

**A STUDY OF PATENT FILING TRENDS AND ITS IMPACT ON  
SELECT ENGINEERING UNITS IN PUNE REGION  
BEFORE & AFTER 2005**

**A Thesis**

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## **Tilak Maharashtra Vidyapeeth, Pune**

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## **List of Abbreviations**

CGPDTM	Controller General of Patents, Designs & Trade Marks
CPC	Cooperative Patent Classification
DST	Department of Science and Technology
FDI	Foreign Direct Investment
GDP	Gross domestic product
GI	Geographical Indication
IC	Integrated Circuit
IP	Intellectual Property
IPC	International Patent Classification
IPM	Intellectual Property Management
IPO	Indian Patent Office
IPR	Intellectual Property Right
ISA	International Searching Authority
IT	Information Technology
HBN	Honey Bee Network
JPO	Japan Patent Office
L&G	Liberalization & Globalization
LPG	Liberalization Privatisation Globalization
MCCIA	Mahratta Chamber of Commerce Industries & Agriculture
MNCs	Multi-National Companies
MSME	Ministry of Micro, Small and Medium Enterprises
NIF	National Innovation Foundation
NRDC	National Research Development Corporation
PCRA	Petroleum Conservation Research Association
PCT	Patent Cooperation Treaty
SAIL	Steel Authority of India Limited
SIPP	Startups Intellectual Property Protection
SME	Small and Medium Enterprises
TIFAC	Technology Information, Forecasting and Assessment Council
TRIPS	The Agreement on Trade-Related Aspects of Intellectual Property Rights
TRIZ	Theory of Inventive Problem Solving
UEES	Unidyne Energy Environment Systems Pvt. Ltd.
USPTO	United States Patent and Trademark Office's
WIPO	World Intellectual Property Organization
WTO	World Trade Organization

## **Preface / Forward**

A patent is an exclusive right granted by a government to an applicant or assignee for a limited period. This is granted in exchange for detailed public disclosure of an invention. With the advancement of a knowledge economy, a patent, given its five limited rights to create, practice, trade, proposal to trade, and import has grown from an infringement monitoring into an effective mechanism of industrial power. The patent system has been established by legal statutes worldwide for coherences, its shield, and commercialization in all jurisdictions.

As an indication of technological invention, patent databases of different countries and WIPO patent database are the largest knowledge source, providing a great foundation of technological advancements for analysis and exploitation, legal and commercial intelligence. MNCs, Companies, SMEs could employ such intelligence to derive their business plan. WIPO reported that the patent filing rate is growing exponentially on a global scale. The driving force behind the patent race is a systematically done R&D activity. The patent law across the world is undergoing rapid changes, creating uncertainty. This makes the company to file multiple patents according to market needs to cope up with changing legal system. Pharma Industry has flourished and benefited from the IPR system worldwide. In this study, we are trying to understand the engineering sector patenting activity in India by focusing on select engineering units in Pune region; this study is an effort to address this gap.

### **Layout of thesis**

The objectives of this study were to see whether patenting trend has affected Engineering Units in Pune and to study its impact regarding R & D activities.

This thesis is presented in five chapters.

**Chapter 1** provides background of the research study, basic information about the patent, the use of the patent in engineering units / SMEs, and need and significance of the study. It also describes in general about IPR and details about Indian patent system and its procedure, patenting criteria, different patent databases, PCT facility for patent filing and its advantage.

**Chapter 2** presents a review of the literature on the progress of patenting activities, the driving forces. The relevant literature is grouped in the broad headings such as Information about Patent; Patent office procedures; Training; Certification in Intellectual Property Rights (IPR); Patent Tools; Software used for Patent Analysis; role of IPR in Economic development; Patent valuation; Government Initiatives; Patent and SMEs; Patent trends and its applications in industry.

**Chapter 3** presents the statement defining the problem, research questions, hypothesis and describes the proposed outline for the study. Based on the nature of research questions the research design is presented. It explains the primary and secondary data collection.

**Chapter 4** describes the data collected and its statistical analysis in support of the hypothesis and input from secondary data.

**Chapter 5** integrates the results and discussions, and answers the research questions and draws implications. It summarizes briefly the work done, the major findings of the study, limitations of the present study and scope of future research work.

### **Keywords**

Patent, Patent trend, Engineering, Mechanical

## **Abstract**

The research study titled: “A study of Patent filing trends and its impact on select engineering units in Pune region before & after 2005”, focuses on the overall patenting activities in engineering domain at Indian Patent Office (IPO) and patenting activities of engineering companies in the Pune region at IPO.

The Indian economy had experienced major policy changes from the year 1990 onwards. The new economic reforms, popularly known as Globalization, aimed at making the Indian economy as the fastest growing economy and globally competitive were introduced. The biggest effect of globalization is free flow of capital and technology by MNCs to capture the different markets in the world.

A patent is an exclusive right granted by a government to an applicant or assignee for a limited period. This is granted in exchange for detailed public disclosure of an invention. Patents, also act as a driving force between R&D efforts by company and the market. This patented invention can be practiced by the owner or by interested companies by way of getting licence from the patent owner. In this way it generates competition and business opportunities in the market.

According to WIPO statistics database of 2013, a large number of patent applications filed in India are by foreign companies. There is an average 5% increase in the patent application every year from 1995. In India, in the year 2012, there were 43,955 patent applications filed, and out of which an approximate 78% applications were filed by foreign companies / individuals and in the same year, 4,328 patents were granted in India, and out of which an approximate 83% patents were granted to foreign companies/individuals. It is important to study this patent filing trend at IPO and to study what are the patent filing trends of Indian companies at the IPO.

After a detailed study of these patent applications at IPO filed under various fields of invention, it is observed that in the engineering domain, there is an increasing trend of filing patent applications. As Pune is the engineering industry hub, it is worth studying the patenting activity of engineering units in Pune.

A study by Campbell (1983), explains how to use patent trends as a technological forecasting tool. Study by Smith (1986) emphasizes the importance of technical information as a factor in economic development and points out the advantages of patent documents as a source of technological information. A study by Varsakelis (2001), examines the impact of national culture, openness of the economy and patent protection provisions on R&D investment. Study by Dutta & Sharma (2008), explains that the post-TRIPs era is associated with increased expenditure on R&D and U.S. patent applications by domestic firms in India. A study by Kadri & Saykhedkar (2011), analyzes the Post-TRIPs Patenting Trends in India with special reference to the USA. The analysis has shown that there is tremendous growth in the patent filings and grants in India after the implementation of TRIPs. One positive trend observed has been the continuously increasing patent filing by Indian residents in the USA. However, the patent filing rate is much lower compared to the USA and developing countries.

Study by Jain & Mukundan (2012), discusses the technical quality of a patent, which is a valid output measure for firms investing in R&D. In another study, Dahibhate & Patil (2012) analyse the trends in Indian patents filed in the area of chemical sciences from 1995 to 2008. It explains the importance of patent literature in scientific developments and global trends in patent filings. A study by Kanga & Motohashi (2014), discusses the role of essential patents as knowledge input for future R&D.

There are many studies related to patents in Indian context and it was observed that published literature is in the general area and mainly about chemical and pharmaceutical areas of research, and mostly these studies are done outside India. However, sector-specific studies of patent filing trends in India related to the engineering sector have not been conducted. It is therefore, planned to fill this gap by studying the Patent Filing trends and its impact on engineering units in the Pune region.

The study being exploratory and descriptive in nature, a questionnaire-based survey method is used to collect the responses from the respondents. The primary data has

been analyzed using descriptive statistics. The testing of hypothesis is done using statistical techniques such as z-test for proportion.

To identify the patent filing trends, it is important to study the patent filing data at Indian Patent Office. The secondary data was collected in two parts. Patent applications filed at IPO from the businesses / persons from all over the world in the field of mechanical engineering, and patents filed at IPO in the field of mechanical engineering area by the Pune based engineering companies. The analysis of this data revealed trends.

From the study, it is observed that there is a positive effect of patents filed at IPO by foreign applicants, on Pune based engineering units. Pune based engineering units are aware of the concepts of Patent system, its advantages and are utilizing the patent information in their Research planning as well. They are carrying out R&D activities and filing the patents for their inventions prior to bringing it into the market. Based on the analysis of responses it is observed that the number of companies having granted Indian patent / application is twice of the companies having foreign patent / application in their portfolio. The R&D efforts led to patenting that benefits the organizations and helps in formulating competitive business plan, leading to an increase in the growth of the organization.

Further analysis of the data shows that there are almost comparable patenting trends between companies and individual inventors. Individual inventors are core to certain businesses and start-ups. In this study, it was found that the individual inventors are actively patenting in mechanical engineering field in the Pune region. If the inventions of these individuals are brought to the notice of R&D departments of the companies or venture capitalist, it will benefit both and generate employment opportunities.

To enter in the emergent Indian Marketplace by making use of IP for protecting their business is the main reason behind the patent flow in India by foreign companies. The foreign companies will take part in the expanding Indian market, by protecting their invention in India.



Secondary data analysis of more than ten thousand patents in mechanical engineering area filed in India by Foreign as well as Indian applicants brings out an important aspect that globalization has impacted Indian organizations and as a result, Indian companies have initiated R&D activities, increased patenting and are using patents for their business strategies.

It is believed that this is the first exploratory study on the particulars of patent filing that shows the trends related to engineering discipline / industries and restricted to the Pune region.

A framework has been developed that introduces to the user on how to utilize information contained in the patents and apply it in planning for strategic purposes and for gaining competitive advantage by use of this information. To be aware of current developments and trends with respect to the problems and solutions in the mechanical engineering area, the organizations can make use of this framework to look into the technical knowledge present in patent documents for their existing issues/ new product development.

# Chapter 1

## INTRODUCTION

### 1.1. Title of Research Study

A study of Patent filing trends and its impact on select engineering units in Pune region before & after 2005.

### 1.2. Context, Background, and Introduction of the Topic

Before discussing the research study, the discussion is initiated from the viewpoint of globalization. The Indian economy had experienced major policy changes from the year 1990. The new economic reforms, popularly known as *Liberalization, Privatization, and Globalization*, aimed at making the Indian economy the fastest growing economy and globally competitive. The series of reforms undertaken concerning the industrial sector, trade as well as a financial sector were aimed at making the economy more efficient.

Globalization (Impact of Globalization<sup>[1]</sup>) has many meanings depending on the context and on the person who is talking about it. According to Guy Brainbant<sup>[2]</sup>, the process of globalization not only includes opening up of world trade, development of advanced means of communication, internationalization of financial markets, the growing importance of MNCs, population migrations, and more generally, increased mobility of persons, goods, capital, data, and ideas but also infections, diseases, and pollution. The term globalization refers to the integration of the economies of the world through uninhibited trade and financial flows, as through the mutual exchange of technology and knowledge. Ideally, it also contains the free inter-country movement of labor.

In the Indian context, this implies opening up the economy to foreign direct investment by providing facilities to foreign companies to invest in different fields of economic activity in India. By removing constraints and obstacles to the entry of MNCs in India, allowing Indian companies to enter into foreign collaborations and also encouraging them to set up joint ventures abroad. Carrying out massive import liberalization programs by switching over from quantitative restrictions to tariffs and

import duties, and therefore, globalization has been identified with the policy reforms of 1991 in India.

The Globalization of R&D (Alexander Gerybadze<sup>[3]</sup>) and host-country patenting of multinational corporations in emerging countries emphasize that the establishment of R&D labs in offshore locations continuously increased its importance in the years between 1995 and 2010. During the last ten years, a strong move towards R&D offshoring in emerging countries, namely in Asia, Central, and Eastern Europe, and some Latin American countries, and the growing participation of host-country inventors in patenting activities have been observed.

Until 2008, going global seemed to make sense for just about every company in the world. Western markets were extremely competitive, population expansion had slowed, incomes had flattened, and corporate operating costs were rising. Developing nations, due to ample manpower, had relatively low wages in comparison to rising salaries in western markets. Developing nations also had a welcoming climate for foreign investment. As distances shortened owing to modern transportation and communication technologies, chasing growth globally became universally logical, and hence trade and capital flow rushed.

The most significant effect of liberalization and globalization is the free flow of capital and technology by MNCs to capture different markets in the world. The logical follow-on will be patent filings to protect technology as well as the market.

Secondly, globalization means not only globalization of business, but also, the globalization of R&D, which in turn means more R&D in India, leading to more patent filing to protect R&D.

Thirdly, the free flow of capital and technology will mean intense competition in a domestic market that will force Indian companies to do more R&D, leading to more Patenting.

In the past few years, Pfizer has encountered globalization's new phase. As part of the Indian Government's effort to make medicine accessible to as many people as

possible, in February 2013, India's Patent Office revoked Pfizer's patent for the cancer drug Sutent and granted a domestic manufacturer, Cipla, the right to produce a cheaper generic version.

MNCs today are developing certain core skills and acquire other skills from wherever it is available in the world; this demands R&D outsourcing, which has led to global exploitation of domestic R&D capabilities.

Patents gain importance due to a variety of reasons and mainly because of the protection of the invention in a new market. A trend can be defined as a general direction in which something is being developed or being changed. The term Patent Trend means the number of patents that are filed in the respective country-specific Patent Offices. Further, these patents can be analyzed to study the trend concerning the area of the invention, the assignees, or the inventor, the year-wise patents filed in a particular area, and there are many other parameters to be studied. This part is discussed in detail in the last few sections of this chapter.

### **R&D Centers of MNCs in India**

According to a study by Zinnov<sup>[4]</sup>, Deccan Triangle makes a significant contribution to the R&D eco system of India, with as many as 200 of these companies already present here. With 125 centers in Bangalore, 45 in Pune, and 43 in Hyderabad. As per the Zinnov study, in Pune, it has a total investment of \$1,543 million and total recruitment of 35,070 people. All three centers are recognized as tier-one locations for MNCs to set up their innovation centers across automotive, electrical and electronics, software, telecom & networking, and semiconductor industries.

### **1.3. The Rationale of the Research topic**

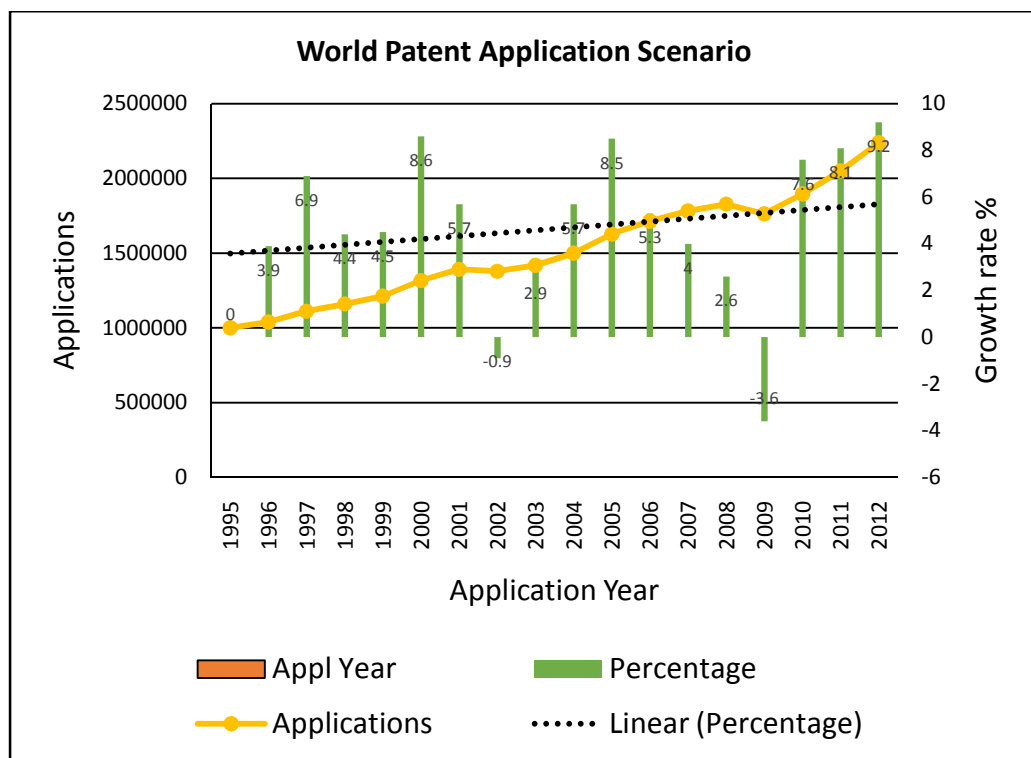
According to the WIPO statistical database of 2013, a large number of patent applications filed in India are by foreign companies.

Many companies protect their final product features with the help of shielding of all forms of IP in it, thus creating an IP boundary around the product. For example, a company selling a locking instrument will protect the name of the instrument as a

trade name, the design of the locking instrument as a design patent, operating instructions as copyright.

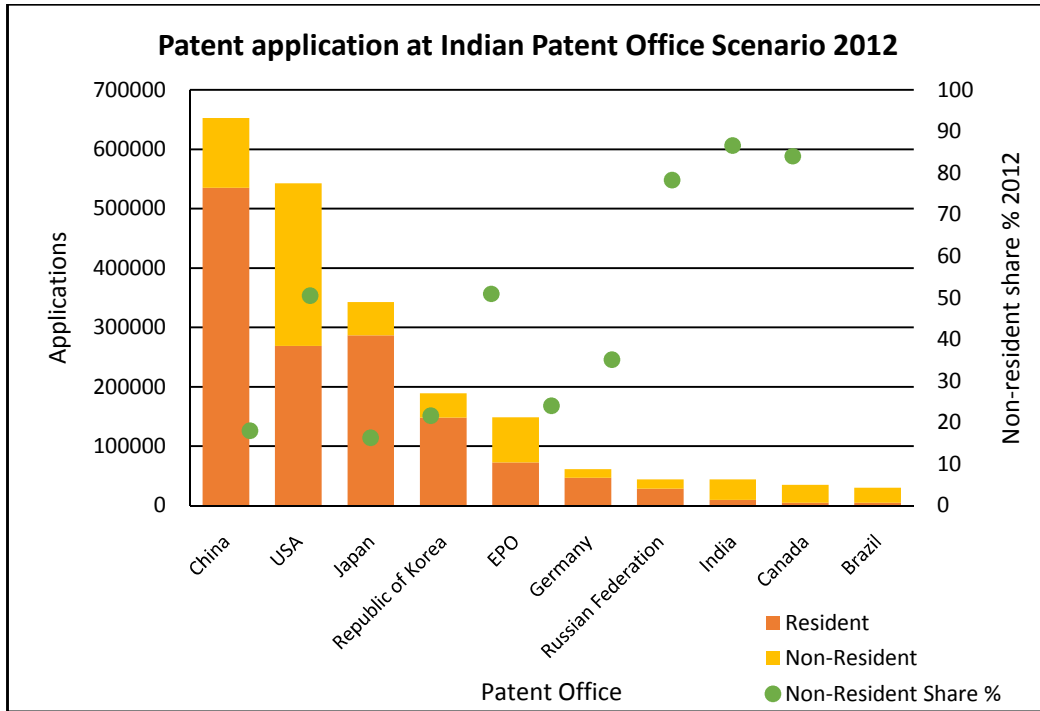
Often this protection approach needs resources, and that has to be always linked with the business value within the available resources of the company, i.e., priority and business strategy have to be decided at the beginning itself.

Now, before discussing on Indian Patent Scenario, attention is drawn to review of the World Patent Scenario (Source - WIPO statistical database 2013<sup>[5]</sup>)



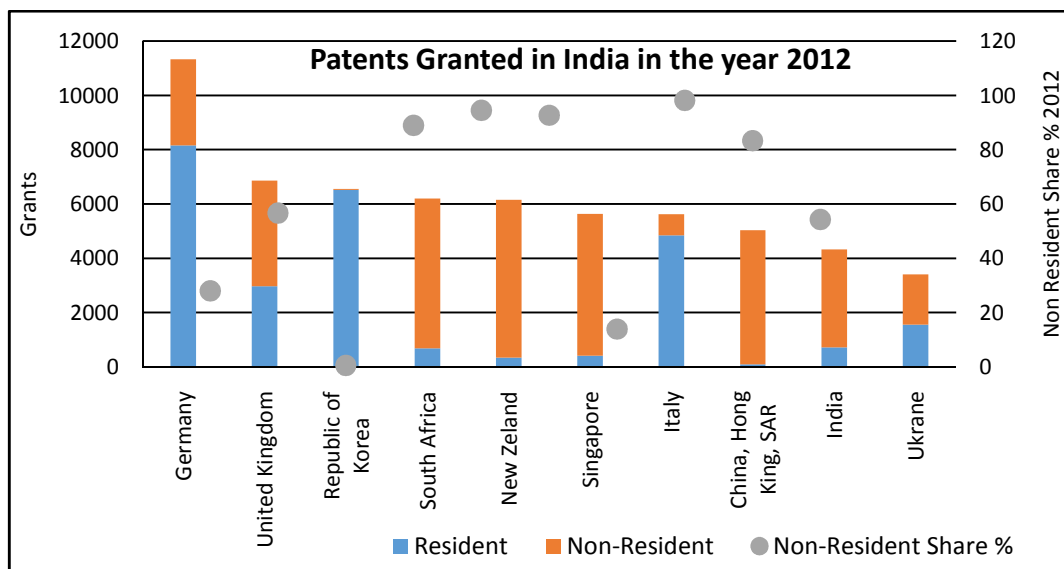
**Figure 1.1. World Patent Applications Scenario**

The above figure 1.1 shows that, in the year 2012, there were an approximate 24 lakhs patent that had been filed in different patent offices worldwide, and it shows a 9.2 % increase over the previous year.



**Figure 1.2. India Patent Scenario**

The above figure 1.2 shows that, in India, in the year 2012, there were 43,955 patent applications filed and out of which approximately 78% applications were filed by foreign companies/ individuals.



**Figure 1.3. Patents granted in India in the year 2012**

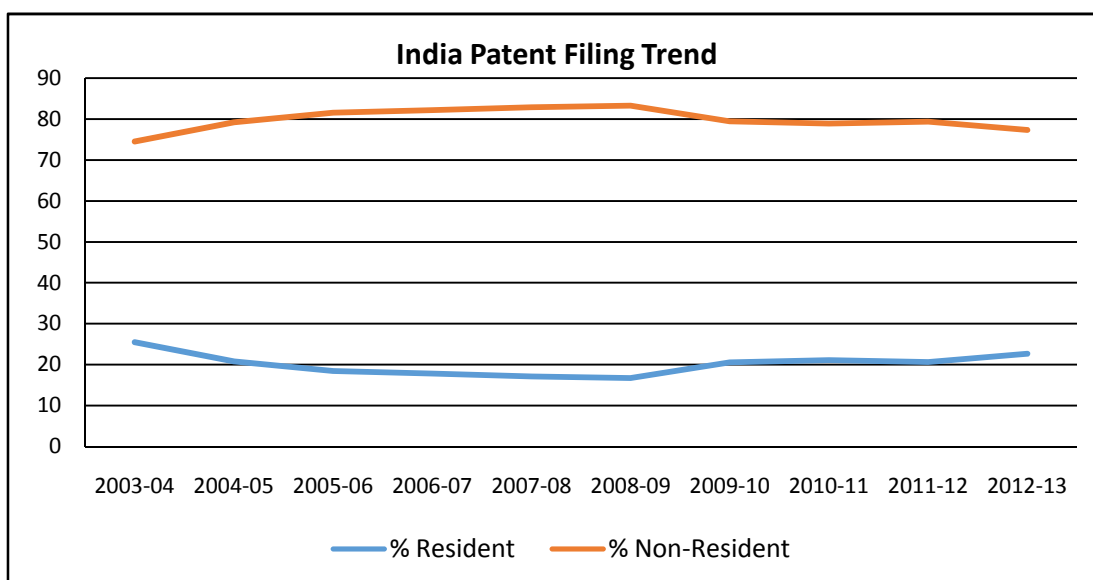
Above figure 1.3 shows that, in the year 2012, 4,328 patents were granted in India and out of which approximately 83% patents were granted to foreign companies / individuals.

The data from the Indian Patent office has been studied -

(Sources – Annual Report-2012\_2013, from Indian Patent Office<sup>[6]</sup>)

**Table 1.1. Applications Filed by Residents and Non-Residents through Various Routes for Last 10 Years**

<b>Applicants</b>	<b>2003-04</b>	<b>2004-05</b>	<b>2005-06</b>	<b>2006-07</b>	<b>2007-08</b>	<b>2008-09</b>	<b>2009-10</b>	<b>2010-11</b>	<b>2011-12</b>	<b>2012-13</b>
Residents (A)	3218	3630	4521	5314	6040	6161	7044	8312	8921	9911
Non Residents										
Ordinary	1678	3165	1008	693	834	681	826	816	1031	1144
Convention*	-	-	3509	3969	4453	4264	2986	3728	4280	4184
National Phase Applications under PCT	7717	10671	15467	19768	23891	25706	23431	26544	28965	28435
Non Residents (B)	9395	13836	19984	24430	29178	30651	27243	31088	34276	33763
GRAND TOTAL (A+B)	12613	17466	24505	29744	35218	36812	34287	39400	43197	43674
<b>% Resident (India)</b>	<b>25.51</b>	<b>20.78</b>	<b>18.45</b>	<b>17.87</b>	<b>17.15</b>	<b>16.74</b>	<b>20.54</b>	<b>21.10</b>	<b>20.65</b>	<b>22.69</b>
<b>% Non-Resident (Foreign)</b>	<b>74.49</b>	<b>79.22</b>	<b>81.55</b>	<b>82.13</b>	<b>82.85</b>	<b>83.26</b>	<b>79.46</b>	<b>78.90</b>	<b>79.35</b>	<b>77.31</b>



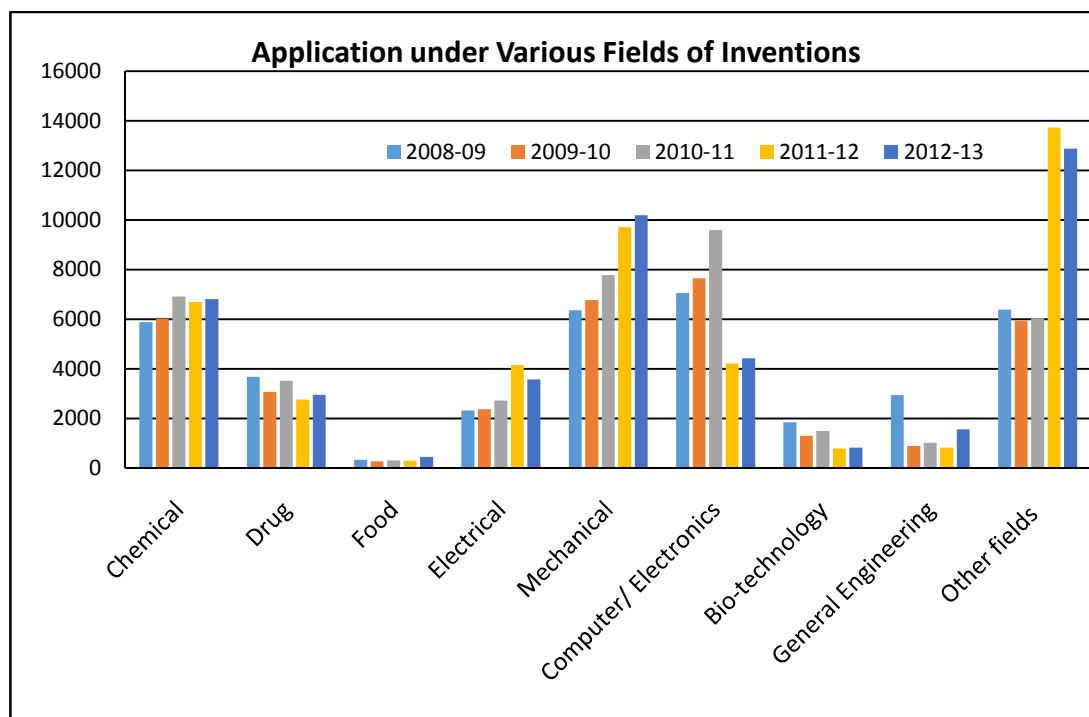
**Figure 1.4. Patent filing in India from the year 2003 to 2013**

The above figure 1.4 shows that there are almost 75% of patents that were filed by foreign companies (Non - Resident) and 25 % of Indian companies (Resident)

**\*International Arrangements – Under Section 133. Convention countries.** – Any country, which is a signatory or party or a group of countries, union of countries or inter-governmental organizations which are signatories or parties to an international, regional, or bi-lateral treaty, convention or arrangement to which India is a signatory or party and which affords to the applicants for patents in India or to citizens of India similar privileges as are granted to their own citizens or citizens to their member countries in respect of the grant of patents and protection of patent rights shall be a convention country or convention countries for this Act.

**Table 1.2. Number of Patent Applications Filed From 2008-09 to 2012-13 under Various Fields of Inventions**

Year	Chemical	Drug	Food	Electrical	Mechanical	Computer/ Electronics	Biotechnology	General Engineering	Other fields (See Table - 1.3)	Total
2008-09	5884	3672	340	2319	6360	7063	1844	2946	6384	36812
2009-10	6014	3070	276	2376	6775	7646	1303	885	5942	34287
2010-11	6911	3526	315	2719	7782	9594	1497	1017	6039	39400
2011-12	6698	2762	294	4160	9716	4225	788	822	13732	43197
2012-13	6812	2954	452	3568	10198	4424	832	1561	12873	43674



**Figure 1.5. Patent applications in India under different fields of Invention**



The above figure 1.5 shows the patent applications that were filed under various fields of invention, and in the Mechanical section, there is an increasing trend.

**Table 1.3. Number of Patent Applications Filed During 2012-13 under Various, Other, and New Fields of Inventions**

<b>Field of Invention - 2012-13</b>	<b>Indian</b>	<b>Foreign</b>
Bio- Medical	183	870
Bio-Chemistry	75	291
Communication	605	3558
Physics	411	2182
Civil	160	498
Textile	104	452
Metallurgy / Material Science	85	509
Agriculture Engineering	103	87
Polymer Science/Technology	135	1290
Biology	113	434
Agrochemical	113	373
Traditional Knowledge / BIO / CHEM / MECH	185	57
Total	2272	10601
%	17.65	82.35
Total (India + Foreign)	12873	

**Table 1.4. Number of Patents Granted From 2008-09 to 2012-13 under Various Fields of Inventions**

<b>Year</b>	<b>Chemical</b>	<b>Drug</b>	<b>Food</b>	<b>Electrical</b>	<b>Mechanical</b>	<b>Computer/ Electronics</b>	<b>Biotechnology</b>	<b>General Engineering</b>	<b>Other fields (See App-Table 1.5)</b>	<b>Total</b>
2008-09	2276	1207	97	1140	3242	1913	1157	1318	3611	15961
2009-10	1420	530	72	404	1024	1195	449	273	801	6168
2010-11	1899	596	84	394	1458	892	165	350	1663	7501
2011-12	1168	282	21	228	888	584	309	153	748	4381
2012-13	1289	344	37	188	749	510	144	121	744	4126

**Table 1.5. Number of Patent Applications Granted During 2012-2013 under  
Various other Fields of Inventions**

<b>Field of Invention (2012-13)</b>	<b>India</b>	<b>Foreign</b>
Bio- Medical	0	11
Bio-Chemistry	1	16
Communication	21	252
Physics	7	58
Civil	3	31
Textile	5	56
Metallurgy / Material Science	11	42
Agriculture Engineering	3	1
Polymer Science/Technology	12	157
Agrochemical	5	25
Microbiology	7	20
Total	75	669
%	10.08	89.92
Total (India + Foreign)	744	

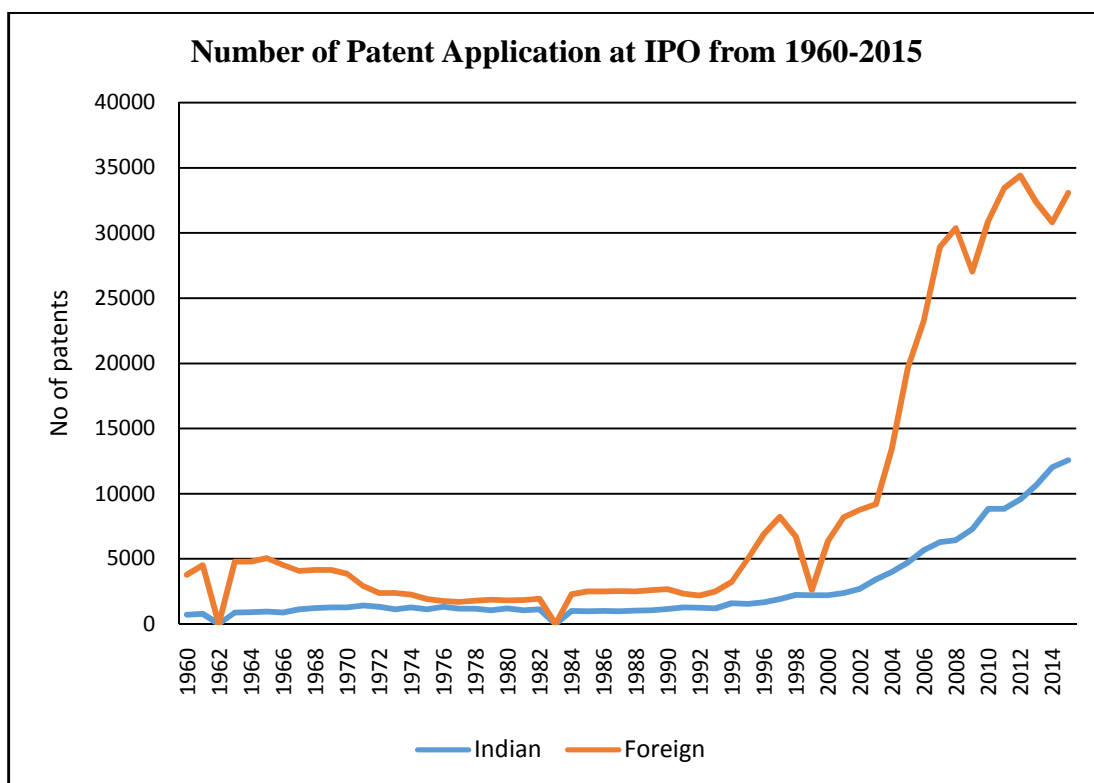
**Table 1.6. Number of Patent Applications at IPO by Indian and Foreign Entities  
before and after 2005**

<b>Year</b>	<b>A</b>	<b>B</b>	<b>Year</b>	<b>A</b>	<b>B</b>	<b>Year</b>	<b>A</b>	<b>B</b>	<b>Year</b>	<b>A</b>	<b>B</b>
	<b>Indian</b>	<b>Foreign</b>		<b>Indian</b>	<b>Foreign</b>		<b>Indian</b>	<b>Foreign</b>		<b>Indian</b>	<b>Foreign</b>
1960	721	3782	1974	1268	2265	1988	1033	2504	2002	2693	8772
1961	774	4515	1975	1122	1917	1989	1048	2600	2003	3425	9188
1962	NA	NA	1976	1324	1769	1990	1147	2673	2004	4014	13452
1963	878	4798	1977	1186	1702	1991	1267	2328	2005	4721	19661
1964	902	4799	1978	1173	1799	1992	1248	2176	2006	5686	23242
1965	948	5054	1979	1053	1857	1993	1209	2511	2007	6296	28922
1966	894	4535	1980	1207	1817	1994	1588	3212	2008	6425	30387
1967	1125	4065	1981	1067	1834	1995	1545	5021	2009	7262	27025
1968	1217	4141	1982	1128	1948	1996	1661	6901	2010	8853	30909
1969	1288	4158	1983	NA	NA	1997	1926	8229	2011	8841	33450
1970	1278	3864	1984	1003	2291	1998	2247	6707	2012	9553	34402
1971	1416	2929	1985	982	2493	1999	2206	2620	2013	10669	32362
1972	1322	2373	1986	999	2497	2000	2206	6332	2014	12040	30814
1973	1118	2372	1987	988	2520	2001	2379	8213	2015	12579	33079

**A-Patent applications, Indian; B-Patent applications, Foreign**

[Ref. – Compiled from Data from World Bank Indicator, <https://data.worldbank.org/> indicator and Annual Reports published by Indian Patent Office]

Table 1.6 shows the number of patent applications<sup>[7]</sup> received from Indian and Foreign applicants at the Indian Patent Office from 1960 to 2015. The same data is depicted in the below Figure 1.6. It is observed that there is a rise in patent filings after the year 1998.



**Figure 1.6. Patent applications in India from 1960 -2015**

There are many indicators to measure the growth rate of a nation. Gross Domestic Product (GDP) is one of them. However, in the development of any nation, Industrial development is highly important, and that through Innovation. One of the best measurement indicators of Industrial development through innovation in any country is the number of Patent Applications filed by it.

By looking into all the above data, it is observed that there is a remarkable increase in the number of patent applications filed by foreign companies in India. As an upcoming nation, one has to look into this trend of patent filing from outside the country and understand what is the driving force behind it. It also pointed the thought to study what are the patent filing trends of Indian companies at the Indian Patent Office. As Pune is an Engineering and Auto Industry hub, it is worth studying the

Patenting activity of engineering units in Pune. Moreover, that is how the topic “A study of Patent filing trends and its impact on select engineering units in Pune region before & after 2005” has been selected for the study.

