with respect to Form-27 filed shows very slight difference. That renowned case 'Natco vs Bayer' made the Indian patentees aware of filing the working statement for the patents. As we can see for the year 2018, the graph shows the drop in all the indicators which can be attributed to the drop in the patents of CSIR which is discussed in the next section.

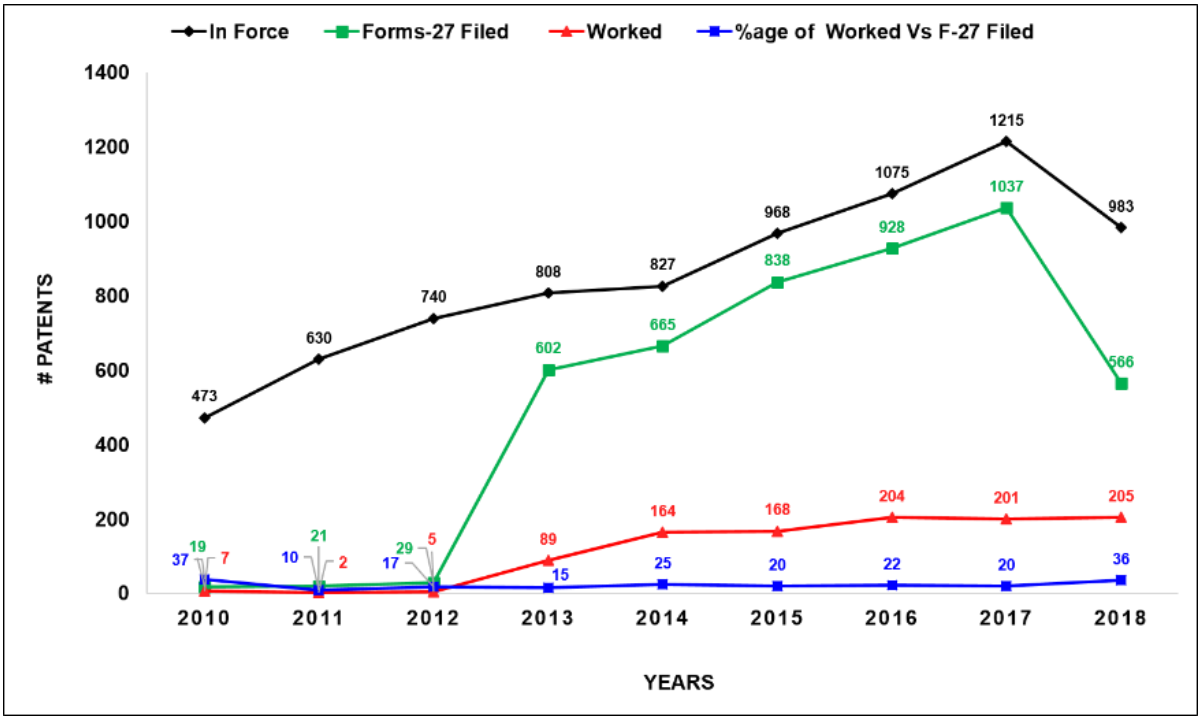


Figure 7: Year-wise Trend of Patents Granted, (In Force/Worked/ filing of F-27), (2010-2018*)

**Period: Information from Form-27 for the patents has been extracted for the period 2010-18*

Table 4: Year-wise Profile of Patents In Force (2010-18)

Year	#In Force	Forms-27 Filed	%age F-27 vs In Force	#Worked Patents	%age working vs F-27
2010	473	19	4%	7	37%
2011	630	21	3%	2	10%
2012	740	29	4%	5	17%
2013	808	602	75%	89	15%
2014	827	665	80%	164	25%
2015	968	838	87%	168	20%
2016	1075	928	86%	204	22%
2017	1215	1037	85%	201	20%
2018	983	566	58%	205	36%

Leading Applicants

Top leading applicants which are dominating in the domain of patents commercialization are depicted below in figure 8 The data for the years 2010-12 has been combined as there were a few working patents. The blue line is representing the trend of CSIR from the year 2010-18 similarly red line represents the trend of DRDO, Black for ISRO, Purple for ICAR and the black line shows the trend of IIT, Bombay. As it is evident from the graph that in the top 5 positions there are 4 research organizations and 5th position is occupied by an institution of national importance i.e. IIT, Bombay. The main mandate of this research organization is to perform target-based research to generate indigenous technologies for the benefit of masses. On average, DRDO has a commendable and most consistent record in patents commercialization throughout the years. The trend of the research organization CSIR was also consistent from 2010 to 2017 but the graph falls down. In 2017 there were 480 patents which were in force, for 476 patents they filed Form-27 and of these 476 patents 48 patents were marked as working and 428 were non-working. Only for 4 patents, the form was not filed. Whereas, in 2018 the number of patents in force was 351, and out of them, Form-27 was filed only for 3 patents and all those 3 patents were marked as non-working.

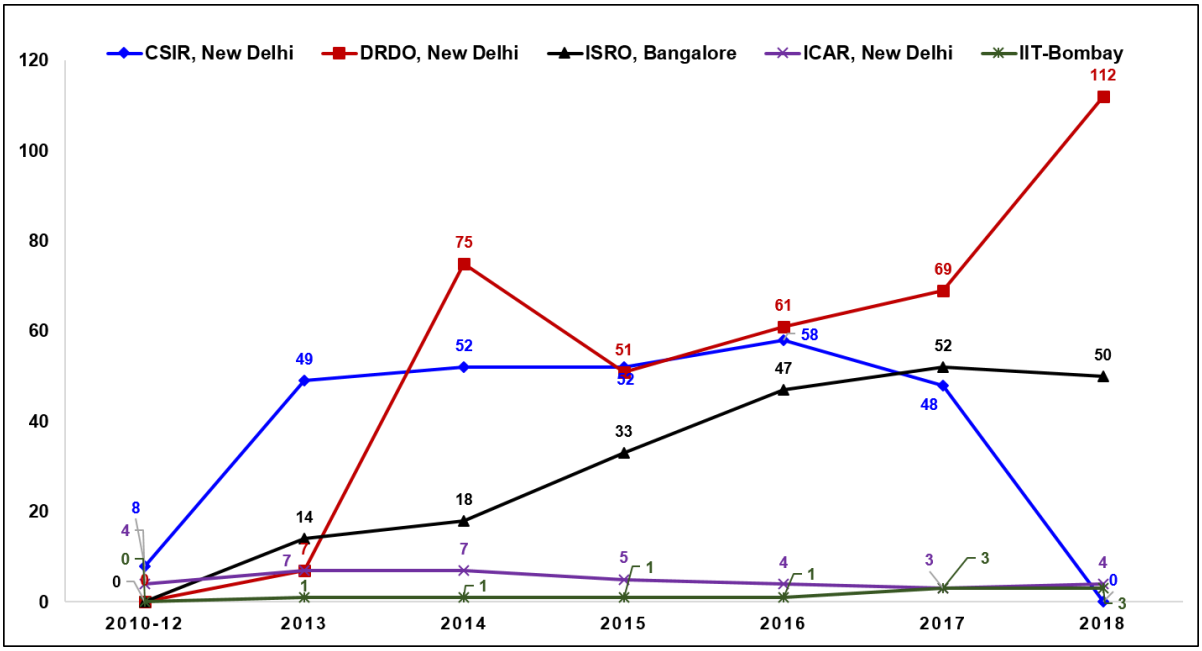


Figure 8: Year-wise Number of Working Patents of Top 5 Applicants (2010 - 18)

Note: *Working statement of patents granted in 2017 or before was filed b/w Jan-March 2018*

Further Detailed Analysis: DST-Centre for Policy Research at Punjab University, Chandigarh has conducted the study in detail. The analysis has been depicted below in graphical and bar diagram representation.

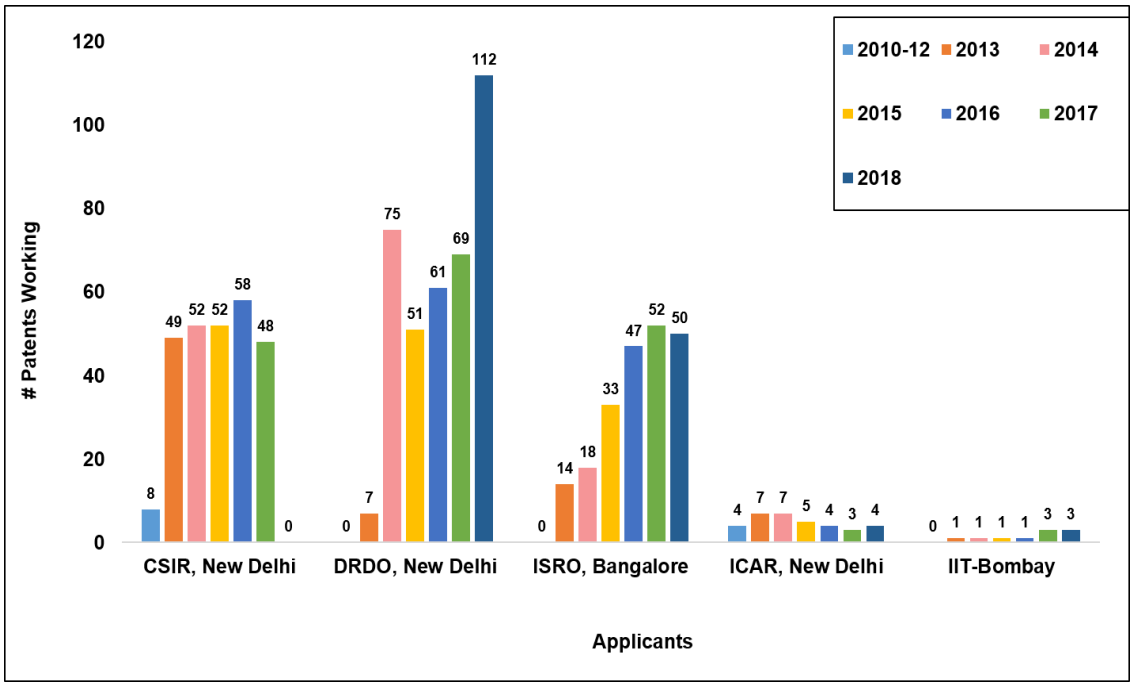


Figure 9: Yearly Categorization of Working Patents of Top 5 Applicants (based on Patents Granted) 2010 – 18

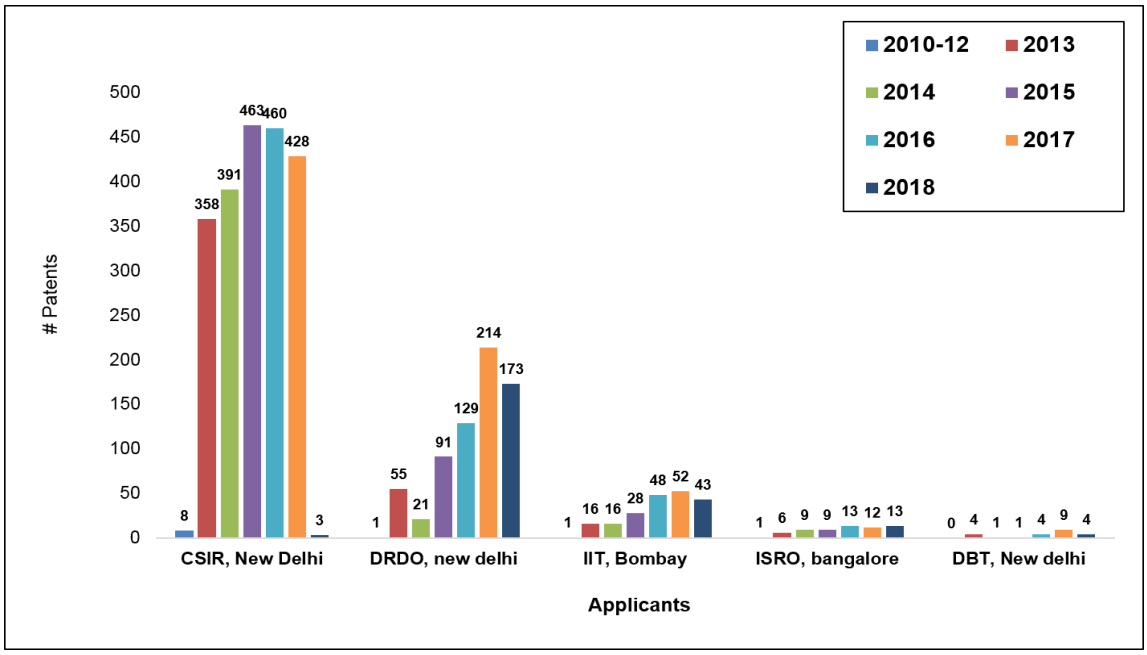


Figure 10: Yearly Categorization of Non-working Patents of Top 5 Applicants (based on Patents Granted) 2010 – 18

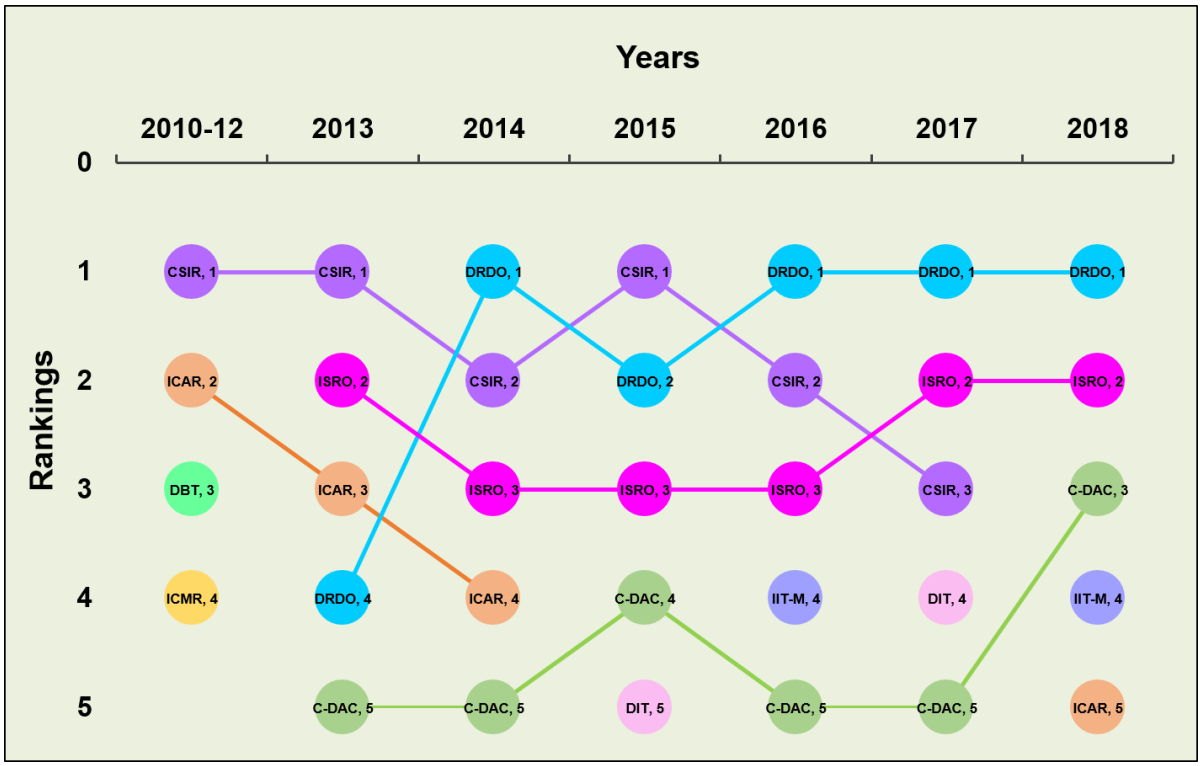


Figure 11: Yearly Trend of Top Applicants (Working Patents) (2010-18)

Table 5: Top 5 Applicants (Working Patents-2010-18)

Applicant	2010-12	2013	2014	2015	2016	2017	2018
CSIR, New Delhi	8	49	52	52	58	48	0
ICAR, New Delhi	4	7	7	5	4	3	4
DBT, New Delhi	1	4	2	3	5	4	3
ICMR, New Delhi	1	1	1	3	5	4	0
C-DAC (Collective)	0	5	5	7	6	5	5
ISRO, Bangalore	0	14	18	33	47	52	50
DeitY, New Delhi	0	3	3	7	6	4	3
IIT-Madras	0	1	0	6	9	1	5
DRDO, New Delhi	0	7	75	51	61	69	112

Rank-1 **Rank-2** **Rank-3** **Rank-4** **Rank-5**

Year wise Top 10 Institutes (as Applicant) (Jan. 2010 - Dec. 2017): Below mentioned are the year wise from 2010-17 (2010-12 combined) analysis of top 10 institutions in the respective year based on patents in force. The number of F-27 filed and working patents are also depicted in the graphs.