The following are the representative cases about the Patent battle in India in the engineering sector. It gives a clear idea about the importance of patents and their business value.

### **1. Scooters India Ltd. and Jay Hind Industries Ltd.**

[Scooters India Ltd. (Lucknow, Uttar Pradesh). V Jay Hind Industries Ltd, (Pune, Maharashtra) 1987 (7) PTC 204(PO)]<sup>[8]</sup>

In the above case, the invention related to an external rotor assembly for a magneto comprising a ferrous yoke fixed to a nonferrous housing having an angular disc with an even number of lugs projecting there from, ferrite magnets (with or without their respective pole shoes) fixed to the said yoke the said lugs use to hold securely between them the said ferrite magnets (with or without their respective pole shoes) and the said housing use to be mount on to the crankshaft of an engine.

Opposition to the grant of a patent under Section 25 of the Patents Act, 1970 was filed by M/s. Scooters India Limited against the grant for Patent No. 151977 of M/s. Jay Hind Industries Limited (who were the Applicants) for “External Rotor Assembly for a Magneto”. The above application was filed on 12th January 1984. The case was heard on 30th June 1986.

Grounds of opposition for grant of a patent as per various sections of the Indian Patent Act, were as follows

- Prior publication section 25 (1) (b)
- Prior public use and prior public knowledge [section 25 (1) (d)]
- Obviousness and lack of inventive step section 25 (1) (e),
- Not an invention or not a patentable invention section 25 (1) (f)
- Insufficiency and clarity of description [section 25 (1) (g)]

Given the findings in consideration of all matters stated in the written statement, reply statement, and evidence, as well as the arguments furnished by the opponents and applicants during the hearings and all the circumstances of the case, it was concluded that the opponents (M/s. Scooters India Limited) had not proved the ground of prior publication, and prior public knowledge and have also not submitted any evidence to the fact that the invention is obvious. Therefore, the opposition filed by the opponents M/s. Scooters India Limited on application No. 151977 was dismissed.

From the above case, it is revealed that the use of patents is not a recent approach, rather Pune based companies had used provisions in the Indian Patent Act to protect their business for long.

## **2. Bajaj Vs TVS**

In 2008, two major motorcycle manufacturers<sup>[9]</sup>- Bajaj and TVS had started their battle that went all the way to the Supreme Court and gave us India's first major non-pharmaceutical patent controversy. The dispute involved TVS Motor Co. Ltd.'s motorcycle "Flame" which used a twin spark plug technology. Bajaj claimed that it had a patent for this technology and that TVS was infringing on its patent. It thus, filed a suit for a permanent injunction to restrain TVS from using this technology in their products. Without dwelling on the merits, the Supreme Court directed that the suit be heard in the Madras High Court itself and allowed TVS to manufacture Flame motorcycles in the interim.

Further, the Court observed that parties in suits pertaining to intellectual property fought for years about the temporary injunction, and hardly any suits were decided finally, which was not proper. The court directed that all Tribunals and Courts hear copyright, patent, and trademark matters on a day-to-day basis and give final judgment within four months from the date of filing suit. However, no final judgment has been given.

According to the recent update<sup>[10]</sup>, TVS Motor and Bajaj Auto entered into a settlement agreement to amicably settle the decade-old dispute related to alleged infringement for digital twin spark plug ignition technology.

The above cited example shows how the Patent information plays a crucial role for a company to position itself in the upcoming market and to make a space for them in an existing market with new technology.

#### **1.4. Pune Engineering Industry Background**

Pune, Maharashtra's second-largest city after Mumbai, has been a hub for the engineering industry for over five decades.

On the industrial front, the progress first began with the setting up of Kirloskar Oil Engines, Tata Motors, and Bajaj Auto in the 1950s and 1960s. The Swedish Group Sandvik Asia, Atlas Copco, Alfa Laval, SKF Bearings followed and were amongst the earliest settlers on Pune - Mumbai Road.

Industrial activity grew gradually as more units were established, including Finolex Cables, Forbes Marshall, Garware Nylons, and Bajaj Tempo (now Force Motors).

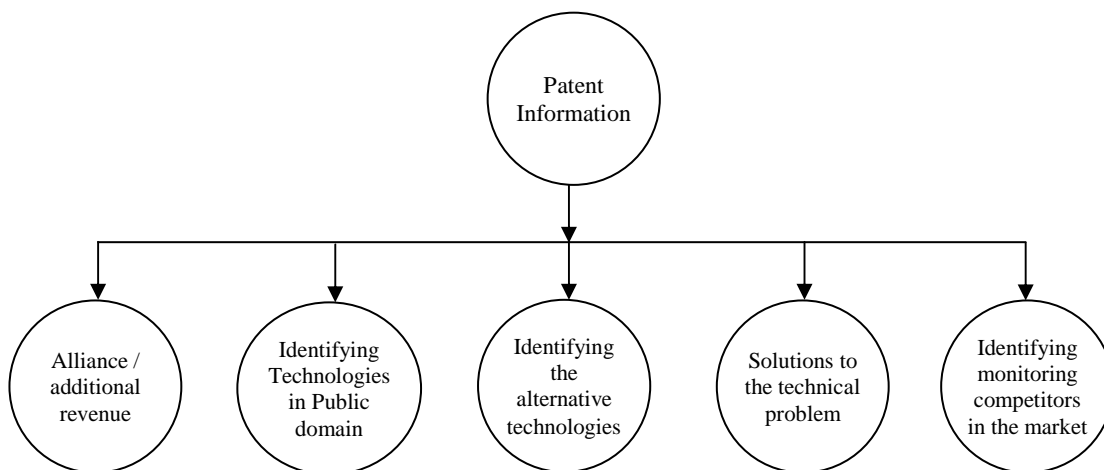
The propagation of the auto industry gave a boost to a multitude of auto ancillaries to flourish. The Pune region has a buzzing auto parts components industry ranging from countless micro, small, and medium scale units to Bharat Forge, now the largest forgings company in the world.

While India's largest vehicle manufacturer Tata Motors and largest two-wheeler maker Bajaj Auto, have been residents of Pune for decades, it was the arrival of global OEMs like Mercedes Benz, Piaggio, Skoda, General Motors, Volkswagen, and Fiat that helped forge its identity as an important destination in India. Predictably, there are many elements to Pune's growth story and now it holds a significant position on the Indian industrial chart.

The setting up of new well planned industrial estates by the Maharashtra Industrial Development Corporation (MIDC) in the last few years has helped manufacturers find land for the setting up of units. These parameters also played a major role in the development of Pune as an industrial hub. MIDC's industrial estates at Ranjangoan, Hinjewadi, Hadapsar, and in the Talegaon - Chakan belt are relatively recent developments in Pune.

### 1.5. Need and Significance of the Study

Patent information has been an underused intelligence resource for businesses. If properly analyzed, the data they contain is a gold mine for corporate strategists.



**Figure 1.7. Use of Patent information in different areas of business**

Above figure 1.7 explains different fields of business problems where patent information can be used to find the solution.

In any business activity, the ultimate goal is to earn revenue, and it is a comprehensive plan outlining major actions through which the organization intends to achieve its objectives in a dynamic environment. Normally, this starts with the new product development and later entering into the market.

For any product development, it starts with Idea --> Technology Development --> Product Development, Prototype and Testing (with IP Protection) --> Product in the market (IP Commercialization). Behind any product development, there are R&D efforts in any organization. R&D Strategy involves high risks, long time horizons, and the uncertainty of results, and infinite variations in inputs which makes strategic management of R&D extremely complex.

At the same time, the business view of management for the investment in R&D is restricted to the areas in which the organization's business needs to grow as well as the level of confidence to achieve results is reasonably high.

For example, these include an estimate of which course R&D may have to take in the considered market segment, how the evolution of potential competitors and customers may unfold, and which partner may be considered for reasonable acquisitions or co-operations. At this point, organization management may think of Market Analysis.

In this process of market analysis, before starting the new business, market data may be collected by the company or it can be purchased from respective commercial suppliers. In many cases, it will be reasonable to involve external expertise by the consultancy. However, in this way, a number of questions will remain unanswered<sup>[11]</sup> - such as estimation of which path of R&D may have to be opted in link with a market segment, how the evolution of possible competitors and clients may progress, and what associates may be considered for realistic acquisitions of technology protected by IP.

To have an effective answer to these questions, collecting the Patent Information and its Analysis is the one point solution.

A patent is an exclusive right granted for an invention, which is a product or a process that provides, in general, a new way of doing something or offers a new technical solution to a problem. To obtain a patent, technical information about the invention (i.e. the method / experimental information about the process or design details about the product) must be disclosed to the public in a patent application<sup>[12]</sup>.

Normally, a patent application is filed before publishing a scientific paper in a journal. Patent contains technological information, which is often not disclosed in any other form of publication<sup>[13]</sup>. Patents have a relatively standardized format, including an abstract, a description of the invention, and in most cases drawings illustrating the invention and full details of the applicant. Patents are classified according to technical fields [like International Patent Classification (IPC) or Cooperative Patent Classification (CPC)]. Patents further provide examples of the industrial applicability of an invention and cover practically every field of technology.

Patents are an exclusive and valuable source of information on recent developments in highly commercially sensitive technology areas.



Firms disclose their invention secrets in the 'patent' document in exchange for a limited duration monopoly. This exchange means more number of disclosures (patent applications filed at patent offices) which results in the reduced value of invention secrets that the company possesses (as more technical information becomes available in the public domain e.g. when patent applications get published it can be accessed by anyone, which may reduce its value over a period of time). A Patent Mapping study aims to restore the original intention by allowing clearer dissemination of knowledge<sup>[14]</sup>. Thus, it serves an urgent need for companies - both large corporations and SMEs - to gain access to the rich network of technical and commercial intelligence contained in patent databases.

It is highly advisable for companies engaging in inventive activities to consult patent databases to find out about existing technologies, identify licensing partners, and avoid duplication of research activities.

Patents can be considered as a topical indicator of levels of R&D effort - being one of the principal outputs of such activities, and a good overview of the activities of major players is essential for the cross-fertilization of R&D efforts at an international level.

Business intelligence derived from such knowledge frequently helps strategic decision-making. Improving access to the information buried within patent databases creates huge opportunities for businesses, especially for new entrants that have yet to build up significant internal technology know-how. Patent landscapes can be used to visualize patterns of technology competition on a global scale. Patent landscaping, as a tool, is increasingly used by large corporations to inform their product development and technology strategies.

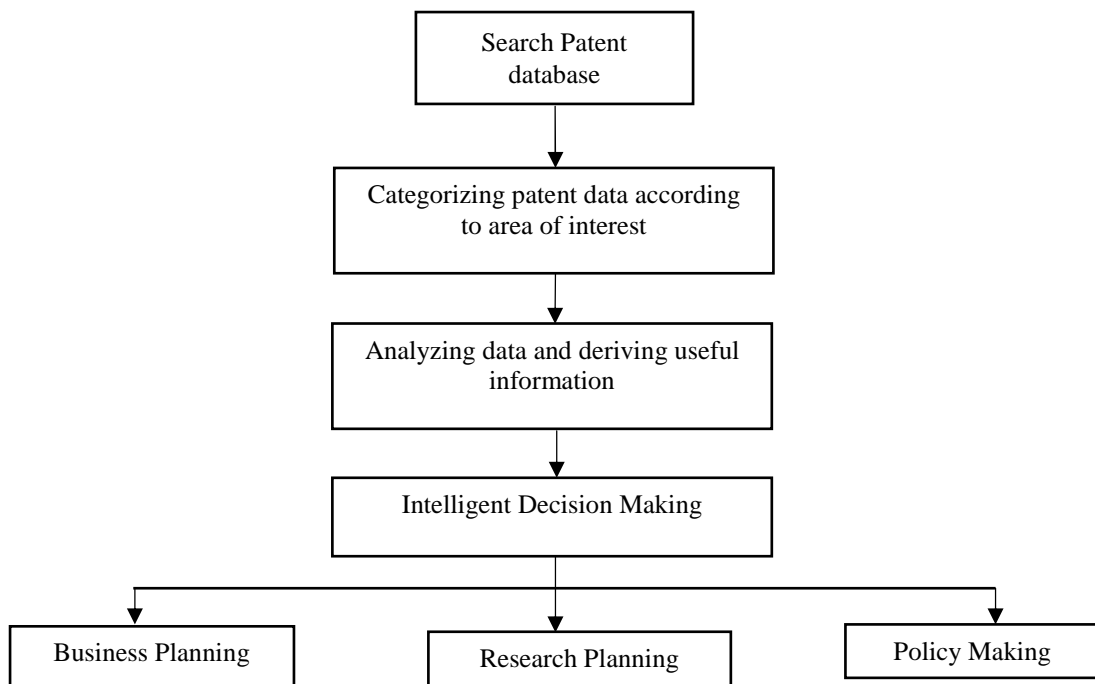
By analyzing vast amounts of data in patent databases, users can gain a significant competitive advantage. For example, patent mapping can give firms comprehensive insights into innovation trends, and the position of competitors can show gaps and opportunities, the parts of the world where specific new technologies are developed, and so on.

This research study explains how the systematic selection and evaluation of patent information may contribute to the assessment of new R&D planning and business opportunities.

The retrieval and evaluation of patent data may be institutionalized within the organization to ensure the continuous and systematic use of patent information in the company's decision-making processes<sup>[15]</sup>.

Patent information is important in the process of initiating, developing, and marketing a new product or process. They are useful because:

- ✓ Patents are valuable sources of technical and scientific information in the world
- ✓ More than 110 million<sup>[16]</sup> patents filed
- ✓ The majority are the first and only publication
- ✓ Discloses the invention and how it can be worked out.
- ✓ Provides the most current information on the Technology
- ✓ Identifying companies that are end-users of a particular product or equipment;
- ✓ Analysis of the patent holdings of specific inventors within a narrow research area that can be used as an aid to recruitment, since it can identify a major player in the field, whose services could be sought.



**Figure 1.8. Patent data and decision making**

The above figure (Fig 1.8) explains how patent data can be grouped, and further analyzed, and used for intelligent decision making for adopting different strategies like business planning, research planning, and policy making.

For many technology companies, developing a patent strategy is an important component of their business plan. However, for many, the approach for developing a patent strategy is more coincidental than the execution of a precisely defined plan. Business and patent portfolio goals starting in the development phase, the patent strategy identifies the key business goals of the company. Clear business goals provide a long-term blueprint to guide the development of a valuable patent portfolio. In particular, the company should list the business goals.

#### **1.6. The objective of the study**

1. The first objective of the study is to find out the reasons behind the patent filing trend in India by foreign companies
2. The second objective of the study is to understand how the organizations are making use of Patent Information for strategic planning and R&D activities for business development.
3. Another objective of the study is to develop a general framework to use patent information for strategic business planning and subsequent practical application derived from patent information
4. How an IP based business strategy helps for revenue generating opportunities if recognized at the initial stages of product development.
5. Finding out the engineering companies in the Pune region having a patent portfolio.

#### **About IPR and Patent and its importance**

##### **1.7 Intellectual Property Rights (IPR)**

According to the World Intellectual Property Organization (WIPO)<sup>[17]</sup>, Intellectual Property refers to - creations of the mind: inventions, literary, and artistic works, and symbols, names, images, and designs used in commerce. IP is divided into two categories: industrial property, which includes inventions (patents), trademarks,

industrial designs, and geographic indications of source; and copyright, which includes literary and artistic works such as novels, poems, and plays, films, musical works, artistic works such as drawings, paintings, photographs and sculptures, and architectural designs. Rights related to copyright include those of performing artists in their performances, producers of phonograms in their recordings, and those of broadcasters in their radio and television programs.

The purpose of the IP system is to nurture an atmosphere in which creativity and innovation can develop. Each country has its own IP laws. IP is only enforceable in the country where it is obtained.

To get the benefits of the patent, the invention must be registered with the appropriate Patent Office of a country. In India, the invention must be registered with the Patent Office. The Indian Patent Offices are located in New Delhi, Kolkata, Chennai, and Mumbai.

The following paragraph explains the different forms of Intellectual Properties as per Indian Patent law, which is helpful to the inventor/company who innovates and would like to get recognition and gain financial benefit.

Intellectual property is divided into two categories: Industrial property, which includes patents, trademarks, industrial design, and geographical indications of source, and Copyright, which includes literary and artistic works. These are governed by different provisions under the Indian Patent Act 1970 and subsequent amendments and are granted for a definite period, e.g., the patent is granted for 20 years from the date of filing application. The research topic of this study is related to one form of IP, i.e., Patent, the details of patenting are discussed in the thesis.

## **1.8 About Indian Patent**

Indian Patent Act<sup>[18]</sup> has a history of patent protection act which ways back to 1884 (The first Indian law on IPR was the Indian Trade and Merchandise Marks Act, 1884).This Act has gone under a number of refinements, and finally, it was passed in Loksabha in 1970, which is now the prevailing Patent Act 1971. Further, it was

subsequently amended<sup>[19]</sup> in 1999, 2002, and 2005 to bring the Act in conformity with the provisions of the TRIPS agreement.

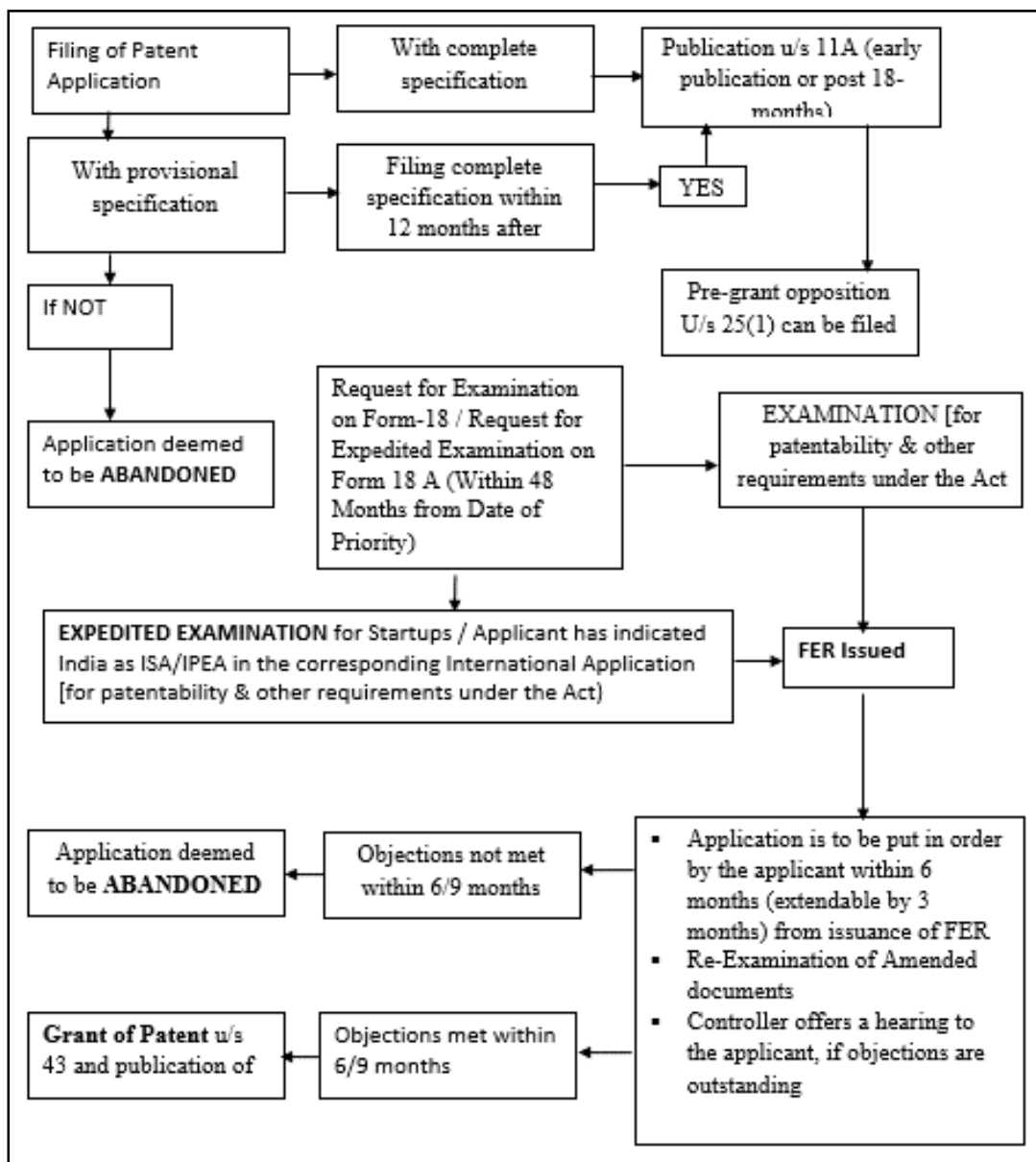
The Patents (Amendment) Act, 1999, brought the concept of Exclusive Marketing Rights and 'mailbox facility' for pharmaceutical and agro-chemical product patent applications.

In the year 2002, the Act was amended to comply with all the substantive provisions of the TRIPS agreement, with the exception of product patent protection for pharmaceuticals, as an additional transition period of five years was applicable under TRIPS Article 65(4) for those countries that did not grant product patents. In the year 2005, the Act was amended to become fully TRIPS compliant by initiating an enforceable product patent regime in India, earlier to which only process patents were allowed in India.

A patent is an exclusive right granted for an invention, which may be a product or a process that provides, in general, a new way of doing something, or offers a new technical solution to a problem. To obtain a patent, technical information about the invention must be disclosed to the public in a patent application<sup>[20]</sup>. The purpose of disclosure of the technical information is that if someone wants to practice the invention, they can do so with the information disclosed in the patent document. Patent protection is a territorial right, and therefore it is effective only within the territory of that country where they are granted / in force.

Patents are an exclusive and valuable source of information on recent developments in highly commercially sensitive technological areas, therefore, often not divulged in any other form of publication such as scientific papers or articles before filing the patent applications. Patent documents have a relatively standardized format, including an abstract, a description of the invention, and in most cases also drawings illustrating the invention and full details of the applicant. Patent documents were classified according to technical fields (like International Patent Classification IPC). The patent document further provides examples of the industrial applicability of an invention and they cover practically every field of technology.

Patent process chart<sup>[21]</sup>, in the following figure 1.9, explains how the individual or a company can make an application at the Indian patent office to protect their product or a process in India.



**Figure 1.9. Patent Process Flow Chart at Indian Patent Office**

The following table 1.7 gives the details of different forms<sup>[22]</sup>, which are in use at the Indian Patent Office to obtain a Patent.

**Table 1.7. List of Forms related to patenting process at Indian Patent Office**

<b>Sr. No.</b>	<b>Process Title</b>	<b>Form No.</b>
1	Application for Grant of Patent	Form 01
2	Provisional/Complete Specification	Form 02
3	Statement and Undertaking Under Section 8	Form 03
4	Request for Extension of Time	Form 04
5	Declaration as to Inventorship	Form 05
6	Claim or Request Regarding any Change in Applicant for Patent	Form 06
7	Notice of Opposition	Form 07
8	Representation for Opposition to Grant of Patent	Form 07(A)
9	Claim or Request Regarding Mention of Inventor as Such in a Patent	Form 08
10	Request for Publication	Form 09
11	Application for Amendment of Patent	Form 10
12	Application for Direction of The Controller	Form 11
13	Request for Grant of Patent Under Section 26(1) and 52(2)	Form 12
14	Application for Amendment of The Application for Patent/Complete Specification	Form 13
15	Notice of Opposition to Amendment / Restoration / Surrender	Form 14
16	Application for Restoration of Patent	Form 15
17	Application for Restoration of Title/Interest	Form 16
18	Application for Compulsory License	Form 17
19	Request/Express Request for Examination of Application for Patent	Form 18
20	Application for Revocation of a Patent for Non-Working	Form 19
21	Application for Revision of Terms And Conditions of License	Form 20
22	Request for Termination of Compulsory License	Form 21
23	Application Registration of Patent Agent	Form 22
24	Application for The Registration of Name in The Register of Patent Agents	Form 23
25	Application for Review/setting Aside Controller Decision/Order	Form 24
26	Request for Permission for Making Patent Application Outside	Form 25
27	Authorization of a Patent Agent/Or any Person in a Matter or Proceeding Under The Act	Form 26
28	Statement Regarding the Working of the Patented Invention on Commercial Scale in India	Form 27
29	To Be Submitted By Small Entity / Startup	Form 28
30	Request For Expedited Examination Of Application For Patent	Form 18(A)
31	Request For Withdrawal Of The Application For Patent	Form 29
32	To Be Used When No Other Form Is Prescribed	Form 30
33	प्ररूप-3	प्ररूप-3

*Annexure-II explains the fee structure at Indian Patent Office, from patent application up to maintenance of the patent.*

### **1.9 About Patenting Criteria**

The main Patentability requirement is that the invention (either product or a process) is Novel, Non-obvious, and has Industrial application; along with this, the invention also does not fall under the list of subjects that are not eligible for a patent according to section 3 and 4 of the Indian Patent Act<sup>[23]</sup>.

Novelty – The invention is patentable only if it is new with respect to the prior art available throughout the world.

Non-obviousness – This is the extremely tough part of the patentability requirement, sometimes referred to as Inventive Step. This involves the technical advancement as compared with the existing knowledge, and that makes the invention not obvious to a person skilled in the art. This step is assessed based on the combined prior art.

Industrial application – The outcome of the invention must have been used in industry and has some merits over the previous available process/technology/product.

### **1.10 Patent Procedure**

- 1) Patent Application – Once the individual or a company does not doubt that their invention meets the three- tests of Patenting, i.e., Novelty, Non-obviousness, and Usefulness, an application can be filed with the appropriate Patent Office. Patent offices are located in New Delhi, Chennai, Kolkata, and Mumbai. The applicant has to give certain details in the application. The application includes complete specifications containing the title, field, background of the invention, and other details like summary, description along with drawing, claims, and abstract. The applicant has to disclose the (embodiment) best method for performing the invention. The Claims define the scope of legal protection. They must be clear, concise, and fully supported by the description.



Drafting of the application requires technical as well as legal knowledge. The applicant should study the patent applications filed with the patent offices to get insight into drafting. If necessary, the help of the experts in the field can be sought.

- 2) Publication -The application is published in the official patent journal after eighteen months. The applicant can request for early publication.
- 3) Examination of the application -The applicant has to make a request for examination of the application. Without such a request, the examination is not done. If such a request is not made within a period of forty-eight months from the date of priority, the application is treated as withdrawn and cannot be revived. The First Examination Report is communicated to the applicant or his agent. The report contains requirements if any. If the requirements are not fulfilled, in the prescribed time limit, the application is treated as abandoned.
- 4) Provision to Pre grant and Post-grant opposition to the patent is provided in the Patent Act.

[The above information has been compiled from BARE Act with Short Comments 2018, The Patents Act, 1970, Professional Book Publishers.]

### **1.11 About PCT**

International Protection Exclusive rights are available in the countries where the invention is registered. Due to various international treaties, it is possible to register a patent in countries other than one's home country. If a patent application is filed within the specified period (from registering in the home country), the applicant gets the date of priority i.e. the other country will consider the date of filing a patent application in the home country for the purpose of grant of patent.

Each country has its own patent law, which may be different from the patent law of one's home country. Therefore, the grant of patent in one country does not guarantee the grant of patent in other countries. In India, computer programme per se or

algorithms cannot be patented (are covered under the Copyright Act), whereas in certain countries like Europe and the USA, they can be patented.

World Intellectual Property Organization has given guidelines to SMEs for evaluating the invention. The guideline<sup>[24]</sup> is in the form of certain questions-

- a. Is there a market for the invention, technology, or product incorporating it?
- b. What are the alternatives to your invention, and how do they compare with your invention?
- c. Is the invention useful for improving an existing product or developing a new Product? If so, does it fit in with your company's business strategy?
- d. Are there potential licensees or investors who will be willing to help to take the Invention to market?
- e. How valuable will the invention be to your business and competitors?
- f. Is it easy to reverse engineer your invention from your product?
- g. How likely are the others, especially the competitors, to invent and patent what you have invented?
- h. Do the expected profits justify the cost of patenting?

The evaluation of the invention on the above guidelines will help the SMEs or interested inventors in deciding whether to file only in home country or making application in other non-home countries using the PCT route.

#### Advantage of the Patent Cooperation Treaty (PCT)

The PCT is an international treaty with more than 150 Contracting States. The PCT makes it possible to file an application seeking patent protection for an invention simultaneously in a large number of countries by filing a single “international” patent application instead of filing several separate national or regional patent applications. The granting of a patent remains under the control of the national or regional patent Offices in what is called the “national phase.”

The PCT procedure includes<sup>[25]</sup>:

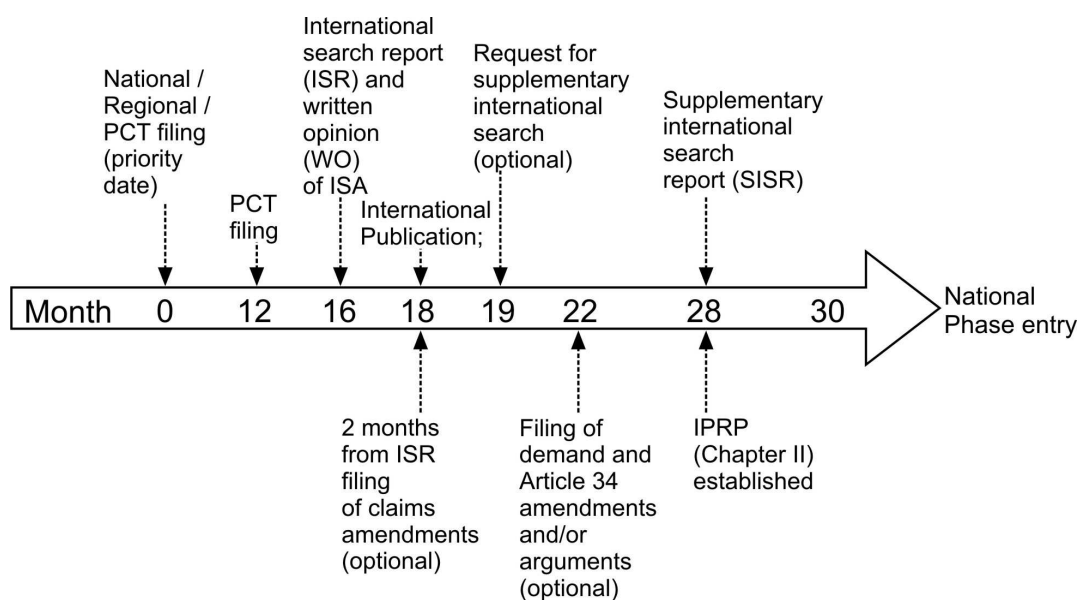
**Filing:** one can file a patent application with a national or local patent Office or WIPO, following the PCT convention prerequisites, by paying required fees.

**International Search Authority:** International Search Authority gives the report of whether an invention is patentable or not.

**International Publication:** International patent application is published after 18 months from the date of filing.

**Supplementary International Search (optional):** Additional report is optional and therefore it is conducted only when it is requested by the applicant.

**National Phase:** After the end of the PCT process, usually at two and a half year from the original filing date of application, from which one can claim priority, can start to follow the grant of patents in the national (or regional) patent Offices of the countries in which the applicant wants to obtain a patent. Below, Figure1.10 explains the timeline during the PCT application.



**Figure1.10. PCT Timeline**

Source: Ref – WIPO -

[http://www.wipo.int/export/sites/www/pct/en/seminar/basic\\_1/timeline.pdf](http://www.wipo.int/export/sites/www/pct/en/seminar/basic_1/timeline.pdf)

## **1.12 SME and IP**

The role of SMEs in job creation and their contribution to GDP is well understood. They also help in reducing the concentration of economic power. SMEs can promote competition in the marketplace, create new industries, and become the motive force behind economic restructuring. In developing countries, SMEs are an important tool for promoting inclusive growth.

Small businesses tend to be more innovative. Quick decisions, less bureaucratic structure and the ability to adapt to the changes improve the innovative ability of SMEs.

Challenges before SMEs - In the 21st century's knowledge economy, their innovativeness is a big asset, provided they secure adequate protection for their innovations through Intellectual Property Rights. There is a misunderstanding that Intellectual Property Rights (Patents, Industrial Designs, Trademark, Copyright, etc.) are relevant to big organizations only. SMEs make many product innovations and develop new technologies, which they should protect through patents. They also have a trade name or one or more trademarks and should protect them. Most SMEs have valuable confidential business information, from customers' lists to tactics that they may wish to protect. They develop creative, original designs, and many produce or assist in the publication, dissemination, or retailing of a copyrighted work. Artisans produce traditional products, which can be protected as Geographical Indications.

Importance of IPR to SMEs –To stay competitive, SMEs make many innovations in products and their appearance. Securing Patents and Design rights can prevent others from using these without permission.

SMEs can also raise finance by selling or licensing patents and other IPRs. Effective use of trademarks prevents misuse of their trade name, piracy, and counterfeiting. Intellectual Property Rights help to obtain a higher return on investments, attract investors and are very valuable in the case of mergers and acquisitions.

### **Benefits of patenting**

**Strong market position** - Through these exclusive rights, one can be able to prevent others from commercially using their patented invention, thereby reducing competition and establishing themselves in the market as an eminent player.

**Higher returns on investments** -Having invested a considerable amount of money and time in developing innovative products, SME could, under the umbrella of these exclusive rights, commercialize the invention enabling the SME to obtain higher returns on investments.

**Opportunity to license or sell the invention** - If anyone chose not to exploit their patent themselves, they may sell it or license the rights to commercialize it to another enterprise, which will be a source of income for them.

**Increase in negotiating power** - If SME is in the process of acquiring the right to use the patents of another enterprise, through a licensing contract, the patent portfolio will enhance the bargaining power.

**Positive image for enterprise** - Business partners, investors, and shareholders perceive patent portfolio as a demonstration of the high level of expertise, specialization, and technological capacity within the company. This may prove useful for raising funds, finding business partners, and raising the company's market value.

The following example illustrates the benefits of patents to a company.

Dr. Lavanian, CEO of Lynk Ambupod Pvt. Ltd.<sup>[26]</sup>, has worked on quality-based, reasonable, and available healthcare to villages. Developed ambulance on a two-wheeler, the Ambu Pod (patent pending) which is a 3-in-1 fully equipped mini-ambulance plus mobile Clinic plus telemedicine center that can provide any village with affordable, quality-based, daily healthcare, along with 24/7 ambulance services. LYNK has been officially certified as a Start-Up by the DIPP, Government of India.

For start-ups recognized by the Government under the scheme, an expedited method for examination is available.

### 1.13 Scheme for Facilitating Startups Intellectual Property Protection – SIPP

The Government of India has initiated the Scheme for Facilitating Startups Intellectual Property Protection (SIPP)<sup>[27]</sup> for Startups. Startups, with limited resources and workforce, can sustain in this highly competitive world only through continuous growth and development-oriented innovations; for this, it is equally crucial that they protect their IPRs. The scheme for Startups Intellectual Property Protection (SIPP) is envisaged for facilitating the protection of Patents, Trademarks, and Designs of innovative and interesting startups.

SMEs have gained benefits of patenting either by using patents themselves or by licensing their patents to others (licensing out) and or by licensing from others (licensing in)

In many countries, SMEs are using patents for business growth and for gaining a competitive advantage. Thus, patenting inventions and using them strategically can be a game-changer for SMEs.

### 1.14 Patent Databases

In today's world, the database is the catchword. There are many patent databases by the Government of the respective countries and value-added databases from private players. Many public patent databases like Indian Patent Office, USPTO, EPO (European Patent Office), and Patent scope by the World Intellectual Property Organization are available on the Internet. Some of the databases are mentioned in table 1.8.

**Table 1.8. List of databases related to patent searches**

<b>Free Databases</b>	<b>URL</b>
Indian Patent Office	<a href="http://ipindiaseservices.gov.in/publicsearch">http://ipindiaseservices.gov.in/publicsearch</a>
The European Patent Office's (EPO)	<a href="http://ep.espacenet.com">http://ep.espacenet.com</a>
USPTO	<a href="https://www.uspto.gov/">https://www.uspto.gov/</a>
JPO	<a href="https://www.jpo.go.jp/">https://www.jpo.go.jp/</a>
WIPO	<a href="http://www.wipo.int/patentscope/en/">http://www.wipo.int/patentscope/en/</a>
Google Patents	<a href="http://www.google.com/patents">http://www.google.com/patents</a>

<b>Paid Databases</b>	<b>URL</b>
Orbit	<a href="https://www.orbit.com/">https://www.orbit.com/</a>
Pat Base	<a href="https://www.patbase.com/">https://www.patbase.com/</a>
Derwent Innovation	<a href="https://www.derwentinnovation.com/login/">https://www.derwentinnovation.com/login/</a>
Tota lPatent	<a href="https://www.lexisnexis.com/totalpatent">https://www.lexisnexis.com/totalpatent</a>
Pat Seer	<a href="https://acc.patseer.com/">https://acc.patseer.com/</a>

Database plays an important role in patenting activity. It is highly advisable for companies engaging in creative activities to search patent databases to find out about existing technologies, identify licensing partners, and avoid duplication / reinventing the wheels of research activities.

Patent databases also have immense value for SMEs. Patents, which are expired, can be freely used by anybody. Such patents can open up opportunities for a new business or new products or new processes.

Patent searching on the database should be the beginning point of R&D activity for any company that wants to explore new products/technology to grow. Patent databases could be used to:

- ✓ Avoid unnecessary expenses in researching, what is already known
- ✓ Identify and evaluate technology for licensing and technology transfer
- ✓ Identify alternative technologies
- ✓ Keep up-to-date with the latest technologies in the field of expertise
- ✓ Find ready solutions to technical problems
- ✓ Get ideas for further innovation

### **Patinformatics**

The term Patinformatics<sup>[28]</sup> was coined in the year 2002 to provide a recognizable phrase to encompass the various analytical methods used to analyze patent information. Patinformatics describes the science of analyzing patent information to discover insights, relationships, and trends. Originally, the discipline focused on the analysis of large amounts of patent information (macro-level analysis) but more recently, it has been recognized that the analysis of small numbers or even single patents (micro-level analysis) is also a critical activity and should be incorporated into the idea of Patinformatics.

Following is a checklist<sup>[29]</sup> that will be helpful in preparation for developing a comprehensive patent strategy for a company.

- ✓ Identify key industry players (competitors, partners, customers).
- ✓ Identify technology and/or product directions (within the company and industry).
- ✓ Determine whether a patent portfolio be used offensively (i.e., as a “sword” asserted against others; revenue generation, etc.), defensively (i.e., used as a “shield” or counterclaim against others who file suit first), for marketing purposes (i.e., to show the outside world a portfolio to demonstrate company innovation), or a combination of these.
- ✓ Meet with information scientists / professional searchers/attorneys working in the patent areas to align goals, industry information, technology/product information, and patent portfolio uses to outline core patent strategy.

#### **1.15 Aspects related to Management of Intellectual Property Rights (IPR)**

- ✓ The commercial potential of any research undertaken should be evaluated.
- ✓ All the scientists and technologists and management in the organization should be aware of the importance of various Intellectual Property Issues and the consequences
- ✓ The patentability of the invention should be evaluated.
- ✓ It should be understood that completing the procedure of patenting is both costly and time-consuming, and hence due consideration should be given to the potential advantages that could be accrued before initiation of action for the filing of the patent.
- ✓ The time for filing the patent should be very carefully identified.
- ✓ Decisions relating to licensing of a patent or the sale of a patent should be taken carefully.
- ✓ A systematic procedure for R&D record maintenance should be in place
- ✓ Technological trends in the field of research undertaken should be continuously tracked.
- ✓ In respect of ownership of an invention, the employer-employee relationship should be clearly stated in a contract. Same with joint R&D collaborations outside the organization.



- ✓ Aspects relating to the sharing of know-how and data during the upscaling of any process/product should also be clearly specified.
- ✓ The process of licensing technology and the transfer of know-how should be carefully managed.
- ✓ While acquiring technology, the pros and cons of opting for licensing of patent or transfer of know-how are to be carefully assessed before decisions are taken.
- ✓ The Research and Development Unit of a manufacturing organization should be given adequate focus and sufficient resources.
- ✓ At no stage, one should lose sight of the various costs associated with the management of IPRs.

This chapter details the importance of patents, the rationale of the study, the relationship between business and patents, and also the procedure for obtaining a patent in India and other countries using the PCT route. The chapter also provides a list of guidelines that SMEs can use in the evaluation of the invention while making a decision for filing a patent. The Government of India schemes about supports to startups for their IP protection and management of IPR are also discussed.

## **Chapter 2**

### **REVIEW OF LITERATURE**

This chapter explains the literature in the area of Intellectual Property Rights (IPR), more particularly about Patent Filing trends and its impact in many areas like R&D, engineering industry, the pharmaceutical industry, market research, etc.

#### **2.1 Introduction**

Literature Review is a comprehensive, in-depth, systematic, and critical review of scholarly publications. It is helpful to a researcher to familiarize them self with the available body of knowledge in the area of interest. It starts from concept (issue/topic/problem) further with organizing sources of information and then searching online, in various databases, or offline like in library sources. A further step is to eliminate the irrelevant information, and from balance relevant information, one has to read and summarize critically.

In this chapter, the relevant literature is grouped in broad headings such as Information about Patent, Patent office procedures, Training, Certification in Intellectual Property Rights (IPR), Patent Tools, Software used for Patent Analysis, the role of IPR in Economic development, Patent valuation, Government Initiatives, Patent and SMEs, Patent trends and its applications in industry.

Literature Review will be helpful for the researchers to locate the research gaps in the area of patenting activity.

#### **2.2 Information about Patent / Patent office procedures**

**Manual of Patent Office Practice and Procedure, Indian Patent Office**<sup>[30]</sup> - Indian Patents Act, 1970 was amended in 1999, 2002 & 2005. The amended Act, by TRIPS, has provided for product patents in foods, medicines, and chemical substances. India became a signatory to PCT in 1998. As a consequence, patent filing, including PCT National Phase Applications, has increased exponentially. Considerable changes have been made in the patenting procedure through the introduction of Patents Rules, 2003, which were further amended in 2005 and 2006, resulting in new practices and

procedures. This manual will be useful as a practical guide for the understanding of the patent system in India. (<http://www.ipindia.nic.in>).

**Intellectual Property Protection in India: A Practical Guide** by TIFAC<sup>[31]</sup> this is a practical guide for – Scientists, Technologists, Researchers, Corporate Planners, Managers, etc. In this guide, the whole range of the subject is presented systematically with specific practical suggestions. An effort is made such that the reader can get the complete spectrum of the patent law and practice about i) Patent, ii) Design, iii) Trade Mark & iv) Copyrights in general.

**How to get a European<sup>[32]</sup> Patent, Guide for applicants**, and this guide has been designed to provide inventors, companies, and their representatives with an outline of the procedure involved in applying for a European patent, offering practical advice to smooth the way through various stages.

**United States of America (USA) Patent Process Overview<sup>[33]</sup>**, along with other learning resources is available online. Manual of Patent Examining Procedure (MPEP)<sup>[34]</sup> explains the detailed patent process for patenting in the USA.

**World Intellectual Property Organization (WIPO)** WIPO<sup>[35]</sup> is the global forum for intellectual property services, policy, information, and cooperation. WIPO is a self-funding agency of the United Nations, with 188 member states; it leads the development of a balanced and efficient international intellectual property (IP) system that enables innovation and creativity for the benefit of all.

**Patent Drafting Manual - Patent Drafting Manual<sup>[36]</sup>** was prepared by WIPO for the benefit of different stakeholders. It is designed to assist inventors, and those providing services to them, to acquire the technical skills necessary to prepare and file patent applications, including the capacity to draft the claims that determine the scope and coverage of the protection to be granted by the patent.

**The Patent Cooperation Treaty (PCT) Applicant's Guide<sup>[37]</sup>** is updated almost every week with information received by the International Bureau. It is a valuable resource for any end-user. The Patent Cooperation Treaty (PCT) assists applicants in

seeking patent protection internationally for their inventions, helps patent Offices with their patent granting decisions, and facilitates public access to a wealth of technical information relating to those inventions. By filing one international patent application under the PCT, applicants can simultaneously seek protection for an invention in 148 countries throughout the world.

**PCT time limit calculator**<sup>[38]</sup> timeline is a very important aspect in the life of a Patent, PCT time limit calculator provide the timeline/limit information to the user such as Submission of Priority Document, Earliest Potential Date for International Publication, Time Limit for Entry into National / Regional Phase, etc.

**(Schoch-Grübler, 1995)**<sup>[39]</sup> discuss the role of Patent offices and commercial patent services. For industrial users of patent information, the services of commercial value-added databases are essential for the first stage of a search to identify relevant documents, while in later stages, the products and services of patent offices are vital. The author questions the policies of some patent offices in producing, both as CD-ROM and online, their patent databases modeled on their requirements, and in duplicating each other's work. However, at present, almost all of the National Patent Offices are providing unique country-specific data online.

**(Kardam, 1997)**<sup>[40]</sup> has taken an overview of Patenting Activities in India. Explain the Patents Act, 1970, its salient features, comparison with the Patents & Designs Act 1911, and post WTO scenario is discussed in detail. It also claims that despite the limitations of the Patents Act, 1970, it has provided much-needed motivation not only to the R&D activities but also to the industrial development of the country.

**(Ranjan, 2003)**<sup>[41]</sup> discusses the benefits of the PCT system under which the filing of one international patent application leads to protection in several countries. The emergence of the PCT system and its benefits and raising the level of patent work are discussed in detail. Among the developing countries, India has also gained substantially and holds the third position in the international filing of patent applications, and the Council of Scientific & Industrial Research (CSIR) is second to Biowindow Gene Development Inc. from China. The paper also discusses the PCT reforms and automation briefly to make the system more useful and beneficial.

(Sachin Mangal, 2005)<sup>[42]</sup> explains the various aspects of Intellectual Property Rights and the need for a stringent IPR system, as globalization deepens further, it also increasingly encompasses the sharing, utilization, and enjoyment of IP based products.

(Sharmendra Chaudhry, 2011)<sup>[43]</sup> The article discusses in detail the Product Vs. Process Patent with reference to the Indian context and Indian Patent Law. The product Patent is applicable in India and is valid from 1.1.2005.

(Dolli, 2012)<sup>[44]</sup> discusses the regulations and trends in intellectual property such as patents, designs, trademarks, and geographical indications in India and the initiative taken by the Government of India to protect the IPR and updating the Patent Law. Since India is one of the progressively developing economies, there is enormous scope for improvement in all these fields.

#### **(Inovia, 2014)<sup>[45]</sup> U.S. Global Patent & IP Trends Indicator**

The U.S. Global Patent & IP Trends Indicator is an annual report issued by Inovia, the global leader in foreign patent filing. Now in its fifth year, the Indicator has become a go-to resource for identifying the trends that have the most significant impact on the foreign filing strategies of U.S. patentees.

### **2.3 Training / Certification in IPR**

(Pilote, Endacott, Miller, Peterson, & Poolman, 2011)<sup>[46]</sup> conducted an electronic survey to identify training needs of Chemists for specific skills about patents and the patenting process, searching and retrieving patent information, and interpreting search results. From the results of the survey, a training program consisting of several modules was developed and marketed globally through the corporate intranet and by using targeted emails.

(Hantos, 2011)<sup>[47]</sup> explains the importance of certification of patent information professionals carefully considered by some stakeholders within the patent information industry. According to the author, a profession is recognized as such not only for its specialized body of knowledge and the generous use of such knowledge but also the standards of practice by which conduct is judged as being competent, knowledgeable,

and trustworthy. It also reviews the progress towards such a certification scheme and explains the current PIUG proposal, an essential element of which is a three-tiered examination structure.

#### **2.4 Patent Tools/software**

(Wilson, 1987)<sup>[48]</sup> author suggests that for industrial information units, which lack the manpower to carry out the extensive and time-consuming, the access to online patents databases and simple analytical software allows the information specialist to obtain measures of technological and competitive activity which, may help to focus attention on present underlying trends in the market.

(Dou, 2004)<sup>[49]</sup> explains how the combination of free patent databases and dedicated software makes it possible to perform quickly and rapidly tests on new ideas, the automatic benchmarking of an enterprise's activity, and the stimulation of innovative thinking.

According to (H. Raviraj, 2006)<sup>[50]</sup>, TRIZ continues to be unique in its strength to help problem solvers generate great ideas and novel solutions. It concludes that it could become a driving force for Industrial Development. This article has taken a preview of some of the familiar and most popular TRIZ tools, methods, and strategies initially framed for solving complex problems.

(Dereli & Durmusoglu, 2009)<sup>[51]</sup> developed a trend-based patent alert system (PAS) to find out current trends in patents on industrial technologies. Patent count data based on some patents filed in a specified duration is considered an indicator to define a current trend. The trend extraction algorithm is developed based on linear regression analysis of patent data. Implementation of PAS is tested on real-time data of textile technologies extracted from the online patent database was used for making a policy decision on existing technology up-gradation and research planning.

(Moehrle, Walter, Bergmann, Bobe, & Skrzipale, 2010)<sup>[52]</sup> has presented a framework that can be employed for structuring essential tasks related to patinformatics. This framework enables an assignment of essential functions and a localization of coverage by supporting computer-implemented tools. The paper shows

that there is not one single tool that fulfills all functions of the Patinformatics process. On the other hand, the variety of applications available in the market might overstrain the users. This opens a research space for IPR services.

**(Gassmann, Ziegler, Ruether, & Bader, 2012)**<sup>[53]</sup> conducted a study based on a data set of 106 IP intensive firms worldwide, find that firms use at least one of three major IT tools for IP management: search tools, administrative tools, and evaluation tools. The article concludes by outlining where and how IT tools can improve the management of IP.

## **2.5 Economic development / Patent valuation**

**(Thompson & Rushing, 1996)**<sup>[54]</sup> investigate the role of IPRs in economic growth by introducing the model of analysis of economic growth, an equation that tests the relationship between patent protection and openness of trade, level of GDP per capita, political instability educational attainment. The empirical analysis confirms what previous researchers speculated; like greater the degree of open trade, the greater the observed level of patent protection; Countries that have not developed a significant R&D infrastructure have not emphasized strong patent protection and vice versa; Low-income countries with low educational achievement levels are not likely to have high patent protection levels, and the degree of political instability does not appear to share a statistically significant relationship with the level of patent protection. This approach may fit in the developed economies with good R&D infrastructures and economic data; it will probably not be a feasible approach for developing nations.

**(N. Varsakelis, 2001)**<sup>[55]</sup> examines the impact of national culture, openness of the economy, and patent protection framework on R&D investment. Assumptions are tested by using a cross-country analysis for 50 selected countries. The study concludes that countries with a strong patent protection framework invest more in R&D, and the national culture is correlated to the R&D investment.

**(Audretsch et al., 2002)**<sup>[56]</sup> survey the landscape of topics that are related to the field of economics of science and technology. The study of patents and intellectual property included relatively few important contributions among applied economists.

Patent databases and measurement techniques have greatly facilitated the field of study, but equally important has been the influence of public policy.

(Rao, 2002)<sup>[57]</sup> has submitted a doctoral dissertation on Patents and Technological Progress in Developing Countries: A Case Study of India. The thesis gives an empirical account of the functioning of the patent system in a developing country. Most of the Indian firms active in patenting are foreign-controlled companies. Foreign firms are dominant in foreign patenting in India. Many important large firms take patents regularly in India, as shown by the patenting activities of Fortune 500 firms. There seems to be a correlation between having an investment interest in India and the decision to patent in India. Notable to provide any concluding evidence of the relationship between foreign firms patenting and technology transfer.

(Andersen, 2003)<sup>[58]</sup> illustrated that IPR systems are not neutral; they set the rules of the game in which individuals and organizations interact and in which corporate leaders and stakeholders are shaped and technological curves selected or reinforced. Due to the not neutral nature of IPR systems, the author argues that the motivations and social and economic effects of the IPR system are vital and must be addressed at the political level. The typology developed in this article can assist in guiding empirical research concerning addressing if IPR systems implement the right mechanism that will help us to reach our political aims and objectives.

(Archibugi & Carlo, 2003)<sup>[59]</sup> explains the Globalization of Technology and its Implications for Developing Countries. It is certainly significant that countries that have a better performance in education indicators are the same that have a significant and growing share of R&D and patents by giving the example of Taiwan and South Korea inventors alone have registered more patents in the United States than all other developing countries of the world together.

### **Implementing Intellectual Property Management (IPM) under the CICM Model, 2003<sup>[60]</sup>**

In this book, the author explains that the IP audit is a preliminary process aimed at creating the IP portfolio, which provides the platform for effective management of the primary IP of the organization both on the strategic and operational levels.



At the strategic level, the portfolio is used by top management to forge the appropriate strategies for leveraging IP for both competitive positioning and commercialization purposes. On the operational level, the portfolio is used by the IP strategy unit and IP synergy teams to operationalize the competitive and commercialization strategies, respectively. The main processes are

1. Undertake an IP audit and create a portfolio,
2. Decide on IP competitive strategies to enable the use of IP as a competitive weapon
3. Decide on the appropriate IP commercialization strategies to leverage IP as a business asset
4. Create IP strategy units at the business unit level
5. Create cross-functional, cross-divisional IP synergy teams responsible for leveraging the IPs that can be used as business assets
6. Devise and implement an IP program designed to raise IP awareness and make IPM the job of everyone in the organization
7. Provide the tools and methods that enable the use of IP as both a competitive weapon and a business asset.

**(Dubiansky, 2005)**<sup>[61]</sup> described an analysis of the value of patents held by startup firms by analyzing the out-licensing of startup technology to established firms. It considers six factors that determine patent value like Litigation Risk, Patent Scope, Technical Quality, Technology Market, Technology Pull, and Technology Liquidity. These factors are used in an analysis that uses market comparable to find royalty rates, and a discounted cash flow calculation to find the present value and will be valuable to venture capital firms in evaluating the use of patent-based transactions.

**(Goyal, 2006)**<sup>[62]</sup> explains the contours of the ongoing process of Globalization, Liberalization, and Privatization. Throughout this paper, there is an underlying focus on the impact of LPG on the Indian economy.

**(NISTADS, 2006)**<sup>[63]</sup> this report emphasizes the need for a centralized system of pooling publications data by individual research organizations, similar to that already existing for patents worldwide can be considered as one of the approaches to creating

a national database in S & T. Countries like China and South Africa have already taken such initiatives, and as a result, they have been able to monitor their research output more effectively than those dependent on international databases.

**(Mukherjee, 2009)**<sup>[64]</sup> shows that currency patents exist in this world today; however, how far they can affect a currency is for a country's administration to decide. The paper merely theorizes what impact it could have on the currency and economy of not only that country but of the whole world, based on the current trends of the society, economy, and the IP scenario.

**(IPpro Services (India) Pvt. Ltd, 2009)**<sup>[65]</sup> in their report, explains that Technology is one of the main stages in the economic development of industries and nations, and IPR plays a crucial role in technology transfer. For the successful technology transfer, it needs to be protected by IPR.

**(Wilton & Wilton, 2011)**<sup>[66]</sup> examines the costs and benefits of patents from the perspective of early-stage technology startups and growing businesses, and it provides some general guidance on best practices for developing IP and patent activity plans for building a patent portfolio that appropriately supports business objectives.

**(S. Dutta, 2011)**<sup>[67]</sup> explores the transformative power of innovation. Significantly, it identifies the conditions and qualities that allow innovation to thrive and highlights the role innovation can play in a nation's economic and social development. It gives information about the Innovation Index of different Countries and their Economy Profiles.

**(Caviggioli, 2011)**<sup>[68]</sup> explains some of the possible factors which could have had a significant role in the increase in the yearly number of foreign patent applications at the Japan Patent Office. The analyzed period ranges from 1991 to 2005. In the years considered, foreign applications constantly increased while the number of domestic filings remained almost the same or even decreased. This increase is more when compared to similar figures of the US Patent and Trademark Office and the European Patent Office, where the corresponding ratio did not change too much in the same period. Building on previous literature, this paper analyses the impact of some

macroeconomic and structural characteristics of the extending countries, on one side, and, on the other side, some features specific to the receiving country and its Patent Office (here Japan and the JPO).

**(Mrinalini, Nath, & Sandhya, 2013)**<sup>[69]</sup> shows an overview of the investments made by multinational companies (MNCs) for research and development (R&D) in India during 2003-2009. It focuses on some salient features of foreign direct investment (FDI) in R&D in India and makes a preliminary assessment of the gains from the R&D initiatives of MNCs in India. The patent behavior indicates that the R&D activities by MNCs in India do not reflect much importance of their Indian set-up or their interest in high-end R&D initiatives. Sector-based classification of investment showed that a major part of the FDI in R&D was flowing to the software and IT sector, the auto industry is a poor second, closely followed by the pharma and biotechnology sector.

**(Danguy, 2014)**<sup>[70]</sup> investigate the role of technological distance in the globalized production of innovation. It uses aggregate patent-based indicators for a unique panel dataset covering international co-invention between 29 countries across 21 industries between 1988 and 2005. The empirical findings show a dual impact of technological distance on the intensity of international collaborative innovation at the industry level. The similarity of industry-specific knowledge of two countries tends to easily collaborate by sharing common industrial knowledge. If there is a difference in their non-industry-specific knowledge, more they collaborate to gain access to broad and interdisciplinary expertise.

## **2.6 Government Initiatives**

**(Arai, 2000)**<sup>[71]</sup> Japanese Patent Office (JPO) is trying to encourage the shift to quality patent, by releasing data on the ratios of applications filed to patents granted. Because of this, companies are starting to pay more attention to the costs involved and to the return on their patent investment, with the result that the rate of patents granted is going up. It also refers to the recent study by the European Patent Office that European SMEs waste 20 billion dollars every year duplicating research and development work that has already been done elsewhere, and that they could have accessed by merely checking the patent records. It concludes that it is worth

monitoring and mining patent information, both to avoid wasteful duplication and to access useful technology.

**(Prabuddha Ganguli, 2000)**<sup>[72]</sup> provides an assessment in a global framework of many aspects of developing changes in intellectual property rights (IPR) in response to the current rapidly changing technological and information industries. It also explains the list of steps to be considered in formulating IPR policy, concerning India and countries in a similar situation.

**(OECD, 2004)**<sup>[73]</sup> The analysis presented in this report suggests a series of policy issues and options, and recommended topics for more in-depth analysis in the future. In the United States, R&D in SMEs grew at almost twice the rate of R&D in large firms during the 1990s, with the smallest firms increasing most rapidly. This trend was supported partly by venture capital funding and explains how patents are especially important to new technology-based firms because such firms often have few assets other than their intellectual property, and need patent protection to attract venture capital.

**(European Patent Office-Scenarios for the future, 2007)**<sup>[74]</sup> mainly it debates about the future of IP and the Patenting system. Many pressures are affecting the patent system – political, economic, societal, environmental, technological, and historical – over which its guardians and stakeholders have little or no control. They also identified the five most important driving forces that will create the greatest uncertainty causing the system to become increasingly complex and unpredictable, which are Power, Global Jungle, Rate of Change, Systemic Risks, and Knowledge Paradox.

**(Lichtenthaler, 2007)**<sup>[75]</sup> develop a questionnaire-based study into the patent and non-patent technology out-licensing activities of 154 European firms across industries. This study provides large-scale empirical evidence for the current scope of corporate out-licensing activities.

(Jauhar & Narnaulia, 2010)<sup>[76]</sup> discusses the evolution of patenting life in the United States, Europe, and India. Additionally, the implications of each country's impact on the international patent regime in light of the TRIPS Agreement are also discussed.

**The Government of India, Ministry of Chemicals & Fertilizers, Department of Pharmaceuticals, Annual Report 2011-12<sup>[77]</sup>** - This report highlights the Impact of Product Patent on medicine prices with the enactment of the Patents (Amendment) Act 2005, the process of bringing Patents Act in line with the TRIPS Agreement has been completed. It also explains that the new patent regime is not expected to have much impact on prices/availability of medicines for reasons like (a) at any given point of time, globally only 5-10 percent of the drugs would be under patent protection. (b) The price competition among different drugs in the same therapeutic group should keep the prices under control. (c) Since the majority of the patients in India pay from their pockets, the limited purchasing power will act as a check on the very high price.

**The Government of India, Ministry of Micro, Small and Medium Enterprises, Annual report – 2012-12<sup>[78]</sup>** - This report explains the Scheme for “Building Awareness on Intellectual Property Rights” (IPR) for the Micro, Small & Medium Enterprises (MSME). The objective of the scheme is to enhance the MSME sector. Under this scheme, the primary task is the promotion of individual innovators so that they could become technology-based entrepreneurs. The Department has selected 102 Business incubators for implementing the above scheme and released Rs. 10.676 crore so far. These are helpful to bring awareness in MSMEs about Intellectual Property Rights (IPRs) for taking measures for protecting their ideas and business strategies.

This scheme is continued to be implemented since the 11th Five-year Plan. Under this programme, financial assistance is provided for taking up the identified activities viz.

- (1) Awareness/ Sensitisation Programmes,
- (2) Pilot Studies for Selected Clusters/ Groups of Industries,
- (3) Interactive Seminars / Workshops,
- (4) Specialized Training,
- (5) Assistance for Grant on Patent/ GI Registration,
- (6) Setting up of 'IP Facilitation Centre and

(7) Interaction with International Agencies.

These initiatives are being developed through a Public-Private Partnership (PPP) model to encourage economically sustainable models for the overall development of MSMEs.

**The Government of India, Ministry of Commerce & Industry Department of Industrial Policy & Promotion, 2013-14 Annual Report<sup>[79]</sup>** - This report explains the initiatives of the Government from time to time regarding the protection of Intellectual Property Rights. The Department, through the Office of CGPDTM, has been conducting the programme for creating general awareness in the area of IPR for the stakeholders.

**(Neuhäusler, Frietsch, 2013)<sup>[80]</sup>** compare patenting between mechanical engineering and green biotechnology. Mechanical engineering has a relatively higher patent activity over the years than green biotechnology, and green biotechnology patenting has somewhat decreased in recent years.

**WIPO statistics (2014) database<sup>[81]</sup>** provides a statistical profile of each country on patents, utility models, trademarks, and industrial designs. They cover different dimensions of intellectual property (IP) activity, including incoming and outgoing filings, the share of filings in different technological fields, total patents in force, and the use of international IP systems by applicants. The statistics also associate IP activity relative to the country's economic performance.

## 2.7 SMEs

**(Radauer & Walter, 2010)<sup>[82]</sup>** describes critical issues relating to the performance and challenges of publicly funded patent information services. The paper has discussed vital quality factors for publicly funded patent information services. Its emphasis is on value-added information rather than raw information services, which extends beyond pure patent information and will help SMEs as a new customer group.

**(Sharma, 2012)<sup>[83]</sup>** Explains the actual condition of the SME system in India, where these companies are lacking in a lot of strategies and rules and the effect of the IPR

system on Small and medium enterprises. It also discusses the efforts by the Government in forming many new reforms for the upliftment of SMEs.

**(Gibb & Bili, 2013)<sup>[84]</sup>** builds a conceptual model that can be used as a basis for characterizing SME governance strategies and behavioral patterns, and take a strategic view of their intellectual assets. The model as an approach seems to fit well to characterize the behavior of SMEs about the governance of their intellectual assets. In addition to serving as a diagnostic framework, it is also useful as a benchmarking tool.

**(Rane, M)<sup>[85]</sup>** The case study is described in this article from Concept to Commercialization Benefits of the Patent System and R&D of Matrix Heat Recovery Unit (MHRU), its patenting and licensing part. The author explains the potential benefits that can result from the practical use of the patent system.

**(Agostini, 2015)<sup>[86]</sup>** investigate the association between patents and SME sales performance, taking into consideration the patent quality as well. The main suggestion for SME entrepreneurs and managers is that relying on a large number of patents does not automatically lead to higher performance; instead, filing those patents, which protect particularly valuable innovations, could be more productive regarding SME sales performance. Moreover, the results suggest that a long time lag between patent filing and SME sales performance might be possible.

## **2.8 Patent trends and their use / IP practices and use**

**(Häusser, E. 1979)<sup>[87]</sup>** explains the importance of publications on a specific technical field issued by the patent offices within a specified period reflect the creative activities and the production of new technical knowledge in a country; it also throws light on forthcoming industrial activities and therefore indicates new technological trends.

**(Faust & Schedl, 1983)<sup>[88]</sup>** explained the patent statistics and established indicators of technological development using a number of patents applied for or granted worldwide, preventing sampling and weighting errors; methods were established to identify areas with critical technological developments.

(Aspden, 1983)<sup>[89]</sup> shows statistical patent data is useful as a relative measure when applied to patent applicants following similar strategies. This is compared with the use of such data in efforts to assess technological trends and assess vitality in an absolute sense.

(Campbell, 1983)<sup>[90]</sup> explains how to use patent trends as a technological forecasting tool. In good business practice, to begin new product development with a market study, it is also mandatory to systematically and objectively measure its technological strengths and weaknesses through patent analysis, to continue and to compete successfully.

(Smith, 1986)<sup>[91]</sup> has emphasizes the importance of technical information as a factor in economic development and points out the advantages of patent documents as sources of technological information. It describes the possible uses of information in patent documents and discusses the extent to which patent literature is used in research and development in various countries. The importance of patent statistics for revealing trends in the technological activities of competitors is illustrated, and the usefulness of patents in the transfer of technology to developing countries is emphasized.

(Shen J, 1990)<sup>[92]</sup> describes the progress in patent work in China, technical information contained in patent documents has been seen as indispensable to people dealing with the technology market. Also, it throws some light on the lessons if anyone neglects the importance of the legal status of patented technology while importing or exporting.

(Mogee & Kolar, 1992)<sup>[93]</sup> illustrates how international patent data can be used to analyze the substantial amounts of new technology being produced by government research organizations and to identify activities within agencies that may be particularly interesting to a firm from the perspective of technology acquisition.

(Karki, 1993)<sup>[94]</sup> has analyzed Biotechnology patents filed in India during 1972-90. Foreign patenting has dominated the scene, with the USA emerging as first among the foreign patentees followed by Japan and Germany. The study validates the



conclusions of earlier studies in respect of the Third World; that is, foreign patentees, hold most patents in developing countries, and that too by multi-national companies, and the developing countries are technologically less inventive.

**(Prabuddha Ganguli, 1994)<sup>[95]</sup>** author explains the pattern of patenting by the chemical industries in India in recent years in relation to other countries. The effect of the Indian Patent Act 1970 on the chemical industries in India is also discussed.

**(Bigwood, 1997)<sup>[96]</sup>** discusses the patent trend analysis, and it is a significant activity that will always be based on the content of the database, up to which it is updated (i.e., the limitation of the database). This means that the analysis can only be performed up to the year for which all the patents have been captured in the database. To obtain a quantitative estimate of lag time, the author has analyzed the rate at which patents are being added to Derwent's World Patent Index database. The time lag between a patent's publication date and the time it appears on the database is three months.

However, at present many patent databases are updated every week, e.g., DWPI now covers more than 28.6 million inventions (Basic Records/patent families) detailed in over 61.7 million patent documents (as of July 2, 2015)<sup>[97]</sup>. Therefore, the time lag between a patent's publication date and the time it appears on the database is reduced.

**(Pilkington, Dyerson, & Tissier, 2002)<sup>[98]</sup>** explain the use of US patents to analyze responses to regulatory change in the automobile industry. It focuses on the development of the electric vehicle (EV) and, in particular, the identification of networks of firms developing EVs. The author explains, with a limited survey of patent data, how to use the international classification scheme that allows an insight into the development of new networks as a result of the technological development required for EVs to become viable product propositions. A key finding of the study is that the way that car firms have formed links with competitors and with firms and inventors outside the automobile industry to develop the technology.

**(Trippe, 2002)<sup>[99]</sup>** The author of this paper introduces the notion of "Patinformatics." This term is borrowed from the more common fields of bioinformatics or

cheminformatics. The term Patinformatics describes the science of analyzing patent information to discover relationships and trends that would be difficult to see when working with patent documents on a one-on-one basis. The term encompasses all forms of analyzing patent information, including Patent intelligence, Patent mapping, and Patent citation analysis.

This article primarily explains the basic principles of patentinformatics, tools, resources, and websites that have evolved in this space over the last few years. The patentinformatics field is continually shifting. New practitioners are joining the field and contributing to the development of new methods of gathering value from patent data.

**(Guruprasad, Kanagavel, Srikanth, Radhika, & Sonal, 2003)<sup>[100]</sup>** analyze 1,566 US patents granted to Indian inventors that indicates a steady rise in the patenting activity during the last eight years. The majority of the patents are in chemistry and metallurgy. Out of the 42 Indian patent assignees, the Council of Scientific & Industrial Research (CSIR) is the major contributor to the US patents. Analysis of data indicates that about 60% of patents are collaborative patents, only inventors from India. About 39% of patents are such where Indian Inventors collaborate with inventors from other countries. The number of patents by Indian inventors is on the rise, while patents, where Indian inventors collaborate, are on the decline.

**(Ernst, 2003)<sup>[101]</sup>** addresses how patent information can be used for competitor monitoring, technology assessment, R&D portfolio management, the identification and assessment of potential sources for the external generation of technological knowledge, primarily using mergers and acquisitions, and human resource management. Indicators of patenting strategies and various portfolio concepts, which can be used for these purposes, are described.

**(Xu, 2004)<sup>[102]</sup>** explains the need for corporate IP management. Systematic efforts in IP management ensure continued IP development, appropriate IP protection, and maximum IP commercialization. The value index described in this paper provides a quantitative way to measure patent portfolio performance.

**(Gupta, 2004)<sup>[103]</sup>** has reviewed in his paper about multi-disciplinary studies on IPR in R&D. The existing practices in R&D management lack explicit information guidelines, which is the growing concern about IPR. The author points the need for analysis of references to non-patent and patent literature in patent documents that can provide insights into the scientific and technical information needs in R&D.

**(Hirwani, 2004)<sup>[104]</sup>** explain the use of Patents as indicators of technological performance. The author also explained the drawback related to differences in patent regulations among countries, which hamper international comparability. Changes in patent law may also affect patent time series. He suggested the importance of methods for counting patents that minimize statistical biases while conveying a maximum amount of information. He also explains the importance of count by priority office (to count by inventor's country origins, which indicates the inventiveness of the local labor force) and counts by the applicants country of residence (the owner of the patent at the time of application), which indicates control of the invention.

**(Fai, 2004)<sup>[105]</sup>** explains the issues regarding the patent system in China that is largely in a negative light and focuses upon the negligent enforcement issues. The existing Chinese patent system, although in its relatively initial stages in international terms, can also be viewed positively as a rich source of information that can be tapped to assist in location decision-making as well as in identifying potential indigenous collaborators or competitors in China.

**(Kaminski, 2005)<sup>[106]</sup>** explains and identifies what measurements or benchmarks could be employed by corporate IP departments to measure the success of their patent activities. One of the suggested measurements is quantifying the value of risk avoided by patents. In addition, the overlap between a company's patents and its products will be highlighted as a possible measurement.

**(Mittal & Singh, 2005)<sup>[107]</sup>** made an attempt to study the trends of patenting activity in the field of agriculture concerning India using data from various databases. The study covers the data from the year 1995 to 2004 (WTO era), wherein 415 patents exclusively related to agriculture have been taken for analysis. The study indicates the focus of research of different organizations/industries in specific areas of agriculture

and highlights the important technological directions and gaps for further pursuing R&D in agriculture. Major patenting activity in India is in the area of biocides. The methods to isolate these compounds from various plants have been patented. It concludes that the public sector is more active in comparison to the private sector.

**(Peeters & Van Pottelsberghe De La Potterie, 2006)<sup>[108]</sup>** studies the relationship between the innovation strategy adopted by firms and their patenting behavior. The patenting behavior is measured both by the probability of having a patent portfolio and the number of active patents held by the firm. According to the author, the ‘need’ effect would be of particular importance for R&D collaborations with competitors. The key finding of the paper is that an outward-oriented innovation strategy of the firm relies on partnerships with external organizations for research projects.

**(Fabry, Ernst, Langholz, & Ko, 2006)<sup>[109]</sup>** analyzed the patent in the nutrition and health industry. The analysis shows that the market segment of Dietary Supplements and the appending individual fields of technology have visibly increased their dynamics over the years, which speaks for highly technical and economic importance. It also identifies companies of particular significance that dominate the whole segment because their portfolio shows the highest patent strength. It concludes that this market segment is mostly application-driven.

**(Falvey, Foster, & Memedovic, 2006)<sup>[110]</sup>** explains the role of Intellectual Property Rights in Technology Transfer and Economic Growth. The author expresses concern about IPR protection that tends to be polarized, and it is believed that stronger IPR protection can encourage innovation, technology diffusion, and enhance growth. On the other part, it is thought that stronger IPR protection leads to monopoly power for patent holders, reduces the motivation to innovate, and limits the dissemination of knowledge.

**(A. Dutta & Sharma, 2008)<sup>[111]</sup>** developed a methodology that relates industries to their intrinsic, technological dependence on innovation and R&D and attempts to correlate the trends in innovative efforts made by Indian firms in the post-TRIPs era to this dependence. They conclude that the post-TRIPs era is associated with increased expenditure on R&D and U.S. patent applications by domestic firms in

India. Inferences from the result are that stronger IPRs were responsible for generating greater incentives to invest in innovative activities by domestic firms and for facilitating the transfer of technology between firms.

**(Park, 2008)**<sup>[112]</sup> provides an update to the index of patent protection published in Research Policy journal in 1997. The original paper presented the index for the period 1960–1990 for 110 countries. The present index is updated upto 2005 and extended to 122 countries. It shows the adoption of stronger patent laws, and the composition of patent rights varies across countries by level of economic development. The index of patent rights for India was 1.03 during 1960 – 1990, 1.23 during 1995, 2.27 during 2000, and 3.76 during 2005.

**(Yunwei, Zhiping, & Meyer, 2009)**<sup>[113]</sup> analyzes the application activities of Chinese patents in the eight economic regions of PR China, covering a period of 1999 to 2004. This paper also discusses the relationship between GDP, R&D, and Chinese patent applications in various regions and different organizations. An important finding is that the East Coast is more efficient in technology innovation than the North Coast. Therefore, domestic entities and/or foreign investment entities in the North Coast, including colleges, corporations, and research institutions, should pay more attention to the location of future S&T efforts to keep up with the advanced step of the East Coast.