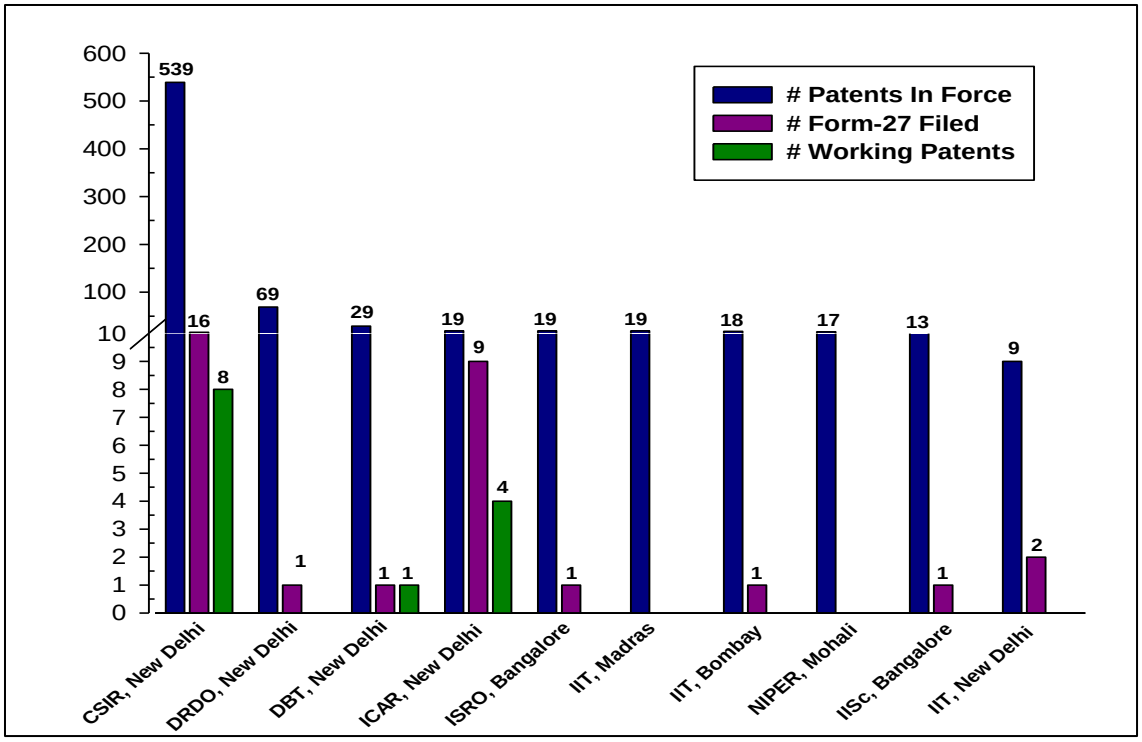


Figure 12: Top 10 Applicants (Patents In Force) 2010-12

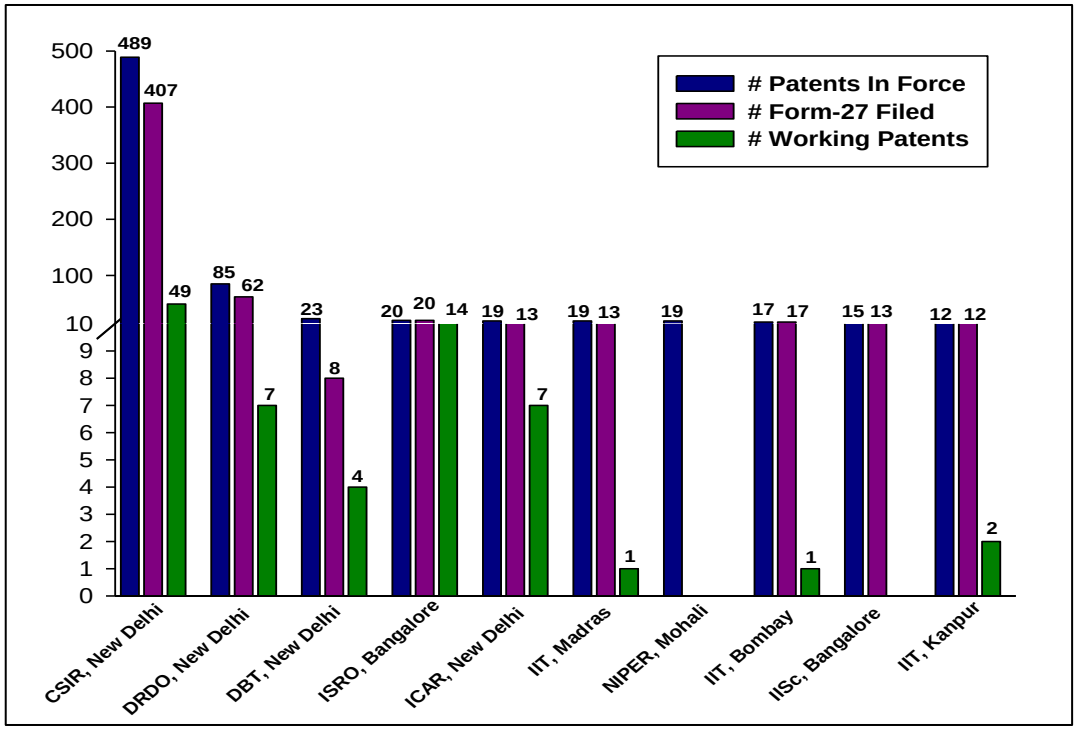


Figure 13: Top 10 Applicants (Patents In Force) 2013

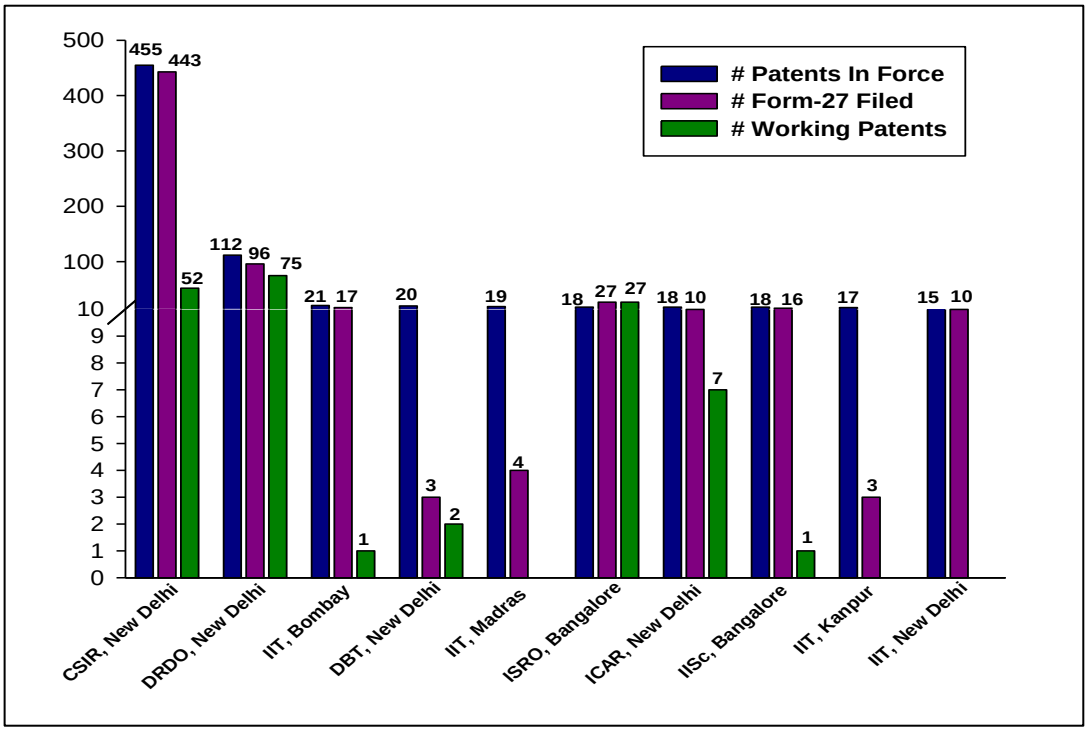


Figure 14: Top 10 Applicants (Patents In Force) 2014

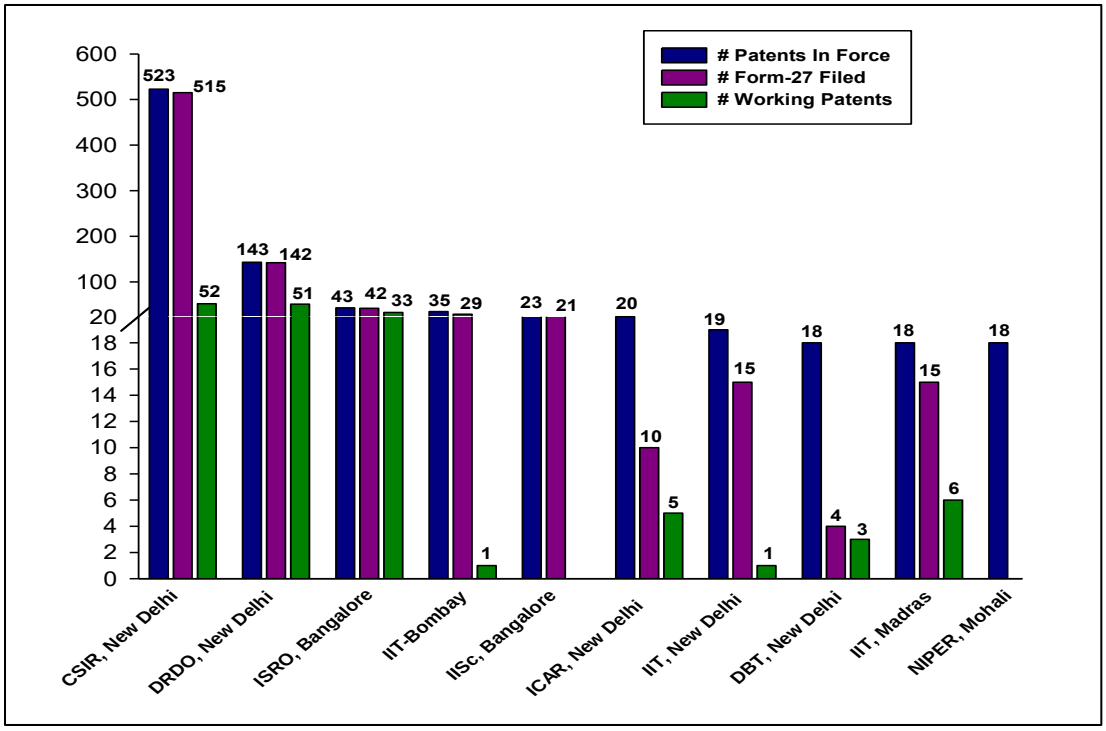


Figure 15: Top 10 Applicants (Patents In Force) 2015

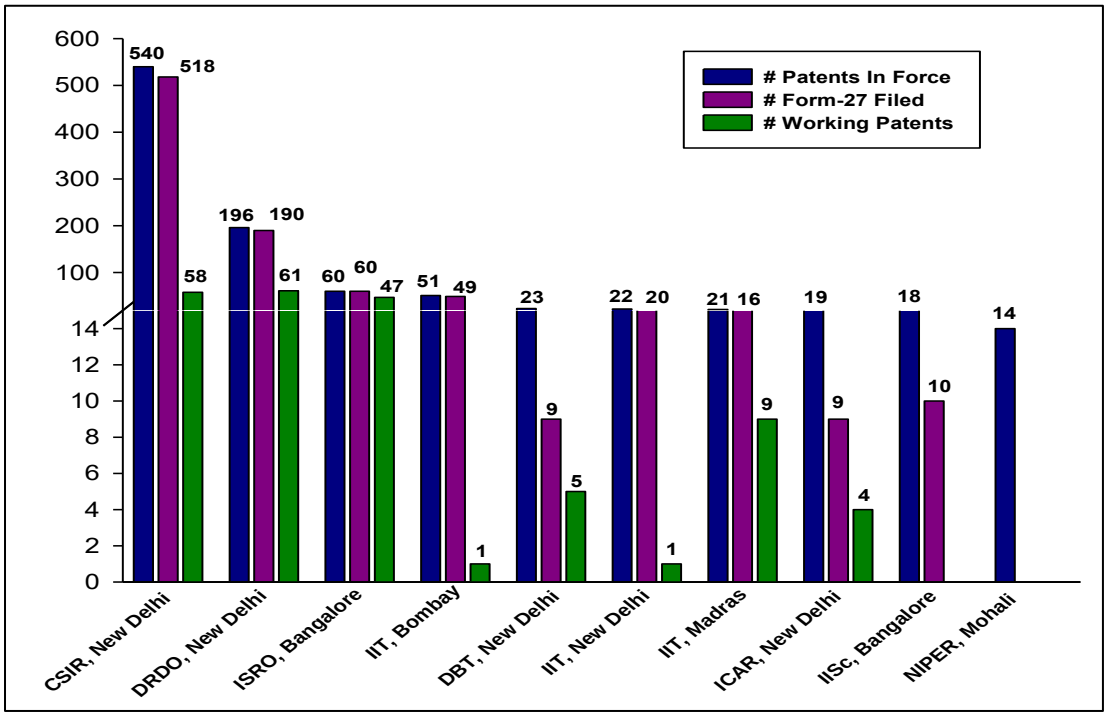


Figure 16: Top 10 Applicants (Patents In Force) 2016

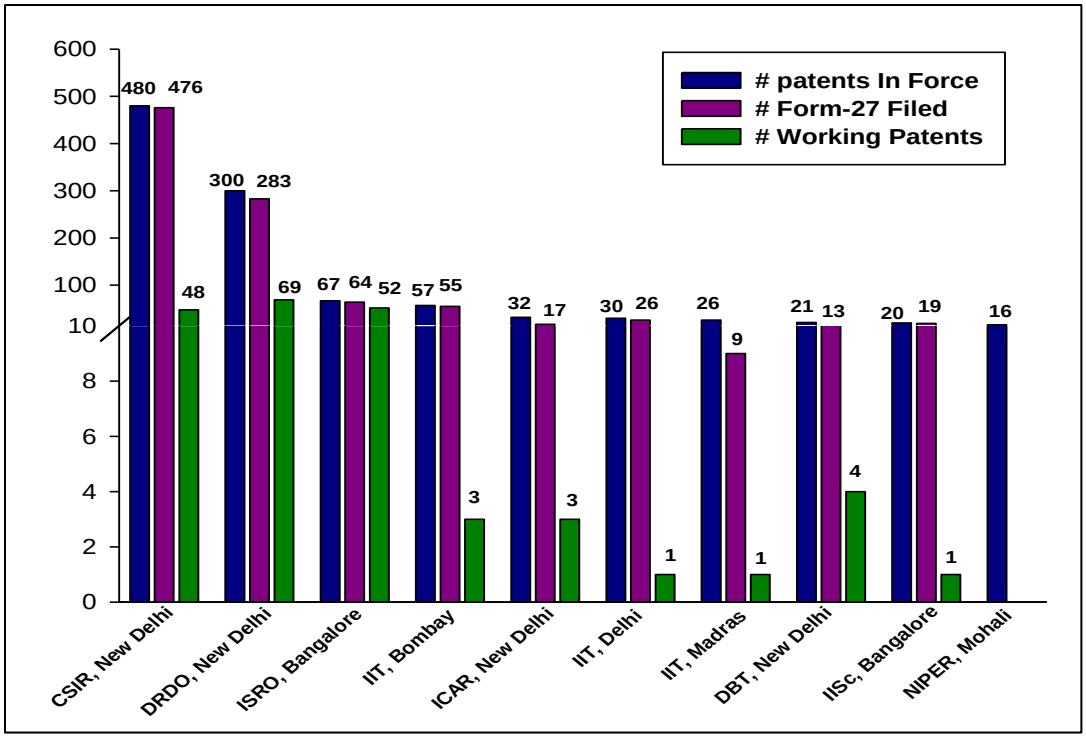


Figure 17: Top 10 Applicants (Patents In Force) 2017

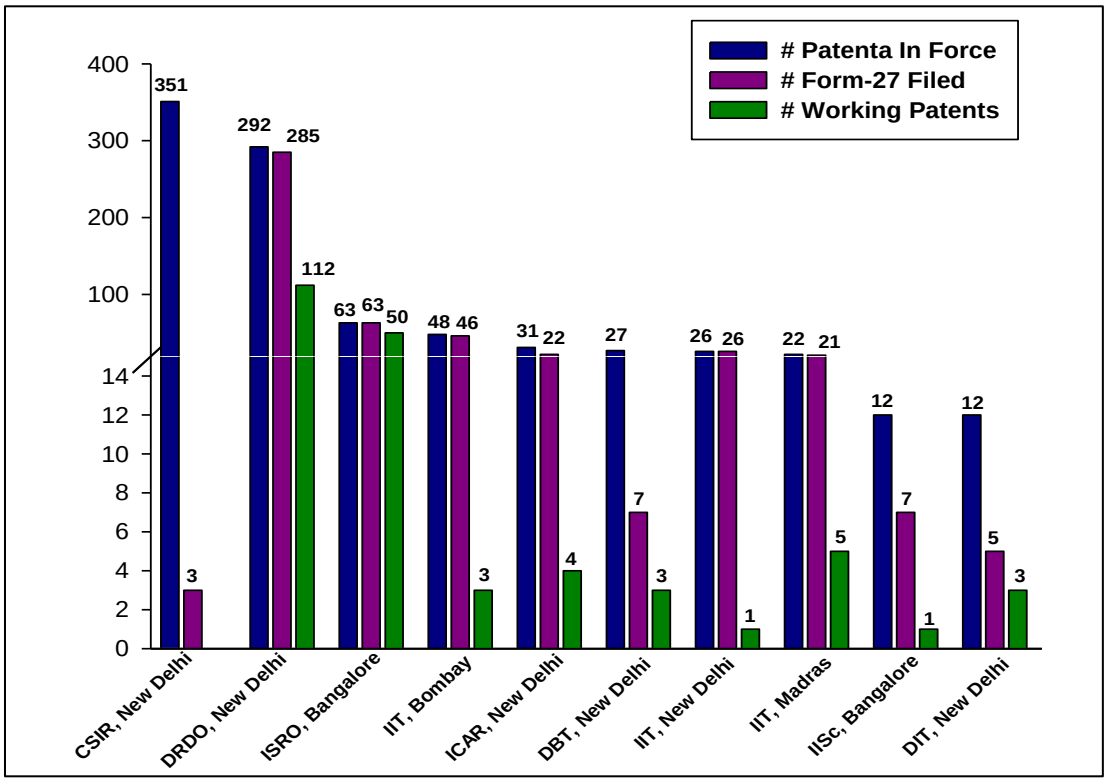


Figure 18: Top 10 Applicants (Patents In Force) 2018

FIELD WISE TREND OF GRANTED PATENTS

The study has been further extended to the categorization of patents subject wise such as Chemical Sciences, Engineering, Pharma/Drugs, Food/Agriculture, Biotechnology, Physics, Medical Science, etc. The maximum patents were granted under the field of Chemical Sciences (851), followed by Engineering (Electronics, Electrical & Mechanical) with 327 patents and Pharma/Drugs with 204 patents (Figure 19). In the field of Medical Science, there are only 31 patents granted which can be attributed to the fact that rules and regulations of the Indian Patents Act, 1970 says, the methods of treatment are excluded from the subject matter of patentability but the novel devices related to medical science are patentable.

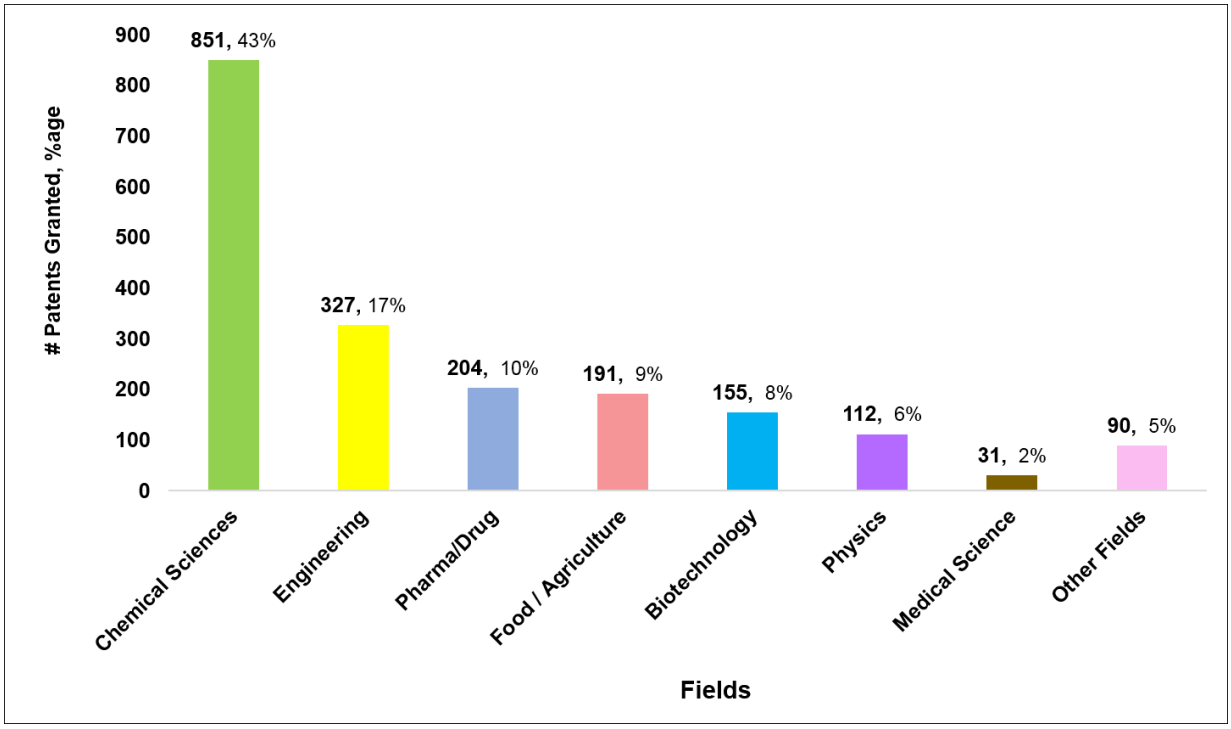


Figure 19: Field wise Categorisation (In force/Form-27 Filed/Worked) of Patents Granted 2010-12

Working Patents in Various Fields

The working patents have been further analyzed on the basis of different fields mentioned earlier. In the year 2010-12, there was a total of 12 patents working out of which 6 belong to Chemical Sciences, 3 to Biotechnology. 3 Food/Agriculture and only 1 patent were in the field of Engineering. In the year 2013, maximum patents (33) were granted the field of Chemica1

Sciences, which was same till 2017. In 2018 maximum (59) patents are of the field Engineering whereas, 57 were from the field Chemical Sciences. As we can see in figure 9. The best performing field throughout the years 2010 to 2018 are Chemical Sciences and Engineering. The category 'other fields' is related to the patents of domains like transport, customer goods, games and handling, etc. The lowest working patents are related to medical science. In the field of Medical Science, only devices are patentable but treatment procedure and method of treatment are not patentable. Although the United States allows the patenting of medical procedures and treatment methods, more than 80 countries including India exclude medical procedures from patentability.

Figure 20: Field-wise Breakup (Patents Granted & Working) Jan. 2010 – Dec. 2017

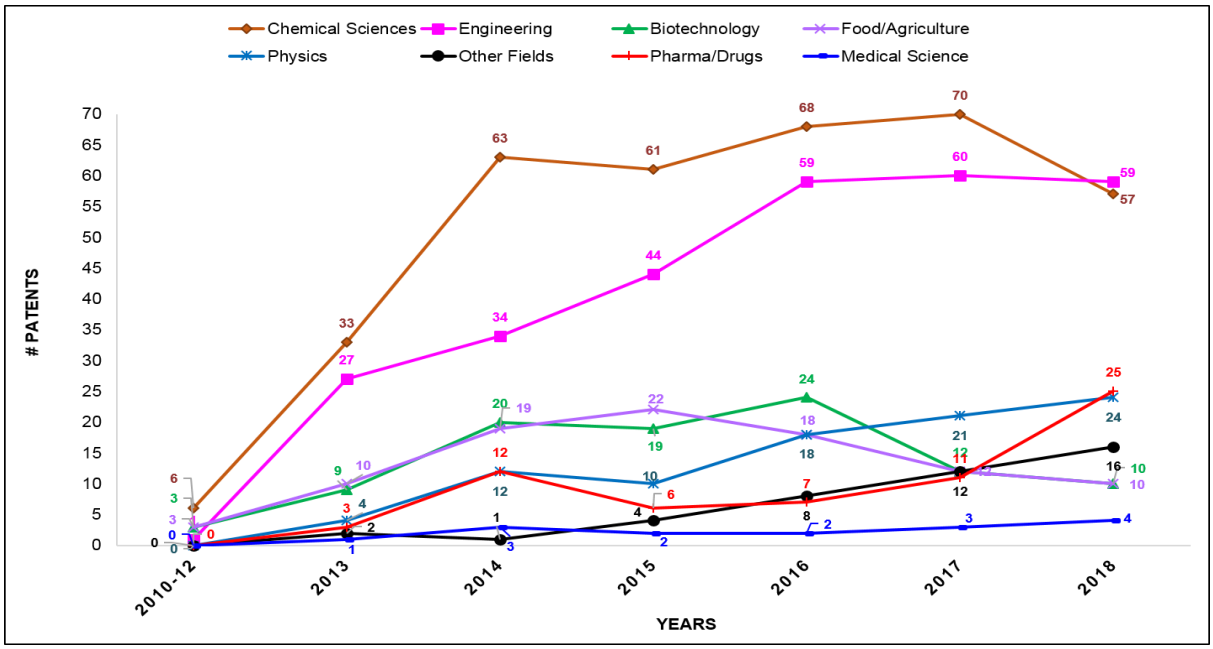


Figure 21: Year-Wise Break-up of Working Patents for Various Fields

Yearly Trend of Working and Non-working Patents in Various Fields

All 8 fields have been analysed on the yearly basis from 2010-18. In the analysis, it was found that chemical sciences are dominating the graph for both categories vis-à-vis working and non-working patents.

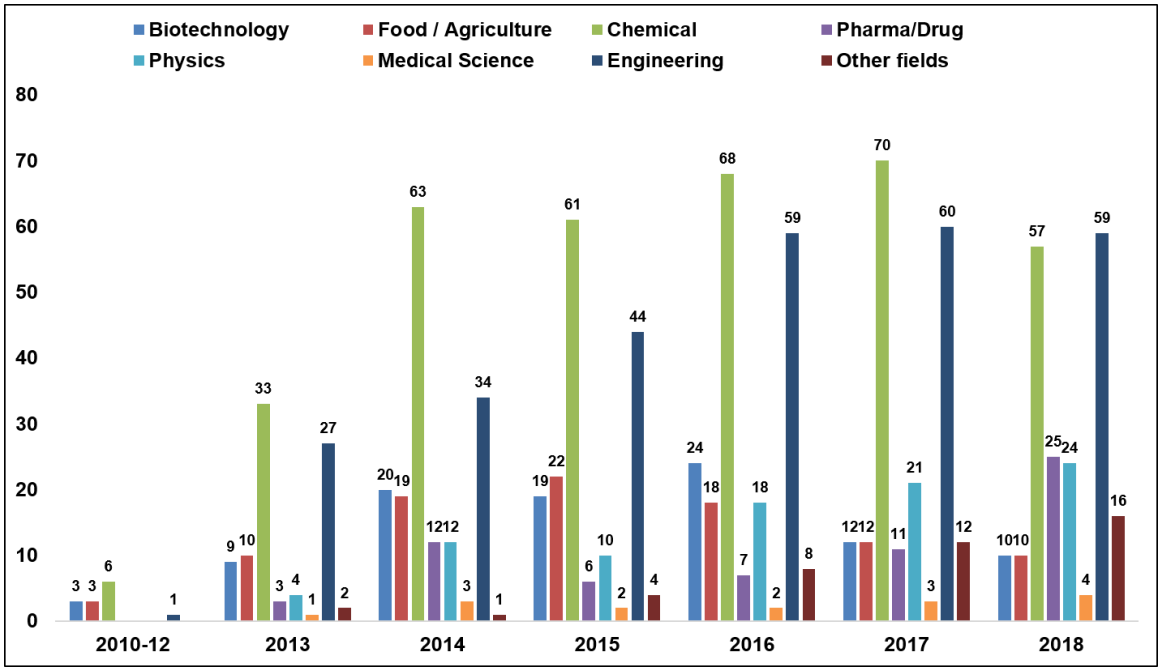


Figure 22: Yearly Trend of Various Fields (for Working Patents) (2010-18)

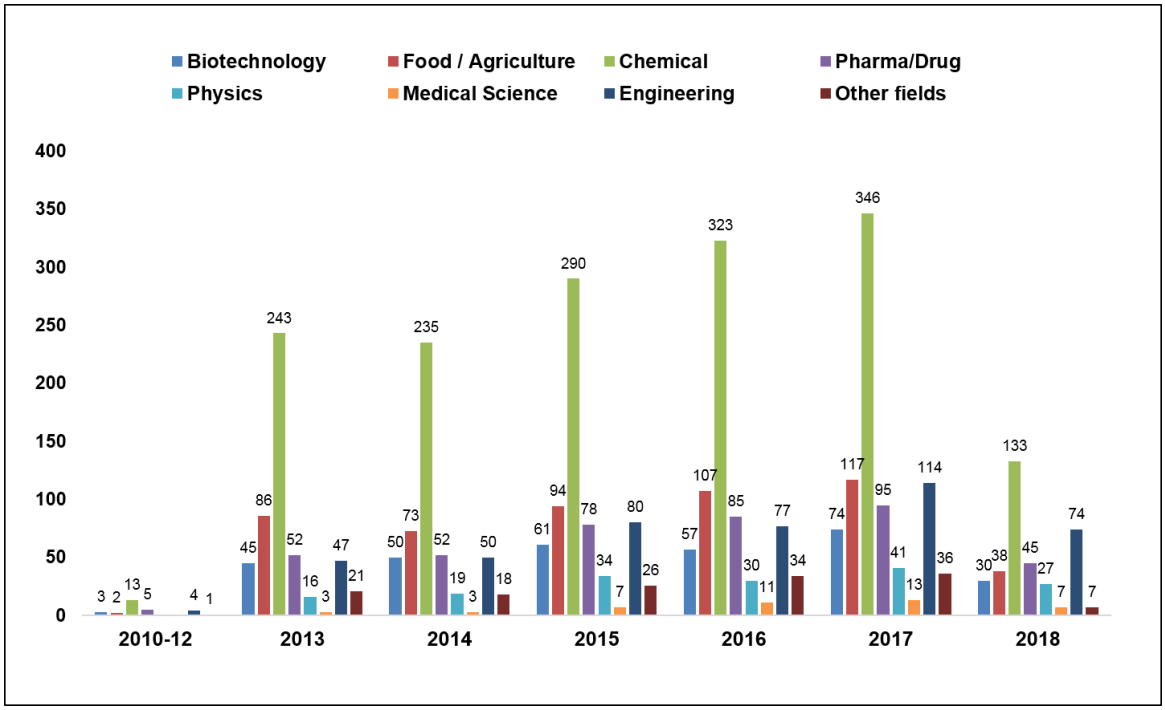


Figure 23: Yearly Trend of Various Fields (for Non-Working Patents) (2010-18)

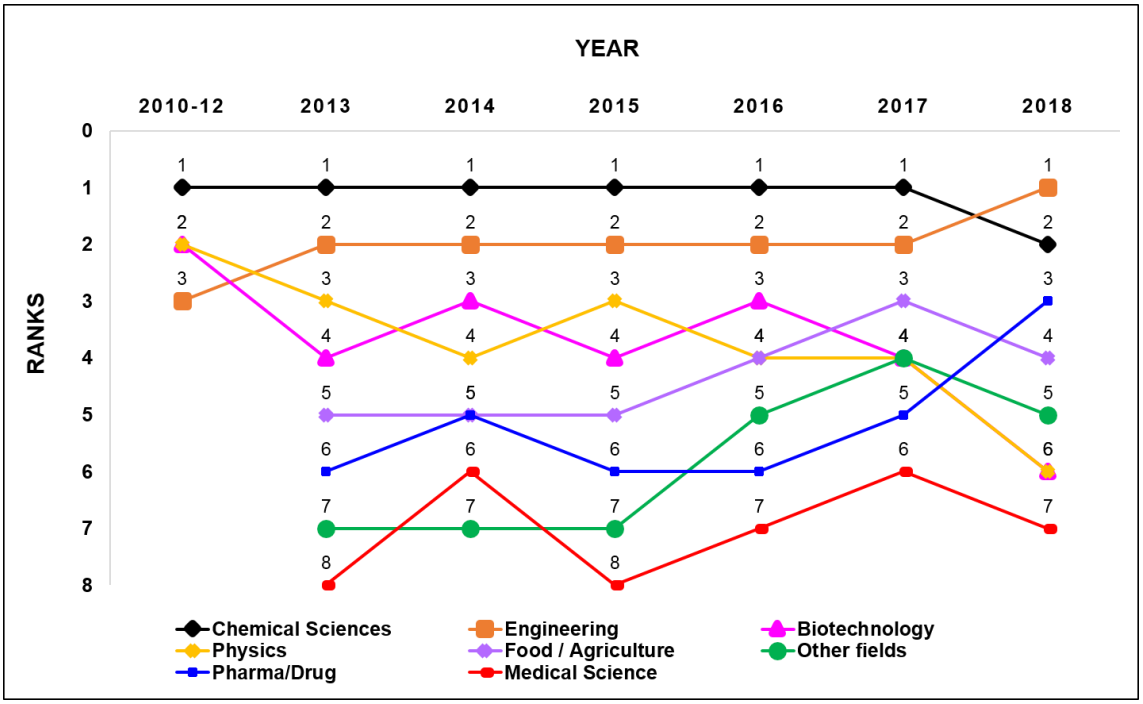


Figure 24: Field wise Ranking Trend (Patents Granted) (2010-18)

Table 6: Number of Working Patents under "Various Fields for Each Year (2010-18)"

Field of Invention	2010-12	2013	2014	2015	2016	2017	2018
Chemical Sciences	6	33	63	61	68	70	57
Engineering	1	27	34	44	59	60	59
Biotechnology	3	9	20	19	24	12	10
Food/Agriculture	3	10	19	22	18	12	10
Physics	0	4	12	10	18	21	24
Other Fields	0	2	1	4	8	12	16
Pharma/Drugs	0	3	12	6	7	11	25
Medical Science	0	1	3	2	2	3	4

Rank-1 **Rank-2** **Rank-3** **Rank-4** **Rank-5** **Rank-6** **Rank-7** **Rank-8**

Field Wise Detailed study: Field wise Categorisation (In force/Form-27 Filed/Worked) from 2010-18 (2010-12 combined). A further detailed analysis has been shown below in the pictorial form:

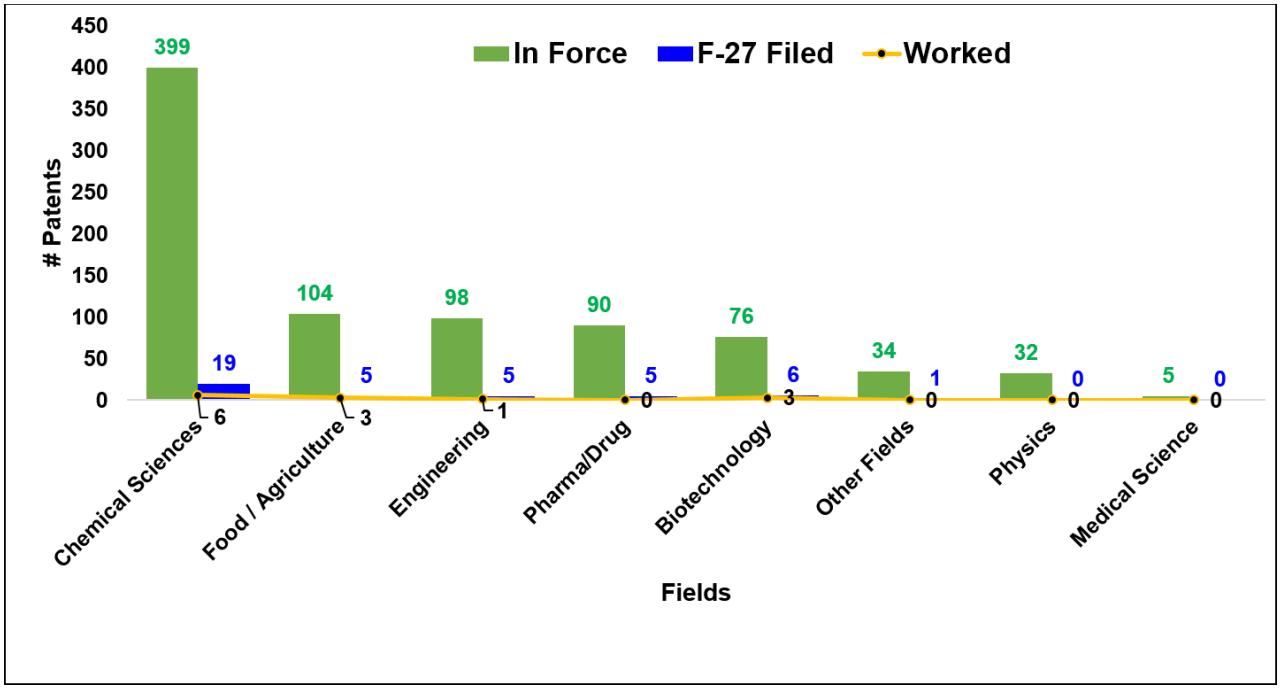


Figure 25: Field wise Categorisation (In force/Form-27 Filed/Worked) of Patents Granted 2010-12