**(Janodia et al., 2009)**<sup>[114]</sup> studied the situation in India after the product patent regime was implemented. The authors attempted to identify how Indian pharmaceutical companies view the product patent regime, hindering the growth of an industry or providing an incentive to R&D. The measures taken by these companies to survive and grow in the product patent regime have also been analyzed. In this study, the sample size is very small and is just indicative of the opinion of people working in the pharmaceutical industry.

**(Guo, 2009)**<sup>[115]</sup> explains the effects of patent characteristics as signals on the growth of follow-on innovations in context with Chinese patenting activities in the U.S. Using evidence from Chinese patenting activities in the US and employing the patent

‘signal theory’, this paper attempts to investigate certain characteristics of a Chinese patent subsequently filed and granted in the U.S.

Based on US grant patent with a Chinese priority, this paper finds that the number of the patent claim, number of patent class, number of cross-national inventors, and number of multinational assignees has a significant and positive relationship with its forward citations by follow-on innovation, while a patent developed under robust patent regime does not necessarily increase its forward citations and technological innovation. This finding is inspiring to both management practice and policy application.

**(Yogesh Sumana, Nishy P & Gupta, 2009)<sup>[116]</sup>** analyses trends in patents filed/owned from India in the area of information technology (IT). It was found that foreign private companies were leading in patenting activities. Patenting activity in IT in India picked up from the year 2001 onwards. Due to the applied and profit-oriented nature of industrial endeavors, the private industrial sector leads regarding some patents filed/owned compared to universities or government research organizations. By IPC codes, most of the Indian IT patents belong to computing, necessary electronic circuitry, and electrical communication techniques; creative activity in hardware modification and computer system architecture; data processing systems and data communication systems, respectively. It is observed that foreign private companies operating through their R&D centers in India had obtained more patents than their Indian counterparts.

**(Hidalgo, Molero, & Penas, 2010)<sup>[117]</sup>** This paper aims to contribute to a better knowledge of the existing relationship between the incorporation of technology and the industrial take-off, based on the case study of the sectoral dynamism of the Spanish industry during its period of highest development. The conclusion addresses the desirability of implementing mechanisms focused on design and support technology transfer strategies and their relation to the processes of technology sale and market presentation. Among these mechanisms, commercial agreements can be included, as well as technology leasing agreements, production licenses, development of licenses, and patents.

In today's knowledge economy, intellectual and industrial property and associated rights are of growing importance for companies. It is essential to be aware of how to manage these assets.

**(Petit, Dubois, Harand, & Quazzotti, 2011)**<sup>[118]</sup> has explained in the article about a European project co-financed by the European Commission, an action aimed at solving such issues. The author developed an IP questionnaire, based on the adaptation of the marketing and sales based on the AIDA model (Attention, Interest, Decision, and Action), allowing classifying IP practices and uses within a progressive scale. The first phase of this methodology, the "audit" phase, has shown very positive results in a test phase with several enterprises.

**(Kadri & Saykhedkar, 2011)**<sup>[119]</sup> analyzes the Post-TRIPS Patenting Trends in India with Special Reference to the USA. The analysis has shown that there is tremendous growth in the patent filings and grants in India after the implementation of TRIPS, but creative activity in India seems to have decreased. Most of the patents in India are owned by foreign inventors, mostly from the USA, which seems to indicate that the US has been the significant TRIPS beneficiary rather than India. One positive trend observed has been the continuously increasing patent filing by Indian residents in the USA. However, the patent filing rate is much below compared to the USA and developing countries. The present patenting trend in India is indicative of the fact that TRIPS has neither encouraged innovation in India nor has it played any significant role in development as expected.

The author also shows the concern about the 'green' picture of a rising rate of filing of patents in India does not seem to be all that green, hale, and hearty. Rather, it may be a 'red' signal for the Indian innovation policy and a threat to the dream India of 2020 since a major chunk of the applications filed in India are of foreign origin, particularly from the USA.

**(Liu & Luo, 2011)**<sup>[120]</sup> has explained and shown how to construct a new energy technology patent strategy in China. This is important when the obstacles in the transfer and diffusion of new energy technology, the author put forward some

suggestions on how to construct a new energy patent strategy in China to solve these questions.

**(Uchôa, Ferreira, Sachetto-Martins, & Müller, 2011)**<sup>[121]</sup>explains about Brazilian scientific and technological production that is mainly concentrated in public institutions, since almost 90% of patent applications in the genomic area were associated with the leading public universities. These findings show further evidence that the Brazilian R&D activities in this area were overwhelmingly concentrated in government universities or other public research institutions instead of the private sector.

**(Ernst & Omland, 2011)**<sup>[122]</sup>explains patent metrics, and how they are increasingly used to assess the competitive position of technology-oriented firms. Patent rankings and patent scoreboards are popular methods to benchmark patent portfolios of firms against each other. The authors have developed a new benchmarking methodology that overcomes the limitations of existing approaches and offers a more accurate assessment of a firm's patent portfolio vis-a-vis its competitors. Firms were ranked according to the Patent Asset Index, which was derived from a set of newly developed patent indicators.

**(Yoon & Lee, 2012)**<sup>[123]</sup>identify relevant industries where patent information can be effectively utilized to scrutinize the trends and effects of technological activities. The author has found the sectoral differences in patenting activities by analyzing the community innovation survey (CIS) data. Second, the applicability of patent trend analysis for technological forecasting is examined in each industry through the S-curve fitting process with patent data. Finally, correlation analysis between R&D data (R&D investment and royalty income) and patent application data is performed to demonstrate the explanatory power of patent information in R&D management, by investigating the relationship between the inputs and outputs of R&D system. It concludes that the study will support a strategic process for using the patent analysis to envisage future trends and understand the diverse faces of technology.

**(Jain & Mukundan, 2012)**<sup>[124]</sup>discussed the technical quality of a patent, which is a valid output measure for firms investing in R&D. A focus on technical quality will



automatically lead to better valuation and the outcome of improved and cutting-edge technological capabilities.

**(Dahibhate & Patil, 2012)<sup>[125]</sup>** analyzed the trends in Indian patents filed in the area of chemical sciences from 1995 to 2008. It explains the importance of patent literature in scientific developments and global trends in patent filings. A result of Indian patent filing analysis indicated that filing in India is increasing in the past few years, and many public and private organizations are filing patents in India and other countries for protecting their inventions.

**(Yang, Xu, & Neuhäusler, 2013)<sup>[126]</sup>** analyzes the domestic performances of China's (Electric Vehicles) EV technology and its international competitiveness by adopting the recently developed concept of transnational patents. The results show outstanding performance for China's EV technology in the domestic market, but a relatively poor performance in the international markets.

**(Raghavan, Jain, & Jha, 2013)<sup>[127]</sup>** explains about the firms centered on technological assets would need to develop value generation strategies attached to commons management. It becomes essential when such advancements introduce modifications in a resource's fundamental attributes. This work suggests two plans, one, a firm's technology strategy strongly influences the creation of tragedy of commons and anti-commons, and two, patent pools as a semi-common construct help firms to balance the tragedies of commons (access) and anti commons (availability) and maximize their returns.

**(Paik, Y & Zhu, F. 2013)<sup>[128]</sup>** This paper views the firm's patents as a competitive weapon and shows how the patent litigations affect market participants in the global market for smartphones. This study sheds new light on the firm's patent enforcement strategies by highlighting the significance of heterogeneity in the effectiveness of patent systems for global competition. Firms use markets with strong IP protection as a natural battleground for their patent enforcement strategies, which leads to increased litigation risk for other participants in those markets. The authors find that, as the patent war intensifies, firms focus their businesses more on markets with weak IP

protection than on those with strong IP protection, even when they are not involved in patent litigation themselves.

**(J. Danguy, 2014)<sup>[129]</sup>**the empirical findings of this paper indicate that the home-based augmenting motives drive the globalization of innovation production. Concludes that countries tend to be more globalized in industrial sectors in which they are less technologically specialized. Provides evidence-based suggestion that international patenting is a way to compensate for technological weaknesses at home, rather than to exploit home technological strengths in significant foreign markets. The author also expresses the need for a more detailed study about who collaborates with whom in the globalized production of innovation, which will be more useful for strategic planning.

**(Ajay D., Sangamwar A. T. 2014)<sup>[130]</sup>**analyses trends and patterns of the Indian Council for Scientific & Industrial Research (CSIR)'s Patents for ten years. CSIR's patenting trends were categorized into two periods, one before 2005, where CSIR showed more interest in protecting their inventions through filing more patent applications in India than abroad. Whereas after 2005. CSIR has changed the scenario of publishing patents and focused more on strategically novel inventions and commercializing the same by encouraging trans disciplinary leadership / entrepreneurship. The paper also addressed the various trends and discussed the reasons for downfalls and identified milestones along with pictorial representations.

**(Baker, 2014)<sup>[131]</sup>**studies the innovation and patent generation in a cross-industry effect. This research is practically significant because it highlights and extends the body of knowledge to include a multi-industry perspective on innovation strategy and its relationship to a firm's performance. This research confirms and extends findings from industry-specific studies that innovation strategy as operationalized by year-over-year patent generation, are statistically significant in predicting and explaining some performance measures. This study attempts to help managers gain confidence related to innovation investment decisions.

**(Kanga & Motohashi, 2014)<sup>[132]</sup>**discusses the role of essential patents as knowledge input for future R&D. The central hypothesis of this paper is that the selection of

knowledge sources for R&D differs among business models. Each firm under study accumulates different knowledge and expertise from different R&D and business experiences.

**(Dongen, Van, Winnink, Tijssen, & Robert, 2014)**<sup>[133]</sup>the paper describes a new methodology to identify patent applications based upon research at different universities in the Netherlands, and a case study was elaborating subsequent, scientifically research-based, IP exploitation in several sectors. The main findings reveal that a variety of IP exploitation strategies have been used. Overall, more than 50% of the patents still wait to be used for further development and innovations. An interesting fact is the number of jobs created by spin-offs from university research institutes is approximately 9500 jobs over a period of 10 years, and average revenues from these patents amounted to € 42,000.

**(Sharma & Akriti Jain, 2014)**<sup>[134]</sup>explains the research and patenting in Indian universities and technical institutes. This study uses data on the publication, and patents, of 347 universities and technical institutes of India from 1970 to 2010, to understand their current research status. The study concludes that though the total number of patents and publications has been increasing gradually, the contribution of Indian academic institutions in patenting is still low and needs to be incentivized.

**Clairvolex Knowledge Processes Pvt. Ltd.**<sup>[135]</sup>provide a landscape study on Automobile Companies and their patenting trends in India. This report is based on observations and broad strategic insights and explains through various tables and charts an overview of the Indian automobile market and the patenting trend of major automobile companies.

**(Dumay, Guthrie, & Puntillo, 2015)**<sup>[136]</sup>compare Intellectual Capital (IC) and the public sector with the private sector through a structured literature review. Suggests that most IC frameworks and models have the private sector in mind; developing public sector IC frameworks and models is another way of ensuring the best fit rather than just developing inclusive models to cover a broad range of organizations.

(Benson & Magee, 2015)<sup>[137]</sup> explains a statistically significant comparison between metrics that were derived from individual patent sets from a group of technological domains and the performance improvement rates of the same individual domains. This was done to test hypotheses derived from existing theories of technological change, to initiate predictive theory development, and to establish a stronger practical basis for technology strategy and planning for firms and governments.

(Grimaldi, Cricelli, Giovanni, & Rogo, 2015)<sup>[138]</sup> develops a practical and reproducible framework that can support scholars and practitioners to leverage the value of patents and to extract all possible strategic information from the patent portfolio. The framework employs determinants of patent value that are produced from patent databases, such as claims, citations, and market coverage, and that is expressed regarding judgments achieved by interviewing involved managers, such as strategic relevance and economic relevance.

(Kapoor, Karvonen, Ranaei, & Kässi, 2015)<sup>[139]</sup> explores the use of citation categories assigned by patent examiners to study the overlap of patent portfolios among top wind power firms. Cooperative Patent Classification (CPC) is used to obtain a sample of wind industry patents. Results show high inter-firm citations among the top wind industry players that can suggest a concentration of innovation. The results can be useful for patent analysts, technology managers, and policy makers. The author also suggests Cooperative Patent Classification (CPC) as a better alternative to the International Patent Classification (IPC) in the identification of wind industry patents.

## **2.9 Research Gaps**

In the current economic scenario, a large number of Engineering Companies have started outsourcing part of their R& D work by way of contract research of technical services to India. Search on the Indian Patent database also shows the number of patent filing from foreign countries has increased. Indian companies are also trying to explore their technical experiences and trying to yield market opportunities to become suppliers of R&D services or be a partner in developing new technologies.

All the above literature studies on Patent filing trends and their impact focuses on the principle that the number of patents filed in the specific area of interest, and how the organization can take advantage of it, to take the new initiatives for new product development and increase their market share. It was observed that published literature is in the general area and mainly about chemical and pharmaceutical areas of research, and mostly these studies are done outside India. Some interesting studies are from China, like patent filing trends studied in the area of activities of Chinese patents in the eight economic regions of China, new energy technology patent strategy, electric vehicle technology, and its international competitiveness.

However, sector-specific studies on the impact of patent filing trends in India related to the engineering sector have not been conducted. We, therefore, plan to fill this gap by studying the Patent Filing trends and its impact on engineering units in the Pune region.

The second chapter focuses on a literature review and it brings out various aspects related to intellectual property rights based on unpublished studies. The papers involved in the literature review are related to the majority areas such as background information related to patents, prosecution of patent applications and the processes followed by the patent office. Courses related to Intellectual Property Rights (IPR), tools, and techniques routinely used in the analysis of patents. The chapter also summarises the role played by intellectual property rights in economic progress, various factors considered for Patent valuation, Government schemes, and Initiatives for SMEs to help them in the patent filing. Some of the papers also discussed the use of patent information and filing trends alongwith their utility for various industries. The chapter concludes by identifying the research gaps.

## **Chapter 3**

### **RESEARCH METHODOLOGY**

In this chapter, the study region, research design, population, sample size, sampling technique, and tool for data collection, and data analysis are described.

It is a study about the Patent Filing Trends and its impact on select engineering firms in Pune. The preliminary review of the literature suggests that there is an increasing rate of patents filing in India by foreign firms.

#### **3.1 Statement / Defining the Problem**

Does the Intellectual Property (IP) strategy based on Patent information Analysis help the Organization to develop their R&D / business plan with respect to a specific industry?(Engineering / Mechanical).

Understanding the purpose behind the increasing trend of patent filing in India by foreign organizations; and the relation between Patent information Analysis and Strategy, of organizations.

#### **3.2 Research questions**

1. Can the patent information be utilized in the R&D planning of the engineering sector?
2. Does a company having the patents in their portfolio use them in business?
3. Does joint collaboration between Indian and foreign companies help in R&D and leads to the filing of patents?
4. What is the effect of Globalization on R&D by Indian companies and patent filing?
5. What is the effect of Globalization on patenting by MNCs in India?
6. What is the patent filing position of R&D centers of MNCs in India?

The objectives of the study are explained in chapter 1.

### **3.3 Formulation of Hypotheses**

1. Engineering companies in Pune use patent information in their R&D planning.
2. Engineering companies in Pune have IP (Patent) rights in their portfolio and uses the same as a business tool for market capture.
3. Engineering companies in Pune have joint collaboration with foreign partners for R&D activities and are filing the patents in India and Abroad
4. Liberalization and Globalization lead to increased R&D by Indian companies as represented by their patent filings.
5. Liberalization and Globalization lead to an increase in patenting activity by MNCs in India.
6. R&D behavior of MNCs leads to more R&D by their R&D centers and subsidiaries, as represented by the patents filed by them.

### **3.4 Data Collection**

#### **Primary Data**

The scope of the study is limited to Patent Applications filed in India by Foreign and Indian companies in the engineering sector. The time period considered for this study is in two phases: before and after 2005 to see the changing trend in Engineering Cluster.

The source of the primary data is the personal interview of R&D / patent experts from the Pune region working in engineering companies. The nature of research questions is exploratory and descriptive, and therefore a questionnaire-based survey method is used.

#### **Questionnaire**

The reliability of the questionnaire using 17 questions along with sub-questions related to the study is calculated, and Cronbach's Alpha value is 0.765. Thus, the reliability of the questionnaire is good.

A detailed questionnaire is placed as Annexure I.

## **Secondary Data**

Pune region has been a hub for engineering and manufacturing companies. For this study, it is felt that the actual patent filing data of IPO is required.

Mostly all the data are from Patent databases available worldwide on an electronic database from country-specific government patent websites.

In this study, the secondary data is collected in two parts.

1. Patent applications registered at IPO from businesses/persons from all over the world in the field of mechanical engineering. This is also explained in Chapter 1. To find the patents in this area, we have used the value-added patent database with a time limit from 2008 to 2013 to find the patents under this category. There are approximately 10500 + patents.
2. Patents filed in the Indian Patent office, in the field of mechanical engineering area by the Pune based engineering companies were retrieved. There are approximately 1200 patents.

Patent information collected in the above two parts was analyzed based on the contents of it. We used quantitative and qualitative techniques to analyze the patent information and presented this data in a matrix and graphical form. This secondary data analysis is placed at Annexure – 3.

## **Data Analysis:**

The primary data has been analyzed using descriptive statistics. The testing of the hypothesis is done using various statistical techniques such as a z-test for proportion.

Type of Research design: Descriptive research design.

Population: The population with respect to this study is the engineering companies in and around the Pune region. We have considered the companies under Auto & Ancillary, Engg., M/C, and M/C tools for the study; there are 739 companies under this classification.



Sample element: The R&D personnel's from Pune based engineering companies will be sample elements in this research study who have awareness about their R&D, patenting activity, and benefit of the intellectual property rights they derive from it.

Sampling technique: In the present study, the researcher has used a Non-probability purposive sampling technique. Purposive sampling is a sampling technique in which the sample is selected based on the researcher's appropriate judgment. Here the responses were collected from those who have awareness about their R&D, patenting activity, and benefit of the intellectual property rights they derive from it.

Sample size calculation: Total 125.

[List of companies is provided in Annexure 7]

The population size is 739 and the necessary sample mass according to reference<sup>[140]</sup> is 150. Since this sample, the mass has surpassed 5% of the population size; the Rectification procedure referred in reference is used to estimate the sample size, and it is 125.

Sample instrument: Personal Interview, Structured Questionnaire were used; Refer see Annexure 1. The questionnaire has three sections: A, B, and C. The questions are arranged as A. basic information (first seven demographic questions) followed by B. specific questions (next 17 questions are close-ended questions) in support of research study and C. last seven open-ended questions to get the note of any additional information.

[More details about research methodology is presented in Annexure 7]

This chapter describes the method followed during the course of conducting the research for the present study. In this chapter, the data collection method involving the administration of a questionnaire for primary data collection and the approach used for secondary data collection (patents filed) is described. Further statistical tools and test used in data analysis including determination of sample size is described.

## Chapter 4

### ANALYSIS AND INTERPRETATION

This chapter describes the analysis of primary data to check the hypothesis. By analyzing the data, we have tried to study the impact of patent filing on engineering units in Pune.

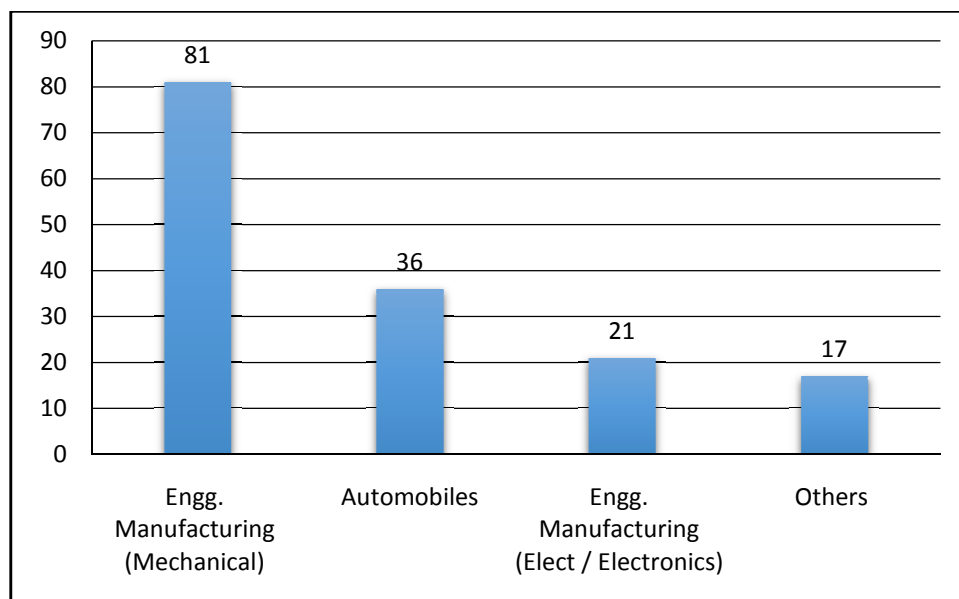
Secondary data is considered and analysis is prepared in support of primary data to validate the hypothesis.

#### 4.1 Statistical analysis of data

Initially, the frequency distribution from the data is depicted below. The frequency distribution of respondents according to Q5: Company's Main Work Area is given below in table 4.1 along with its bar graph.

**Table 4.1. Frequency distribution - Company's Main Work Area**

Company's Main Work Area	Frequency	Percent
Engg. Manufacturing (Mechanical)	81	64.8
Automobiles	36	28.8
Engg. Manufacturing (Elect / Electronics)	21	16.8
Others	17	13.6

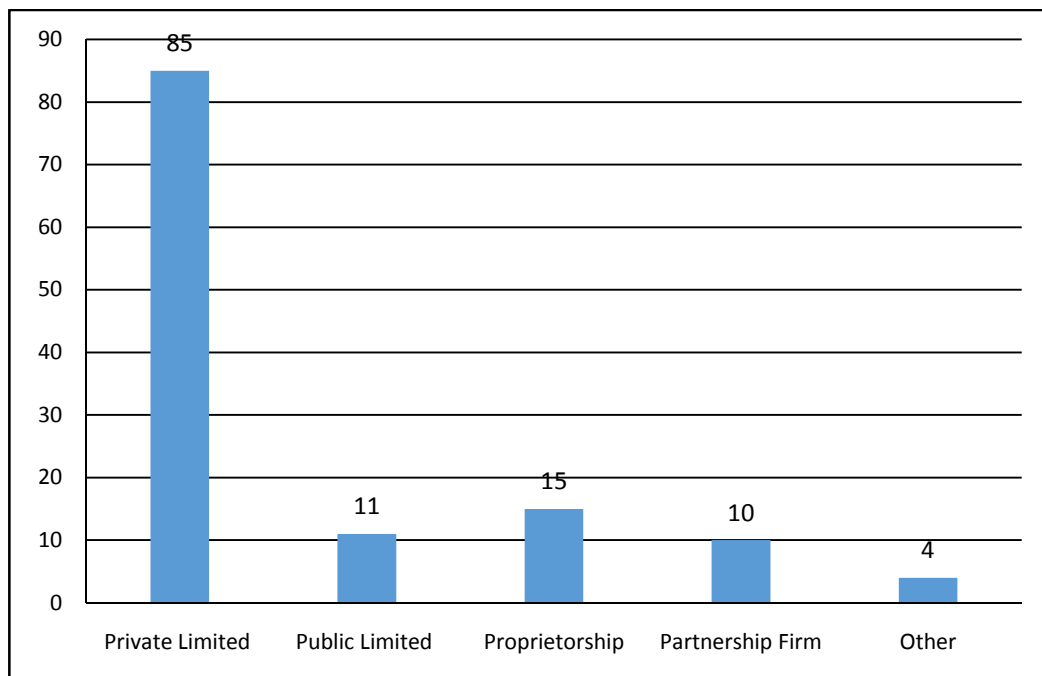


From the above graph, it is observed that most of the companies from where responses have been obtained belong to areas such as mechanical engineering manufacturing, automobile, electrical/electronic, and others. The majority of these are related to mechanical engineering probably because Pune is an engineering and auto industry hub.

The frequency distribution of respondents according to Q6: Company Registered as given below in table 4.2 along with its bar graph.

**Table 4.2. Frequency distribution - Company Registered**

Company Registered as	Frequency	Percent
Private Limited	85	68.0
Public Limited	11	8.8
Proprietorship	15	12.0
Partnership Firm	10	8.0
Other	4	3.2
Total	125	100.0

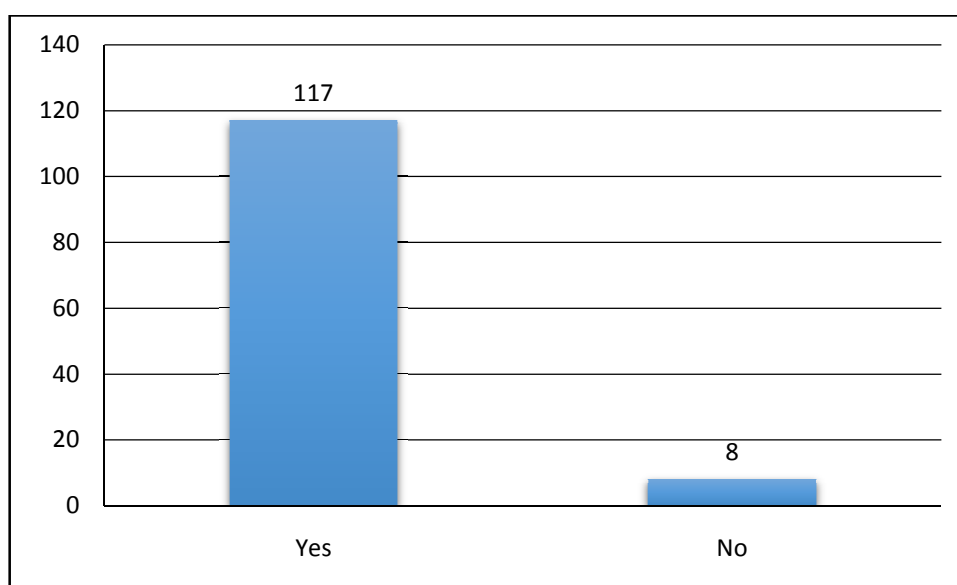


From the above graph, it is observed that there are private as well as public and proprietorship-based organizations, however, the number of public limited organizations are less. This may be because Pune has large auto ancillaries.

The frequency distribution of respondents according to Q8: Are you aware of the concept of Patent is given below in table 4.3 along with its bar graph.

**Table 4.3. Frequency distribution - Aware of the concept of Patent**

Answer	Frequency	Percent
Yes	117	93.6
No	8	6.4
Total	125	100

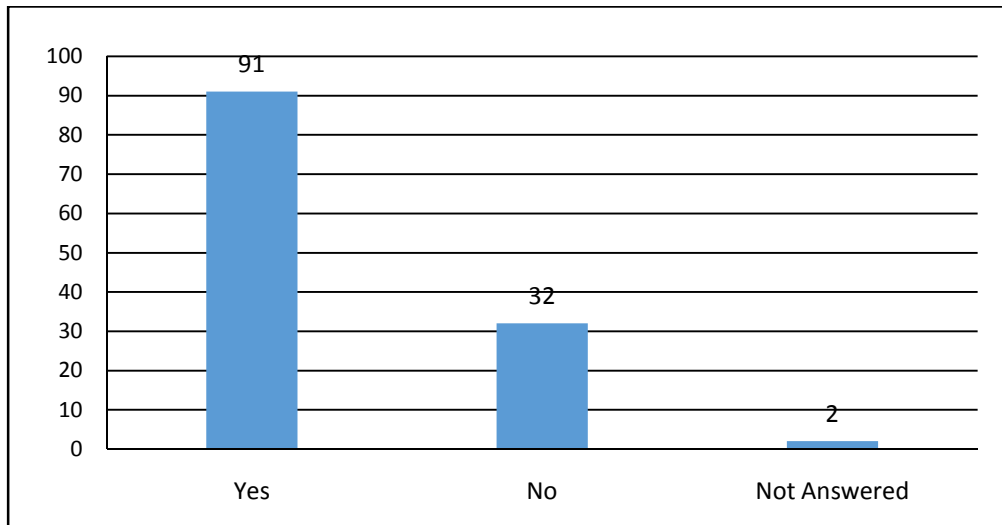


From the above graph, it is observed that major companies are aware of the concept of the patent and they also have awareness about the patent process and use.

The frequency distribution of respondents according to Q9: Does your company have R&D Setup is given below in table 4.4 along with its bar graph.

**Table 4.4. Frequency distribution - Company have R&D Setup**

Answer	Frequency	Percent
Yes	91	72.8
No	32	25.6
Not Answered	2	1.6
Total	125	100

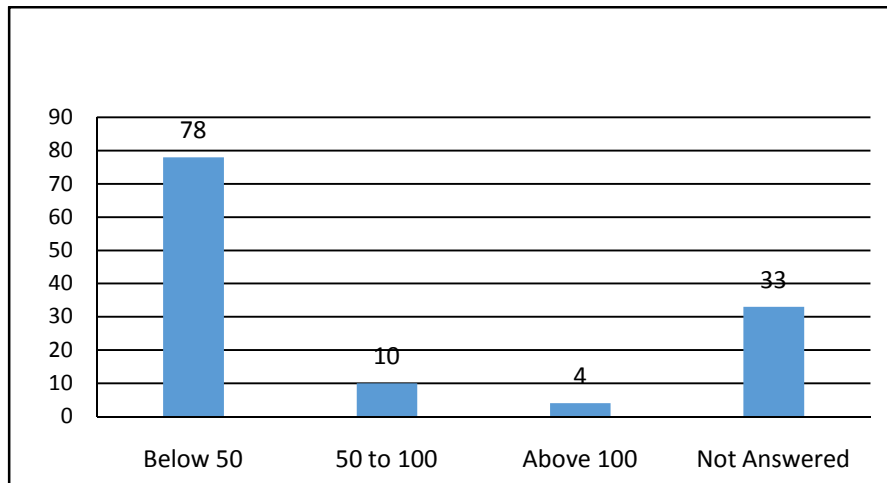


From the above graph, it is observed that many companies have R&D facility that shows their awareness about Research and Development and their capability.

The frequency distribution of respondents according to Q10: The number of staff working in R&D is given below in table 4.5 along with its bar graph.

**Table 4.5 Frequency distribution - Number of staff working in R&D**

Answer	Frequency	Percent
Below 50	78	62.4
50 to 100	10	8.0
Above 100	4	3.2
Not Answered	33	26.4
Total	125	100

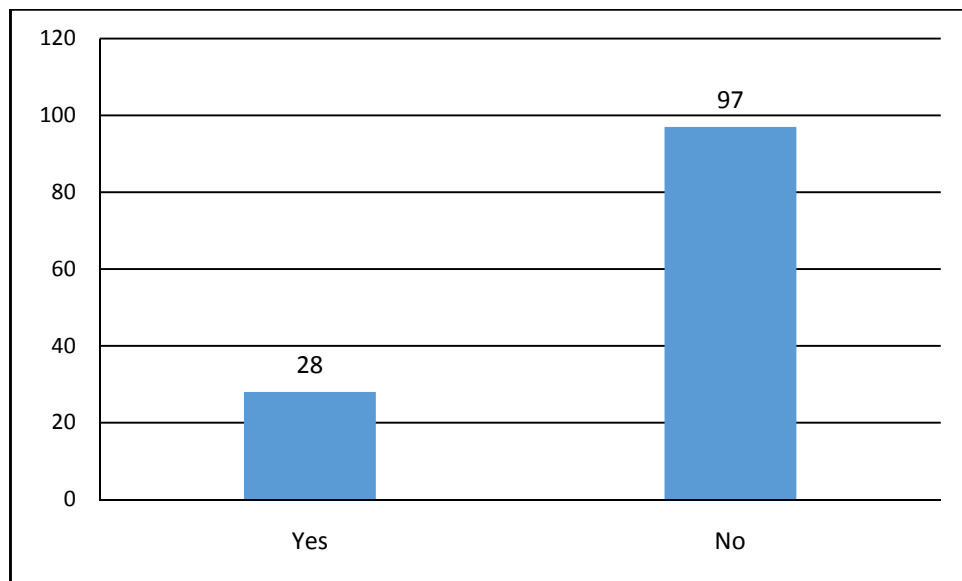


From the above graph, it is observed that 60% of companies have R&D staff below 50, this may be because more people may be working on the manufacturing/shop floor rather than in R&D or there may be limited funds available for R&D.

The frequency distribution of respondents according to Q11: Does your Company have a joint collaboration for R&D? - Yes/ No; is given below along table 4.6 with its bar graph.

**Table 4.6. Frequency distribution - Company have a joint collaboration for R&D**

Answer	Frequency	Percent
Yes	28	22.4
No	97	77.6
Total	125	100

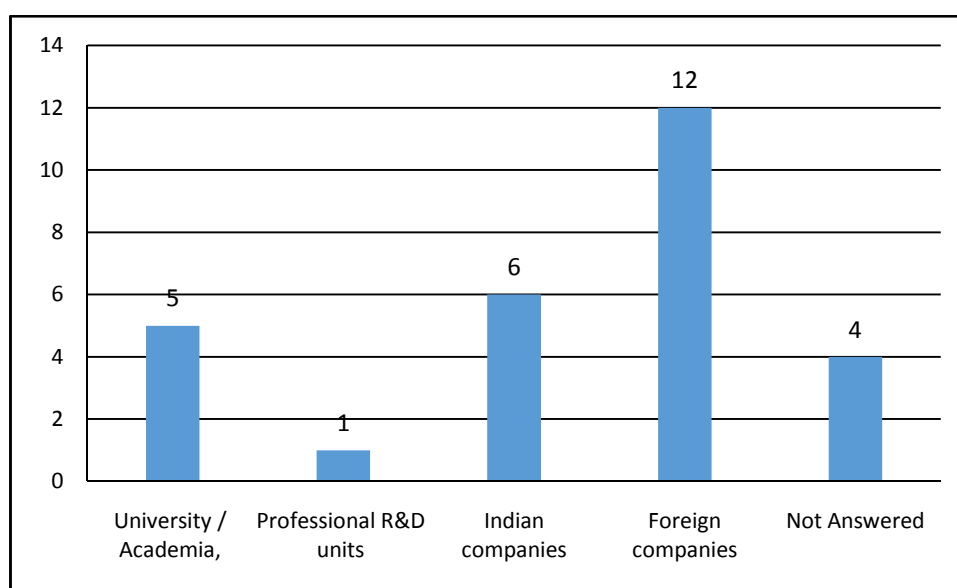


From the above graph, it is observed that very few companies have a joint collaboration for R&D and this may be because of the reason that most of the industries are auto ancillaries and may be driven by demands of bigger auto players or the respondents may wish to keep the information confidential.

The frequency distribution of respondents according to Q11a: if Yes, with whom? is given below in table 4.7 along with its bar graph.

**Table 4.7. Frequency distribution - Joint collaboration for R&D with whom?**

Answer	Frequency	Percent
University / Academia	5	17.9
Professional R&D units	1	3.6
Indian companies	6	21.4
Foreign companies	12	42.9
Not Answered	4	14.3
Total	28	100

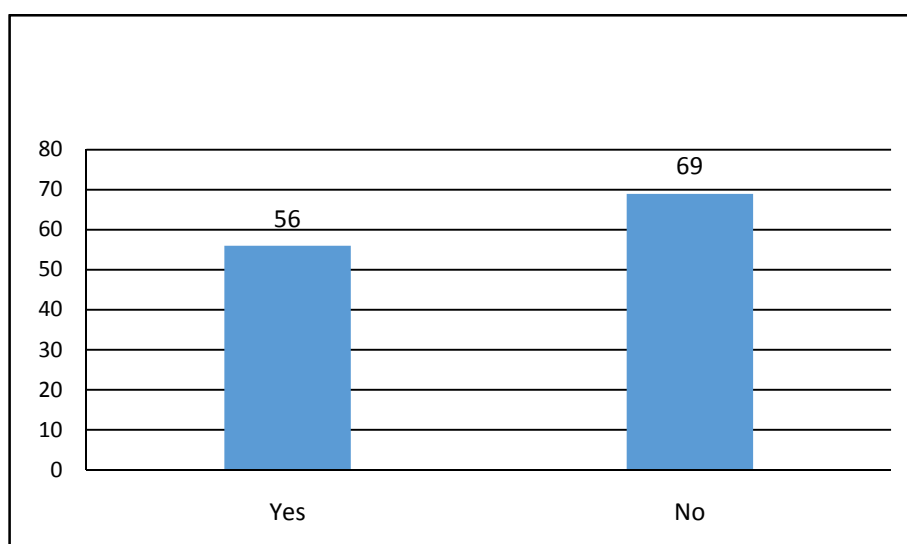


From the above graph, it is observed that a joint collaboration for R&D is seen with foreign companies and universities. This may be because of their common business interest.

The frequency distribution of respondents according to Q12: Does your Company has an Indian Patent Application OR Granted Indian Patent in its name – Yes/ No is given below in table 4.8 along with its bar graph.