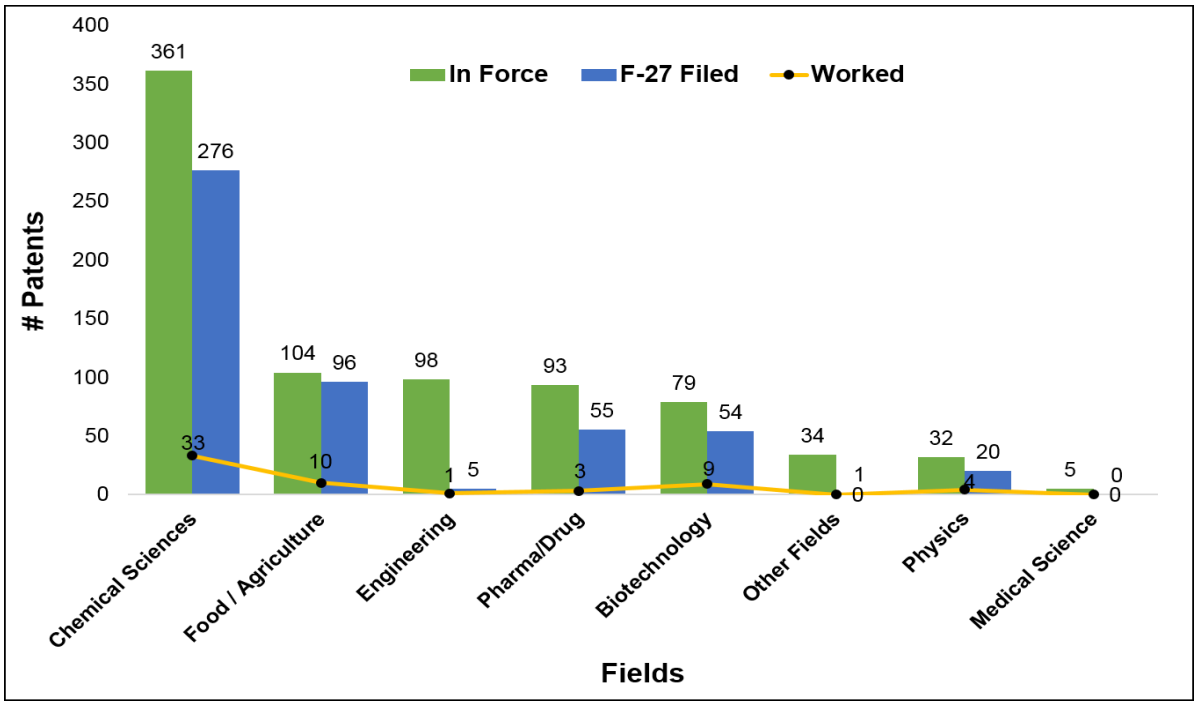


Figure 26: Field wise Categorisation (In force/Form-27 Filed/Worked) of Patents Granted 2013

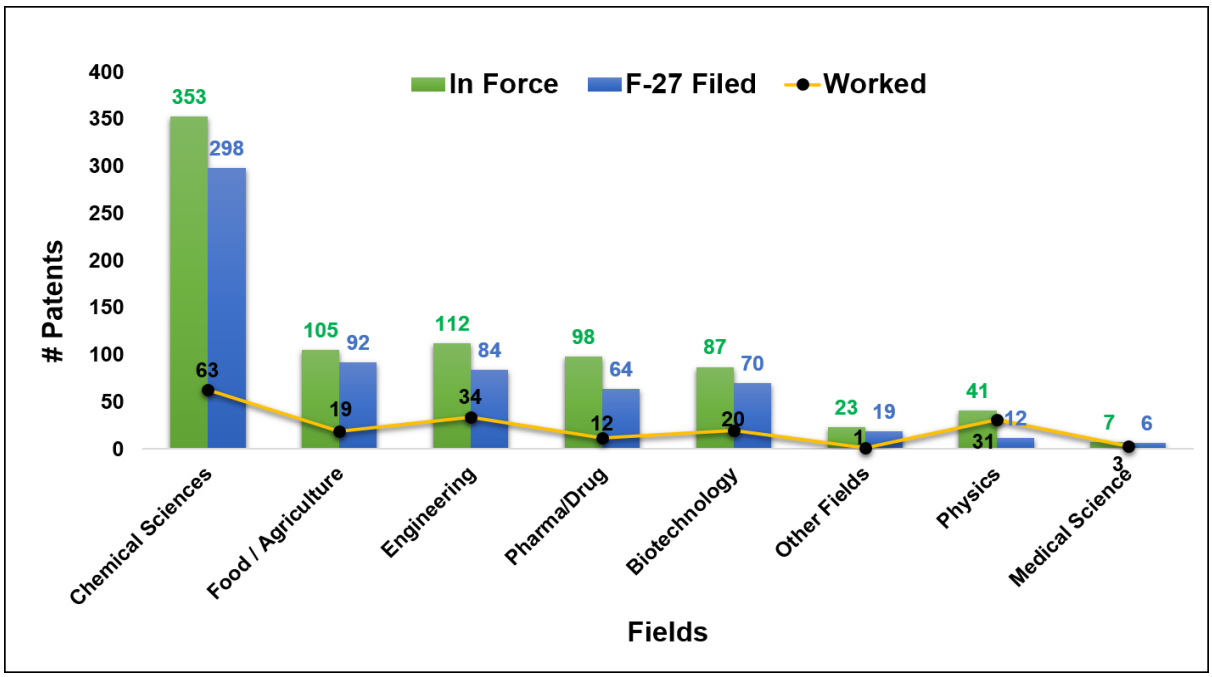


Figure 27: Field wise Categorisation (In force/Form-27 Filed/Worked) of Patents Granted 2014

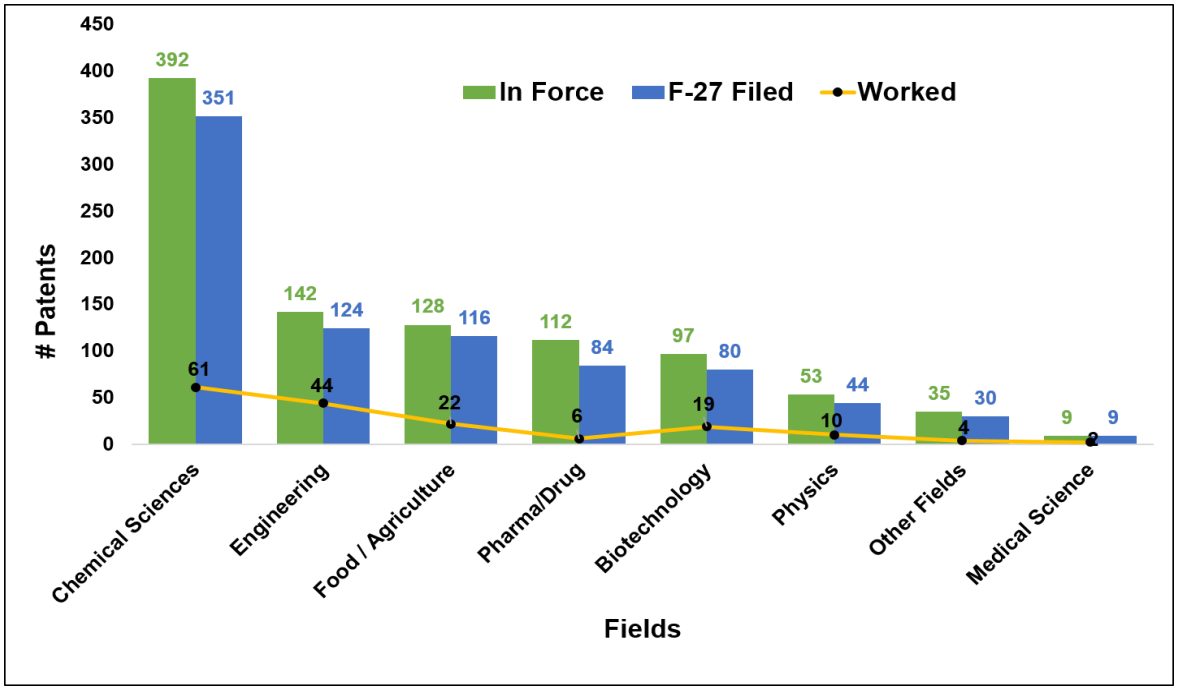


Figure 28: Field wise Categorisation (In force/Form-27 Filed/Worked) of Patents Granted 2015

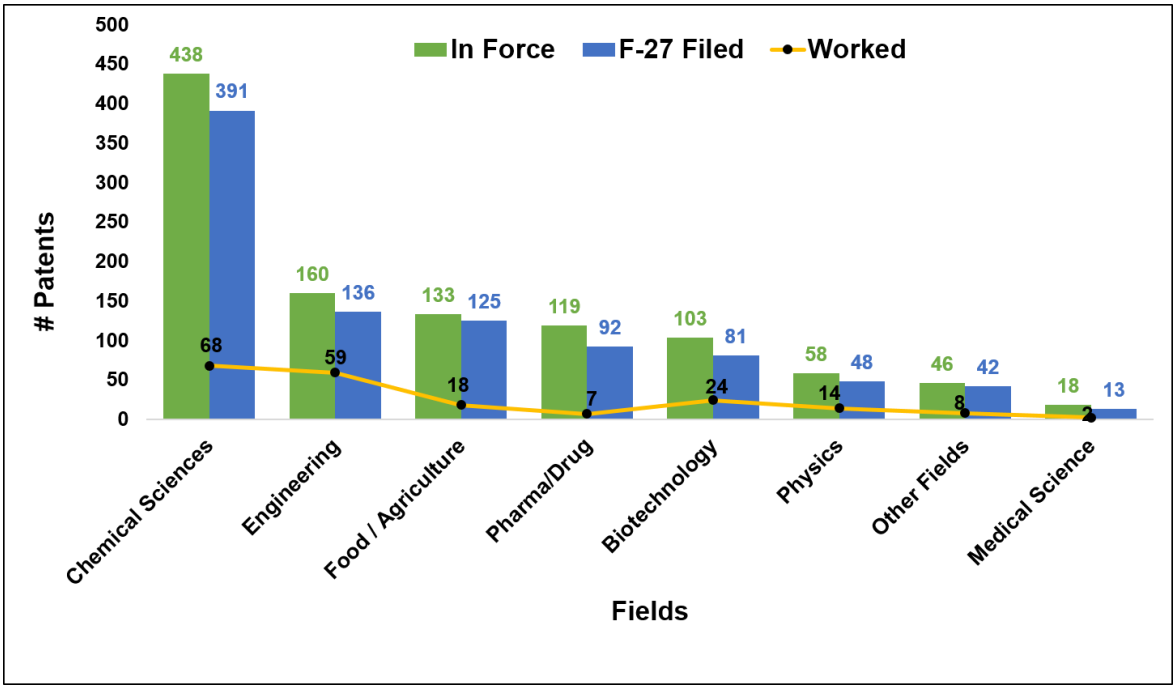


Figure 29: Field wise Categorisation (In force/Form-27 Filed/Worked) of Patents Granted 2016

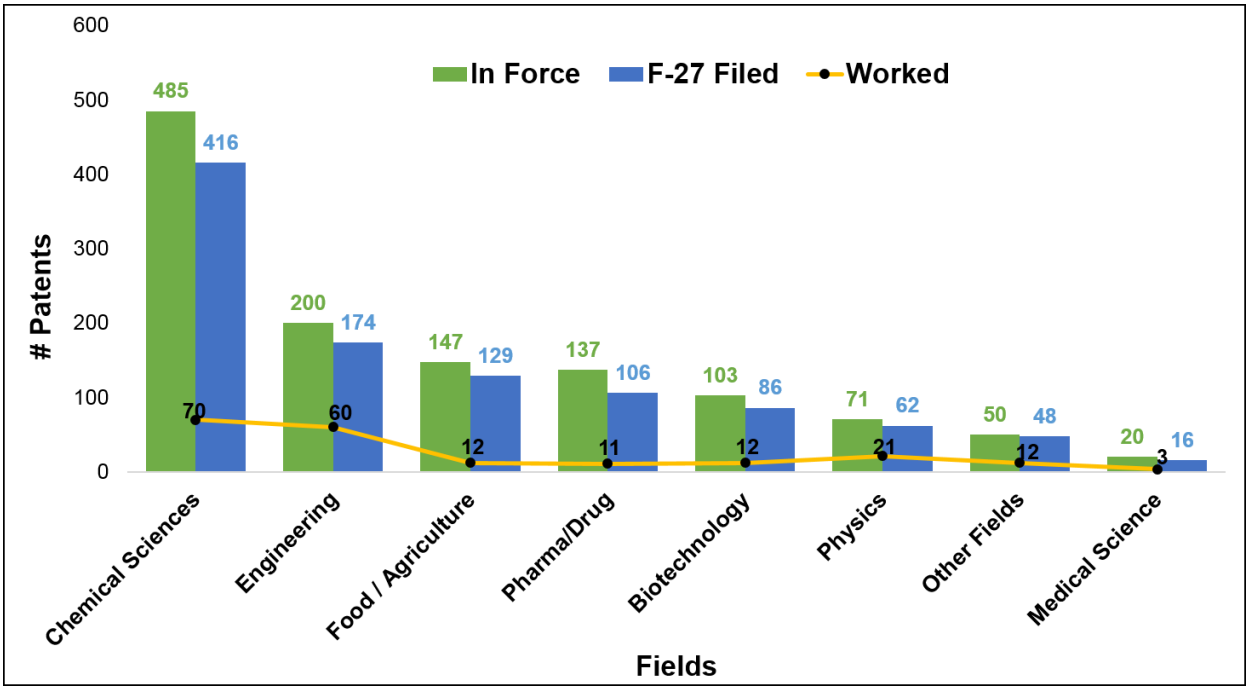


Figure 30: Field wise Categorisation (In force/Form-27 Filed/Worked) of Patents Granted 2017

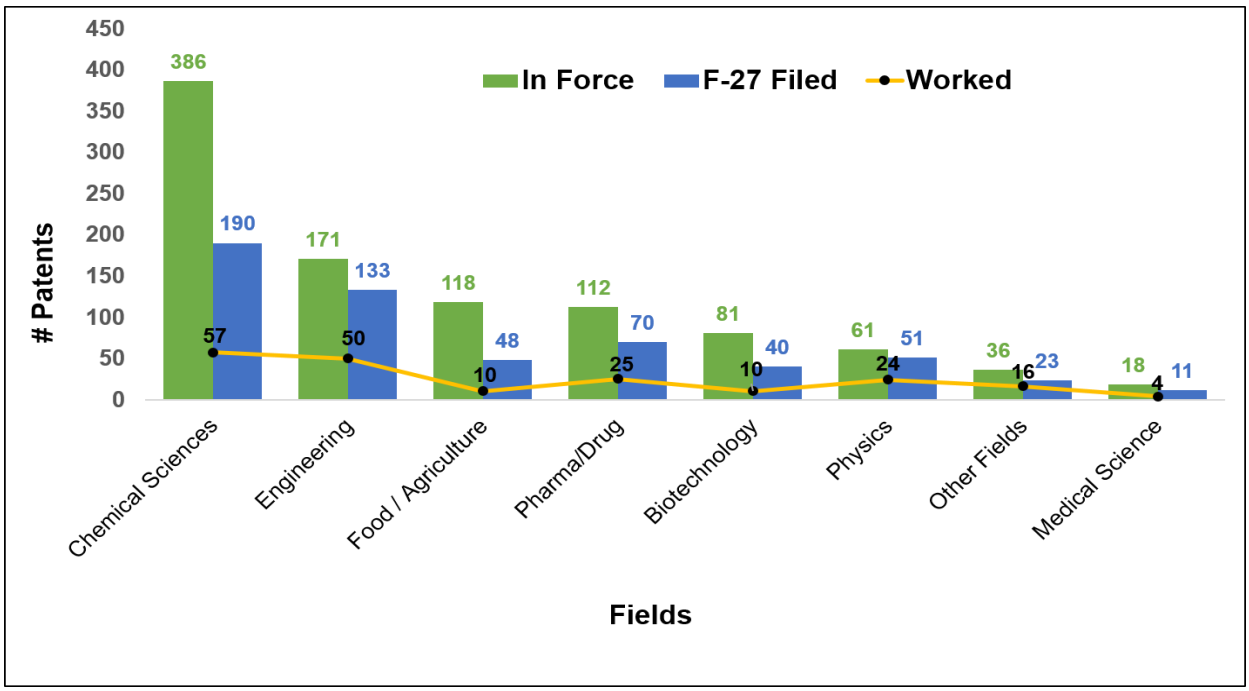


Figure 31: Field wise Categorisation (In force/Form-27 Filed/Worked) of Patents Granted 2018

Year-wise Categorization of Various Fields (In force/Form-27 Filed/Worked) from 2010-18

Below in graphs, year-wise analysis is depicted for all the fields, which show the trend of the domain throughout the time from 2010 to 2018.