**Table 4.8. Frequency distribution - Company has an Indian Patent Application OR Granted Indian Patent**

Answer	Frequency	Percent
Yes	56	44.8
No	69	55.2
Total	125	100



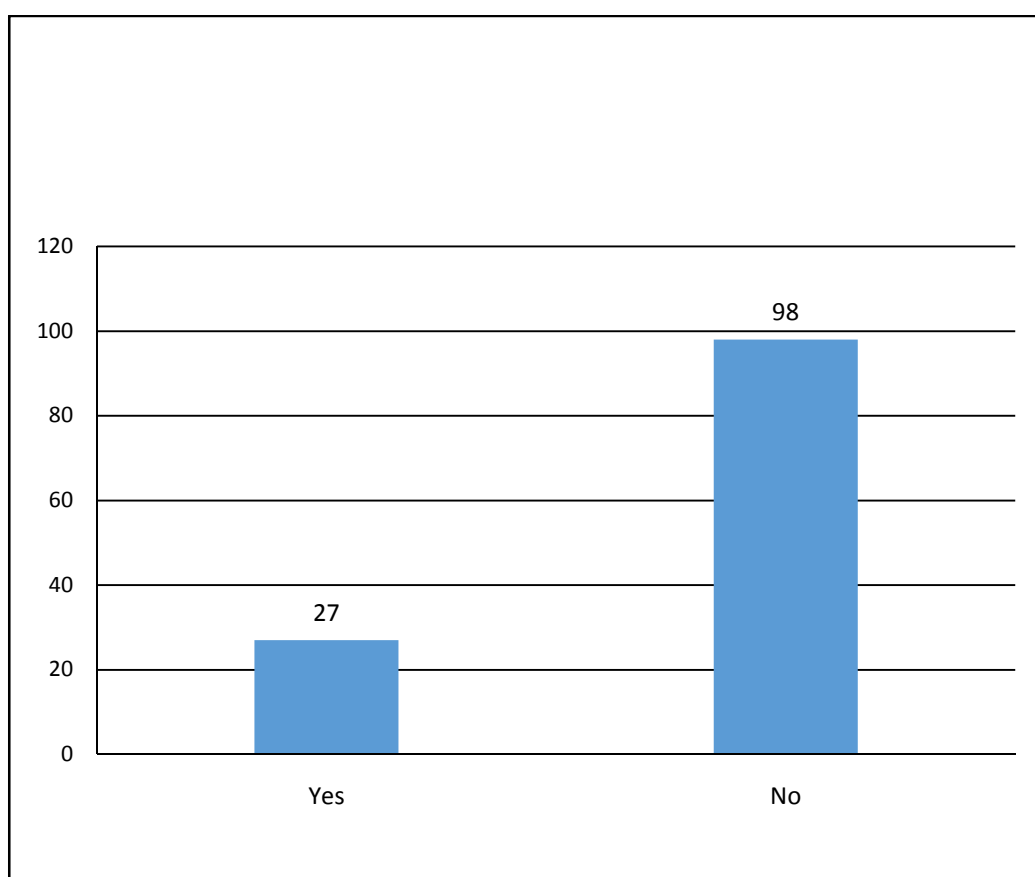
From the above graph, it is observed that almost 45% of companies are having the Indian patent application or granted Indian patents in their portfolio to protect their business interest in the Indian Market.



The frequency distribution of respondents according to Q13: Does your Company has filed a patent application(s) in foreign countries OR have granted a foreign patent in their name - Yes/ No is given in table 4.9 below along with its bar graph.

**Table 4.9. Frequency distribution - Company has filed a patent application(s) in foreign countries OR have granted a foreign patent**

Answer	Frequency	Percent
Yes	27	21.6
No	98	78.4
Total	125	100

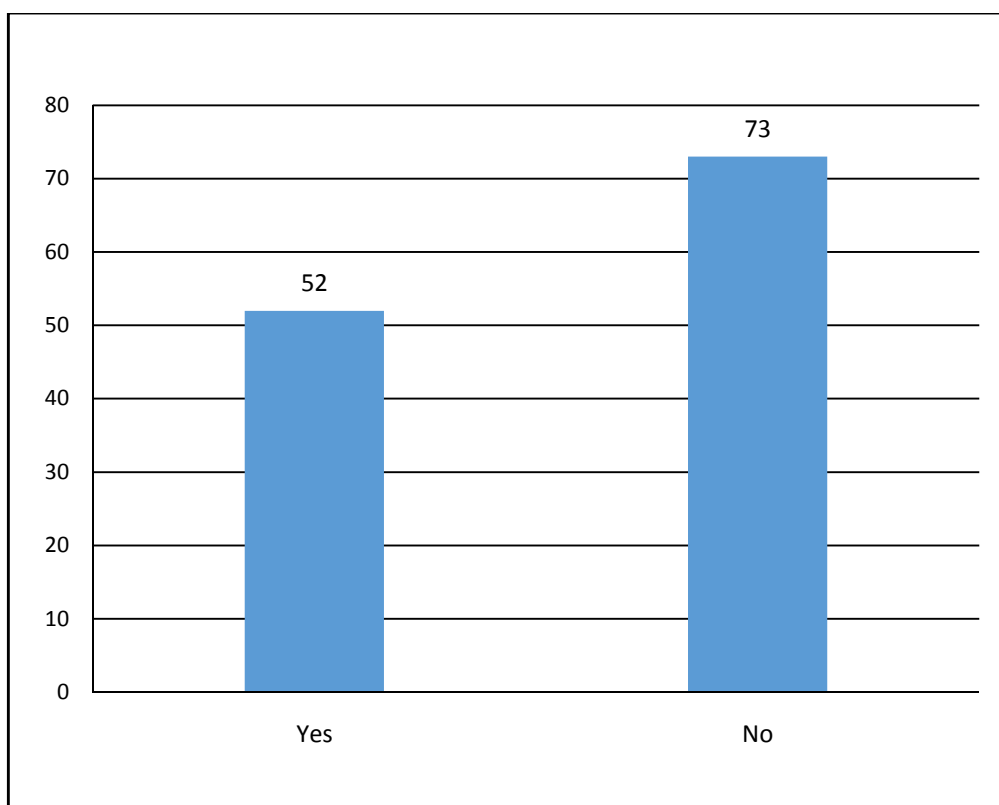


From the above graph, it is observed that very few companies are having a foreign patent application or granted Foreign Patent and the reason for this could be that the companies are supporting the bigger Indian players and therefore they may not feel it necessary to protect their invention outside India.

The frequency distribution of respondents according to Q14: Does your Company use patent information in its R&D Planning? - Yes/ No is given in table 4.10 below, along with its bar graph.

**Table 4.10. Frequency distribution - Company uses patent information in its R&D Planning**

Answer	Frequency	Percent
Yes	52	41.6
No	73	58.4
Total	125	100.0

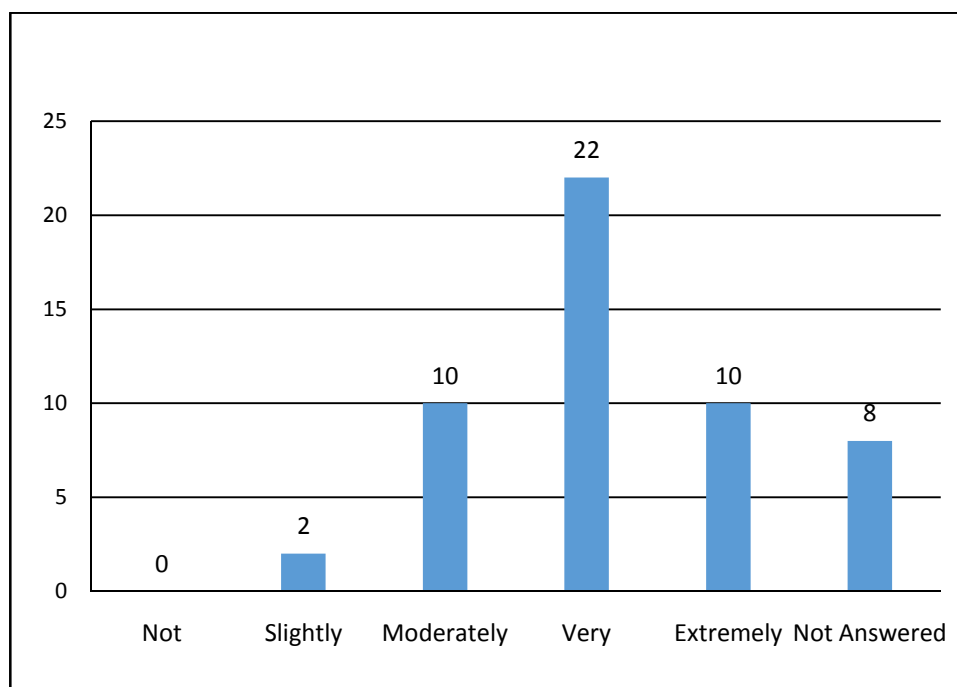


From the above graph, it is observed that around 40% of companies are using patent information in their R&D planning and this may be because of less awareness / difficulty in understanding the patent information and techno-legal language of the patent document.

The frequency distribution of respondents according to Q14 a: How useful is it on a scale of 1 to 5, where 1 is least useful and 5 is most useful? is given in table 4.11 below, along with its bar graph.

**Table 4.11 Frequency distribution - How useful the patent information, on a scale of 1 to 5**

How useful is it	Frequency	Percent
Not	0	0.0
Slightly	2	3.8
Moderately	10	19.2
Very	22	42.3
Extremely	10	19.2
Not Answered	8	15.4
Total	52	100

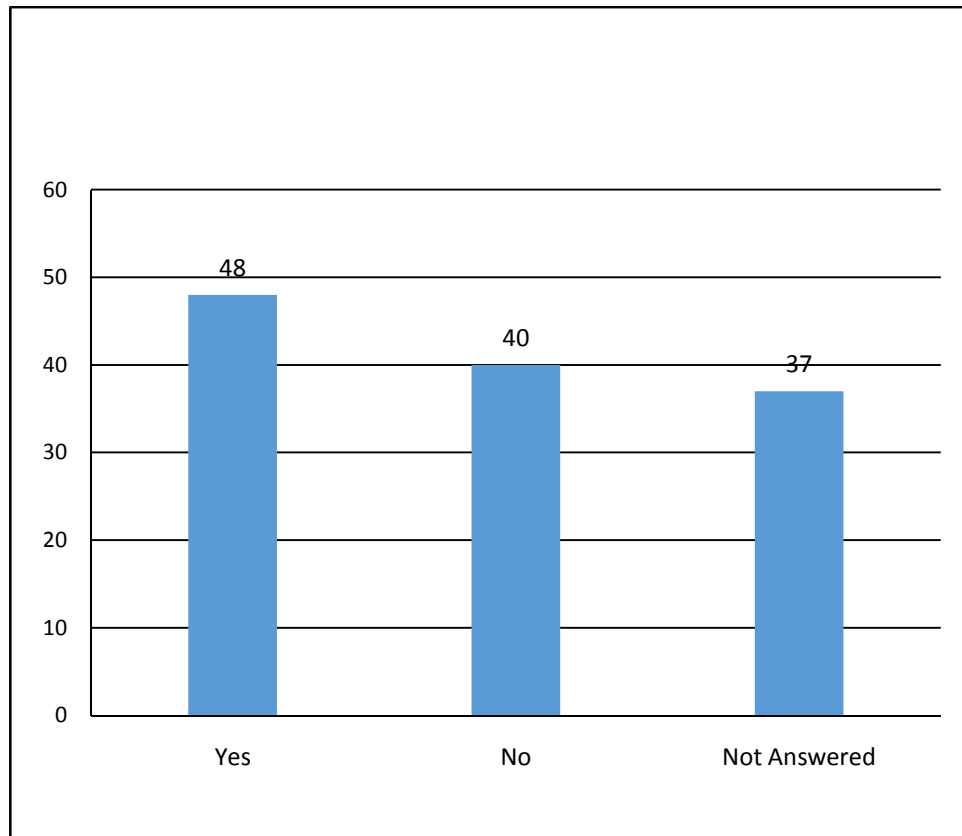


From the above graph, it is observed that out of 125 respondents 52 respondents are using patent information in their R&D Planning and the majority of these 52 respondents who use patent information in their R&D planning agreed that it is useful.

The frequency distribution of respondents according to Q15: Does your Company use the patent information in business? Yes/ No is given in table 4.12 below, along with its bar graph.

**Table 4.12. Frequency distribution - Company uses the patent information in business**

Answer	Frequency	Percent
Yes	48	38.4
No	40	32.0
Not Answered	37	29.6
Total	125	100.0

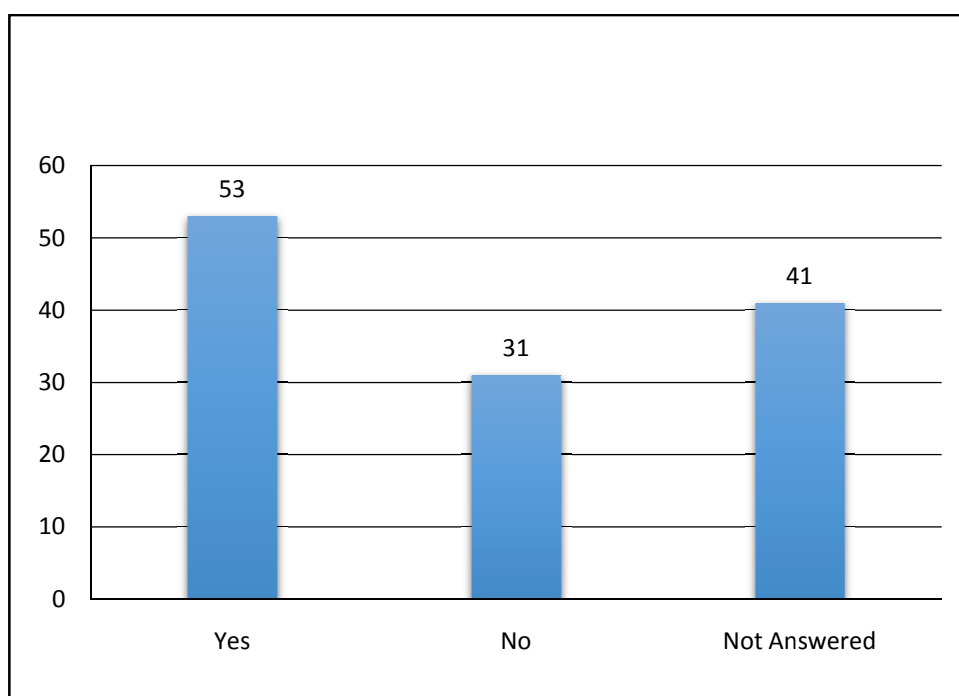


From the above graph, it is observed that many of the companies are aware of the benefits of the patent and it is reflected in their affirmative response.

The frequency distribution of respondents according to Q16: Does this Patent help you towards market capture?- Yes / No is given in table 4.13 below, along with its bar graph.

**Table 4.13. Frequency distribution - Patent helps you towards market capture**

Answer	Frequency	Percent
Yes	53	42.4
No	31	24.8
Not Answered	41	32.8
Total	125	100.0

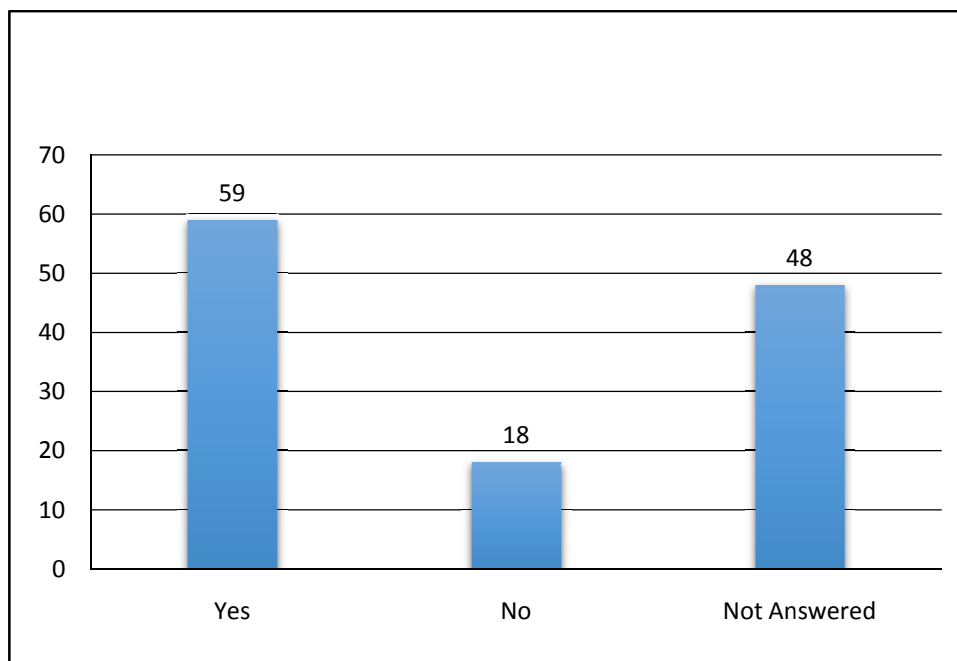


Patent grants monopoly rights to the patent assignee and prevents others from making/ using / selling patented inventions. This helps the patent holder to capture the market and the respondents in the study are aware of it which is seen from the above graph, that 40% of respondents agree that patent information helps for market capture.

The frequency distribution of respondents according to Q17: Do you agree that the financial earning of the company has increased after getting the Patent - Yes / No is given in table 4.14 below, along with its bar graph.

**Table 4.14. Frequency distribution - Financial earning of the company has increased after patenting**

Answer	Frequency	Percent
Yes	59	47.2
No	18	14.4
Not Answered	48	38.4
Total	125	100.0

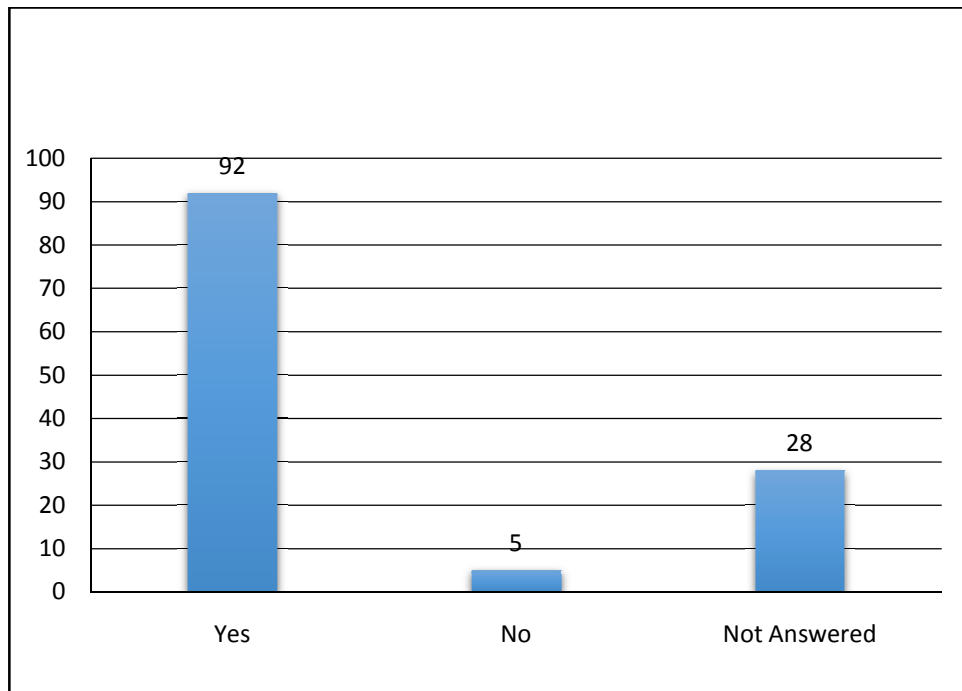


From the above graph, it is observed that almost 50% of respondents agree that the financial earnings of the company have increased after patenting as it creates an opportunity for revenue generation through patent rights.

The frequency distribution of respondents according to Q18: Do you agree that Patent improves the image of the company in the market? - Yes / No is given in table 4.15 below, along with its bar graph.

**Table 4.15. Frequency distribution - Patent improves the image of the company in the market**

Answer	Frequency	Percent
Yes	92	73.6
No	5	4.0
Not Answered	28	22.4
Total	125	100.0

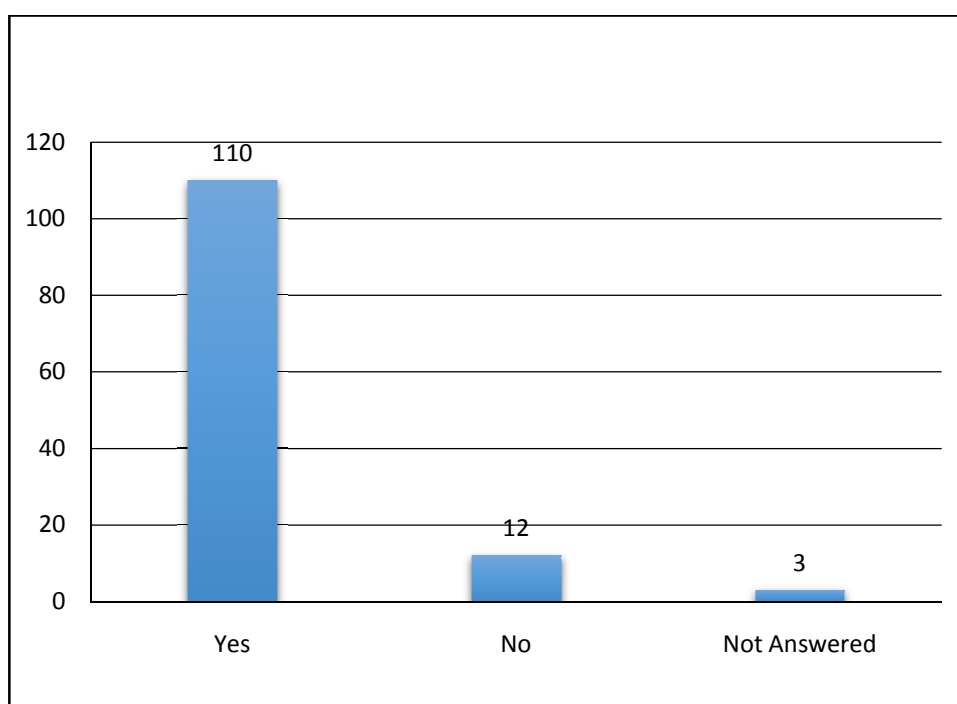


Because of the legal protections available in the business and also grant and use of a patent as an indicator of innovation and technological capability, the same is depicted from the above graph that majority of respondents agree that the patent improves the image of the company in the market.

The frequency distribution of respondents according to Q20: Do you agree that due to Globalization, R&D and patenting activity of Indian companies have increased? - Yes/ No is given in table 4.16 below, along with its bar graph.

**Table 4.16. Frequency distribution -Due to Globalization, the R&D and patenting activity of Indian companies have increased**

Answer	Frequency	Percent
Yes	110	88.0
No	12	9.6
Not Answered	3	2.4
Total	125	100.0



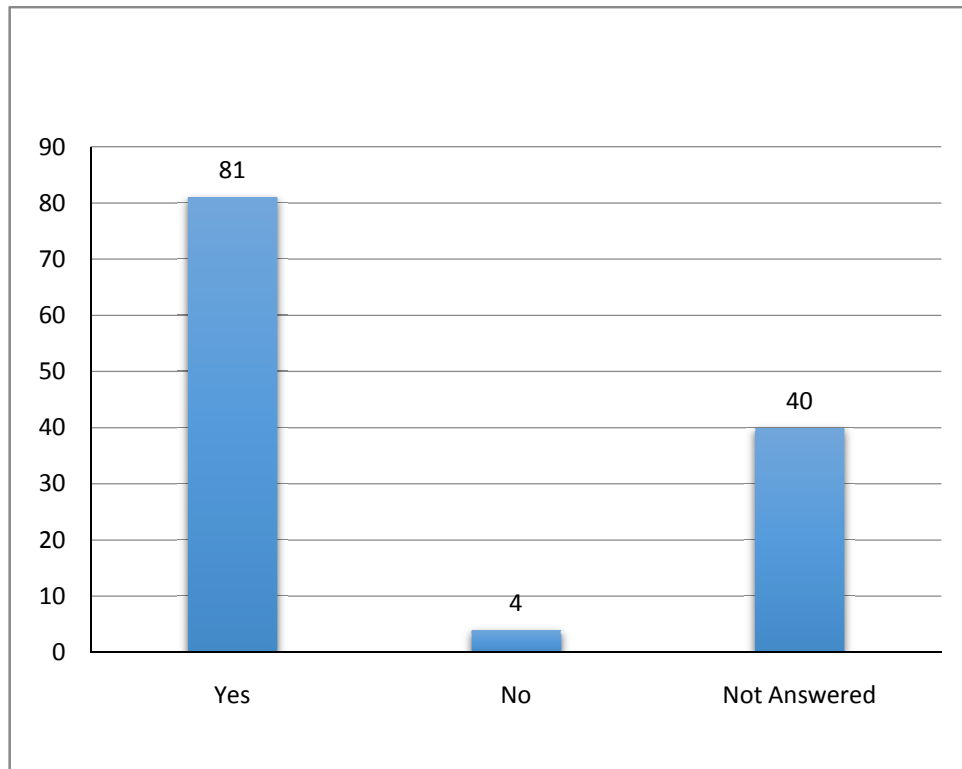
From the above graph, it is observed that the majority of respondents agree that due to globalization, the R&D and patenting activity of Indian companies have increased.



The frequency distribution of respondents according to Q21: After Globalization, Indian companies are looking essentially into R&D activity, and Patent filing – Yes/ No is given in table 4.17 below along with its bar graph.

**Table 4.17. Frequency distribution - After Globalization, Indian companies are looking essentially into R&D activity and Patent filing**

Answer	Frequency	Percent
Yes	81	64.8
No	4	3.2
Not Answered	40	32.0
Total	125	100.0



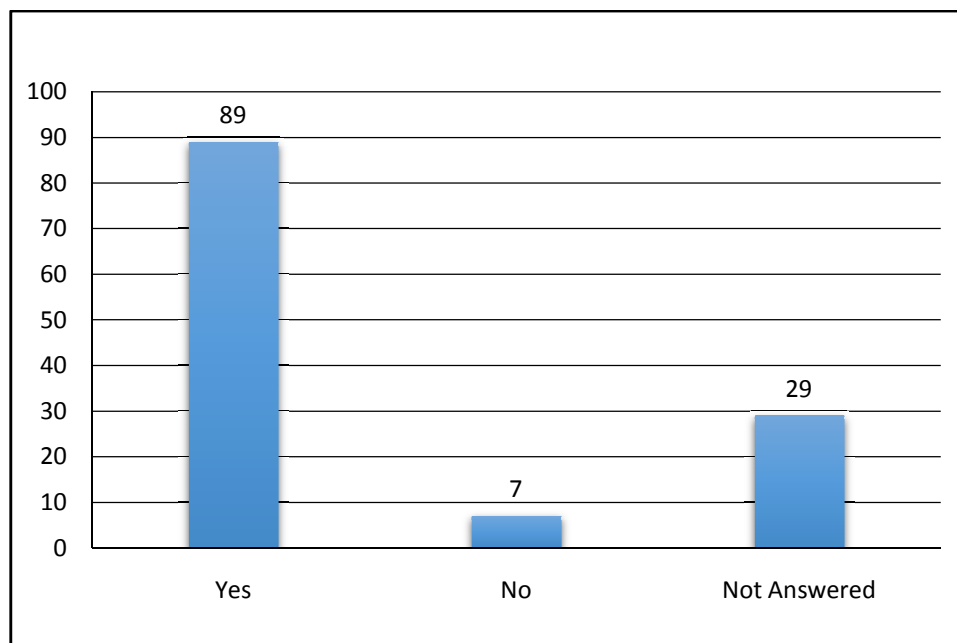
From the above graph, it is observed that almost 60% of respondents agree that after globalization, Indian companies are looking essentially into R&D and Patent filing.

Post globalization, the worldwide competition increased, it improved R&D, resulting in more innovations being protected by patents, and the same is observed from above Table 4.16, 4.17 and their Graphs.

The frequency distribution of respondents according to Q22: Do you agree that due to Globalization, Patent(s) filed by foreign companies in India have increased? - Yes/ No is given in table 4.18 below, along with its bar graph.

**Table 4.18. Frequency distribution - Due to Globalization, Patent(s) filed by foreign companies in India have increased**

Answer	Frequency	Percent
Yes	89	71.2
No	7	5.6
Not Answered	29	23.2
Total	125	100.0



Post globalization, India became an open and lucrative market for worldwide companies, further compliance with product patent regime started in India, the foreign companies started to increasingly file patents in India, the same can be seen from the above graph, and the majority of respondents agree that due to globalization, patents filed by foreign companies in India has increased.

## 4.2 Study of Objective

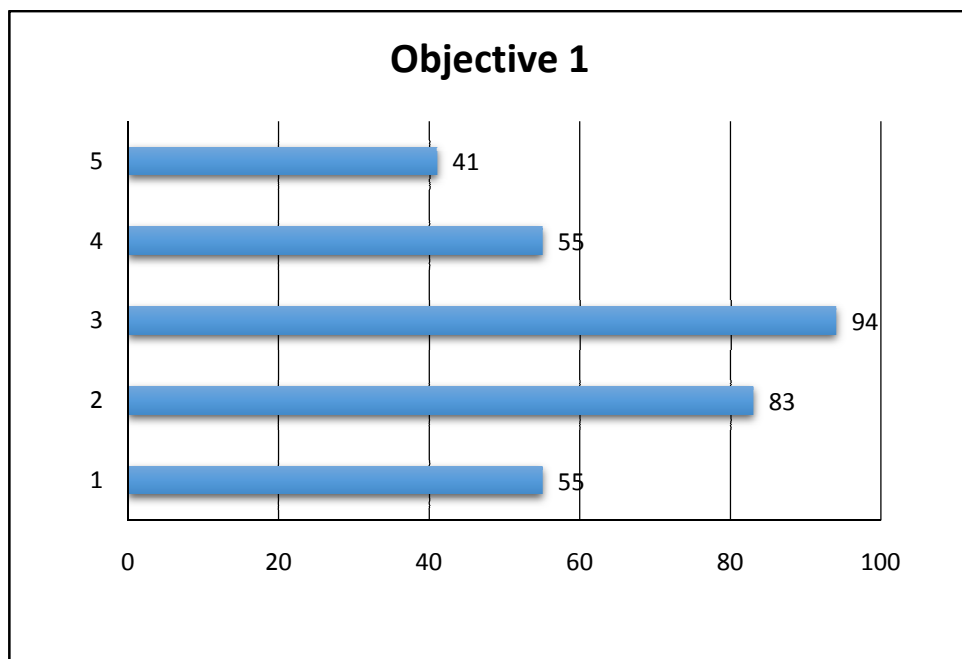
Objective 1: The first objective of the study is to find out the reasons behind the patent filing trend in India by foreign companies. The responses to the question selected to study the objective are as given in table 4.19 below.

Q23. According to you, what could be the reasons behind the increase in Patent filing in India by foreign companies in the engineering sector?

The opinions regarding the question listed above of the respondents are as given below in table 4.19.

**Table 4.19.Objective 1**

Answer	Frequency	%
1	55	44.0
2	83	66.4
3	94	75.2
4	55	44.0
5	41	32.8



**Summary:**

Referring to Fig. 1.6 page no 10. it is observed that there is an increase in the number of foreign filing at the Indian Patent Office from the year 1992 onwards. Considering the time frame, India opened up its market during this period and embraced globalization. The increase in the patent application filed by foreign assignees is more predominant from 2000 onwards. To understand the reasons behind these increased patent filings, the researcher has sought responses from selected engineering companies from the Pune region. From the responses, it is observed that increased filing was to capture the Indian Market followed by setting up of manufacturing facilities in India due to availability of skilled manpower in surplus and also at an economical rate. It was also observed that Government initiatives and policy changes resulted in the setting up of science & technology infrastructure, resulting in a conducive environment aimed at positioning India as R&D destination for the engineering sector. At the same time, India had complied with the TRIPS agreement resulting in a favorable environment for foreign companies patent filing in India.

The above Table 4.19 and Graph depicts maximum response is for (3)To capture the Indian market; then (2)Availability of skilled manpower in a labor surplus country like India at an economical rate; then (1)Relative importance of India as R&D destination for the engineering sector & (4)To avail Science & Technology infrastructure available in India; & lastly (5)Policy of the Government of India has been helpful for Patenting in India.

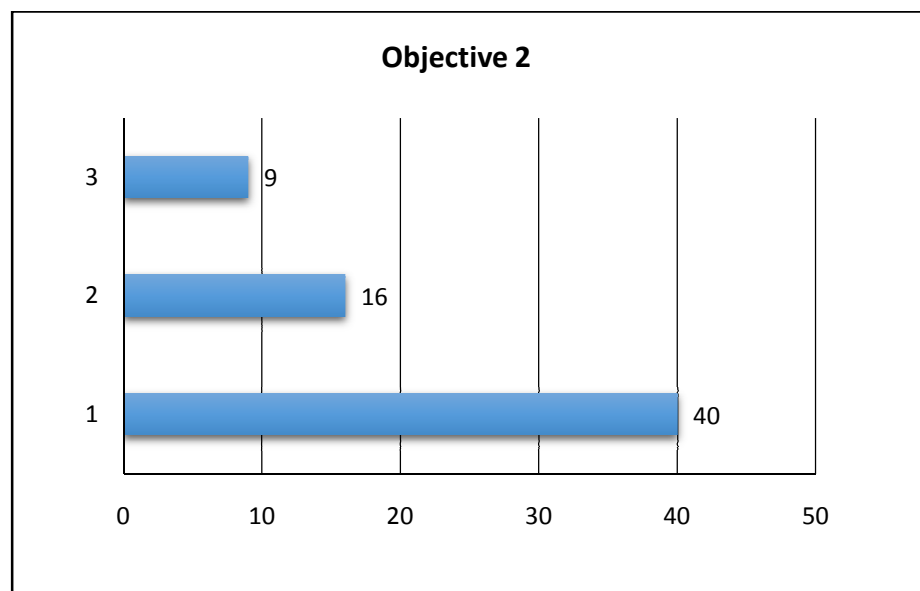
Objective 2: To understand how the organizations are making use of Patent Information for strategic planning and R&D activities for business development. The responses to the question selected to study the objective are as given below.

Q19. How does your company use the Patent Portfolio?

The opinions regarding the questions listed above of the respondents are as given in table 4.20 below.

**Table 4.20. Objective 2**

Answer	Frequency	%
1	40	32.0
2	16	12.8
3	9	7.2



**Summary:**

As explained in Fig. 1.7 page no 14, Patent information can be used in many ways in the different parts of the business. Patents can be used for internal consumption by a company for manufacturing and selling their products. Alternatively, patents can also be permitted to be used by third parties in return for certain fees thereby adding to the company's revenue. Sometimes, patents are taken as a strategic restraint against the competition, in such a scenario, they may not be used at all but they act as entry barrier for others.

The respondents are aware about the various ways in which the patent can be used in business. The above Table 4.20 and Graph reveals that the patents are preferably used (1)in the company itself (For e.g. internally in new product development)(2)in-house and licensed to other companies.

Objective 3: To develop a general framework to use patent information for strategic business planning and subsequent practical application derived from patent information

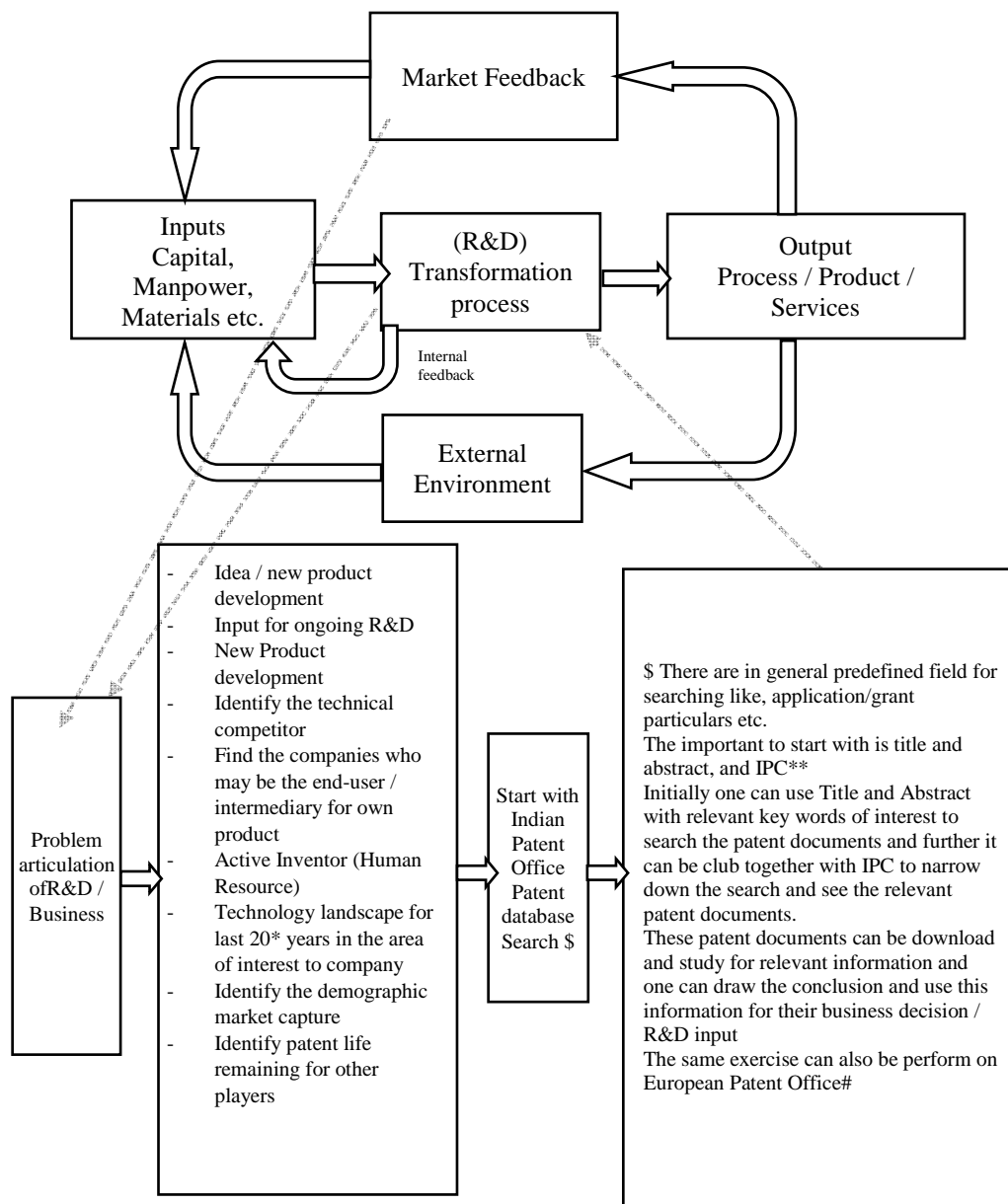
A common factor in any business environment is technology. Technology that uses knowledge is a mainstay of any business. We need to comprehend that there is an over-production of information in the world, and it is possible that someone has already derived knowledge based on that information to provide a solution to the existing problem. If the presence of such knowledge is known, then it can be applied immediately. The patent office's world over has published over 110 million Patent documents which act as a repository of global technical information. The skilled person who is looking for a solution to a technical problem, by combining his domain expertise, prior experience, and technical information from the patent documents, can transform this patent information into meaningful knowledge.

It includes a vast store of organized knowledge about everything, and it is the Patent Information.

The purpose of R&D in any company is to give input to management to connect R&D and business of the company to deliberately impart a competitive advantage to the organization.

As can be seen in figure 4.1, product development may be internal or external. In a competitive environment, there has to be a continuous process of improvement in process/product/services. Response from the market and internal feedback are used to direct further development. Conversion of ideas into inventions into products necessitates inputs such as capital, workforce, material, etc. It is the sum of the total number of inputs that form an organization's business, policies, and capabilities. A common structure is developed and presented in figure 4.1. As shown in the figure,

R&D and business problems can be solved by using patent information. If anyone practices this, it is of definite use for the technology/product development and learning from successive knowledge. The practical example is explained in Annexure 5.



**Figure 4.1. A general framework to use patent information for strategic business planning**

*20\* - A patent's life is 20 years, and after that, it falls under the public domain, i.e., their exclusivity period had expired, and anyone in the world is free to use them without obligation to patent holders. (This can also include expired patents, non-*

*jurisdiction patents, patents that are not granted, abandoned applications, and invalid patents).*

\$ - <http://ipindiaservices.gov.in>

*\*\*IPC – There is an option of Catch Word to locate the relevant IPC for the technical term/keyword interest of, on WIPO website URL reference is given below*

*(<http://www.wipo.int/classifications/ipc/ipcpub/?notion=scheme&version=20180101&symbol=none&menulang=en&lang=en&viewmode=f&fipcpc=no&showdeleted=yes&indexes=no&headings=yes&notes=yes&direction=o2n&initial=A&cwid=none&tree=no&searchmode=smart>)*

*#<https://worldwide.espacenet.com/>; at present, Espacenet cover the patent data of 209 countries; this will be useful to understand the relevant patent activity outside India.*

Objective 4: Another objective of the study is to see how an IP based business strategy helps for revenue generating opportunities if recognized at the initial stages of product development.

A case study approach is used to study this objective.

Dr. Rane<sup>[141]</sup>, an inventor, is an engineering professional from India. He designed and developed a Thermal Energy Regaining Device related to heat management.

The creative step of this invention was the grouping of a minimum of two arrays of heat removal paths captured in a conducting medium, wherein one of the paths conveys hot fluids, and the heat regaining fluid passes through the other path. This invention had reduced the cost of the product by 30% as compared with the current methods being practiced in the market.

The inventor filed a temporary patent application in India in 1999. The invention was licensed based on this patent application to UEES at the cost of the patent process.

UEES gets the license of this product to produce and sell as engine exhaust-fired steam generators, water, and thermic furnaces. This licensing gain was at a royalty rate of 3 to 5% of net sales for the inventor.



Through this business contract, UEES widens its technology and customer base at one part, and at another part, for the inventor, the license provided a vehicle for the commercialization of the invention and encouragement for the next inventions.

The inventor has sustained his R&D work and the development of new technologies and products. The details are placed in Annexure 4.

Objective 5: Finding out the engineering companies in the Pune region having a patent portfolio.

Part a) The responses to the question selected to study the objective are as given below.

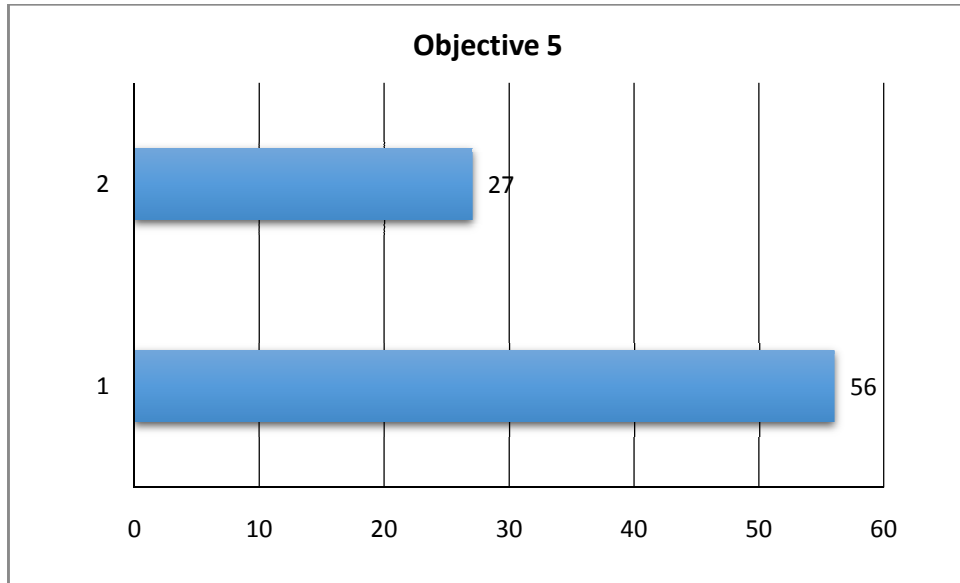
Q12. Does your Company has an Indian Patent Application OR Granted Indian Patent in its name – Yes/ No

Q13. Does your Company have filed patent application(s) in foreign countries **OR** have granted a foreign patent in their name - Yes/ No

The opinions regarding the questions listed above of the respondents are as given in table 4.21below.

**Table 4.21.Objective 5**

S. No.	Questions	Frequency (Yes)	Percent
1	Does your Company have an Indian Patent Application <b>OR</b> Granted Indian Patent in its name	56	44.8
2	Does your Company have file patent application(s) in foreign countries <b>OR</b> have granted a foreign patent in their name	27	21.6



The effect of the opening of the Indian Market i.e. globalization is visible from the patent filing data at Indian Patent Office from the year 1960 to 2015 as referred to in Table 1.6 page no 10. Considering the data in Table 1.6 it is observed that the patent filings by Indian Companies after the year 2005 are increased by 4 times when compared with the previous filing from the year 1991 to 2004. From Table 4.21 it is observed that 44.8% of engineering companies in the Pune region have an Indian Patent Application or Granted Indian Patent in its name & 21.6% of companies have filed a patent application(s) in foreign countries or have a granted foreign patent in their name.

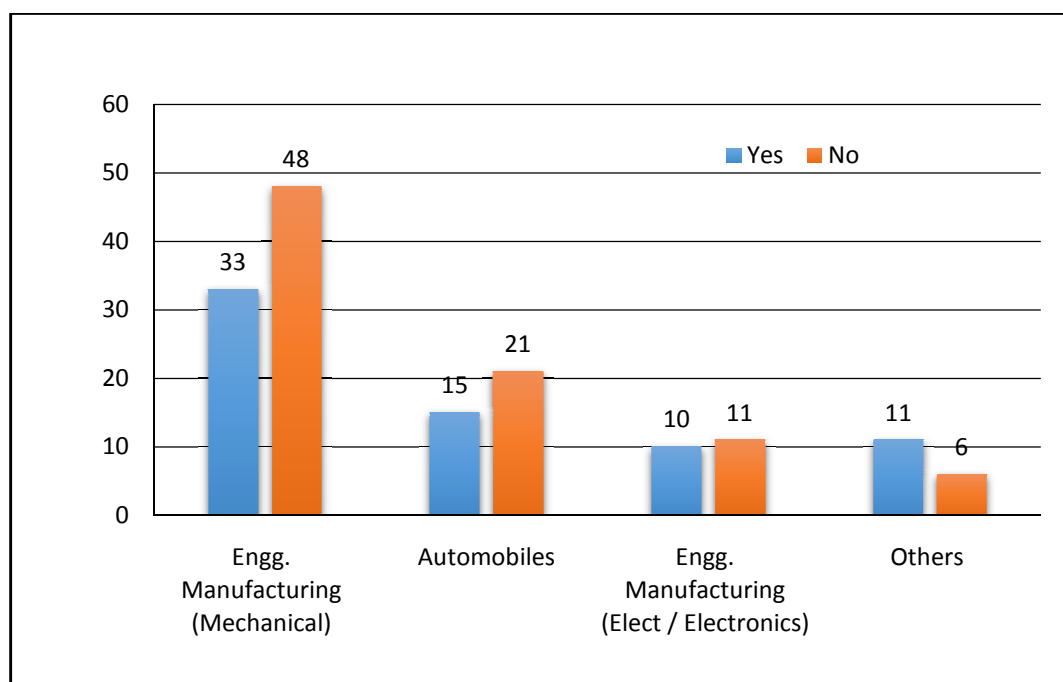
Part b) The cross-tabulation of responses of questions selected to study the objective with the company's main work area is as given below.

Q12. Does your Company has an Indian Patent Application OR Granted Indian Patent in its name – Yes/ No

The cross-tabulation of the opinions regarding the question listed above of the respondents with the company's main work area is as given in table 4.22 below.

**Table 4.22. Objective 5 – Cross Tabulation Indian Patent**

Answer	Yes	%	No	%	Total	%
Engg. Manufacturing (Mechanical)	33	26.4	48	38.4	81	64.8
Automobiles	15	12	21	16.8	36	28.8
Engg. Manufacturing (Elect / Electronics)	10	8	11	8.8	21	16.8
Others	11	8.8	6	4.8	17	13.6

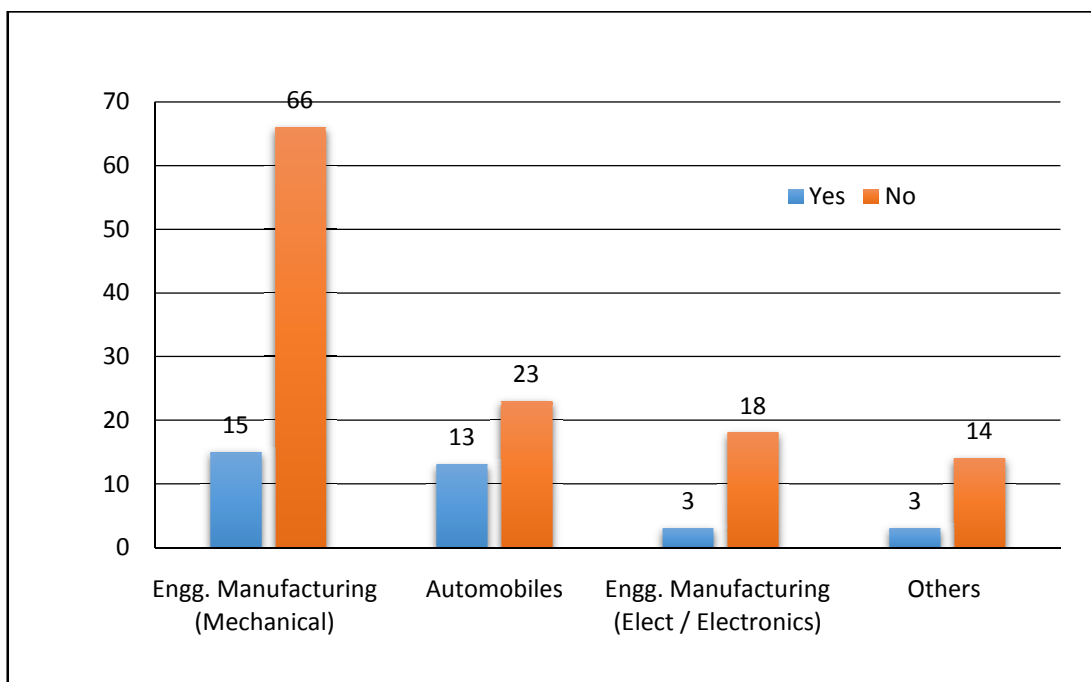


Q13. Does your Company has filed a patent application(s) in foreign countries **OR** have granted a foreign patent in their name - Yes/ No

The cross-tabulation of the opinions regarding the question listed above of the respondents with the company's main work area is as given in table 4.23 below.

**Table 4.23. Objective 5 - Cross Tabulation Foreign Patents**

Answer	Yes	%	No	%	Total	%
Engg. Manufacturing (Mechanical)	15	12	66	52.8	81	64.8
Automobiles	13	10.4	23	18.4	36	28.8
Engg. Manufacturing (Elect / Electronics)	3	2.4	18	14.4	21	16.8
Others	3	2.4	14	11.2	17	13.6



From table 4.22 and 4.23, it is observed that the patents filed by engineering companies are more for Indian filling compared with foreign filling.

Following table 4.24 lists companies having patent portfolio.

**Table 4.24. Companies having patent portfolio**

Name of the Company	Patents (Applications / Grants)
Bajaj Auto Ltd	189
Mahindra & Mahindra	117
Kirloskar Brothers Ltd	89
Kalyani Group	47
Tata Motor	43
Bharat Forge Ltd.,	41
Welmade Locking Systems Pvt Ltd	31
Manman Mfg Co Pvt Ltd	9
Rinder India Pvt. Ltd.	8
Precision Automation & Robotics India Pvt Ltd.	6
h2e Power Systems Pvt. Ltd.,	3
Datsons Engineering Works Pvt. Ltd	2
Advandes	1
Bhagyashree Accessories Pvt Ltd	1
Gartech Equipment's Pvt. Ltd.	1
Hodek Vibration Technologies Pvt.Ltd.	1

Further, a case study approach is used to understand the companies, which have a better IP position. The detailed information is captured and studied with respect to the nature of the business in which they are operating and the details are placed in Annexure 4. These companies had a well-established business setup and hold a good patent portfolio.

### 4.3 Testing of Hypothesis

#### **Hypothesis 1: Engineering companies in Pune use the patent information in their R&D planning.**

The question used to assess this hypothesis is as listed below.

Q14. Does your Company use patent information in its R&D Planning?

There are 52 respondents with the response 'Yes' to this question.

To test the hypotheses,

The null hypothesis,  $H_0$ : The proportion of Engineering companies in Pune that use the patent information in their R&D planning is less than or equal to 20%.

Vs.

The alternative hypothesis,  $H_a$ : The proportion of Engineering companies in Pune that use the patent information in their R&D planning is greater than 20%.

The test used is the z test for proportions.

Test statistics:

$$Z = \frac{\hat{p} - p_0}{\sqrt{\frac{p_0(1-p_0)}{n}}}$$

Here  $\hat{p}$  = sample proportion,  $p_0$  = hypothetical value = 20% = 0.20, n = sample size = 125

There are 52 out of 125 companies that use patent information in their R&D planning.

Hence Z calculated = 6.04 & p value = 0.00

If p value < 0.05, the level of significance, the null hypothesis is rejected.

**Conclusion:**

The proportion of Engineering companies in Pune that use the patent information in their R&D planning is greater than 20%.

Hence, hypothesis 1 is accepted.

**Hypothesis 2: Engineering companies in Pune have IP (Patent) rights in their portfolio and uses the same as a business tool for market capture.**

The questions used to assess this hypothesis are as listed below.

Q12. Does your Company has an Indian Patent Application **OR** Granted Indian Patent in its name?

Q13. Does your Company has filed a patent application(s) in foreign countries **OR** have a granted foreign patent in their name?

Q16. Does this Patent help you towards market capture?

There are 37 respondents with the response 'Yes' to Q12 or Q13 & Q16.

To test the hypotheses,

The null hypothesis,  $H_0$ : The proportion of Engineering companies in Pune, those having IP (Patent) rights in their portfolio and using the same as a business tool for market capture is less than or equal to 20%.

Vs.

The alternative hypothesis,  $H_a$ : The proportion of engineering companies in Pune, those having IP (Patent) rights in their portfolio and using the same as a business tool for market capture is greater than 20%.

The test used is the z test for proportions.

Test statistics:

$$Z = \frac{\hat{p} - p_0}{\sqrt{\frac{p_0(1-p_0)}{n}}}$$

Here  $\hat{p}$  = sample proportion,  $p_0$  = hypothetical value = 20% = 0.20,  $n$  = sample size = 125

There are 37 out of 125 companies that have the patent and use the same as a business tool.

Hence Z calculated = 2.68 & p value = 0.0036

If p value < 0.05, the level of significance, the null hypothesis is rejected.

**Conclusion:**

The proportion of engineering companies in Pune, those having IP (Patent) rights in their portfolio and using the same as a business tool for market capture is greater than 20%.

Hence, hypothesis 2 is accepted.

**Hypothesis 3: Engineering companies in Pune have joint collaboration with foreign partners for R&D activities and are filling the patents in India and Abroad.**

The questions used to assess this hypothesis are as listed below.

Q11. Does your Company have a joint collaboration for R&D?

Q12. Does your Company have an Indian Patent Application **OR** Granted Indian Patent in its name?

Q13. Does your Company have filed patent application(s) in foreign countries **OR** have a granted foreign patent in their name?

There are 20 respondents with the response 'Yes' to Q11 & Q12 OR Q13.

To test the hypotheses,

The null hypothesis,  $H_0$ : The proportion of Engineering companies in Pune, those having joint collaboration with foreign partners for R&D activities and also filing the patents in India and Abroad is less than or equal to 20%.

Vs.

The alternative hypothesis,  $H_a$ : The proportion of Engineering companies in Pune, those having joint collaboration with foreign partners for R&D activities and also filing the patents in India and Abroad is greater than 20%.

The test used is the z test for proportions.

Test statistics:

$$Z = \frac{\hat{p} - p_0}{\sqrt{\frac{p_0(1-p_0)}{n}}}$$

Here  $\hat{p}$  = sample proportion,  $p_0$  = hypothetical value = 20% = 0.10, n = sample size = 125

There are 20 out of 125 companies that have joint collaboration.

Hence Z calculated = -1.12 & p value = 0.8682

If p value > 0.05, the level of significance, the null hypothesis cannot be rejected.



**Conclusion:**

The proportion of Engineering companies in Pune, those who are having joint collaboration with foreign partners for R&D activities and also filing the patents in India and Abroad is less than or equal to 20%.

Hence, hypothesis 3 is rejected.

**Hypothesis 4: Liberalization and Globalization led to increased R&D by Indian companies as represented by patent filings**

The questions used to assess this hypothesis are as listed below.

Q12. Does your Company have an Indian Patent Application **OR** Granted Indian Patent in its name?

Q13. Does your Company has filed a patent application(s) in foreign countries **OR** have granted a foreign patent in their name?

Q20. Do you agree that due to Globalization, the R&D and patenting activity of Indian companies have increased?

Q21. After Globalization, Indian companies are looking essentially into R&D activity and Patent filing?

There are 43 respondents from Indian companies with the response 'Yes' to Q12 OR Q13 & Q20 OR Q21.

To test the hypotheses,

The null hypothesis,  $H_0$ : The proportion of agreement to Liberalization and Globalization led to increased R&D by Indian companies as represented by patent filings is less than or equal to 20%.

Vs.

The alternative hypothesis,  $H_a$ : The proportion of agreement to Liberalization and Globalization led to increased R&D by Indian companies as represented by patent filings is greater than 20%.

The test used is the z test for proportions.

Test statistics:

$$Z = \frac{\hat{p} - p_0}{\sqrt{\frac{p_0(1-p_0)}{n}}}$$

Here  $\hat{p}$  = sample proportion,  $p_0$  = hypothetical value = 20% = 0.20, n = sample size = 125

There are 43 Indian companies out of 125 companies that agree to Liberalization, and Globalization led to increased R&D by Indian companies as represented by patent filings.

Hence Z calculated = 4.02 & p value = 0.00

If p value < 0.05, the level of significance, the null hypothesis is rejected.

**Conclusion:**

The proportion of agreement to Liberalization and Globalization led to an increase in R&D by Indian companies as represented by patent filings is greater than 20%.

Hence, hypothesis 4 is accepted.

**Hypothesis 5: Liberalization and Globalization lead to an increase in patenting activity by MNCs in India.**

The question used to assess this hypothesis is as listed below.

Q22. Do you agree that due to Globalization, Patent(s) filed by foreign companies in India has increased?

There are 89 respondents from Indian companies with the response 'Yes' to Q22.

To test the hypotheses,

The null hypothesis,  $H_0$ : The proportion of agreement to the Liberalization and Globalization (L&G) lead to increasing patenting by MNCs in India, is less than or equal to 20%.

Vs.

The alternative hypothesis,  $H_a$ : The proportion of agreement to the Liberalization and Globalization (L&G) lead to increasing patenting by MNCs in India is greater than 20%.

The test used is the z test for proportions.

Test statistics:

$$Z = \frac{\hat{p} - p_0}{\sqrt{\frac{p_0(1-p_0)}{n}}}$$

Here  $\hat{p}$  = sample proportion,  $p_0$  = hypothetical value = 20% = 0.20, n = sample size = 125

There are 89 Indian companies out of 125 companies that agreed to the Liberalization and Globalization (L&G) has to lead to increasing patenting by MNCs in India.

Hence Z calculated = 14.31 & p value = 0.00

If p value < 0.05, the level of significance, the null hypothesis is rejected.

**Conclusion:**

The proportion of agreement to the Liberalization and Globalization (L&G) leads to increasing patenting by MNCs in India is greater than 20%.

Hence, hypothesis 5 is accepted.

**Hypothesis 6: R&D Behavior of MNCs leads to more R&D by their R&D centers and subsidiaries, as represented by the patents filed by them.**

This hypothesis is explained with the case study of Gabriel India Ltd. It shows that there is an increase in R&D and patent filing by them from the year 2007.

**Gabriel India Ltd.****Background**

Gabriel India started in 1961 by Mr. Deep Anand, as a young businessperson, started his very first project - Gabriel India, in association with Maremont Corporation (now Gabriel Ride Control Products of ArvinMeritor Inc., USA), for the manufacturing of shock absorbers at Mulund, Mumbai.

The Company's indigenous technology offers world-class products custom-made to Indian market necessities. Gabriel launches new products with new features regularly and now providing technology to customers abroad.

They have three state-of-the-art R&D centers at Chakan, Hosur, and Nashik (which are approved by the Department of Scientific and Industrial Research (DSIR), Government of India). These centers develop products, optimize product performance, and enhance product capability. Gabriel has filed 58 patents and received 14 patent approvals as of March 2018. Three R&D facilities provide value-added services, e.g., noise measurement, value engineering, and improving product quality through root cause analysis and cost reduction through localization. These centers are equipped with facilities to conduct on-site ride tuning exercises through custom-built mobile ride tuning vans.

The R&D center at Chakan has recently commissioned the highly complex corner module testing, which provides the capability to stimulate the suspension and damper testing using actual road input data, in a shorter time.

The R&D centers employ highly qualified research professionals who work in a creative environment. Last year, the Company invested substantially in new generation testing and validation equipment to upgrade its testing facilities to global standards. The R&D team continuously focuses on new technology to provide the customer experience of new suspension technologies in India, i.e., light weighing and adjustable suspension at a reasonable cost.

State-of-the-art technology has helped Gabriel to sustain its leadership position in the Indian automotive industry. To cater to market needs more effectively, Gabriel India has a technical collaboration with KYB Corporation, Japan, KYBSE, Spain, and Yamaha Motor Hydraulic Systems, Japan. It also signed a technology license agreement with KONI Shock Absorbers. Gabriel, in turn, has provided technical assistance to Gabriel De Colombia and Torre South Africa based on its own R&D.

Gabriel is a research-driven ride control products Company. The Company's research team possesses the capability of customizing products around Indian conditions. The Company's competence is reflected in its patents.

Gabriel is one of the few Tier I Indian auto ancillary companies possessing global and Indian patents. The Company demonstrated a commitment to invest 1.07% of net sales in R&D initiatives as against a sectorial average of 0.50%. The engagement of 85 full-time R&D professionals is the largest in the Indian shock absorber industry.

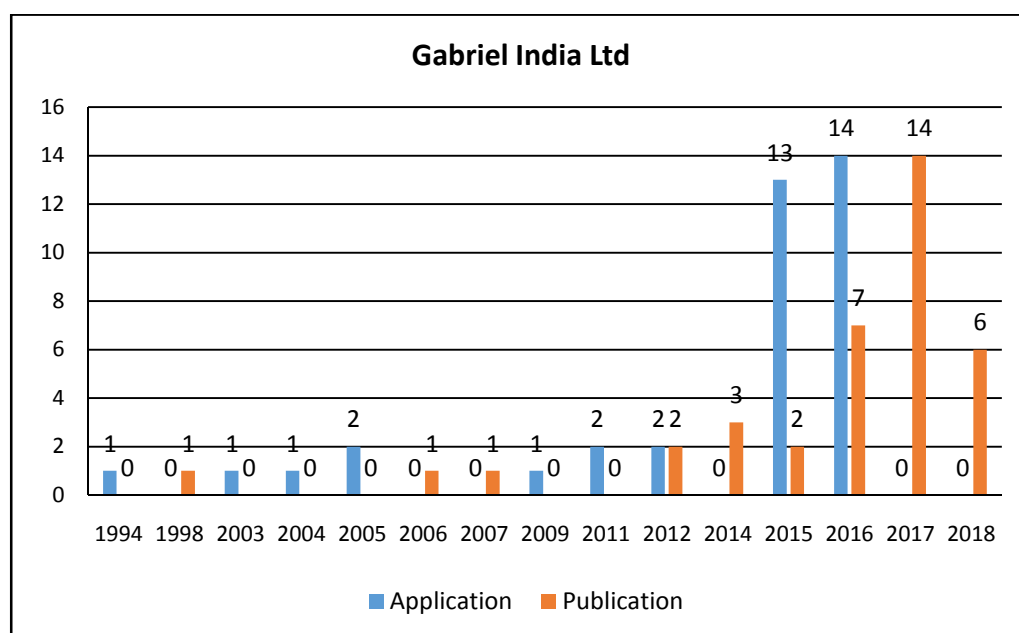
These R&D efforts helped the company in Consumer consummation; Import Replacement; Price discount; Cultivating market diffusion; Technology advantage; Eco-friendly products; Benchmarking and up-gradation of their products and processes; Developing new products by disruptive innovations.

The focus of invention and patenting are included in the casting of metals; cladding or plating by soldering or welding; cycle frames; cycle steering devices; cycles;

launching, hauling-out, or dry-docking of vessels; means for damping vibration; positive-displacement machines for liquids; shock-absorbers; soldering or unsoldering; springs; tools for grinding, buffing or sharpening; treatment of alloys; vehicle suspension arrangements; welding; It is described in table 4.25 and figure4.2.

**Table 4.25. Patent Application and Publication Details - Gabriel India Ltd.**

Year	Application	Publication
1994	1	0
1998	0	1
2003	1	0
2004	1	0
2005	2	0
2006	0	1
2007	0	1
2009	1	0
2011	2	0
2012	2	2
2014	0	3
2015	13	2
2016	14	7
2017	0	14
2018	0	6



**Figure 4.2: Patenting activity - Gabriel India Ltd.**

From the above graph, it is observed that patenting activities have increased after the year 2014 onwards.

**Additional Hypotheses:**

**Hypothesis A: There is a positive impact of the patent on business.**

To test the hypotheses,

The null hypothesis,  $H_0$ : There is no impact of the patent on business.

Vs.

The alternative hypothesis,  $H_a$ : There is a positive impact of the patent on business.

The test used is the Wilcoxon Signed Rank test.

The coding for impact is done in the following way.

-1 for -ve impact; 0 for no response; +1 for +ve impact

Calculation table 4.26.

**Table 4.26. Impact of patent on a business**

<b>Ranks</b>				
		<b>N</b>	<b>Mean Rank</b>	<b>Sum of Ranks</b>
(Effect of Patenting) After - Before	Negative Ranks	0	0.00	0.00
	Positive Ranks	25	13.00	325.00
	Ties	11		
	Total	36		

<b>Test Statistics<sup>a</sup></b>	
	(Effect of Patenting) After - Before
Z	-4.512 <sup>b</sup>
P value (2-tailed)	.000
a. Wilcoxon Signed Ranks Test	
b. Based on negative ranks.	

Since both p values are less than 0.05, level of significance, there is strong evidence to reject the null hypothesis.

**Conclusion:**

There is a positive impact of the patent on business. Hence, hypothesis A is accepted.

**Hypothesis B: There is an association between ‘Having R&D setup in company’ & ‘having an Indian Patent Application OR Granted Indian Patent in its name’.**

To test the hypotheses,

The null hypothesis,  $H_0$ : There is no association between ‘Having R&D setup in company’ & ‘having an Indian Patent Application OR Granted Indian Patent in its name’.

Vs.

The alternative hypothesis,  $H_a$ : There is an association between ‘Having R&D setup in company’ & ‘having an Indian Patent Application OR Granted Indian Patent in its name’.

The test used is the Chi-Square test for the association of attributes.

**Table 4.27. Association between R&D and patents**

<b>R&amp;D Setup / Indian Patent Application / Granted Indian Patent in its name Cross tabulation</b>				
<b>Count</b>				
		<b>Indian Patent Application OR Granted Indian Patent</b>		<b>Total</b>
		<b>Yes</b>	<b>No</b>	
<b>R&amp;D Setup</b>	<b>Yes</b>	47	45	92
	<b>No</b>	9	24	33
<b>Total</b>		56	69	125

<b>Chi-Square Tests</b>			
	<b>Value</b>	<b>df</b>	<b>P value (2-sided)</b>
Pearson Chi-Square	5.570 <sup>a</sup>	1	.018
Continuity Correction <sup>b</sup>	4.649	1	.031
N of Valid Cases	125		
a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 14.78.			
b. Computed only for a 2x2 table			



Since the p value is less than 0.05, the level of significance, there is strong evidence to reject the null hypothesis.

Conclusion: There is an association between 'Having R&D setup in company' & 'having a Patent'.

If the company is having a R&D set up, then the frequency is at maximum in having a patent & if the company is not having R&D set up then the frequency is at maximum in not having a patent. Hence if the company is having a R&D setup, there are greater chances to have a patent.

Hence, hypothesis B is accepted.

#### **4.4 Interpretation of result and conclusion:**

From this analysis, it is observed that,

1. Acquiring the emergent Indian Marketplace and make the trade safe with the help of IP protection is a key motto behind the patent flow in India by non-resident companies.
2. Few of the companies are using technical information for their commercial progress.
3. An overall outline is developed to show how to use technical input from the patent.
4. IP driven plan makes it feasible to revenue-generating openings in commerce.

#### **Hypothesis**

Hypotheses 1, 2, 4, 5 are accepted, Hypothesis 3 is rejected, and Hypothesis 6 is explained with the help of a case study.

#### **Additional Hypothesis**

There is an optimistic influence of patent filed at IPO by foreign applicants in Pune based engineering units. Companies having R&D setup with appropriate R&D staff give more chance of systematic invention and product development process, followed by IP protection for their invention and secure market openings.

In this chapter, details of data analysis results as well as a conclusion derived from analysis are described. The chapter also lists out major analysis output in the form of tables and charts. Further, the hypothesis testing and interpretation of the result are also discussed.

## **Chapter 5**

### **FINDINGS, CONCLUSION, AND RECOMMENDATIONS**

This chapter aims to categorize research findings from the present study and comment on the results to arrive at conclusion. In chapter 4, the analysis of primary data was carried out to understand the demographics, descriptive statistics, and testing of the hypothesis.

#### **5.1 Demographic Assessment –**

The assessment involving demographics was carried out based on the information of respondents' organizations. This information is useful in arriving at conclusion with respect to whether the participants in the study are the representative sample of the population.

The captured demographic information for the organizations' were- main area of work, type of company, presence of R&D setup, and the number of staff working in R&D. Companies main work area was observed to be in Engg. Manufacturing (Mechanical) 64.8 %, followed by automobiles 28.8%, Engg. Manufacturing (Elect / Electronics) 16.8% and others. The conclusion here is that the majority of the respondents belong to the company in the area of manufacturing involving mechanical engineering.

Information was also sought with respect to respondent's company type such as Private Limited, Public Limited, Proprietorship, Partnership Firm, and Others. It was observed that 68% of the respondents were from private limited companies followed by 12% from proprietorship firms, 8.8% from public limited companies, 8% from partnership firms, and others. It was concluded that the majority of the respondents come from private limited companies.

The respondents were also asked about the presence of R&D setup in their organizations. It was observed that 72.8% of the respondents had R&D setup in their organizations. This is helpful for the present study as the output of R&D might get protected in form of patents.

Respondents were also asked about the number of staff working in R&D in their companies. This information was grouped into 3 categories- less than 50 R&D staff, 50 to 100 R&D staff, and R&D staff above 100. It was observed that the majority of the organizations had R&D staff below 50. It can be concluded that the R&D staff in the majority of the organization is below 50 because many of the studied companies are registered as small private limited companies. Demographic enquiries to respondents about the R&D expenditures of their companies received poor response. Based on the responses received it is observed that the R&D expenditure ranges from 0.5% to 10% of the company's turnover.

## **5.2 Descriptive assessment**

The respondents of the survey were exposed to various aspects through questionnaires relating to awareness about the concept and process of patenting and whether they have followed the route of patent protection to shield and expand their business interests domestically as well as globally.

From the analysis of the responses, it was observed that there is an awareness about basic information and concept of patent and process of the patenting amongst the respondents which lead to the conclusion that there is awareness about patenting amongst the studied engineering units around the Pune region.

It is observed that due to awareness about the patenting process and its benefits, respondents / companies have filed a patent application in India or they own granted patents for protecting and expanding their business interest. This has also resulted in a few of them filing and owning patents even outside India.

Very few companies were observed to have entered into a joint R&D collaboration even after the opening of the Indian economy.

It is also observed that few of the companies are acting as a vendor / support player to bigger engineering / auto players, making them dependent on the bigger organization. This has resulted in attaining manufacturing excellence but they may be limited by

contractual obligations imposed by bigger companies and as a result, they are not able to file patents.

From the analysis of data, it is concluded that there is awareness about patenting process and its advantages in engineering companies around Pune.

### **5.3 Hypothesis Assessment**

From the analysis and testing of hypotheses framed in the present research study, it is concluded that

- 1 From the first hypothesis, it is concluded that Engineering companies around Pune are aware of patenting and make use of patent information in their R&D planning. They are doing R&D activities and filing the patents for their inventions before bringing them into the market.
- 2 From the second hypothesis it is concluded that Engineering companies around Pune have been obtaining and securing Patent rights for their inventions and also use the same as a business tool for capturing the market.
- 3 From the third hypothesis it is concluded that very few Engineering companies around Pune have joint collaboration with foreign partners for R&D activities and therefore lesser patent filings in India and Abroad with joint collaboration.
- 4 From the fourth hypothesis it is concluded that Liberalization and Globalization forced Indian companies to introspect thereby leading to increased R&D by Indian companies resulting in patent filings by them.
- 5 From the fifth hypothesis it is concluded that Liberalization leads to opening up of attractive Indian market to MNCs and to protect their innovations, resulting in increasing patenting by them in India. From the analysis, it was observed that the objective of filing a patent in India by foreign companies is to take part in the expanding Indian market by protecting their invention and

getting advantage of specialist manpower by employing them in their R&D centers.

- 6 From the case study of Gabriel India, it is observed that the invention activity of multinational enterprises has contributed to more inventions by their Research centers and affiliates, as indicated by patents filed by them. This supports the sixth hypothesis and it is concluded that the R&D behavior of MNCs or their subsidiaries has led to more patent filing by them in India.

#### **5.4 Overall Summary of the Findings and Conclusions**

This research study was focused on the Study of Patent filing trends and its impact on Select Engineering Units in Pune region before and after 2005. The study showed that 93% of companies are aware of the concept of patent, almost 45% of companies are having granted Indian patent/application and 21% of companies are having foreign patent/application in their portfolio.