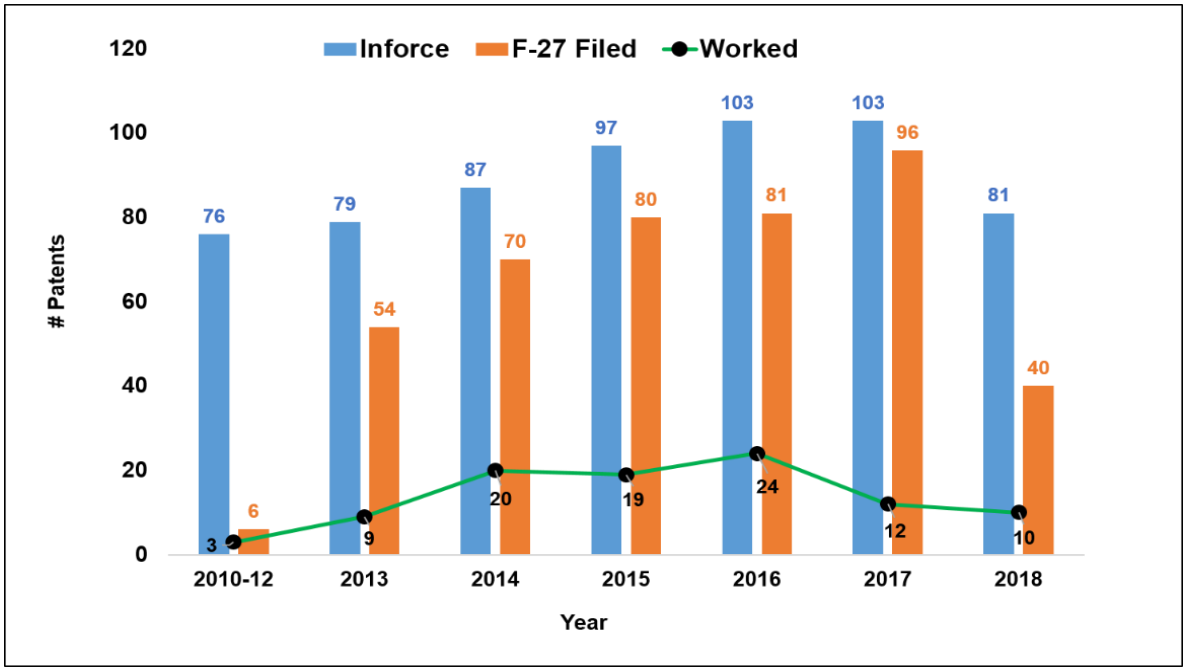


Figure 32: Year-wise Categorization of Patents Granted (In force/Form-27 Filed/Worked) Biotechnology (2010-18)

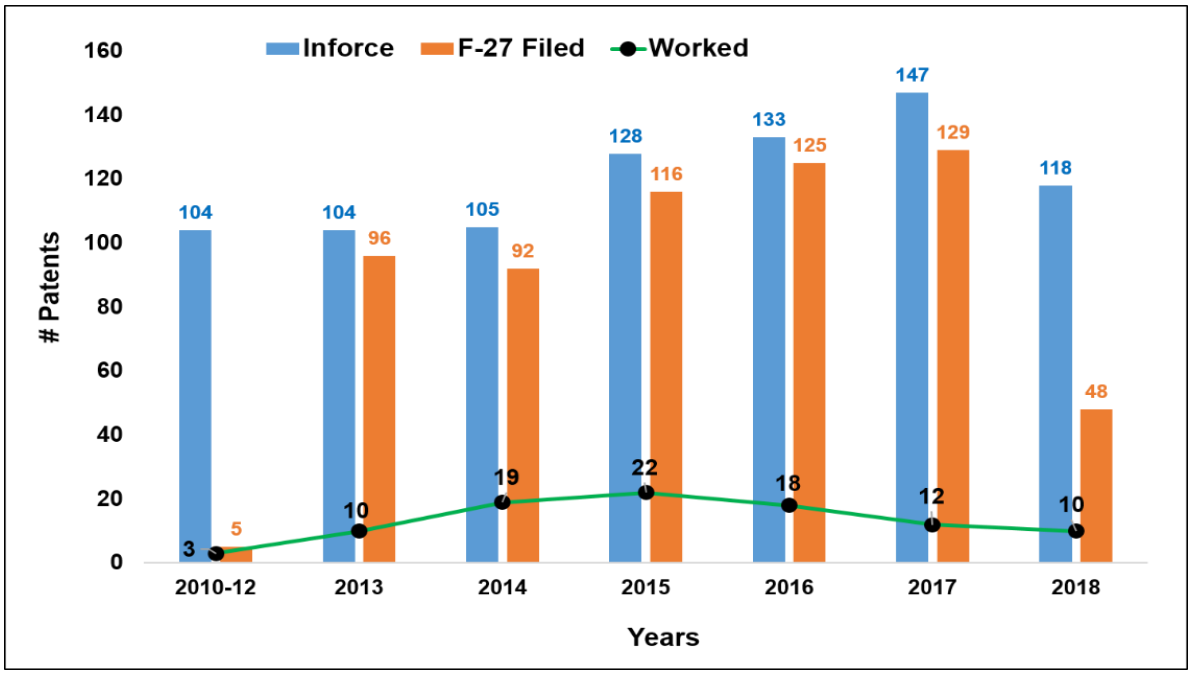


Figure 33: Year-wise Categorization of Patents Granted (In force/Form-27 Filed/Worked) Food/Agriculture (2010-18)

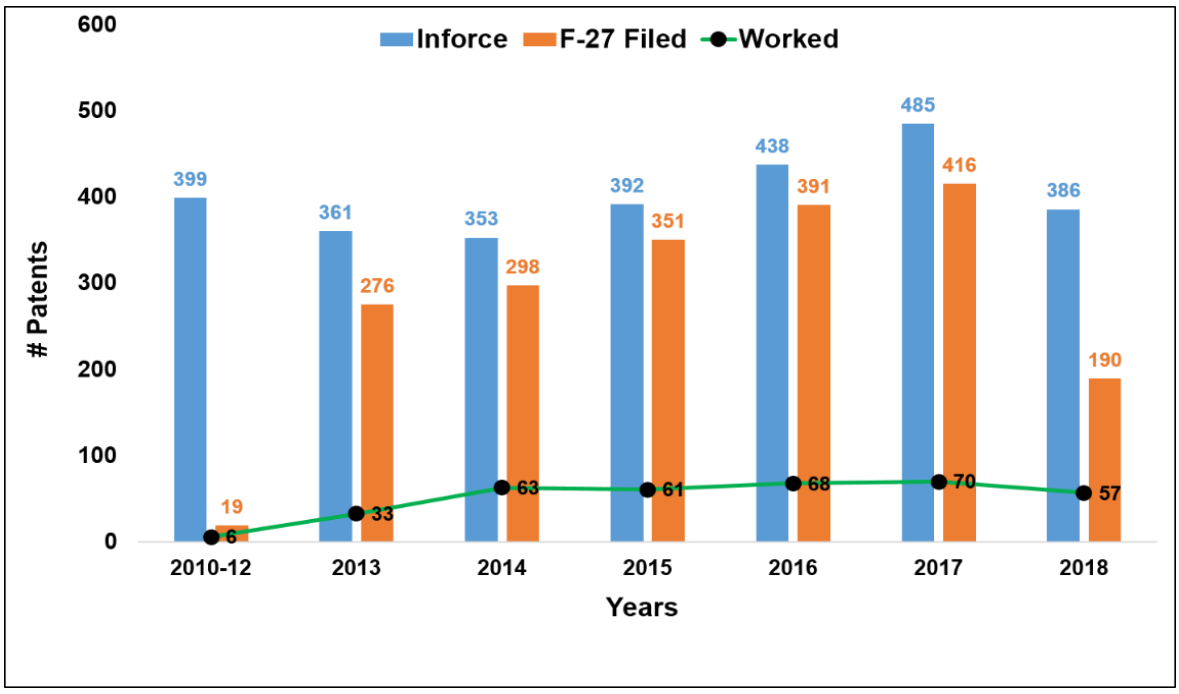


Figure 34: Year-wise Categorization of Patents Granted (In force/Form-27 Filed/Worked) Chemical Sciences (2010-18)

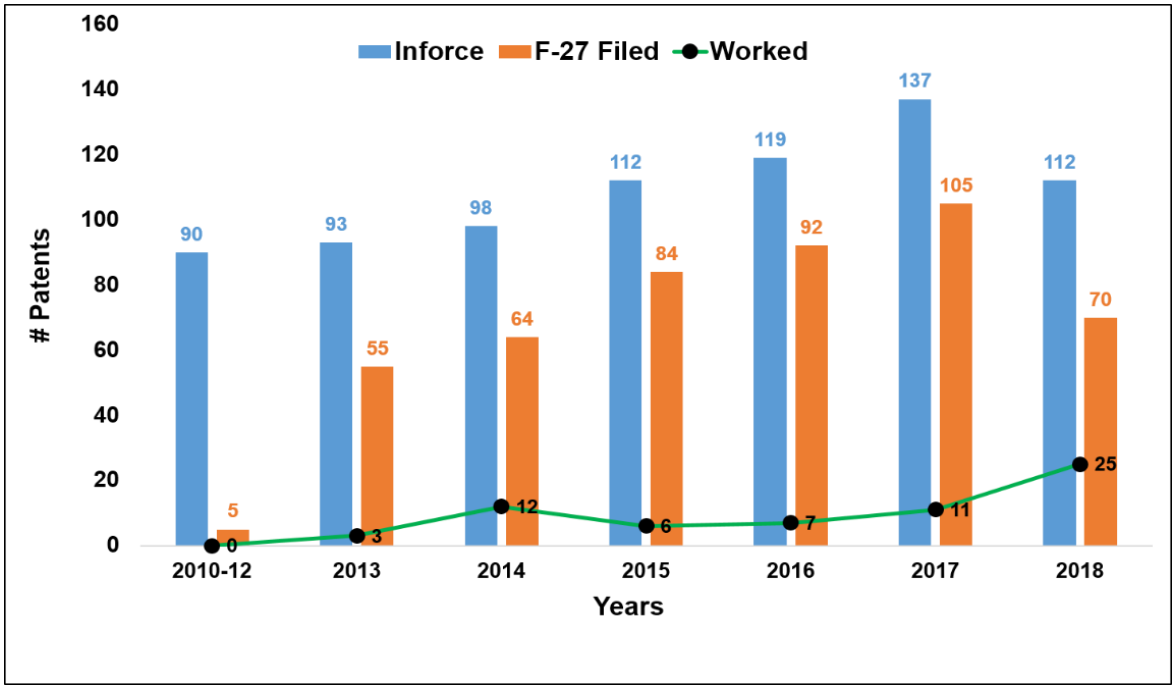


Figure 35: Year-wise Categorization of Patents Granted (In force/Form-27 Filed/Worked) Pharma/Drug (2010-18)

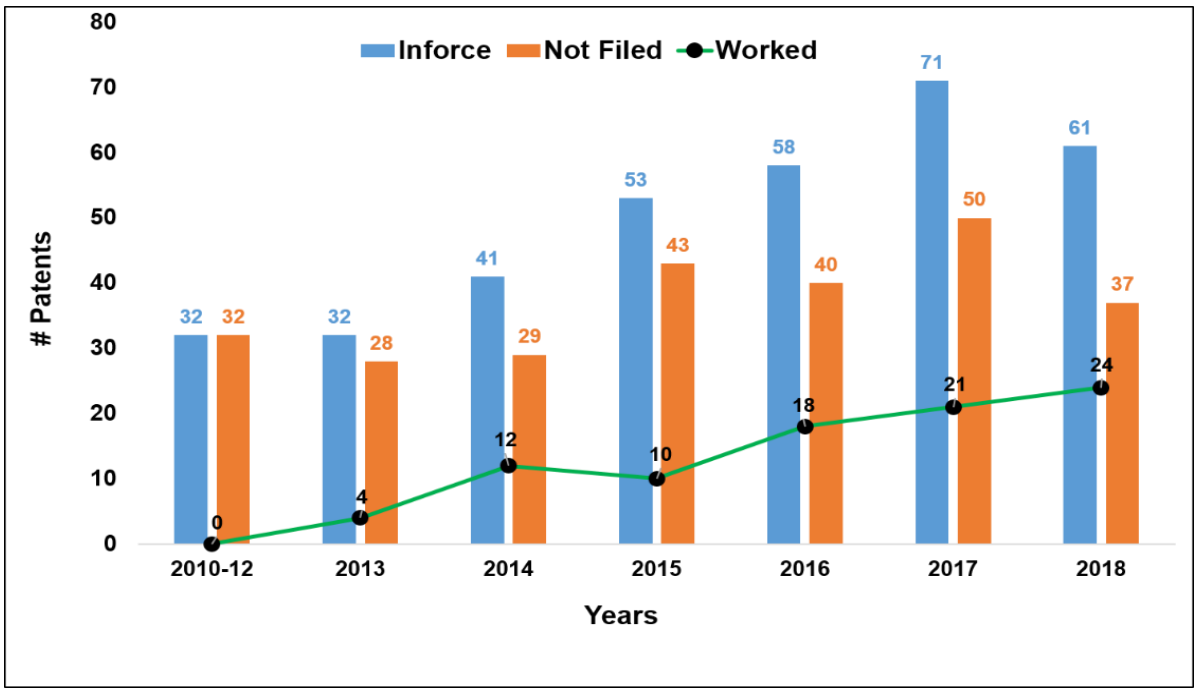


Figure 36: Year-wise Categorization of Patents Granted (In force/Form-27 Filed/Worked) Physics (2010-18)

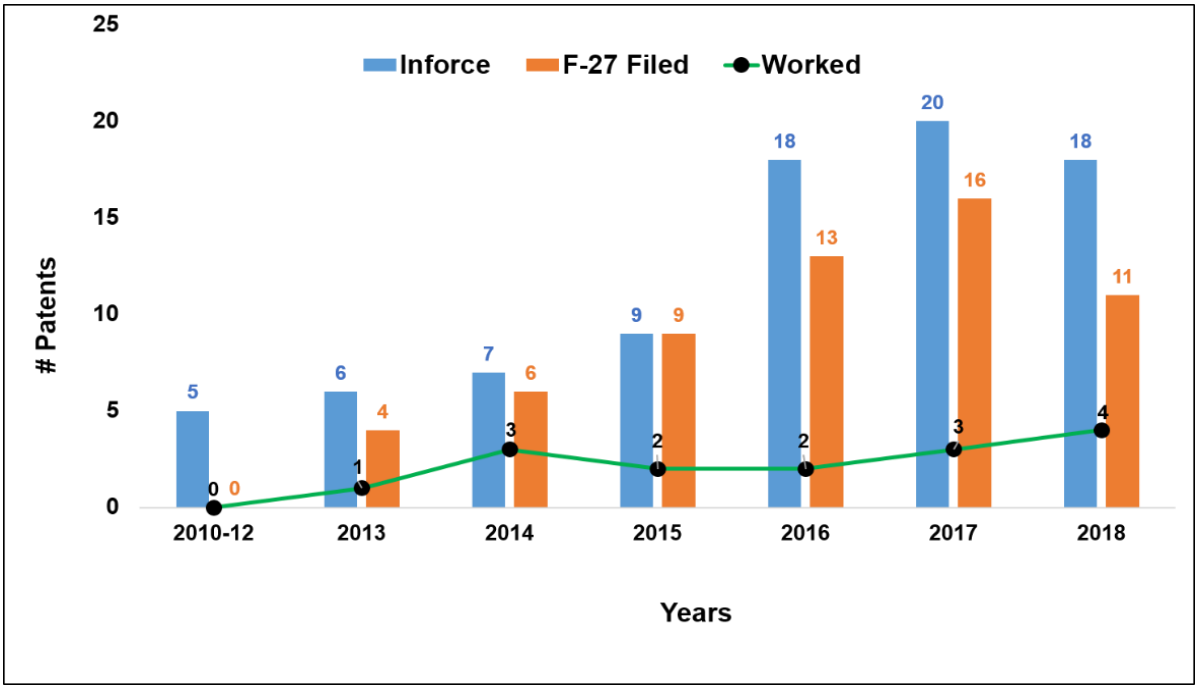


Figure 37: Year-wise Categorization of Patents Granted (In force/Form-27 Filed/Worked) Medical sciences (2010-18)

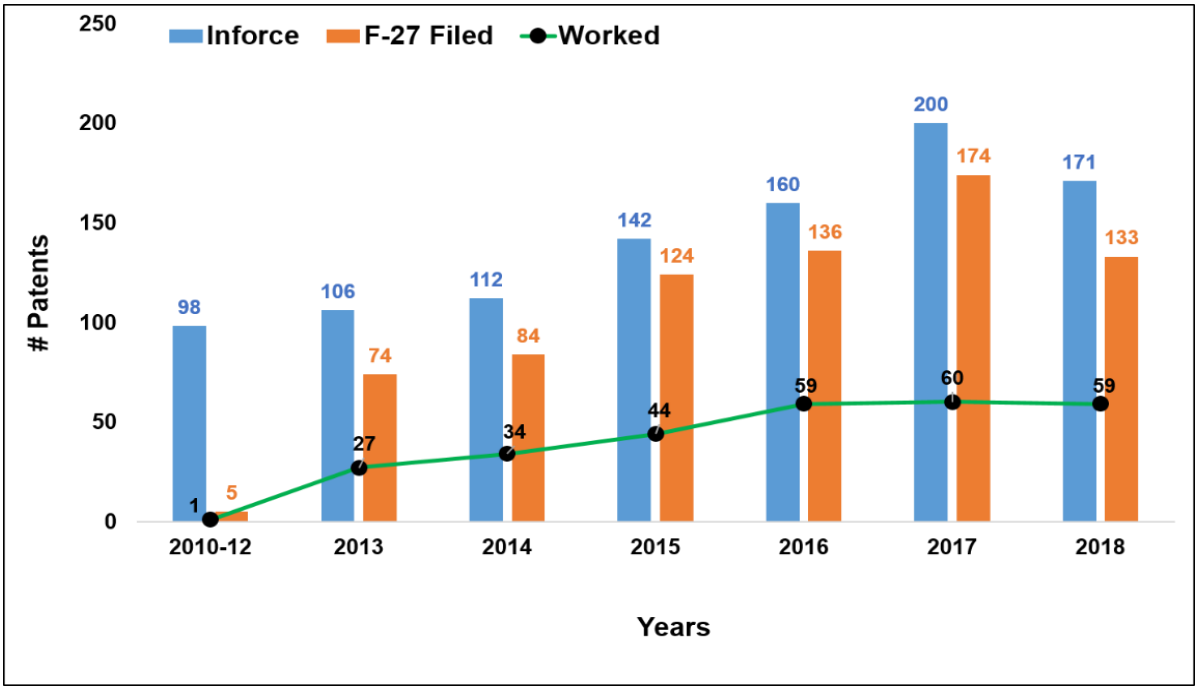


Figure 38: Year-wise Categorization of Patents Granted (In force/Form-27 Filed/Worked) Engineering (2010-18)