It is concluded that R&D led to patenting benefited the organizations and helps in formulating competitive business strategies leading to an increase in the financial growth of the organization.

The study showed that 40% of the companies have understood that the patent information is very useful and they are making use of it in their R&D planning, new product development by anticipating the competitor's technology direction.

It is concluded that technical information encoded in patent documents is being used for competitive intelligence.

From the secondary data analysis (Annexure 3), it is observed that patenting activities in the mechanical engineering area from the Pune region has increased from the year 2000, whereas, less patenting activity was observed prior to that. This may be due to the reason that awareness in this region started after the entry of foreign companies and resulted in patent filing by them in India.

It is concluded that mechanical engineering companies from the Pune region are practicing the patenting activity more aggressively from the year 2000 by doing R&D, protecting it by filing patents, and striving to achieve a leadership position in the mechanical engineering area.

The questionnaire administered to respondents also had few open-ended questions. The findings and the conclusion based on the responses received are summarized below.

During interaction with the respondents, they raised concerns about the delay taken in the patent granting process. This delay resulted in a number of issues, such as there is no linkage between the life cycle of invention/product and the patent issuance as the grant of patent is delayed in most of the cases. It is also observed that the companies that have filed patents outside India found that the patenting process is too slow in India when compared with other patent offices outside India.

It is concluded that this delay in patent granting is also one of the reasons for the non-filing of the subsequent patent applications by the inventor.

Another finding from the respondents was about the difficulties encountered or faced in the availability of the funding for R&D activities. Due to the funding issues, it has been observed that few companies have limitations for patenting. Some of them are aware of the funding opportunities from Government. However, they look forward to a hassle-proof mechanism for R&D financing. Few of them are also ready to showcase / demonstrate their technologies/products if they get the opportunity by way of implementing pilot projects with aid from the Government sector.

It is concluded that funding for R&D is a major issue that impacts patent filings.

During the interaction with the respondents who were working / heading R&D, it was revealed that the freshers / newly appointed workforce in the engineering field is not aware of the patent system and its advantages that help in achieving the competitive position for the company assisted by patent protection. Knowledge about software

patenting is also needed, for interdisciplinary areas such as mechatronics that involves filing software patents outside India as software patenting is not allowed in India.

The researcher also had an opportunity to interact with some of the academicians from the engineering domain. It is observed that there is a need of conducting a patent search before the commencement of project work at the Master's Level. This would also be beneficial for selecting the right project work which will have an interest in Industry and further leading to commercialization opportunities.

It is concluded that there is a requirement for trained manpower in the engineering domain who also possess the knowledge of IPR.

Respondents are of the opinion that there are very few reported instances of patent infringement cases related to engineering industries. Some of the respondents are of the opinion that though they are having Patent rights for their invention/product, still they have encountered similar imitating products in the market, however, they have not been able to prevent others from copying their product.

It is concluded that there is a need for strong supporting infrastructure for enforcement of IPR in India.

It is also observed that some of the organizations are contract manufacturers and they have to comply with the given specifications based on the contractual terms of the respective company, it is therefore concluded that this is also one of the reasons for not filing patents.

## **5.5 Recommendations**

On the basis of research findings, the researcher has certain recommendations which are described below:

1. The research findings suggest that there is a considerable time delay in the patent granting process which discourages inventors from filing and making use of the patent. A lot of respondents in their personal experience have shown concern about the time taken for patent processing. This may be because of the number of patent examiners is less. However, the situation is changing with



the recruitment of new patent examiners by the Patent Office and hopefully, this will bring down the time for the grant of patent.

Therefore it is recommended that if the government authorities can develop a strict and specific timeline that will be faster and more communicative with the patent applicant for the patent process and which will also be followed by the patent applicant and examiners thereby reducing the time involved in patent grant and more inventors will be attracted for patent filing.

2. It was observed in the current research study that there are higher patent attorney charges for patenting activity. For the established companies, appointing an agency and paying the charges to a patent attorney for their patenting activities may not be an issue. However, a number of small players believe that the patent attorney charges are higher than the patent application fee and they cannot afford these higher charges.

To overcome this problem, it is recommended that individual registered qualified Patent Agents from the Pune area can be approached for patent drafting and filing and its further processing up to the grant of patent. The fees can be affordable by the small companies as patent agents operating on an individual basis may charge less fees than legal organization.

It is also recommended that a commerce chambers / Industry association can prepare a database of Patent Agent Exam passed by candidates who are registered with the patent office from the Pune area and make it available to the engineering units in Pune. Indian Patent Office might give some incentives to them for assisting the engineering units to file the patent application and assist the company until the patent is granted.

3. As respondents expressed the concern for R&D funding, it is recommended that industries can be connected with organizations such as the National Research Development Corporation (NRDC) / honeybee network/ National Innovation Foundation, who can help with funding for filing of patents till its grant and also help for commercialization of inventions by helping inventor to

identify the manufacturing partners and in prototype development. It is also recommended that the local commerce chambers can arrange awareness programmes to Pune region industries about funding opportunities by connecting with organizations such as NRDC.

4. During the interaction with the respondents, a concern related to a limited knowledge / awareness about IPR especially patent amongst the newly recruited manpower working in the engineering industry around Pune was raised.

It is therefore recommended that during Academic education, awareness programmes on Intellectual Property Rights such as patents, their use and advantages for R&D and patent filing procedures, and their commercialization may be incorporated.

For existing working employees in R&D organizations, who are not aware of IPR can be sensitized by organizing short term orientation program or refresher courses with the help of organizations / personnel working in IPR.

## **5.6 Scope of future work**

Future work can be focused on the following:

1. In this study, from the Secondary data analysis it was observed that along with companies, individual inventors are also actively patenting in the mechanical engineering area. However, mere patent filings and getting a patent granted are not sufficient. The granted patents also need to be monetized. Therefore if such patents are brought to the notice of diverse businesses and investors, it will help in commercialization that will benefit both and also generate employment opportunities. We, therefore, propose to prepare a database of Pune based engineering companies as future scope of work with an emphasis on their patent application or granted patent and their linkage with working technologies / products in practice.
2. This sort of research may be conducted for other sectors like electronics / pharmaceuticals/ biotechnologies.

3. A study and analysis of various policy measures which are initiated by the government pertaining to the IPR applicable for SMEs and MSMEs.

### **5.7 Contribution to the body of knowledge**

The study contributes to the body of knowledge:

- We believe that ours is the first exploratory study on the particulars of patent filing trends related to engineering discipline / industries and restricted to the Pune region.
- Secondary data analysis based on more than ten thousand patents in mechanical engineering area filed in India by Indian as well as Foreign applicants brings out an important aspect that globalization has impacted Indian organizations and as a result, Indian companies have initiated R&D activities, increased patenting and are using patents for their business strategies.
- The researcher has developed a framework that is helpful in understanding how to use patent information for strategic business planning which can be applied to almost any business. To be aware of current developments and trends with respect to the problems and solutions in the mechanical engineering area, the organizations can make use of this framework to look into the technical knowledge present in patent documents for their existing issues/ new product development.

### **5.8 Limitations of the study**

We believe that our study has provided new insights into patenting activities from the Pune region.

1. The focus of the study is limited to the Mechanical Engineering Industry in the Pune region.
2. However, there might be many more clusters as well as industries that might be patenting and making use of the patent for business strategy and that input may remain unfolded.

3. Companies working in the engineering area may be contributing to the patenting process from all over Maharashtra, and that input may remain unfolded.

This chapter details major findings and conclusions based on the observations. Further, this chapter also presents a contribution to the body of the knowledge and provides certain recommendations along with the scope of future work.

## Annexure 1 –Questionnaire

Confidential

Q1	Name of the Company	:			
Q2	Name of the Chairman / Managing Director	:			
Q3_1	Name of the R&D Manager / IP coordinator	:	If not R&D, it is taken care of by Chairman / MD -> Yes/No		
Q3_2					
Contact Details:					
Q4_1	1. Address	:			
Q4_2	2. Tel No	:			
Q4_3	3. Mobile No	:			
Q4_4	4. Email	:			
Q4_5	5. Year of Incorporation	:			
Q4_6	6. Business Activities	:			
Q5	Company's Main Work Area	:	<input type="checkbox"/> Engg. Manufacturing (Mechanical) <input type="checkbox"/> Automobiles <input type="checkbox"/> Engg. Manufacturing (Elect / Electronics) <input type="checkbox"/> Others (please specify) - _____		
Q5_OTH					
Q6	Company Registered as	:	<input type="checkbox"/> Private Limited <input type="checkbox"/> Public Limited <input type="checkbox"/> Proprietorship <input type="checkbox"/> Partnership Firm <input type="checkbox"/> Other (please specify) _____		
Q6_OTH					
Q7a_1	Financial Background	:	Year	R&D Expenditure (in Rs. Lakh)	Turnover of Company (in Rs. Lakh)
Q7a_2			(2013-14)	Q7a_1	Q7b_1
Q7a_3			(2014-15)	Q7a_2	Q7b_2
Q7b_1			(2015-16)	Q7a_3	Q7b_3
Q7b_2					
Q7b_3					

Q8	<ol style="list-style-type: none"> <li>1. Are you aware of the concept of Patent - Yes/ No</li> <li>2. Does your Company have R&amp;D Setup - Yes/ No</li> <li>3. Number of staff working in R&amp;D - _____</li> <li>4. Does your Company have a joint collaboration for R&amp;D? - Yes/ No; if Yes with whom?               <ol style="list-style-type: none"> <li>a) University / Academia,</li> <li>b) Professional R&amp;D units like (Automotive Research Association of India - ARAI in automobile)</li> <li>c) Indian companies</li> <li>d) Foreign companies</li> </ol>               If possible the name of the joint collaboration - _____             </li> </ol>
Q9	
Q10	
Q11	
Q11a1	
Q11a2	
Q11a3	
Q11a4	
Q11a5_Sp	

Q12	5. Does your Company have an Indian Patent Application OR Granted Indian Patent in its name –				
Q12-1	Yes/ No				
Q12_2	If Yes				
	<table border="1"> <tr> <td>Patent No</td> <td>Patent Application No</td> </tr> <tr> <td></td> <td></td> </tr> </table>	Patent No	Patent Application No		
Patent No	Patent Application No				
Q13	6. Does your Company have file patent application(s) in foreign countries OR have granted foreign patent in their name - Yes/ No				
Q13-1	Yes/ No				
Q13_2	If Yes				
	<table border="1"> <tr> <td>Patent No</td> <td>Patent Application No</td> </tr> <tr> <td></td> <td></td> </tr> </table>	Patent No	Patent Application No		
Patent No	Patent Application No				
Q14	7. Does your Company use patent information in its R&D Planning? -				
Q14a	Yes/ No				
	7a. How useful is it on a scale of 1 to 5, where 1 is least useful and 5 is most useful? - <input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5				
Q15	8. Does your Company use the patent information in business? Yes/ No				
Q16	9. Does this Patent help you towards market capture? - Yes / No				
Q17	10. Do you agree that financial earning of the company has increased after getting the Patent - Yes / No				
Q18	11. Do you agree that Patent improves the image of company in the market? - Yes / No				
Q19	12. How does your company use the Patent Portfolio?				
Q19_1	a) used in the company only - Yes / No				
Q19_2	b) used in-house and licensed to other companies - Yes / No				
Q19_3	c) not used at all - Yes / No				
Q20	13. Do you agree that due to Globalization, R&D and patenting activity of Indian companies has increased? - Yes/ No				
Q21	OR After globalisation Indian companies are looking essentially into R&D activity and Patent filing – Yes/ No				
Q22	14. Do you agree that due to Globalization, Patent(s) filed by foreign companies in India has increased? - Yes/ No				
Q23	15. According to you what could be the reasons behind the increase in Patent filing in India by foreign companies in engineering sector				
Q23_a	a) relative importance of India as R&D destination for the engineering sector - Yes / No				
Q23_b	b) availability of skilled manpower in a labour surplus country like India at an economical rate – Yes / No				
Q23_c	c) to capture the Indian market - Yes / No				
Q23_d	d) to avail Science & Technology infrastructure available in India - Yes / No				
Q23_e	e) policy of the Government of India has been helpful for Patenting in India - Yes / No				
Q23_f_OTH	f) Any Other (please specify) - _____				

Q24	<p>16. According to you what is the Impact of patenting on your business:</p> <table border="1" style="margin-left: auto; margin-right: auto; border-collapse: collapse; width: 80%;"> <tr> <td style="padding: 5px; text-align: center;">Before Patenting-</td> <td style="padding: 5px; text-align: center;">After Patenting -</td> </tr> <tr> <td style="padding: 5px; height: 80px; vertical-align: top;">Q24_1a</td> <td style="padding: 5px; height: 80px; vertical-align: top;">Q24_2a</td> </tr> </table>	Before Patenting-	After Patenting -	Q24_1a	Q24_2a
Before Patenting-	After Patenting -				
Q24_1a	Q24_2a				
Q25 Q25_1 Q25_2 Q25_3	<p>17. Any Research contribution by your company, that outside world will appreciate?</p> <p>-----</p> <p>-----</p> <p>-----</p>				
Q26 Q26_1 Q26_2 Q26_3	<p>18. According to your experience, what are the most common problems that you are facing on the R&amp;D front -</p> <p>-----</p> <p>-----</p> <p>-----</p>				
Q27 Q27_1 Q27_2 Q27_3	<p>19. According to your experience, what are the most common problems that you are facing on the Patenting front -</p> <p>-----</p> <p>-----</p> <p>-----</p>				
Q28 Q28_1 Q28_2 Q28_3	<p>20. What kind of Advisory Services and Assistance are required from the Government OR different chambers / associations regarding Patenting-</p> <p>-----</p> <p>-----</p> <p>-----</p>				
Q29 Q29_1 Q29_2 Q29_3	<p>21. Any Other Comment(s) / Suggestion(s) –</p> <p>-----</p> <p>-----</p> <p>-----</p>				
Q30 Q30_1 Q30_2 Q30_3	<p>22. If your company does not have Patent; reason for Non-Patenting:</p> <p>-----</p> <p>-----</p> <p>-----</p>				

(For any additional input separate sheet can be used)

## Annexure 2–Fees Structure at Indian Patent Office

### The First Schedule <sup>[142]</sup>

(See rule 7)

**Table I - Fees Payable**

Number of entry	On what payable	Number of the relevant Form	For e-filing			For physical filing		
			Natural person(s) and/ or Startup	Small entity, alone or with natural person(s) and/ or Startup	Others, alone or with natural person(s) and/ or Startup and/ or small entity	Natural person(s) and/ or Startup	Small entity, alone or with natural person(s) and/ or Startup	Others, alone or with natural person(s) and/ or Startup and/ or small entity
1	2	3	4	5	6	7	8	9
			Rupees	Rupees	Rupees	Rupees	Rupees	Rupees
1.	On application for a patent under sections 7, 54 or 135 and rule 20(1) accompanied by provisional or complete specification—	1	1600	4000	8000	1750	4400	8800
			Multiple of 1600 in case of every multiple priority.	Multiple of 4000 in case of every multiple priority.	Multiple of 8000 in case of every multiple priority.	Multiple of 1750 in case of every multiple priority.	Multiple of 4400 in case of every multiple priority.	Multiple of 8800 in case of every multiple priority.
	(i) for each sheet of specification in addition to 30, excluding sequence listing of nucleotides and/ or amino acid sequences under sub-rule (3) of rule (9);		(i) 160	(i) 400	(i) 800	(i) 180	(i) 440	(i) 880
	(ii) for each claim in addition to 10;		(ii) 320	(ii) 800	(ii) 1600	(ii) 350	(ii) 880	(ii) 1750
	(iii) for each page of sequence listing of nucleotides and/ or amino acid sequences under sub-rule (3) of rule (9).		(iii) 160 subject to a maximum of 24000	(iii) 400 subject to a maximum of 60000	(iii) 800 subject to a maximum of 120000	Not allowed	Not allowed	Not allowed
2.	On filing complete specification after provisional up to 30 pages having up to 10 claims –	2	No fee	No fee	No fee	No fee	No fee	No fee
	(i) for each sheet of specification in addition to 30, excluding sequence listing of nucleotides and/ or amino acid sequences under		(i) 160	(i) 400	(i) 800	(i) 180	(i) 440	(i) 880



Number of entry	On what payable	Number of the relevant Form	For e-filing			For physical filing		
			Natural person(s) and/ or Startup	Small entity, alone or with natural person(s) and/ or Startup	Others, alone or with natural person(s) and/ or Startup and/ or small entity	Natural person(s) and/ or Startup	Small entity, alone or with natural person(s) and/ or Startup	Others, alone or with natural person(s) and/ or Startup and/ or small entity
1	2	3	4	5	6	7	8	9
			Rupees	Rupees	Rupees	Rupees	Rupees	Rupees
	sub-rule (3) of rule (9);							
	(ii) for each claim in addition to 10.		(ii) 320	(ii) 800	(ii) 1600	(ii) 350	(ii) 880	(ii) 1800
	(iii) for each page of sequence listing of nucleotides and/ or amino acid sequences under sub-rule (3) of rule (9).		(iii) 160 subject to a maximum of 24000	(iii) 400 subject to a maximum of 60000	(iii) 800 subject to a maximum of 120000	Not allowed	Not allowed	Not allowed
3.	On filing a statement and undertaking under section 8.	3	No fee	No fee	No fee	No fee	No fee	No fee
4.	i) On request for extension of time under sections 53(2) and 142(4), rules 13(6), 80(1A) and 130 (per month).	4	480	1200	2400	530	1300	2600
	ii) On request for extension of time under sub-rule (5) of rule 24B (per month).	4	1000	2000	4000	1100	2200	4400
	iii) On request for extension of time under sub-rule (11) of rule 24C (per month).	4	2000	5000	10000	2200	5500	11000
5.	On filing a declaration as to inventorship under sub-rule (6) of rule 13.	5	No fee	No fee	No fee	No fee	No fee	No fee
6.	On application for postdating.	-	800	2000	4000	880	2200	4400
7.	On application for deletion of reference under section 19 (2).	-	800	2000	4000	880	2200	4400
8.	(i) On claim under section 20(1);	6	800	2000	4000	880	2200	4400
	(ii) On request for direction under section 20 (4) or 20 (5).	6	800	2000	4000	880	2200	4400

Number of entry	On what payable	Number of the relevant Form	For e-filing			For physical filing		
			Natural person(s) and/ or Startup	Small entity, alone or with natural person(s) and/ or Startup	Others, alone or with natural person(s) and/ or Startup and/ or small entity	Natural person(s) and/ or Startup	Small entity, alone or with natural person(s) and/ or Startup	Others, alone or with natural person(s) and/ or Startup and/ or small entity
1	2	3	4	5	6	7	8	9
			Rupees	Rupees	Rupees	Rupees	Rupees	Rupees
9.	(i) On notice of opposition to grant of patent under section 25(2);	7	2400	6000	12000	2600	6600	13200
	(ii) On filing representation opposing grant of patent under section 25(1).	7A	No fee	No fee	No fee	No fee	No fee	No fee
10.	On giving notice that hearing before Controller shall be attended under rule 62(2).	-	1500	3800	7500	1700	4100	8300
11.	On application under sections 28(2), 28(3) or 28(7).	8	800	2000	4000	880	2200	4400
12.	Request for publication under section 11A(2) and rule 24A.	9	2500	6250	12500	2750	6900	13750
13.	Application for withdrawing the application under section 11B(4), and rules 7(4A) and 26.	29	No fee	No fee	No fee	No fee	No fee	No fee
14.	On request for examination of application for patent—	18						
	(i) under section 11B and rule 24(1);		4000	10000	20000	4400	11000	22000
	(ii) under rule 20(4)(ii).		5600	14000	28000	6150	15400	30800
14A.	On request for expedited examination of application for patent under rule 24C.	18A	8000	25000	60000	Not allowed	Not allowed	Not allowed
14B.	Conversion of the request for examination filed under rule 24B to request for expedited	18 A	4000	15000	40000	Not allowed	Not allowed	Not allowed

Number of entry	On what payable	Number of the relevant Form	For e-filing			For physical filing		
			Natural person(s) and/ or Startup	Small entity, alone or with natural person(s) and/ or Startup	Others, alone or with natural person(s) and/ or Startup and/ or small entity	Natural person(s) and/ or Startup	Small entity, alone or with natural person(s) and/ or Startup	Others, alone or with natural person(s) and/ or Startup and/ or small entity
1	2	3	4	5	6	7	8	9
			Rupees	Rupees	Rupees	Rupees	Rupees	Rupees
	examination under rule 24C.							
15.	On application under section 44 for amendment of patent.	10	2400	6000	12000	2650	6600	13200
16.	On application for directions under section 51(1) or 51(2).	11	2400	6000	12000	2650	6600	13200
17.	On request for grant of a patent under sections 26(1) and 52(2).	12	2400	6000	12000	2650	6600	13200
18.	On request for converting a patent of addition to an independent patent under section 55 (1).	-	2400	6000	12000	2650	6600	13200
19.	For renewal of a patent under section 53—							
(i)	before the expiration of the 2nd year from the date of patent in respect of 3rd year;	-	800	2000	4000	880	2200	4400
(ii)	before the expiration of the 3rd year in respect of the 4th year;	-	800	2000	4000	880	2200	4400
(iii)	before the expiration of the 4th year in respect of the 5th year;	-	800	2000	4000	880	2200	4400
(iv)	before the expiration of the 5th year in respect of the 6th year;	-	800	2000	4000	880	2200	4400
(v)	before the expiration of the 6th year in respect of the 7th year;	-	2400	6000	12000	2650	6600	13200
(vi)	before the expiration of the 7th year in respect of the 8th year;	-	2400	6000	12000	2650	6600	13200
(vii)	before the	-	2400	6000	12000	2650	6600	13200

Number of entry	On what payable	Number of the relevant Form	For e-filing			For physical filing		
			Natural person(s) and/ or Startup	Small entity, alone or with natural person(s) and/ or Startup	Others, alone or with natural person(s) and/ or Startup and/ or small entity	Natural person(s) and/ or Startup	Small entity, alone or with natural person(s) and/ or Startup	Others, alone or with natural person(s) and/ or Startup and/ or small entity
1	2	3	4	5	6	7	8	9
			Rupees	Rupees	Rupees	Rupees	Rupees	Rupees
	expiration of the 8th year in respect of the 9th year;							
(viii)	before the expiration of the 9th year in respect of the 10th year;	-	2400	6000	12000	2650	6600	13200
(ix)	before the expiration of the 10th year in respect of the 11th year;	-	4800	12000	24000	5300	13200	26400
(x)	before the expiration of the 11th year in respect of the 12th year;	-	4800	12000	24000	5300	13200	26400
(xi)	before the expiration of the 12th year in respect of the 13th year;	-	4800	12000	24000	5300	13200	26400
(xii)	before the expiration of the 13th year in respect of the 14th year;	-	4800	12000	24000	5300	13200	26400
(xiii)	before the expiration of the 14th year in respect of the 15th year;	-	4800	12000	24000	5300	13200	26400
(xiv)	before the expiration of the 15th year in respect of the 16th year;	-	8000	20000	40000	8800	22000	44000
(xv)	before the expiration of the 16th year in respect of the 17th year;	-	8000	20000	40000	8800	22000	44000
(xvi)	before the expiration of the 17th year in respect of the 18th year;	-	8000	20000	40000	8800	22000	44000
(xvii)	before the expiration of the	-	8000	20000	40000	8800	22000	44000

Number of entry	On what payable	Number of the relevant Form	For e-filing			For physical filing		
			Natural person(s) and/ or Startup	Small entity, alone or with natural person(s) and/ or Startup	Others, alone or with natural person(s) and/ or Startup and/ or small entity	Natural person(s) and/ or Startup	Small entity, alone or with natural person(s) and/ or Startup	Others, alone or with natural person(s) and/ or Startup and/ or small entity
1	2	3	4	5	6	7	8	9
			Rupees	Rupees	Rupees	Rupees	Rupees	Rupees
	18th year in respect of the 19th year;							
(xviii)	before the expiration of the 19th year in respect of the 20th year.		8000	20000	40000	8800	22000	44000
20.	On application for amendment of application for patent or complete specification or other related documents under section 57—	13						
(i)	before grant of patent;		800	2000	4000	880	2200	4400
(ii)	after grant of patent;		1600	4000	8000	1750	4400	8800
(iii)	where amendment is for changing name or address or nationality or address for service.		320	800	1600	350	880	1750
21.	On notice of opposition to an application under sections 57(4), 61(1) and 87(2) or to surrender a patent under section 63(3) or to a request under section 78(5).	14	2400	6000	12000	2650	6600	13200
22.	On application for restoration of a patent under section 60.	15	2400	6000	12000	2650	6600	13200
23.	Additional fee for restoration under section 61(3) and rule 86(1).	—	4800	12000	24000	5300	13200	26400
24.	On notice of offer to surrender a patent under section 63.	—	1000	2500	5000	1100	2750	5500
25.	On application for the entry in the	16	1600	4000	8000	1750	4400	8800

Number of entry	On what payable	Number of the relevant Form	For e-filing			For physical filing		
			Natural person(s) and/ or Startup	Small entity, alone or with natural person(s) and/ or Startup	Others, alone or with natural person(s) and/ or Startup and/ or small entity	Natural person(s) and/ or Startup	Small entity, alone or with natural person(s) and/ or Startup	Others, alone or with natural person(s) and/ or Startup and/ or small entity
1	2	3	4	5	6	7	8	9
			Rupees	Rupees	Rupees	Rupees	Rupees	Rupees
			(In respect of each patent)	(In respect of each patent)	(In respect of each patent)	(In respect of each patent)	(In respect of each patent)	(In respect of each patent)
26.	On application for alteration of an entry in the register of patents or register of patent agents under rules 94(1) or rule 118(1).	—	320	800	1600	350	880	1750
27.	On request for entry of an additional address for service in the Register of Patents under rule 94(3).	—	800	2000	4000	880	2200	4400
28.	On application for compulsory license under sections 84(1), 91(1), 92(1) and 92A.	17	2400	6000	12000	2650	6600	13200
29.	On application for revocation of a patent under section 85(1).	19	2400	6000	12000	2650	6600	13200
30.	On application for revision of terms and conditions of licence under section 88(4).	20	2400	6000	12000	2650	6600	13200
31.	On request for termination of compulsory licence under section 94.	21	2400	6000	12000	2650	6600	13200
32.	On application for registration as a	22	3200	Not applicable	Not applicable	3500	Not applicable	Not applicable

Number of entry	On what payable	Number of the relevant Form	For e-filing			For physical filing		
			Natural person(s) and/ or Startup	Small entity, alone or with natural person(s) and/ or Startup	Others, alone or with natural person(s) and/ or Startup and/ or small entity	Natural person(s) and/ or Startup	Small entity, alone or with natural person(s) and/ or Startup	Others, alone or with natural person(s) and/ or Startup and/ or small entity
1	2	3	4	5	6	7	8	9
			Rupees	Rupees	Rupees	Rupees	Rupees	Rupees
	patent agent under rule 109(1) or rule 112.							
33.	On request for appearing in the qualifying examination under rule 109(3).	—	1600	Not applicable	Not applicable	1750	Not applicable	Not applicable
34.	For continuance of the name of a person in the register of patent agents—							
	(i) for the 1st year to be paid along with registration;	—	800	Not applicable	Not applicable	880	Not applicable	Not applicable
	(ii) for every year excluding the 1st year to be paid on the 1st April in each year.	—	800	Not applicable	Not applicable	880	Not applicable	Not applicable
35.	On application for duplicate certificate of patent agent under rule 111A.	--	1600	Not applicable	Not applicable	1750	Not applicable	Not applicable
36.	On application for restoration of the name of a person in the register of patent agents under rule 117(1).	23	1600 (Plus continuation fee under entry number 34)	Not applicable	Not applicable	1750 (Plus continuation fee under entry number 34)	Not applicable	Not applicable
37.	On a request for correction of clerical error under section 78(2).	—	800	2000	4000	880	2200	4400
38.	On application for review or setting aside the decision or order of the controller under section 77(1)(f) or 77(1)(g).	24	1600	4000	8000	1750	4400	8800
39.	On application for permission for applying patent outside India under section 39 and rule	25	1600	4000	8000	1750	4400	8800

Number of entry	On what payable	Number of the relevant Form	For e-filing			For physical filing		
			Natural person(s) and/ or Startup	Small entity, alone or with natural person(s) and/ or Startup	Others, alone or with natural person(s) and/ or Startup and/ or small entity	Natural person(s) and/ or Startup	Small entity, alone or with natural person(s) and/ or Startup	Others, alone or with natural person(s) and/ or Startup and/ or small entity
1	2	3	4	5	6	7	8	9
			Rupees	Rupees	Rupees	Rupees	Rupees	Rupees
	71(1).							
40.	On application for duplicate patent under section 154 and rule 132.	—	1600	4000	8000	1750	4400	8800
41.	(i) On request for certified copies under section 72 or for certificate under section 147 and rule 133(1).	—	1000 (up to 30 pages and, thereafter, 30 for each extra page)	2500 (up to 30 pages and, thereafter, 75 for each extra page)	5000 (up to 30 pages and, thereafter, 150 for each extra page)	1100 (up to 30 pages and, thereafter, 30 for each extra page)	2750 (up to 30 pages and, thereafter, 75 for each extra page)	5500 (up to 30 pages and, thereafter, 150 for each extra page)
	(ii) On request for certified copies under section 72 or for certificate under section 147 and rule 133(2).	--	2400 (up to 30 pages and thereafter, 30 for each extra page)	6000 (up to 30 pages and thereafter, 30 for each extra page)	12000 (up to 30 pages and thereafter, 30 for each extra page)	3300 (up to 30 pages and thereafter, 30 for each extra page)	6600 (up to 30 pages and thereafter, 30 for each extra page)	13200 (up to 30 pages and thereafter, 30 for each extra page)
42.	For certifying office copies, printed each.	—	800	2000	4000	880	2200	4400
43.	On request for inspection of register under section 72, inspection under rule 27 or rule 74A.	—	320	800	1600	350	880	1750
44.	On request for information under section 153 and rule 134.	—	480	1200	2400	530	1300	2650
45.	On form of authorisation of a patent agent.	26	No fee	No fee	No fee	No fee	No fee	No fee
46.	On petition not otherwise provided for.	—	1600	4000	8000	1750	4400	8800
47.	For supplying of photocopies of the documents, per page.	—	10	10	10	10	10	10
48.	Transmittal fee for International application.	—	3200	8000	16000	3500	8800	17600
49.	For preparation of certified copy of priority document	—	1000	2500	5000	1100	2750	5500



Number of entry	On what payable	Number of the relevant Form	For e-filing			For physical filing		
			Natural person(s) and/ or Startup	Small entity, alone or with natural person(s) and/ or Startup	Others, alone or with natural person(s) and/ or Startup and/ or small entity	Natural person(s) and/ or Startup	Small entity, alone or with natural person(s) and/ or Startup	Others, alone or with natural person(s) and/ or Startup and/ or small entity
1	2	3	4	5	6	7	8	9
			Rupees	Rupees	Rupees	Rupees	Rupees	Rupees
	and for transmission of the same to the International Bureau of World Intellectual Property Organization.		(up to 30 pages and, thereafter, 30 for each extra page)	(up to 30 pages and, thereafter, 75 for each extra page)	(up to 30 pages and, thereafter, 150 for each extra page)	(up to 30 pages and, thereafter, 30 for each extra page)	(up to 30 pages and, thereafter, 75 for each extra page)	(up to 30 pages and, thereafter, 150 for each extra page)
50.	On statement regarding working of a patented invention on a commercial scale in India under section 146(2) and rule 131(1).	27	No fee	No fee	No fee	No fee	No fee	No fee
51.	To be submitted for claiming the status of a small entity or startup	28	No fee	No fee	No fee	No fee	No fee	No fee
52.	Request for adjournment of hearing under rule 129A (for each adjournment).	-	1000	2500	5000	1100	2750	5500
53.	Miscellaneous form under rule 8(2), to be used when no other form is prescribed.	30	As applicable					

**Table II - Fees Refundable**

On what account fee refundable	Refund of fees
Refund of fees under sub-rule (4A) of rule 7	90% of the fee paid for the request for examination or request for expedited examination

Source: Ref - Fees - [http://www.ipindia.nic.in/writereaddata/Portal/IPO\\_FormUpload/1\\_11\\_1/Fees.pdf](http://www.ipindia.nic.in/writereaddata/Portal/IPO_FormUpload/1_11_1/Fees.pdf)

## Annexure 3–Secondary data analysis

### Secondary Data Analysis Part 1: Patents filed at IPO from all over the world.

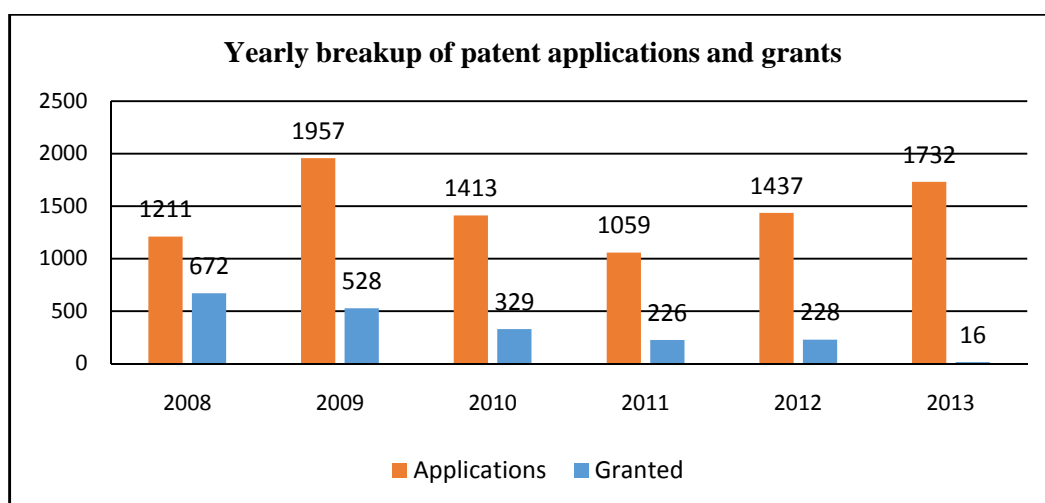
Patents are filed at Indian Patent Office by companies/individuals from all over the world. As explained in chapter 3 about data collection, the collected data under the above category was further cleaned and analyzed to find out Yearly breakup, Application and Granted Patents, Assignee, Assignee Type, Country of Origin, Inventor, IPC, R&D Partnership, Use, etc.

### Yearly breakup

Following table A1 and figure A1 show the number of patent applications and grants from the year 2008 to 2013. There are a total of 10808 patents (including application and grant) under IPC = F.

**Table A1. Number of Patent Applications and Granted from under IPC = F**

Year	Applications (A)	Granted (B)
2008	1211	672
2009	1957	528
2010	1413	329
2011	1059	226
2012	1437	228
2013	1732	16
Total	8809	1999
(A+B) Total = 10808		



**Figure A1: Yearly breakup of patent application and grants**

It is observed that there is some downfall in patent applications between 2010 and 2011; however, the filing trend again increased from 2012 onwards.

### **Top Assignee**

We found Top 30 assignees who are active in this area [*Company name, number of records*] such as Robert Bosch GMBH – 419, GM Global Technology Operations Inc, US - 507, Honda Motor Co Ltd, JP - 306, Bharat Heavy Electricals Limited, IN - 254, TVS Motor Company Limited - 152, Siemens Aktiengesellschaft - 179, General Electric Company, CA - 154, Mitsubishi Heavy Industries Ltd. - 121, Borgwarner Inc, US - 104, Tata Motors Limited - 119, Alstom - 77, LG Electronics Inc, KR - 82, Crompton Greaves Limited - 84, Toyo Riki Seizo Kabushiki Kaisha, JP - 73, BSH Bosch Und Siemens Hausgerate GMBH, DE - 78, Eaton Corporation, US - 67, Vestas Wind Systems A/S - 58, Daikin Industries Ltd - 48, Federal-Mogul Borschardt GMBH - 56, Mahindra and Mahindra Limited - 50, Danfoss AS, DK - 35, Praxair Technology Inc, US - 50, Carrier Corporation, US - 49, Council of Scientific and Industrial Research, IN - 47, Sanyang Industry Co. Ltd. - 36, Steel Authority of India Limited - 41, Thermax Limited - 43, Indian Institute of Technology, IN - 35, Knorr-Bremse Systeme Fur Nutzfahrzeuge GMBH, DE - 39, Alfa-Laval AB - 36,

Country of origin –

**Table A2. Number of Patent Applications and Granted Patents from different countries**

Sr No	Country	Application	Granted	Total A	Sr No	Country	Application	Granted	Total B	Sr No	Country	Application	Granted	Total C
1	IN	3099	685	3784	21	FI	22	4	26	41	RS	3		3
2	US	1740	384	2124	22	ES	24	1	25	42	KZ	2		2
3	DE	1086	183	1269	23	IL	18	7	25	43	SG	1	1	2
4	JP	766	316	1082	24	BE	19	5	24	44	AZ	1		1
5	EP	339	27	366	25	ZA	14	10	24	45	BG		1	1
6	FR	235	59	294	26	CH	18	3	21	46	CO	1		1
7	GB	213	56	269	27	UK		16	16	47	HK	1		1
8	WO	239	27	266	28	RU	11	3	14	48	ID		1	1
9	IT	159	35	194	29	NZ	11	2	13	49	IS	1		1
10	KR	129	59	188	30	CZ	5	2	7	50	JM	1		1
11	CN	143	13	156	31	TR	6	1	7	51	KP	1		1
12	AU	97	30	127	32	GR	6		6	52	LT	1		1
13	SE	95	22	117	33	MY	4	1	5	53	MX	1		1
14	DK	91	5	96	34	TH	5		5	54	PK	1		1
15	AT	43	9	52	35	AR	4		4	55	PT	1		1
16	NO	35	4	39	36	CL	4		4	56	RO	1		1
17	NL	33	4	37	37	LU	2	2	4	57	UA	1		1
18	TW	31		31	38	HU	2	1	3	58	UY	1		1
19	BR	24	5	29	39	IE	3		3	59	VN	1		1
20	CA	12	14	26	40	PL	2	1	3					
				10546					239					23
<b>Total (A+B+C) = 10546+239+23=10808</b>														

Above table A2 shows the country of origin of Invention that has filed the patent applications in India; approximately there are 65% patent applications from foreign countries, in which the USA is at the top with 2124 followed by Germany 1269, Japan 1082, and so on. There are also applications through PCT<sup>[143]</sup> route.