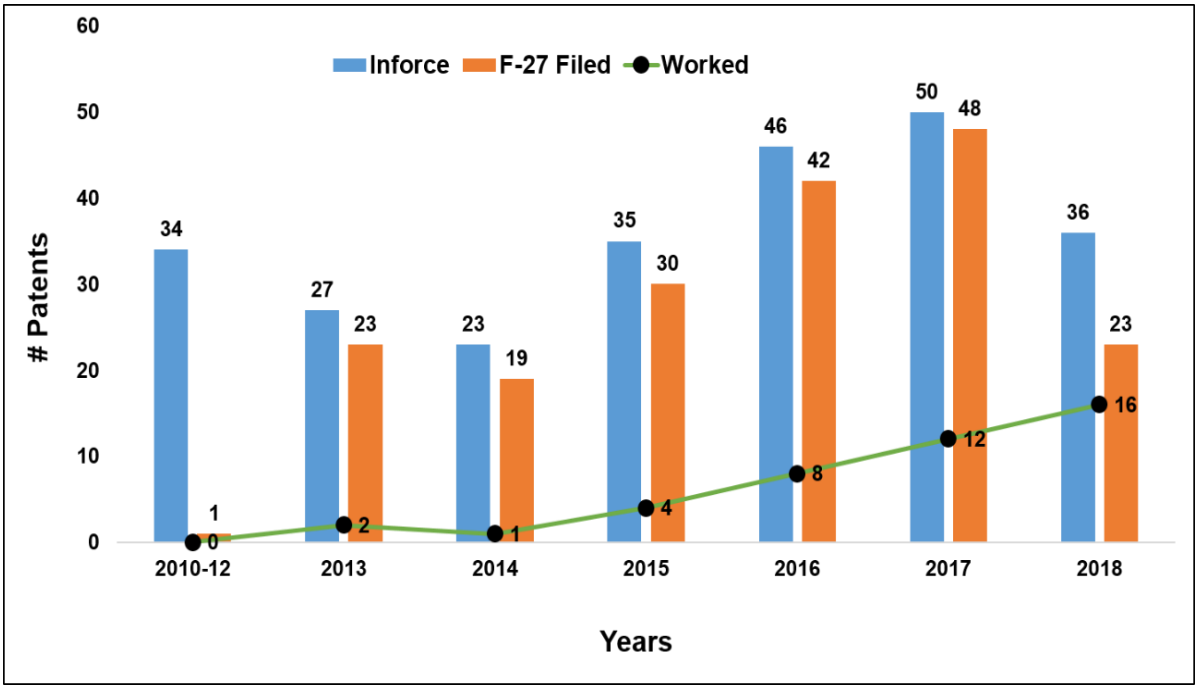


Figure 39: Year-wise Categorization of Patents Granted (In force/Form-27 Filed/Worked) Other Fields (2010-18)

COLLABORATIVE PATENTS

Patents by 2 or more Applicants (Collaborative Patents) (Jan. 2010 - Dec. 2017): The collaborations between the academic institutions and industry is an important factor for the economic and academic development of the country. DST-CPR has further identified the institutes, which have filed patents in collaboration. The collaboration may be as an applicant or as inventors. All the information regarding as inventor has been extracted from InPASS. Joint patent owners are wherein two or more institutions team up for carrying out R&D in a particular field. Collaboration can be in the form of researchers of one institute using the resources of another or one institute providing funds to researchers of another institute, etc. Collaborations can offer benefits in terms of sharing expenses and experiences towards reaching a common goal.

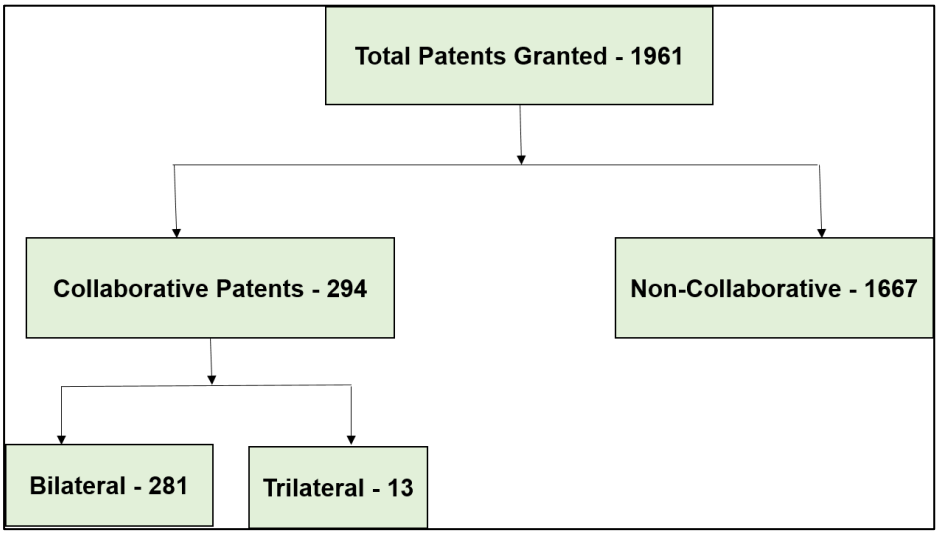


Figure 40: Collaborative Patents (Granted)

The bilateral collaborations of HEIs and NRLs including their Inter and Intra collaborations along with their collaborations with Government Department/Council, Industry/PSU, and Others are shown in below tables. The collaborative parties (Government Department/Council, NRL, Industry/PSU, HEI, Others (Trust, Foundation)) are divided into the following sections:

1. **Bilateral**
2. **Trilateral**

Table 7: Bilateral Collaborations (281) in Patents Granted (1961)

HEIs (170 Patents)				
Collaborations	Government*	NRL	Others**	HEIs
National (158)	71	50	26	11
International (12)	1	9	0	2
NRLs (170 Patents)				
Collaborations	Government*	NRL	Others**	HEIs
National (160)	50	25	35	50
International (10)	0	0	1	9

**Councils, Departments, Organizations, Ministry, Board, Corporation and Association*
***Trusts, Industry/PSU, (Private Medical Centre, Hospital, Contract Res. Org.)*

Table 8: Trilateral Collaborations (13)

Collaborating Parties			**# Patents**
HEI	HEI	HEI	1
HEI	HEI	Others*	2
HEI	NRL	NRL	2
HEI	NRL	Government**	4
HEI	NRL	Others*	2
HEI	Government**	Others*	2

* *Industry and Private Hospital*
** *Councils, Departments, Organizations, Ministry, Board, Corporation and Association*

Table 9: Details of Trilateral Collaborations (13)

NRL IGIB, New Delhi	**HEI** DU, New Delhi	**NRL** Tuberculosis Research Centre, Chennai
HEI Dr. B.C. Guha Central For Genetic Engineering And Biotechnology Culcutta University, Kolkata	**Industry** Lambda Televenture Private Limited, Delhi	**Government** NRDC, New Delhi
HEI J.N.V.University Department of Chemistry Jodhpur	**NRL** Science and Technology Center for Cooperative Research, , Kasuga-shi, Fukuoka	**NRL** Desert Medicine Research Center, Jodhpur
HEI IIT, Chennai	**NRL** Shri Amm Murugappa Chettiar Research Center (MCRC), Taramani, Chennai	**Industry** Parry Agro Industries Ltd, Chennai
NRL Naval Materials Research Laboratory, Thane	**HEI** Indian Institute of Technology Bombay	**Government** DRDO, New Delhi
HEI University Institute of Pharmaceutical Sciences, Panjab University	**HEI** Kalpana Chawla Government Polytechnic for Woman, Ambala City	**Industry** Matrix Laboratories Ltd, Formulation R & D Centre Hyderabad-500078, In| Ranbaxy Laboratories Ltd., Gurgaon
Government Department of Biotechnology, Delhi	**NRL** Rajiv Gandhi Centre of Biotechnology, Trivandrum	**HEI** University of Kerela Trivandrum
NRL National Center for Cell-Science, Ganeshkhind, Pune	**HEI** Indian Institute of Science Bangalore	**Government** Department of Biotechnology, New Delhi
NRL Centre for Plant Molecular Biology	**Government** Department of Biotechnology	**HEI** Tamil Nadu Agricultural University
HEI Iisc, Bangalore, Sri Satya Sai Institute of Higher Medical Sciences, Bangalore	**Hospital** Manipal Hospital, Bangalore	**Government** Council of Scientific & Industrial Research
HEI All India Institute of Medical Sciences, Department of Biochemistry, New Delhi	**HEI** Indian Institute of Technology, Guwahati	**Intergovernmental Org.** International Centre of Genetic Engineering and BiotechnologyNew Delhi
NRL INMAS, Delhi	**HEI** Jamia Hamdard, New Delhi	**Hospital** LNJP Hospital, New Delhi
HEI Nevjabai Hitkarini College, Bramhapuri	**HEI** Rtm Nagpur University, Nagpur	**HEI** Ramdeobaba Kamla Nehru Engineering College Nagpur

Table 10: Collaborations of Top 10 Applicants based on Patents Granted

Applicants	Collaborative Parties	Total Patents Granted
CSIR, New Delhi	57	863
DBT, New Delhi	37	58
DRDO, New Delhi	22	308
IIT, Madras	11	44
IISc, Bangalore	10	47
IIT, New Delhi	9	44
ICAR, New Delhi	6	60
IIT, Bombay	5	76
IIT, Kanpur	4	46
ISRO, Bangalore	3	74

Details of Collaborative Parties of top 10 applicants

CSIR, New Delhi

HEIs (28)	NRLs (10)	Others (19)
• Alagappa University, Karaikud • Berhampur University, Berhampur • Goa University, Goa • IISc, Bangalore • IIT, Bombay • IIT, Delhi • IIT, Chennai • IIT, Guwahati • IIT, Kharagpur • Institut für Pharmazie und Biochemie, Germany • Institute of Chemical Technology, Mumbai • JNU, New Delhi • Laboratoire Chimie Des Materiaux Organiques Et Metalliques, France • Manipal Hospital, Bangalore • Nagpur University, Nagpur • National Institute of Advanced Industrial Science and Technology (AIST), Japan • Sree Chitra Tirunal Institute for Medical Sciences & Technology, Thiruvananthapuram • Sri Satya Sai Institute of Higher Medical Sciences, Bangalore • Thapar Instt. of Engg. & Tech., Patiala • University of Delhi (DU), Delhi • Institute of Structural Macrokinetics and Material Science (ISMAN), Russian Academy Of Sciences, Moscow, Russia • Jadavpur University, Kolkata • Technische University Darmstadt, Germany • BHU, Varanasi • Shriram Institute For Industrial Research, New Delhi • Mepco Engineering College, Virudhunagar • University Of Calcutta, Kolkata • Panjab University, Chandigarh	• Center For High Technology, Noida • DBT, New Delhi • DST, New Delhi • National Aerospace Laboratories, Bangalore • NML, Jamshedpur • Vikram Sarabhai Space Centre, Trivandrum • Department of Information Technology, New Delhi • Defence Research & Development Organisation, New Delhi • Department of Atomic Energy, Mumbai • Indian Association for the Cultivation of Science, Jadavpur	• Dabur Research Foundation, Ghaziabad • FDC Ltd., Nalagarh • Godfrey Philips India Ltd., Mumbai • Gujarat Narmada Valley Fertilisers & Chemicals Ltd., Gujarat • M/S Mesco Equipment (P) Ltd, Kolkata • MIR Holistic Pvt. Ltd, Kochi • National Aluminium Company Nalco Bhawan, Bhubaneswar • Nicholas Piramal India Ltd, Mumbai • NTPC Energy Technology Research Alliance, New Delhi • Petroleum Corporation Limited, Chennai • Ramakrishna Mission Medical Centre Free T B Clinic, Delhi • Reliance Industries Ltd, Mumbai • Ahmedabad Textile Industries Research Association, Ahmedabad • LMD Group of construction, Noida • National Research Development Corporation, New Delhi • Petroleum Conservation Research Association, New Delhi • Central Polution Control Board, New Delhi • National Mineral Development Corporation Ltd, Hyderabad (NMDC) • India Explosives (Gomia), Bokaro

DBT New Delhi

HEIs (29)	NRLs (8)
• AIIMS, New Delhi • UoD, New Delhi • JNU, New Delhi • BHU, Banaras • Kyushu University, Japan • Indian Statistical Institute, Kolkata • IISc, Bangalore • Institute of Forest Genetics & Tree Breeding, Coimbatore • IIT, New Delhi • University of Kerala, Kerala • Tamil Nadu Agricultural University, Coimbatore • Aligarh Muslim University, Aligarh • Cochin University of Science & Technology, Kochi • Agharkar Research Institute, Pune • Guru Nanak Dev University, Amritsar • Pondicherry University, Puducherry • Madhav Institute of Technology & Science, Gwalior • G B Pant University of Agriculture & Technology, Pangtnagar • Madras Veterinary College, Chennai • Guru Jambheshwar University of Science & Technology, Hisar • Indian Institute of Horticultural Research, Bangalore • Karnataka Veterinary Animal & Fisheries Sciences University, Manglore • University Of Allahabad, Allahabad • International Institute of Bioechnololgy and Texicology, Kancheepuram • R B S College, Agra • Anand Agricultural University, Anand • Bannari Amman Institute of Technology, Sathyamangalam, Tamil Nadu • IIT, Guwahati • J.N.V.University, Jodhpur	• Rajiv Gandhi Centre for Biotechnology, Thiruvananthapuram • ICAR, New Delhi • CSIR, New Delhi • International Center For Genetic Engineering & Biotechnology, New Delhi • ICMR, New Delhi • Centre for Plant Molecular Biology, Coimbatore • National Centre for Cell Science, Pune • Central Institute of Brackishwater Aquaculture, Chennai

DRDO, New Delhi

HEIs (28)	NRLs (10)	Others (19)
• Anna University, Chennai • All India Institute of Medical Science, New Delhi • International Centre for Genetic Engineering and Biotechnology, New Delhi • IISc, Bangalore • Osmania University, Hyderabad • IIT Delhi • Defence Institute of Advance Technology, Pune • Naval Institute of Aeronautical Technology, Naval Base, Kochi • Sri Krishnadeveraya University Anantapur Andhra Pradesh • Jamia Hamdard, New Delhi • IIT Kanpur • Tezpur University, Tezpur • IIT Bombay • University of Delhi (DU), Delhi	• CSIR, New Delhi	• LNJP Hospital, New Delhi • Rbtb Hospital, New Delhi • Astra Microwave Products Ltd, Hyderabad • Ahmedabad Textile Industry's Research Association (ATIRA), Ahmedabad • Data Pattern (India) Pvt.Ltd., Chennai • Accord Software & Systems Pvt.Ltd., Bangalore • S.M. Creative Electronics Ltd., Haryana

IIT Chennai

HEIs (1)	NRLs (6)	Others (4)
• Madras Institute of Nephrology, Chennai	• Centre of Excellence in Wireless Technology, Chennai • ARCI, Hyderabad • CSIR, New Delhi • DIT, New Delhi • Shri Amm Murugappa Chettiar Research Center, Chennai • Centre for Fuel Cell Technology, Chennai	• Sundaram Medical Foundation, Chennai • Chetana Charitable Trust, Chennai • Coromandel Fertilizers, Secunderabad • Parry Agro Industries, Chennai

IISc., Bangalore

HEIs (2)	NRLs (5)	Others (3)
• IIT, Chennai • University of Colorado at Boulder, USA	• DRDO, New Delhi • DBT, New Delhi • National Centre for Cell Science, Pune • ISRO, Bangalore • CSIR, New Delhi	• Indian Immunologicals Ltd., Hyderabad • TVS Motor Company Limited, Chennai • Balmer Lawrie Ltd., Kolkata

IIT, New Delhi

HEIs (3)	**NRLs (3)**	**Others (3)**
• AIIMS, New Delhi • University of Delhi (DU), Delhi • Gujrat Agriculture University, Gujrat	• DST, New Delhi • DRDO, New Delhi • DBT, New Delhi	• Petroleum Conservation Research Association, New Delhi • Minda Corporation Limited, Noida • Indo French Centre for the Promotion of Advanced Research (IFCPAR), New Delhi

ICAR, New Delhi

HEIs (5)	**NRLs (1)**
• ISI, Kolkata • College of Agriculture (Junagadh Agricultural University), Gujarat • Maharana Pratap University of Agriculture and Technology, Udaipur • College of Technology & Engineering, Udaipur • Central Institute of Agricultural Engineering, Coimbatore	• DBT, New Delhi

IIT, Mumbai

Others* (5)
• Bigtec Private, Bangalore • Tata Consulting Engineers, Mumbai • Tata Consultancy Services, Mumbai • EMBIO Ltd., Mumbai • Tata Steel, Jamshedpur

IIT, Kanpur

NRLs (1)	Others (3)
• ISRO, Bangalore	• Jubilant Organosys Limited, Noida • Gas Authority of India • Samtel Color, New Delhi

ISRO, Bangalore

HEIs (2)	NRLs (1)
• Solapur University, Solapur • IISc, Bangalore	• C-MET, Kerala

REASONS FOR NON-WORKING OF PATENTS

As per the Indian Patent Act, 1970 if a patent is non-worked, the applicant or a patentee is liable to mention the appropriate reason for its non-working. DST-CPR has extracted all the reasons mentioned by the applicants. As per the Indian Patent Act, 1970 it is compulsory to file Form-27 once the patent is granted and the patentee has to fill all the sections asked in the form. One of the sections in Form 27 is ***"If not worked: reasons for not working and steps being taken for working of the invention".*** The reasons mentioned in the table below are written as it was mentioned by the patentee, DST-CPR has just standardized some of the reasons to group them to categories the reasons having same meaning but written differently. Every patentee has to file the statement of working/non-working patents every year for the patents which are in force or are being maintained by paying the annuity every year. These details they have furnished in the prescribed form known as Form-27 (http://www.ipindia.nic.in/writereaddata/Portal/IPOFormUpload/1_39_1/form-27.pdf). There is a section in Form-27 where the patentee or the applicant needs to mention the reason whether the patent is working or not if non-working where the cause behind the status and steps being taken to make it worked and if worked what is the quantum and value of the patented product and licenses and sublicenses granted during the year etc. During the data extraction, it was found that most of the patentees have mentioned similar reasons throughout the years. Some of the

patentees have given inadequate and common reasons such as ‘efforts made for commercialization but unsuccessful, discussion in progress, looking for potential buyers, advertised in the newspaper for dissemination, lab-scale work, future R&D required, etc. A large chunk of patentee did not even mention any reason in the form. As per the Indian patent rules, it is a punishable crime. As per the rules if such information is not furnished by the patentee in the form he can be awarded with fine and 6 years imprisonment. The year-wise details of all the reasons mentioned are depicted in the figure given below. The reasons which stand out differently and the government should look upon to resolve issues patentees facing during licensing technology. Some of such special reasons are mentioned in the further section of the report.

During the data extraction, the reasons for not working of the patent mentioned by the applicants were extracted individually by opening Form-27 one by one for each patent. The mentioned reasons were then standardized because either most of the patentees failed to furnish the information in the form and submitted without mentioning full details regarding the working/non-working status of the patents or the applicants mentioned the similar reasons by tweaking the language of the reason. So it is not practicable to mention all the reasons mentioned by the applicants. Moreover, some applicants such as DRDO, New Delhi and IIT, Bombay had mentioned similar reasons throughout the years for the non-working of the patents. The table is given below (Table 11) shows the percentage of the patents for which the common reasons were mentioned. The percentage has been calculated concerning the number of non-working (Figure 41) patent in the respective year.

The reasons which stand out differently and the government should look upon to resolve issues patentees facing during licensing technology are such as ‘awaiting approval -transgenic material is being cleared by GEAC’, ‘Govt. not taken any decision on the release of GM crops’, ‘the patent is not under any commercial utilization because of some internal company policy’, ‘HCV animal model is not available in India, which is the major hindrance for testing in an animal before commercialization’, etc. But the major reasons mentioned in the form are mentioned below in the graph:

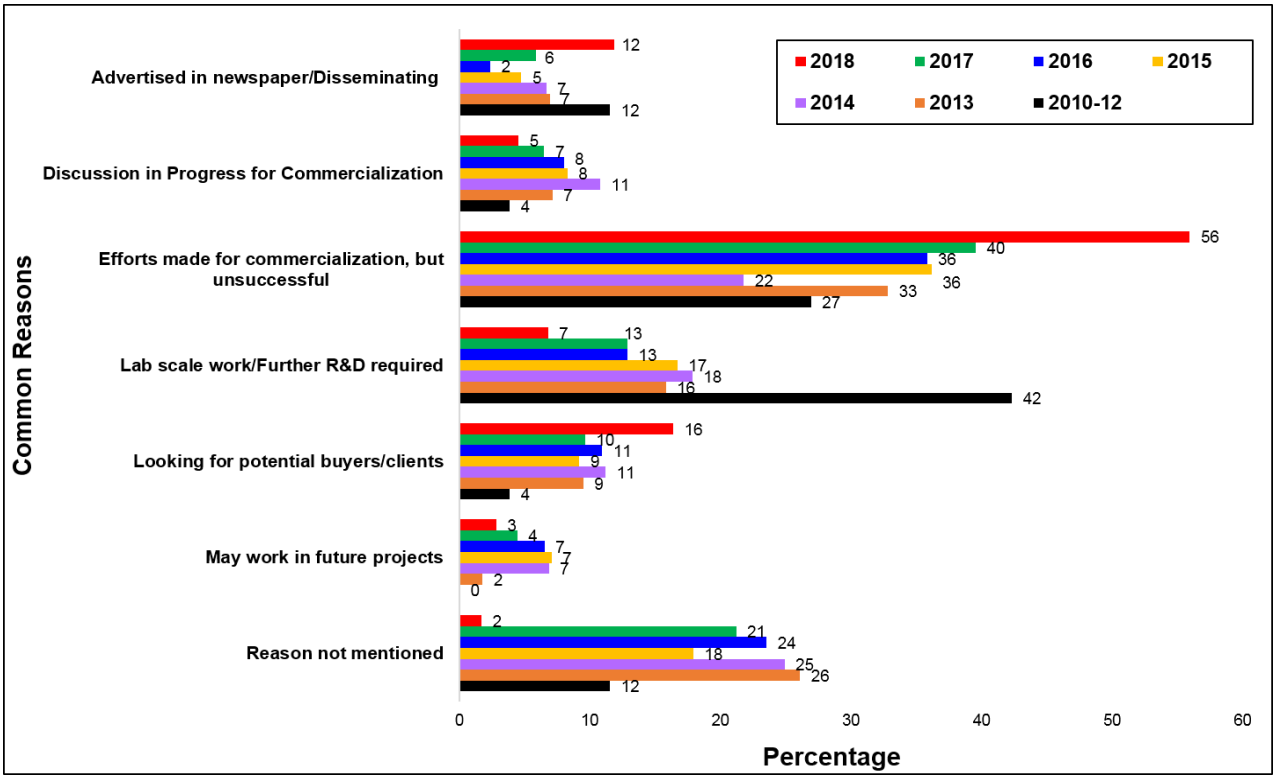


Figure 41: Reasons Mentioned for Not-Working (825)

The Patents (1961) are granted to only 186 institutions out of which 41% are NRLs, 34% are HEIs and 21% is credited to others comprising of industries, Public Sector Undertakings (PSU), trusts, boards, corporation, hospitals, etc. The trend depicted in figure 7 shows that, in 2010, a total of 473 patients were 'In Force' (active patents). Out of 473 patents, the working/non-working statement in Form-27 was filed only for 19 patents and of these 19 patents, only 7 patents were working. Till 2012 the statistics indicate the increase in the number of patents 'In force' whereas, the patents for which the Form-27 was filed was almost stagnant. The word 'In force' means the patent is active, either the applicant is paying the annuity (renewal fee) for the patent in order to maintain it or the patents which were granted in that particular year.

Before 2012 the Form-27 was filed for very limited patents, resultant the number of working/non-working patents are also low. Post 2013 the statistics are depicting consistent increase for all the indicators namely 'patents in force for the respective years (black line), the number of patents for which the Form-27 was filed (purple line), the patents for which the form-27 was not filed (blue line), patents marked as 'worked' by the patentee (green) and the patents marked as non-worked (red) in the respective year. The dip in the patents for every indicator was

observed in 2018 (the Form-27 was filed in March 2018 for the patents which were in force in 2017). The current section has focused on the patents marked as non-worked and reasons mentioned for their non-working.

Table 11: Percentage (%) of patents for which common reasons were mentioned in Form-27

Reasons Mentioned	2012	2013	2014	2015	2016	2017	2018
Efforts made for commercialization, but unsuccessful	29	32	21	35	33	36	55
Looking for potential buyers/clients	4	9	11	9	10	9	16
Advertised in newspaper/disseminating	13	7	6	5	2	5	12
Lab scale work/Further R&D required	46	16	17	16	12	12	7
Discussion in progress for commercialization	4	7	10	8	7	6	4
May work in future projects	0	2	7	7	6	4	3
No reason mentioned in Form-27	13	26	24	17	22	19	2

The reasons mentioned by the patentee were collected individually for the patents marked as non-working and were standardized afterwards because most of the reasons cited meant the same thing but with different words. During the exercise, it was also noticed that most of the patentees were reluctant to mention any reason for non-working in the form. In 2012, for 13% patents, the form was submitted without mentioning any reason which can be attributed to the fact that before 2013 the filing rate of the Form-27 was low, whereas, in 2013, 26% of patents were filed without any reason which is the maximum in the 7 years considered for the study. As depicted in figure 41 in the year 2013 the patents for which the form was filed had also increased drastically (602) which were only 29 in 2012. It was also observed that the maximum patentees had cited the common reason i.e. *"Efforts made for commercialization, but unsuccessful"* for the non-working status. In the year 2018, for 55% patents, the efforts were being made to license them by the patentees. Either the patentees were in the process of negotiation with the interested party or despite efforts any queries were not being received for licensing it. Although, as per the data, some of the patentees are making efforts for disseminating the technology through advertising either in the newspaper or through their respective official websites. Some of the patentees had cited the reason like *'A customized version is being used of this technology or better technology*

available in the market', 'Lack of marketing support', 'Large scale production in progress', 'No availability of facilities, 'Awaiting approval-transgenic material is being cleared by Genetic Engineering Appraisal Committee (GEAC)', 'Strategic importance, 'Department of Atomic Energy (DAE) contacted', etc. Such reasons need to be looked upon and appropriate steps should be taken by the govt. or concerning organizations to resolve them. Moreover, the industries can access easily Form-27 on the official website of the Indian Patent Office. Any interested party for the licensing can access all the patents from the same so it is high time that every patentee should take this seriously and should mention the genuine and precise reason for non-working status of the patent so that the relevant licensor/company can approach them and act upon accordingly. Although, there were some patents for which the exceptional reasons were mentioned by the applicants. These cases are discussed in the further section of the paper.

Special Cases

Additionally, there were some special cases, where, some genuine reasons have been mentioned by the patentee. These reasons need to be addressed and should be resolved for the welfare of society.

1. Industry signed a Non-disclosure Agreement (NDA) with IISc. Bangalore, for licensing of the patent. However, due to non-availability of marketing chain in rural areas, Industry did not peruse the matter. The patent is currently being considered to be taken up for the development of production prototype under the DIC programme at the department.
2. The inventor does not have the requisite experience as well as access to specialised instruments for further research, as asked by the Industry.
3. Awaiting approval -transgenic material is being cleared by the Genetic Engineering Appraisal Committee
4. Better technologies already existing in the market.
5. Genetically modified (GM) crops related - Govt. not taken any decision on the release of GM crops.
6. Hepatitis-C Virus (HCV) animal model is not available in India, which is the major hindrance for testing in an animal before commercialization. We have now managed funds from Department of Biotechnology (DBT) for testing the antiviral efficacy of the above antiviral agent in HCV mice model in Japan (PXB-Bio). Accordingly, we have signed MoU (through our IP cell) with the company and are in progress of sending the material to them

for testing in their assay system. Results will definitely increase the possibility of commercialization.

7. The patent is about biosynthetic colour. The patented product is more expensive than the existing chemically prepared product in the market.
8. The patent was filed along with Reliance, however, now they are not interested
9. Large scale production in progress.
10. Kala-azar (leishmanias) IS A POOR MAN's DISEASE and affects the population in Bihar and other economically deprived areas of the country. Companies are hesitant to license my patent due to this reason.
11. The Claims of the Patent relate to loaded mode 2&3 wheeler for use vehicle testing. Present regulations in India do not address enforcement of methodology as claimed in the Patent. As the IC engine technology matures in India, it is expected that the methodology as claimed will be implemented.

RECOMMENDATIONS

After USA and China, India has the third-largest education system in the world. As per University Grant Commission (UGC-as on July 2020-https://www.ugc.ac.in/oldpdf/Consolidated%20list%20of%20All%20Universities.pdf), there are 950 universities in India pertaining to state universities (412), deemed to be universities (124), central universities (53) and private universities (361). There are around 100 institutions of national importance. As per international studies like Scimago, WIPO and IPRI Report Indian higher education institution are leading in the parameter of research publications but lagging in patents filing. The important matter of concern is the ratio of patents being filed in Indian patent offices by residents and non-residents, which is 33% and 67% respectively. Whereas, it is opposite in other counterparts of India such as China, USA, S. Korea Japan, etc. Further, if we talk about the commercialization of the patent or technologies from academia the percentage is very low. The translational research ecosystem in Indian higher education institutions is abysmal which can be attributed to some voids in governmental and institutional level policies, low technology readiness level and awareness about IPR. Considering the above-mentioned parameters DST-Centre for Policy Research at Panjab University conducted 2 studies first one based on research publications and patents granted to the higher education institutions and

national research labs. In which the centre identified the leading institutions in both parameters and mechanisms of these institutions which can be adopted by other institutions in India (https://dst.gov.in/sites/default/files/FULL%20BOOK-Chandigarh.pdf). The recommendations drawn out of the study have already been submitted to DST, New Delhi. On the recommendation of the 'Advisory Committee', the second study was conducted based on the working/non-working profile of patents granted to the same institutions considered for the previous study.

The study emphasizes that patenting of research is being recognized as a more lucrative option by academic institutions, however, the trajectory of growth still is picking up momentum at a slower pace. It may be remarked that, there is an urgent need for a shift in the mindset of the academic fraternity, from publication towards patenting. Further, even the institutes performing reasonably well in getting patents granted, are not able to commercialize or take full benefits of the patents. There is still a dearth of IPR awareness, which is a crucial attribute to graduate from publication to patenting. The institutes need established dedicated IPR cells and should educate researchers/ students about the proper channel to follow for filing a patent and its commercialization.

Over the last couple of decades, there has been a rising trend towards employing fundamental academic research to develop commercialization worthy innovations. Universities, apart from their traditional roles, are also taking up an entrepreneurial role in order to contribute to the national economy. One of the crucial factors in academic IP commercialization is the formulation of a policy framework that facilitates the transfer of academic know-how to the industry, thus promoting its optimal exploitation. These reforms in some way must also encourage the development of institutional instruments such as IP cell (and Policy), technology transfer offices (and policy) and incubators to promote protection and commercialization of research in academic institutions. This is also reflected through the National IPR Policy, released by the Government of India in 2016, which includes an objective to promote IP as a viable commercial asset. After the analysis, the following are the recommendations to enhance the translational research ecosystem and commercialization of patents in higher education institutes in India:

The compulsory license should be practised on a serious mode. Defined as 'authorizations permitting a third party to make, use, or sell a patented invention without the patent owner's

consent if it is not commercialized after the 3 years of its grant', the significance of compulsory licensing should be promoted among SMEs and generic drug-making companies.

Compulsory Licensing

Compulsory licenses are generally defined as "authorizations permitting a third party to make, use, or sell a patented invention without the patent owner's consent if it is not commercialized after the 3 years of its grant. Under the Patent Act, 1970 of India the provisions of 'Compulsory License' are specifically given under Chapter XVI, and the conditions which need to be fulfilled are given in Sections 84-92 of the Act. In 2012, India granted first compulsory license to a Hyderabad based drug maker firm NATCO. This was a landmark decision in the history of the Indian patent regime. Delhi High Court gave the decision in the favour of NATCO to make and sell a similar version of an advanced kidney cancer drug by Bayer's Nexavar. The Judge imposed a condition on the NATCO Company to pay Bayer 6% royalty of net sales, every quarter. It was observed that, after this case, Indian applicants took the case seriously and came out to furnish the information in the Form-27 as evident from the current study that filing of the Form-27 increased abruptly post the year 2012 (Figure 1). This can be an important aspect for enhancing the technology commercialization ecosystem in India. There are so many patents which are being maintained by paying huge annuity for the sake of reputation but they are not commercialized. This attitude needs to be taken serious and compulsory licensing should be popularized.

India is a low-income country therefore it has fertile ground for the patents licensing and compulsory licensing. The technological proficiency of India needs to be addressed and India should be characterized more appropriately as a 'technologically proficient developing country' as opposed to a mere developing country. This information can be supported by the fact that, in the year 1992-93, the number of patents applications filed in India by foreign applicants was more as compared to the Indian resident applicants whereas, In the year 2001-2002 the reverse trend was observed. India may have more of a technological base today to make licensing and compulsory licensing more feasible. The issues like food, medical, education, etc. can be

addressed through the patents licensing and compulsory licensing. The Indian patents and technologies are being acquired by foreign markets and this scenario is not in the favour of the technological and economic development of India. The stakeholder like funding agencies from the state and central governments, education and research intuitions need to work in collaboration moreover students/researchers needs to be encouraged and educated to participate more in research and further to exploit the research for the societal and economic development of the country.

A clause may be added in the Form-27 to ask patentee about specific requirements and potential industry which can take up that patent. Like the provision provided by WIPO for PCT applications wherein an Applicant can highlight his interest in concluding licensing agreements, From-27 can also include an option wherein the patentee can mark their patent for licensing or any specific requirement they are looking for, in order to commercialise their patent. Similarly, USPTO also provides the Applicants with an option to put their patents for sale or license.

CGPDTM should establish a dedicated cell to look after Form-27 filing issues. Considering the ambiguities revolving around information to be filled in Form-27, the Indian Patent office can set up a dedicated cell which can address such queries. Further, the patent office can issue Guidelines for filling Form-27 and can put answers to frequently asked questions (FAQs) on their website.

Reasons for not commercialisation of patents as mentioned in the Form-27 should be looked into. The patentee should have the option to categorise reasons for not working, like the reasons beyond the control of patentees, such as awaiting government clearance or regulatory issues. These reasons can then be looked into by a dedicated cell.

The information provided in Form-27 should be easily accessible and searchable on the Patent Office website.

Patents and Technology fair should be organised to increase patent commercialization ecosystem, national and state wise. Patent and technology fairs wherein all the stakeholders working in the field of patents can come together in order to display their success stories and discuss their challenges so as to promote the culture of IP, such as *Patent Information Fair & Conference* held in Japan (https://pifc.jp/2019/eng/).

Incentivisation of individuals to successfully execute technology commercialisation (BIRAC Model, Gandhian Young Technological Innovation - SRISTI Awards). Similar to the National IP Awards, each institution must incentivize its teaching faculty/research scholars who have generated patents/technologies (through cash award, salary-hike, financial assistance for visits to national/international events and so on) so as to boost them and assist them in taking steps towards commercialization of their patents.

Creation of a 'National Patent Web Portal' to disseminate existing technologies. In India, organizations such as CSIR, ICMR, and ICAR etc. have independent IP/Technology web portals which have to be scanned individually by a scientist/industry personal, when searching for a particular patent/ technology information, thus making the process very laborious. In this regard, a national level web-portal may be designed, which mentions all the patents (current and expired) and technologies developed by Indian scientists.

Collaborative Programmes by Ministries: IPR and Education are the integral parts responsible for the development of a nation. Ministries like Ministry of Higher Education, Ministry of Science & Technology and DPIIT should work in collaboration so that education and innovation go parallel. These govt. funding bodies can initiate collaborative schemes or programmes to promote science, technology and innovation in the educational institutions.

Creation of an 'Indian Patent Trust System' to deal with ceased or lapsed patents and Non-working patents. A patented invention should not go unworked just because the patentee does not have the knowledge or lacks financial resources to exploit his invention commercially. In order to fill this gap, the patentee should be able to entrust their patent to a specialized agency for its management, utilization, technology transfer or disposal as is practised in S. Korea *through a* specialised agency (Patent Trust System, PTS). *(http://nopr.niscair.res.in/bitstream/123456789/34014/1/JIPR%2021%281%29%2027-37.pdf).*

Introduce 'Patent-Insurance Scheme' to facilitate patentee. Patent insurance, during the process of licensing or commercialization, adds credibility to the patent, since it's issued by the insuring company after a detailed investigation of its claims and value. It also equips the patentee in case of patent infringement. It is especially important for developing countries like India, where there are many small and emerging SMEs. The same is prevalent in USA and some European countries (including UK, Germany, Denmark, Sweden and Finland). China also started (2012) issuing patent insurance products.

National research organisations, MHRD (AICTE and UGC) should have dedicated patent/technology commercialisation cells. In national research laboratories, the cost of filing and maintenance of a patent is borne by the respective organizations. However, MHRD does not offer such facility to researchers from the universities and academicians have to depend on the policy of their university, whether it has set aside funds for patent filing and maintenance or not. In order to promote IP activity in institutes of higher education, it is suggested that MHRD may create 'IP Fund' which could be used for IP related activities of the universities, which will also make the universities less dependent on the central government for financial assistance.

Additional Recommendations by 'Advisory Committee' of DST-CPR for IP

1. The Professors/scientists should be encouraged to promote entrepreneurship as it is clear from the feedback many companies are not taking any further interest after showing initial interest
2. The startup companies may be involved in the commercialization of the patents, there is a need for an effective mechanism for this.
3. There should be revenue sharing propositions between the intuitions/universities and Professors /scientists so that these scientist/professors will also try to coordinate with prospective clients and further motivate them for further research.
4. Now the focus of research should be industry-oriented considering the market demands or problem faced by the government in their health mission or to develop high-end technology rather than usual routine research.
5. The institutions should pool their patents together technology-wise and put up on their website for sale/licensing or even for Patent auctions and invite the potential buyers.
6. Last but not the least these institutions/universities should have technology Transfer Offices (TTO) who will coordinate with industry or other potential buyers for commercialization.

DISCUSSION AND CONCLUSION

To study the PAN India ecosystem of patents commercialization, the institutions considered for the study are state universities, central universities, deemed to be universities, private universities, autonomous institutes and national research institutes/labs. The research reveals that the patentees are reluctant for furnishing the information regarding working and non-working of

the patents inspite of being a punishable offence. The patentees are hesitant to reveal the details in the public domain that's why some of the patentees are submitting the form without filling the important information.

For the enhancement of patents commercialization ecosystem in India, stakeholders need to work in tandem. The academic sector is rich in knowledge but acquiring limited funds whereas, the industrial sector doesn't have financial constraints but lack in knowledge and time for conducting R&D.

The Govt. plays a crucial role by introducing, implementing and monitoring the policies to enhance commercialization ecosystem. There is a need for synchronization between these three entities (Govt., industrial sector, academic sector) as they are working in silos. Moreover, Govt. can incentivize institutions for researching in collaboration mode.

It is also recommended that a dedicated mediator can play a crucial role to bridge the gap between the knowledge creator (academia) and knowledge exploiter (industry). That mediator should have knowledge, experience and exposure of work culture, environment and processing of industries as well as research/academic institutions.

The second measure needs to be taken is to have a serious look upon the reasons mentioned by the patentee. The reasons should be reviewed in detail and action should be taken to resolve them. The pendency will affect the process of licensing too. The task can be assigned to the existing govt. agencies such as Cell for IPR Promotion and Management (CIPAM), National Research Development Corporation (NRDC), Technology Information, Forecasting and Assessment Council (TIFAC), etc. or a special body may be established to look after the issues related to Form-27 and resolving for the issues related to non-working of patents.

The IP rights are granted in return of the sharing the details in the public domain and the right holder has to assure the commercial exploitation of patented IP. The HEIs and NRLs are major chunks of patents and technologies generation. A researcher devotes a lot of efforts and time to reach until the grant of the patent since the inception of the idea conceived. The process is time-consuming and an expensive affair so the researcher should be rewarded for his hard work and dedication. So Patents and technologies generated at HEIs and NRLs should be disseminated by putting the details on the respective websites, flyers, conferences, seminars, technology fairs, etc.

The measures need to be taken for popularizing the licensing through organizing patents and technology fairs, conducting workshops in HEIs in collaborations with the industries. Collaborative research, contract research/sponsored research can play a crucial role in the enhancement of patents licensing. Universities can establish dedicated cells to take care of activities related to sponsored research. The involvement of the cell should start from the inception of the project, submission, management, budget, negotiation with funding organization, recruitment, etc. These cells can work in collaboration with technology transfer/IPR cells of the university. A most suitable example of such kind of initiatives can be witnessed in first-generation IITs such as Kharagpur, Madras, Delhi, Roorkee, Bombay, etc. These institutions can act as role models for the other HEIs in India as these institutes are leading in patents generation and commercialization. Recently IIT, Bombay has received 'National Intellectual Property Award', 2019 under the category of 'Top Academic Institution for Patents and Commercialization' given by Department for Promotion of Industry and Internal Trade (DPIIT), Ministry of Commerce and Industry, Government of India. These institutions also have established close linkages with the industries for knowledge creation and technology development, to identify new and emerging areas, to address real-time problems, for impactful quality of research and to design the curriculum as per the industry perspective.

Govt. of India also has floated some good schemes, which can be availed on the individual or institutional level by the researchers, scientists or faculty members. The most outstanding example of the scheme on the involvement of industries in research activities is 'Patent Acquisition and Collaborative Research & Technology Development' (PACE) by DSIR. This scheme started to support 'Make in India' products on an exclusive and non-exclusive basis. The scheme facilitates the early-stage acquisition of technologies from academic institutions, research institutions, industries from any part of India and abroad. Moreover, to facilitate the public-private partnership and bridge the gap between industry and academia, the scheme also aim to develop a database of existing patents and expertise. Industries can avail the benefits floated by the DSIR through this scheme on exclusive, non-exclusive mode, co-development mode, or undertaking the technology advancement projects. The project categories and benefits have been classified based upon the mode of technology/patent acquisition by the industry.

Biotechnology Industry Research Assistance Council (BIRAC) has also introduced a scheme for academia with a similar name and alike mandates. The scheme mainly has two components i.e. Academic Innovation Research for promoting the development of Proof-of-concept for a process/product by academia with or without the involvement of industry and Contract Research Scheme for the validation of a process/prototype developed by the academia. To avail, the benefits under both aforesaid components the institutes like Public or Private Institute, University, NGO, or Research Foundation, should have proper accreditation and registration from a government body.

Mention of Bayh-Dole Act finds always a place when it comes to the debate on the patent generation and commercialization in the education institutes. This Act is in force in USA and have a great impact on the universities and encourages them to get involved in patenting the research and licensing afterwards. The patents generation have increased in universities about 500% since 1980 when the Act came into practice in the USA and this Act had an impact on the contract and collaborative research as well. It is the fact that every nation has different legislation but such kind of Acts or its equivalents needs to be implemented in India too.

It is also suggested that some crucial initiatives need to be taken on the institutions level such as every institution should have dedicated IPR policy with proper guidelines on revenue sharing in case of patent/technology transfer, guidance for patent/technology management procedures, clarity on ownership criteria, transparency in the decision-making process, etc. This initiative will encourage the researchers more to get involved in active research and they will get their due amount for their hard work and efforts they have rendered in.

Recently CIPAM has created a draft on 'MODEL GUIDELINES ON IMPLEMENTATION OF IPR POLICY FOR ACADEMIC INSTITUTIONS' with the prominent objectives like protecting IP rights generated by faculty and students of the academic institution, laying down the fair and transparent administrative process for ownership control, and sharing of IP generated revenues, promoting collaborations between academia and industry, and establishment of an IP cell for supporting the innovation of students, research scholars, and faculty members. Effective networking between institutions and regional/national IPR agencies may be a crucial aspect of the enhancement of IP generation and commercialization.

Higher education institutes and universities can team up with the local 'Patent Information Centres' (PICs), which have been established by Technology Information and Forecasting Council (TIFAC) (GoI) in 20 states. IP commercialization can play a crucial role in strengthening the innovative capacity of MSMEs. The weak implementation of IPR legislation also impacts the innovation-driven micro and small scale (MSMEs) industries, whereas, MSMEs are the most crucial pillar of the commercialization aspect of the patent/technologies.

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APPENDIX

S. No.	Applicant	Total Patents Granted	Parent Organization/ Status	Working Patents
1.	Astra Microwave Products, Hyderabad	1	Industry	1
2.	Chetana Charitable Trust, Chennai	1	Trust	1
3.	Coromandel Fertilizers, Secunderabad	1	Industry	1
4.	EID Parry, Chennai	1	Industry	1
5.	Exide Industries, Kolkata	1	Industry	1
6.	Parry Agro Industries, Chennai	1	Industry	1
7.	Vidya Sagar (Individual Person)	1	Individual	1
8.	Anand Agricultural University, Anand	1	ICAR	1
9.	Banasthali Vidyapith, Rajasthan	1	Deemed to be University	1
10.	National Bureau of Agriculturally Important Insects, Bangalore	1	ICAR	1
11.	Shri AMM Murugappa Chettiar Research Center, Chennai	1	SIRO	1
12.	Sree Chitra Tirunal Institute for Medical Sciences and Technology, Thiruvananthapuram	1	DST	1
13.	Central Institute of Brackishwater Aquaculture, Chennai	1	ICAR	1
14.	Institute of Chemical Technology, Mumbai	1	Deemed University	0
15.	Ministry of New and Renewable Energy of India, New Delhi	1	Ministry	0
16.	Forest Research Institute (Indian Council of Forestry Research and Education), Dehradoon	1	Deemed University	0
17.	National Sugar Institute, Kanpur	1	Ministry of Consumer Affairs Food and Public Distribution	0
18.	Balmer Lawrie Ltd., Kolkata	1	Industry	0
19.	Bigtec Private, Bangalore	1	Industry	0

20.	Bio Balance, Inc., New York	1	Industry	0
21.	Dabur India Ltd., Ghaziabad	1	Industry	0
22.	Embio Ltd., Maharashtra	1	Industry	0
23.	Engineers India Limited, New Delhi	1	PSU	0
24.	Excel Crop Care, Mumbai	1	Industry	0
25.	Gas Authority of India (Now Known As Gail (India) Limited), New Delhi	1	PSU (Ministry of Petroleum and Natural Gas)	0
26.	Indian Immunologicals Ltd., Hyderabad	1	Industry	0
27.	Jubilant Organosys, Noida	1	Industry	0
28.	Koinoline Electronics Pvt. Ltd., Ahmedabad	1	Industry	0
29.	M.J. Biopharma Private Limited, Mumbai	1	Industry	0
30.	Millennium Rubber Technologies Pvt. Ltd., Thrissur	1	Industry	0
31.	Minda Corporation Limited, Gurugram	1	Industry	0
32.	Mir Holistics Private, Kochi	1	Industry	0
33.	Nicholas Piramal India, Mumbai	1	Industry	0
34.	Steel Authority of India, New Delhi	1	Ministry of Steel	0
35.	Sundaram Medical Foundation, Chennai	1	Not-for-Profit Hospital	0
36.	Tata Consultancy Services, Mumbai	1	Industry	0
37.	Tata Consulting Engineers, Navi Mumbai	1	Industry	0
38.	Tata Energy Research Institute, New Delhi	1	Private Research Institute	0
39.	Tata Steel Ltd, Mumbai	1	Industry	0
40.	TVS Motor, Chennai	1	Industry	0
41.	UPL Limited, Maharashtra	1	Industry	0
42.	USV Private Limited, Mumbai	1	Industry	0
43.	Amrita Vishwa Vidyapeetham, Ettimadai	1	Deemed to be University	0
44.	Anna University, Chennai	1	SU	0
45.	Annamalai University, Chidambaram	1	SU	0
46.	Assam Agricultural University, Jorhat	1	ICAR	0

47.	Bannari Amman Institute of Technology, Sathyamangalam	1	SIRO	0
48.	Department of Plant Protection, Faculty of Agricultural Sciences, Aligarh Muslim University, Aligarh	1	CU	0
49.	Guru Nanak Dev University, Amritsar	1	SU	0
50.	Indian Institute of Carpet Technology, Bhadohi (UP)	1	Ministry of Textiles (But Now Affiliated to U.P. Technical University I.E. SU)	0
51.	Indian Institute of Information Technology, Allahabad	1	MHRD (INI)	0
52.	Jaypee University of Information Technology, Solan	1	Private State University	0
53.	Karnataka Veterinary Animal & Fisheries Sciences University, Bidar	1	State University	0
54.	Madhav Institute of Technology & Science, Gwalior	1	State University	0
55.	Madras Veterinary College, Chennai	1	State Institute	0
56.	Manipal Institute of Technology, Manipal	1	Deemed to be University	0
57.	Manipal University, Manipal (Now Manipal Academy of Higher Education)	1	Deemed University	0
58.	Pondicherry University, Pondicherry	1	Central University	0
59.	PSG College of Technology, Coimbatore (Affiliated To Anna University I.E. SU)	1	Private Engineering College	0
60.	Punjabi University, Patiala	1	State University	0
61.	R B S College, Agra	1	SIRO	0
62.	Ramaiah Institute of Technology, Bengaluru (Affiliated To Visvesvaraya Technological University I.E. SU)	1	Private Engineering College	0
63.	Raman College of Engineering, Bhubaneswar	1	SIRO	0
64.	Sant Longowal Institute of Engineering & Technology, Longowal	1	Deemed University	0
65.	Sharad Pawar College of Pharmacy, Nagpur (Affiliated To Rashtrasant Tukadoji Maharaj Nagpur University I.E SU)	1	AICTE Approve Pharmacy College	0
66.	Tamil Nadu Veterinary & Animal Sciences University, Chennai	1	ICAR	0
67.	University of Kerala, Thiruvananthapuram	1	Central University	0

68.	University of Mysore, Mysuru	1	State University	0
69.	University of Pune, Pune (Now Savitribai Phule Pune University)	1	State University	0
70.	Veer Narmand South Gujarat University, Surat	1	State University	0
71.	Vellore Institute of Technology, Vellore	1	Deemed University	0
72.	Visvesvaraya National Institute of Technology, Nagpur	1	INI	0
73.	C C Shroff Research Institute, Kachchh	1	SIRO	0
74.	Central Council For Research Ayurveda & Siddha, New Delhi	1	MoAYUSH	0
75.	Central Manufacturing Technology Institute, Bengaluru	1	Ministry of Commerce and Industry	0
76.	Central Muga Eri Research & Training Institute, Jorhat	1	Ministry of Textiles	0
77.	Centre for Plant Molecular Biology, Tamil Nadu	1	DBT	0
78.	Indian Plywood Industries Research & Training Institute, SAS Nagar	1	Ministry of Environment Forests and Climate Change	0
79.	Indo French Centre for the Promotion of Advanced Research, New Delhi	1	DST	0
80.	Institute of Advanced Study in Science & Technology, Guwahati	1	DST	0
81.	Institute of Pesticide Formulation Technology, Gurgaon, Haryana	1	Ministry of Chemicals and Fertilizers	0
82.	International Center For Genetic & Biotechnology	1	UNIDO	0
83.	International Institute of Biotechnology and Toxicology, Kancheepuram	1	SIRO	0
84.	Life Sciences Research Board, Delhi	1	DRDO	0
85.	National Aids Research Institute, Pune	1	ICMR	0
86.	National Chemical Laboratory, Pune	1	CSIR	0
87.	National Council for Cement & Building Materials, Faridabad	1	Ministry of Commerce And Industry	0
88.	National Institute of Advanced Industrial Science & Technology, Japan (Collaboration With IIT-Delhi)	1	International (Japan)	0
89.	National Metallurgical Laboratory, Jamshedpur	1	CSIR	0

90.	Northern India Textile Research Association, Ghaziabad	1	Ministry of Textiles	0
91.	Patel Pharmaceutical Education & Research Development Centre, Ahmedabad	1	SIRO	0
92.	Dabur Research Foundation, Ghaziabad	1	SIRO	0
93.	Delhi Institute of Pharmaceutical Sciences & Research, New Delhi	1	Affiliated to State University	0
94.	Upasi Tea Research Foundation, Coimbatore	1	Department of Commerce, Ministry of Commerce and Industry	0

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