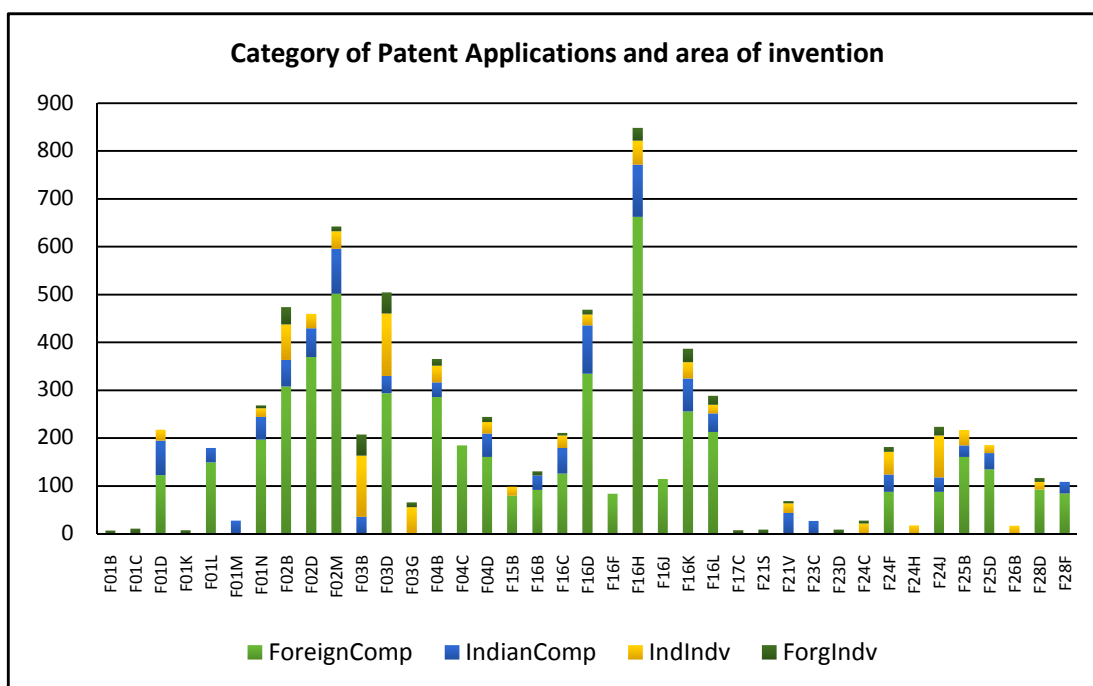
The assignment to countries of origin is an important aspect. In this study, a patent is assigned to a country based on the office of the priority application, which is derived from the legal background. The priority filing is the first application of a specific patent; in many cases, the first application is filed at the patent office of the country where the invention is originated. <sup>[144]</sup>This is the justification for using the priority country as the country of origin.

Further, this data of 10808 patent applications and grants were categorized between Foreign Companies (Foreign Comp) 2117, Indian Companies (Indian Comp) 472, Foreign Individuals (Forging Individual) 754, and Indian Individuals (Indian Individual) 1566. Following the table, A3 shows the International Patent Classification [(IPC) area of invention they are focusing on] by category and area of invention.

**Table A3. Category of Patent Applications and area of invention**

Sr. No.	IPC Current	Foreign Companies	IPC Current	Indian Companies	IPC Current	Indian Individual	IPC Current	Foreign Individual
1	F16H	662	F16H	109	F03D	131	F03D	44
2	F02M	501	F16D	101	F03B	128	F03B	44
3	F02D	369	F02M	94	F24J	88	F02B	36
4	F16D	334	F01D	72	F02B	74	F16K	28
5	F02B	307	F16K	69	F03G	55	F16H	27
6	F03D	293	F02D	60	F16H	50	F16L	19
7	F04B	285	F02B	56	F24F	48	F24J	18
8	F16K	255	F16C	54	F02M	37	F04B	14
9	F16L	212	F04D	49	F04B	35	F04D	11
10	F01N	196	F01N	48	F16K	34	F03G	10
11	F04C	184	F21V	43	F25B	32	F24F	10
12	F25B	160	F16L	39	F02D	30	F02M	10
13	F04D	160	F03D	36	F16C	26	F01C	10

Sr. No.	IPC Current	Foreign Companies	IPC Current	Indian Companies	IPC Current	Indian Individual	IPC Current	Foreign Individual
14	F01L	149	F24F	36	F04D	24	F16D	10
15	F25D	134	F03B	35	F16D	23	F16B	9
16	F16C	125	F25D	34	F01D	23	F28D	8
17	F01D	122	F04B	31	F24C	21	F21S	8
18	F16J	114	F01L	30	F21V	20	F23D	8
19	F28D	92	F16B	30	F15B	19	F17C	7
20	F16B	91	F24J	30	F01N	18	F01K	7
21	F24F	87	F01M	27	F16L	18	F01B	6
22	F24J	87	F23C	26	F25D	17	F24C	6
23	F28F	84	F27B	26	F24H	17	F01N	6
24	F16F	83	F25B	24	F26B	16	F16C	5
25	F15B	79	F28F	24	F28D	16	F21V	5



**Table A4. Top 20 IPCs in which Indian companies are working**

Sr. No.	Assignee/IPC Current	F16H	F02M	F03D	F02B	F16D	F02D	F16K	F04B	F16L	F03B	F01D	F04D	F25B	F01N	F24J	F16C	F04C	F25D	F24F	F01L
1	Bharat Heavy Electricals Limited, IN	5	3	12	4	6	2	9	3	7	17	37	10	2	4	4	4		2	1	2
2	TVS Motor Company Limited	26	27		16	34	11	4	1			1	6		10		11	1			12
3	Tata Motors Limited	16	20		9	15	12	3	1	2		2		1	11		4	1		2	3
4	Crompton Greaves Limited	2	1	3		2		1	4			2	13	1	2	2	7	1		7	
5	Mahindra and Mahindra Limited	9	7		3	6	3	3					2		6		4	1			
6	Council of Scientific and Industrial Research, IN				3		1		1	2	1	2		1		2	2		1	1	2
7	Steel Authority Of India Limited	1	1	1								1	1				1		1		1
8	Indian Institute of Technology, IN		3	6			1		2		3	5		2		1	1		1	1	
9	Larsen & Toubro Limited,IN	8	1			1	1	1	2	1		2	1	1			2				
10	Tata Steel Limited, IN	1				1		2	1			1	2				2				
11	Ashok Leyland Limited, IN	1	2		4		6			1					6						2
12	Bajaj Auto Limited	5	3				8								2		1				
13	Maruti Suzuki India Limited	2	3		2		4														

Sr. No.	Assignee/IPC Current	F16H	F02M	F03D	F02B	F16D	F02D	F16K	F04B	F16L	F03B	F01D	F04D	F25B	F01N	F24J	F16C	F04C	F25D	F24F	F01L
14	Audco India Limited, IN	3						13													1
15	Godrej & Boyce Mfg Co Ltd, IN																		11		
16	Blue Star Limited								1	1				4						2	
17	High Technology Transmission Systems Pvt Ltd, IN				1	8											1				
18	Triveni Engineering & Industries Ltd (Turbine Business Group)							1				8									
19	Department of Space Indian Space Research Organization (ISRO),IN							3					1	1							
20	Department of Science and Technology, GoI.				4													1			



Top 20 IPCs in which Foreign Companies are working – following table A5 shows the top 20 IPC filings by Foreign Companies

**Table A5.Top 20 IPCs in which foreign companies are working**

Sr. No.	Assignee/IPC Current	F16H	F02M	F03D	F02B	F16D	F02D	F16K	F04B	F16L	F03B	F01D	F04D	F25B	F01N	F24J	F16C	F04C	F25D	F24F	F01L
1	Robert Bosch GMBH	10	217		14	10	96	16	44	1		1	10	12	32	5	2	13	3		2
2	GM Global Technology Operations Inc, US	229	33	1	28	29	46	4	7	3		4			40		1	3			24
3	Honda Motor Co Ltd,JP	37	37		25	18	49		4	1			3		13		10	3			32
4	General Electric Company, CA	3	4	45	1	2	6	3	2	1	1	32	8	1	3	1	1	3	1		
5	Mitsubishi Heavy Industries Ltd.	4	14	20	2	2	2	5	8	1		20	12	3		4	5	10		3	4
6	BorgWarner Inc, US	19	7		73	5		5	1			7	6		4						4
7	LG Electronics Inc, KR								17	1			2	5				4	38	3	
8	BSH Bosch und Siemens Hausgerate GMBH, DE								6				4	8					38		
9	Toyo Roki Seizo Kabushiki Kaisha, JP	7	7		7		36								8		2				7
10	Eaton Corporation, US	17			1	14	3	8	2	3			1		1			5			1
11	Vestas Wind Systems A/S	2		64			1		1			1		1							
12	Daikin Industries Ltd								3				2	12				22		19	

Sr. No.	Assignee/IPC Current	F16H	F02M	F03D	F02B	F16D	F02D	F16K	F04B	F16L	F03B	F01D	F04D	F25B	F01N	F24J	F16C	F04C	F25D	F24F	F01L
13	Federal-Mogul Burscheid GMBH		3		1	4											11				
14	Danfoss AS, DK							6	13			1	1	11			1	16	2		
15	Praxair Technology Inc, US												3	2					4		
16	Carrier Corporation, US	1							4	1			3	19				2	5	5	
17	Sanyang Industry CO. LTD.	4	4		3		5						1		2		1				9
18	Knorr-Bremse Systeme Fur Nutzfahrzeuge GMBH, DE	1			3	23	2	1	8						1			1			
19	Alfa-Laval AB							2	1	1			1								
20	Man Diesel AS, DK		5		2		5					1	5		3						4

### **Foreign Companies**

Foreign companies are mainly working in the area of Gearing, Supplying Combustible Mixtures to Combustion Engines, Controlling of Combustion Engines, Couplings for Transmitting Rotation, Combustion Engines, Wind Motors, Positive-Displacement Machines, Valves, Devices for Venting, Pipes Joints or Fittings, Exhaust Apparatus For Machines, Rotary-Piston, Refrigeration Machines, Non-Positive-Displacement Pumps, Cyclically Operating Valves, Flexible Shafts for Transmitting, Pistons; Cylinders; Pressure Vessels, Heat-Exchange Apparatus, Devices for Fastening or Securing Constructional Elements, Air-Conditioning, Springs; Shock-Absorbers.

Indian companies more or less are similar in working on the Inventions like foreign companies; however, their filing is less in this area and besides, they are also working on functional features of lighting devices or systems and structural combinations of lighting devices with other articles; Lubricating of machines or engines in general; lubricating internal-combustion engines; crankcase ventilating.

However, Indian Companies are less active in the area of Fluid-Pressure Actuators, Springs; Shock-Absorbers; Means for Damping Vibration, Pistons; Cylinders; Pressure Vessels, Wind Motors, Refrigeration Machines, Controlling of Combustion Engines.

Also, it has been seen from the data that there are approximate 1566 Indian Individual applicants active in filing the patents in the area of Wind Motor, Positive-Displacement Engine, and Producing Mechanical Power from Heat, Internal Combustion Engines, Mechanical Power Producing Devices, Gearing, Air-Conditioning; and 754 individual foreign applicants working in the area of Wind Motors, Positive Displacement Engine, Internal Combustion Engine, Devices for Venting or Aerating, Gearing, Joints or Fittings For Pipes, Engines or Other Mechanisms for Producing Mechanical Power From Heat.

## **Usage**

Apart from IPC code based categorization of patents, titles of the patents were also scrutinized to understand the nature of the invention, and these inventions are mainly applied in the areas such as internal combustion engine, motor vehicle engine, wind turbine, diesel engine, refrigerator, compressor, gas turbine, two-wheeled motor vehicle, air conditioner, pump, heat exchanger, steam turbine, truck, transmission, motorcycle, the automobile, fuel injection system, multi-speed transmission, hybrid vehicle, scroll compressor, power plant, automatic transmission, cooling system, passenger vehicle, exhaust system, generator, petrol engine, variable transmission, gearbox, wind power plant.

## **R&D Partnership**

Indian companies are working in various areas under mechanical engineering, and there are some interesting findings. Many small scale and big industries are taking efforts in R&D and are coming up with new inventions. For these inventions, they have either filed applications or have granted patents in their name. For example, the invention in the area of Vehicle Jack assembly has been filed (1885/DEL/2011)<sup>[145]</sup> by Rasandik Engineering Industries India Ltd. Patent application no 373/MUM/2012<sup>[146]</sup> is for System for controlling ignition timing of spark-ignited in an internal combustion engine, by Sedemac Mechatronics Pvt Ltd and 4338/CHE/2012<sup>[147]</sup> application is for lever shifter cable control assembly for controlling the operation of, e.g., single-lever throttle cable, in different equipment by Suprajit Engineering Ltd.

Building upon the Honey Bee network philosophy, the National Innovation Foundation-India<sup>[148]</sup> (NIF) started functioning in March 2000 as India's national initiative to strengthen the grassroots technological innovations and outstanding traditional knowledge. Its mission is to help India become a creative and knowledge-based society by expanding policy and institutional space for grassroots technological innovators. Patent No IN222780B<sup>[149]</sup> (Inventor - Mr. Ram Naresh Yadav, Kanpur, Uttar Pradesh) is for double cylinder reciprocating fluid pump capable of being driven independent of the nature of the driving source, whether electrically, on fossil fuels or mechanically, without loss of performance and with significant savings in terms of power requirement. This has been granted to National Innovation Foundation, India. This shows how the individual inventors under the umbrella of NIF are taking

advantage of IP protection and the developed technology that can be used for society with proper IP protection and recognition to Individual Inventor.

Application No 2427/MUM/2010<sup>[150]</sup> is for float valve cap tray for mixing vapor with liquid discharged from the down-comer distillation column by Desmet Ballestra India Pvt Ltd (Controlled by Financière DSBG, a holding company based in Paris, France). Application No 1713/MUM/2010<sup>[151]</sup> is for Rotating mechanical seal element for use as a single/double/balanced/unbalanced / pusher / non-pusher seal element for sealing the gap between rotary and stationary elements by Eagleburgmann India Pvt Ltd (Part of the German Freudenberg and Japanese EKK group).

It is interesting to know that Application No 787/MUMNP/2012<sup>[152]</sup> is for a Modular heat exchanger used in the ocean thermal energy conversion (OTEC) power generation system, filed by Lockheed Martin Corporation.

Yeda Research and Development Company Ltd. Israel<sup>[153]</sup>, is the Technology Transfer Company of the Weizmann Institute of Science, Israel. Yeda markets and commercializes intellectual property created at the Weizmann Institute laboratories. They have filed Indian Patent Application (740/KOLNP/2011)<sup>[154]</sup> in the area of solar receiver for use in the solar energy system, a solar radiation absorber located within chamber surrounding portion of the window to absorb radiation and heating of working fluid.

It is also observed that different companies are working together either in the pre-research / pre-development stage and have a joint patent application in the area of the invention, or the granted patent is reassigned to them.

### **In the Indian part**

Mahindra and Mahindra Limited and M.N. Ramarao & Company hold a patent no IN249076B<sup>[155]</sup>, in the area of Improved Air Filter System for Railway Locomotive.

Council of Scientific and Industrial Research, India, in association with Gas Authority of India Limited, Encon Thermal Engineers (Pvt) Ltd, and National Research

Development Corporation holds a granted patent (IN220134B)<sup>[156]</sup> in the area of the improved industrial gas burner;

Council of Scientific and Industrial Research, India, in association with Central Power Research Institute, National Hydro Power Corporation Limited, and Satluj Jal Vidyut Nigam Limited have the patent application (2653/DEL/2011)<sup>[157]</sup> in the area of Composition for Erosion Resistance Steel.

Steel Authority of India Limited, in association with Petroleum Conservation Research Association, has patent application no (136/KOL/2008)<sup>[158]</sup> in the area of aerodynamic design for high produce tunnel kiln in industrial application

TVS Motor Company Limited, and the Indian Institute of Science, have applications (671/CHE/2011<sup>[159]</sup>, 4026/CHE/2010<sup>[160]</sup>, 594/CHE/2011<sup>[161]</sup>) in the area of internal combust engine and Two-stroke internal combustion engine.

TVS Motor Company Limited and Pinnacle Engines Inc. have an application (8612/CHENP/2012)<sup>[162]</sup> in the area of improving the compression ratio between the pistons and prevent the lubricating oil from undergoing combustion during operation of the engine, and thus pollution can be reduced.

Bajaj Auto Limited, in association with the Indian Institute of Technology, has a patent application (970/MUM/2006)<sup>[163]</sup> in the area of variable valve timing assembly for a 4-stroke internal combustion engine.

### **In Foreign part**

Honda Motor Co Ltd, JP and

Keihin Corporation, JP has patent applications (4983/CHENP/2010<sup>[164]</sup>, 4039/CHENP/2010<sup>[165]</sup>, 5404/CHENP/2009<sup>[166]</sup>, 5007/CHENP/2007<sup>[167]</sup>, 1606/CHENP/2008<sup>[168]</sup>) in the area of Fuel supply module engine injection valve for the two-wheel motor vehicle; Inlet manifold for multi-cylinder internal combust engine; Fuel feed system for the two-wheel motor vehicle; Pressure regulated engine fuel supply system respectively.

Mitsuba Corporation has patent applications (619/CHENP/2008<sup>[169]</sup>, 618/CHENP/2008<sup>[170]</sup>, 5007/CHENP/2007<sup>29</sup>, 1606/CHENP/2008<sup>30</sup>) in the area of Fuel feed pump for two-wheel motor, Fuel pump suction unit suck discharge arranges lower portion cylinder yoke.

Hitachi Co Ltd, JP has patent applications (2106/CHENP/2011<sup>[171]</sup>, 7905/CHENP/2011<sup>[172]</sup>) in the area of Silent chain power transmission device for an internal combustion engine.

Daikin Industries Ltd has a patent application (1553/KOLNP/2012)<sup>[173]</sup> in the area of Transmission oil seals for vehicles.

Tokai Rubber Industries Ltd, JP has a granted patent (IN229059B)<sup>[174]</sup> in the area of Connector for fuel conveying resin tubes.

Mahle Filter Systems Japan Corporation has patent applications (8581 / CHENP / 2013)<sup>[175]</sup> in the area of Seal element for plug tube structure engine base section.

Exedy Corporation, Japan has a granted a patent (IN242302B)<sup>[176]</sup> in the area of clutch apparatus for motorcycle fin with an integral clip guided for lubrication.

Nissin Kogyo Co Ltd, JP, has a granted patent (IN218019B)<sup>[177]</sup> in the area of Disc brake for the vehicle.

Shindengen Electric Manufacturing Co. Ltd has a granted patent (IN194906B)<sup>[178]</sup> in the area of the Ignition device capacitor for two-wheel motor vehicle control operated based voltage terminal zener diode key switch.

Arai Seisakusho Co. Ltd has a granted patent (IN216976B)<sup>[179]</sup> in the area of Reed valve vibration suppress member.

Keihin Corporation has patent application (1132/CHE/2012)<sup>[180]</sup> in the area of Inlet manifold internal combust engine vehicle pipe circulate fluid held hold space branch parallel.

Siemens Aktiengesellschaft and Delavan Inc. have a granted patent (IN252009B)<sup>[181]</sup> – in the area of the burner, gas turbine combusts quench air inlet radial orient outlet direct cooling pilot product exhaust.

Mitsubishi Heavy Industries Ltd (MHI) and Electric Power Development Co Ltd, JP have granted a patent (IN228456B)<sup>[182]</sup> in the area of liquefying natural gas turbine combined cycle power plant heat medium evaporation and suction cooling device; Hitachi Construction Machinery Co Ltd, Japan has patent application (4613/DELNP/2010)<sup>[183]</sup> in the area of Super-charger that can be started or stopped smoothly and surging of super-charger can be prevented.

BorgWarner Inc, US and Bayerische Motoren Werke Aktiengesellschaft, DE have patent application (722/KOLNP/2011)<sup>[184]</sup> in the area of exhaust gas turbocharge internal combust engine in vehicle manifold;

Emitecgesellschaft Fur Emissions technologie GmbH, DE has an Indian patent application (390/DELNP/2010)<sup>[185]</sup> in the area of exhaust gas secondary treatment system for clean diesel engine passenger motor vehicle.

Daikin Industries Ltd and Honda Motor Co Ltd, JP has the Indian patent application (1553/KOLNP/2012)<sup>35</sup> in the area of transmission oil seal, vehicle elastic component.

Toyo Roki Seizo Kabushiki Kaisha, JP, and Nippon Gasket Co Ltd, Japan have a patent application (10736/DELNP/2008)<sup>[186]</sup> in the area of high sealing performance of the cylinder head gasket.

Aisin Seiki Kabushiki Kaisha and Toyota Jidoshokki Kabushiki Kaisha has patent application (3871/CHENP/2012)<sup>[187]</sup> in the area of engine stop determine apparatus for the hybrid vehicle on the basis coolant temperature detection.

Aisan Kogyo Kabushiki Kaisha and Toyota Jidosha Kabushiki Kaisha have a patent application (7420/DELNP/2012)<sup>[188]</sup> in the area of idle rotation speed control device for a bi-fuel engine.



Fujitsu Ten Limited and Toyota Jidosha Kabushiki Kaisha have a patent application (7502/DELNP/2011)<sup>[189]</sup> in the area of the controller for an internal combustion engine.

Pacific Industrial Co. Ltd. and Toyota Jidosha Kabushiki Kaisha have a patent application (169/MUMNP/2013)<sup>[190]</sup> in the area of oil pan inner tank valve structure for vehicles.

Emerson Climate Technologies Inc, US, and Whirlpool Corporation have the patent application (10655/DELNP/2012)<sup>[191]</sup> in the area of suction arrangement for refrigerating compressor inlet nozzle. The arrangement can eliminate the risk of interior liquid-refrigerant fluid returning to the interior of the compression chamber and can prevent the loss of energetic efficiency effectively.

### **Results and discussion from Secondary Data Part 1:**

From this data analysis, various trends are observed along with the R&D partnership in the Indian company and foreign company level.

It has been observed that the Indian companies are not that aggressive like foreign companies in patenting activity and their R&D collaborations are less compared to foreign companies.

There is also development in allied sectors of engineering fields such as automobile, auto components, together with skilled technical human resources available in India. The Indian engineering sector is expected to grow faster with quality and quantity and get recognition in the world.

Considering the growth in the engineering sector in India, it is highly recommended that the Indian Industry has to compete with the International Market in the Intellectual Property (IP) scenario. All the Indian engineering companies may come forward and take advantage of the Patent System.

However, it is not only important to file the patent applications but also use the patent information in the R&D planning of engineering companies, with their business plan,

and it is equally important to come up with new innovative products. Once this is made in practice, it will help Indian companies to showcase their potential and join hands in R&D with their competitors.

The joint collaboration will result in major innovative product development in the engineering sector, which in turn will help them to protect their IP, and this IP can be further used while marketing and exporting the product within the country and in other countries and leverage to make a financial return on it.

## Secondary Data Analysis Part 2: Patents filled at IPO by companies around Pune

1. Patents applied at IPO in the field of engineering area by the Pune based engineering companies.

It is equally important to find the patents that are filed by the Pune based engineering companies at the Indian Patent office. In this study, the Indian Patent Office database *in PASS* (Indian Patent Advance Search System) is used.

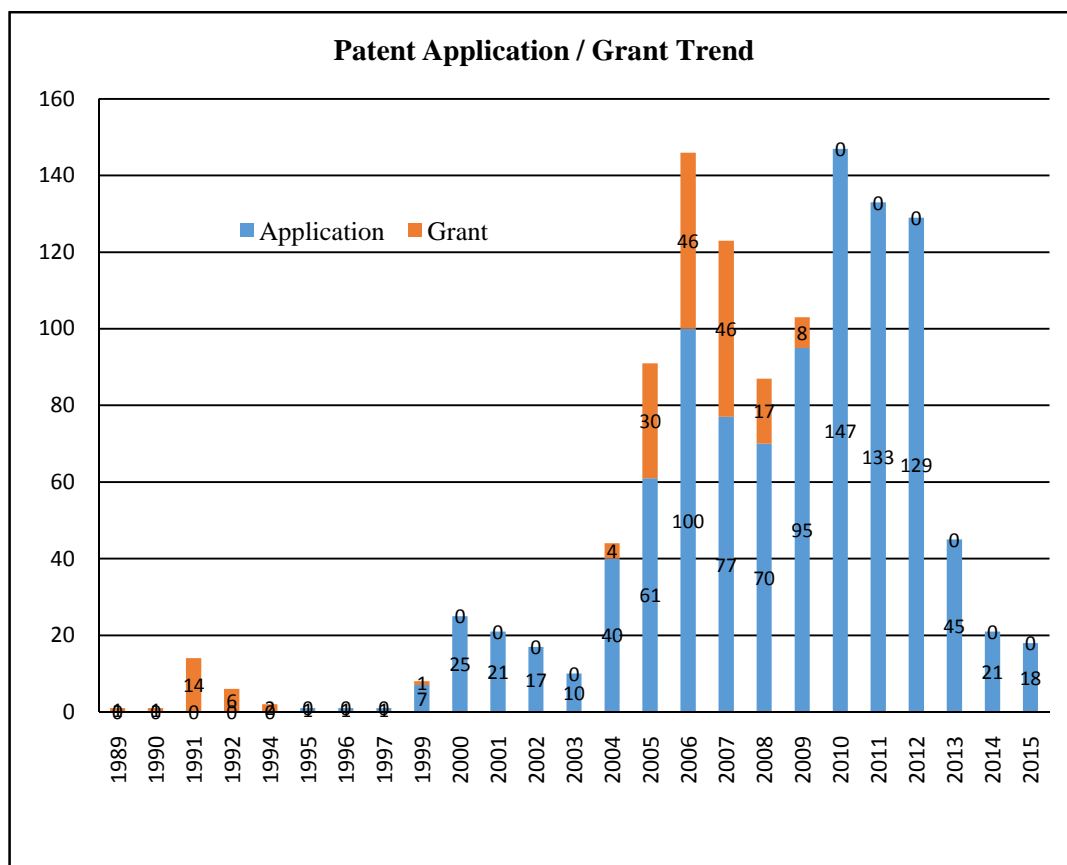
This database has various fields for search, and they are very useful. An appropriate search query with a time limit is used to find the relevant information. The scope of the study is limited to find the patenting activities of companies/individuals who have filed the patent application OR having the granted Indian Patent in their name in and around Pune. There are approximately more than 1100 patents, which are further categorized and analyzed, are presented below. As explained in Chapter 3, these patents are studied in detail.

### Analysis:

Following table A6 and figure, A3 shows the Patent applications and grant data year-wise. Patenting activity has gradually picked up from the year 2000 onwards and highest in the year 2010, and further, it drops down from the year 2013.

**Table A6. Patent application and grants year-wise.**

Year	Application	Grant	Year	Application	Grant
1989	-	1	2004	40	4
1990	-	1	2005	61	30
1991	-	14	2006	100	46
1992	-	6	2007	77	46
1994	-	2	2008	70	17
1995	1	-	2009	95	8
1996	1	-	2010	147	-
1997	1	-	2011	133	-
1999	7	1	2012	129	-
2000	25	-	2013	45	-
2001	21	-	2014	21	-
2002	17	-	2015	18	-
2003	10	-			



**Figure A3: Patent application and grants year-wise.**

Further, these patents are categorized in different categories such as Company, Individual, Government R&D Organization, Academic, and Private R&D organization shown in the following table A7.

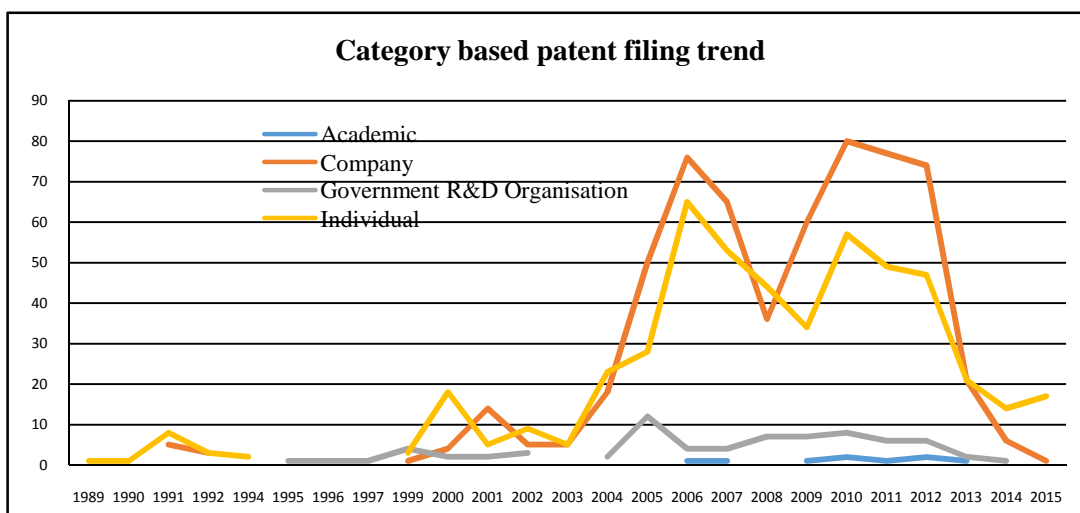
**Table A7. Category VS Number of No of Patents Applications / Grants**

Category	No of Patents Applications / Grants
Company	601
Individual	507
Government R&D organization	74
Academic	10
Private R&D organization	3

Data in table A7 is further drilled down to see the year wise patenting activity in the respective category, which is shown in table A8 and figure A4; This shows that there are almost similar patenting trends like the company (50%) and single inventors (42%); Government R&D organization (6%) whereas the Academic and Private R&D organization is very less.

**Table A8. Year-wise Patenting activity w.r.t. Category**

<b>Year</b>	<b>Academic</b>	<b>Company</b>	<b>Government R&amp;D organization</b>	<b>Individual</b>	<b>Private R&amp;D organization</b>	<b>Year</b>	<b>Academic</b>	<b>Company</b>	<b>Government R&amp;D organization</b>	<b>Individual</b>	<b>Private R&amp;D organization</b>
1989				1		2004	1	18	2	23	
1990				1		2005		50	12	28	1
1991		5	1	8		2006	1	76	4	65	
1992		3		3		2007	1	65	4	53	
1994				2		2008		36	7	44	
1995			1			2009	1	60	7	34	1
1996			1			2010	2	80	8	57	
1997			1			2011	1	77	6	49	
1999		1	4	3		2012	2	74	6	47	
2000		4	2	18	1	2013	1	21	2	21	
2001		14	2	5		2014		6	1	14	
2002		5	3	9		2015		1		17	
2003		5		5							



**Figure A4: Year-wise Patenting activity w.r.t. Category**

### Technology focus (Top IPC) -

Patents are also categorized based on International Patent Classification (IPC)<sup>[192]</sup>; IPC, recognized by the Strasbourg Agreement 1971, is an order based system of codes for the cataloging of patents and utility models rendering to the diverse ranges of technology to which they relate.

Thus, IPC is helpful in understanding the technological focus of the respective patent that we are analyzing. Considering this factor first, we found the Top 20 IPC's in which there are more patents application/grants, based on this following table A9 shows the Top 20 IPC's with their short description of the technological area.

**Table A9. Top IPCs, with short technology description with a number of records**

Sr. No.	IPC 4 digit	IPC description in short	No. of Records
1	F25B	Refrigeration Machines, Combined Heating And Refrigeration Systems	35
2	B60K	Arrangement Or Mounting Of Propulsion Units	33
3	F02M	Supplying Combustion Engines With Combustible Mixtures	31
4	F24J	Engines Or Other Mechanisms For Producing Mechanical Power From Heat	28
5	B65D	Containers For Storage	25
6	B65B	Machines, Apparatus Or Devices For, Or Methods Of, Packaging Articles Or Materials	20
7	F16H	Gearing	20

<b>Sr. No.</b>	<b>IPC 4 digit</b>	<b>IPC description in short</b>	<b>No. of Records</b>
8	B01D	Separation (Separating Solids From Solids By Wet Methods)	19
9	F02B	Internal-Combustion Piston Engines;	19
10	F03D	Wind Motors	19
11	F02D	Controlling Combustion Engines	18
12	A61M	Devices For Administering Food Or Medicines Orally	16
13	F22B	Methods Of Steam Generation;	16
14	F28D	Heat-Exchange Apparatus,	16
15	F16D	Couplings For Transmitting Rotation	15
16	B60G	Vehicle Suspension Arrangements	14
17	F04B	Positive-Displacement Machines For Liquids;	14
18	F28F	Heat-Transfer Apparatus,	14
19	B60H	Air-Treating Devices Specially For Passenger Or Goods Spaces Of Vehicles	13
20	E05B	Locks; Accessories Therefor; Handcuffs	13

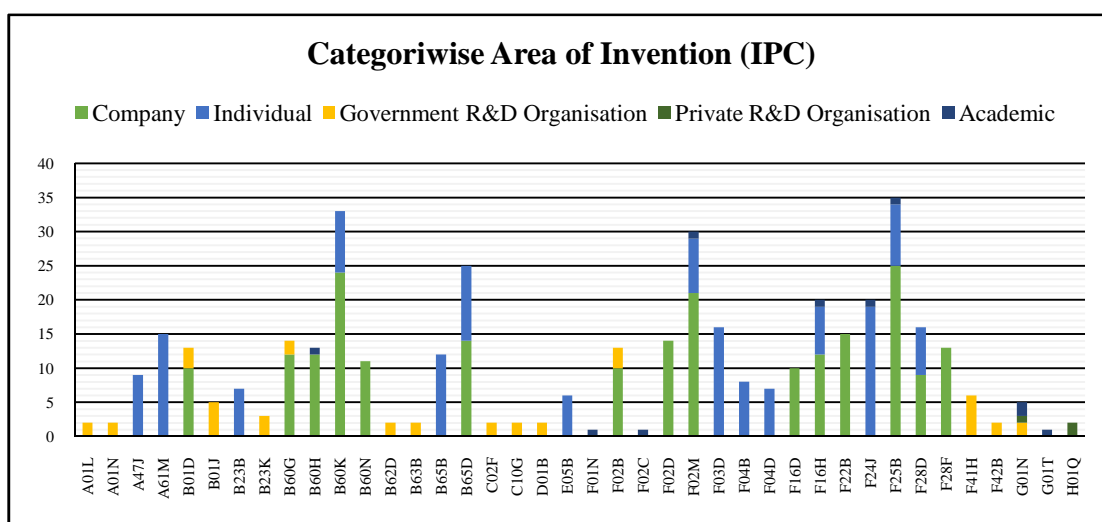
Further, all 1195 patents categorized as mentioned in table A7 are analyzed based on IPC, presented in table A10 and figure A5, which shows Company and Inventors are filing patents / doing research in the same technological area but, it is not known that whether the company is aware of such kind of innovation happening at the individual level, or individual's filing the patent are aware that their invention can be useful to companies working in the same area from same geographical region.

Some technological area, e.g., the arrangement of transmissions in vehicles; instrumentation or dashboards for vehicles; arrangements in connection with cooling, air intake, gas exhaust, or fuel supply, of propulsion units in vehicles, containers for storage, supplying combustion engines with combustible mixtures, refrigeration machines, (IPCs - B60K, B65D, F02M, F25B) areas where individuals and companies if work together will have a successful creative invention which will benefit both.

Whereas in technological areas, e.g., engineering apparatus for manufacturing mills, packaging articles or materials; wind motors, positive-displacement machines for liquids; engine fuel-injection pumps, mechanisms for producing mechanical power from heat, (IPCs - A47J, A61M, B23B, B65B, F03D, F04B, F04D, F24J) only individuals are active; if any business is looking for expansion this will be new input to them and their management to explore the possibility of new ventures.

**Table A10. Category wise IPC (number of records) by Company, Individual, Government R&D organization, Private R&D organization, and Academic**

S. No	IPC	Company	Individual	Government R&D organization	Private R&D organization	Academic	S. No	IPC	Company	Individual	Government R&D organization	Private R&D organization	Academic
1	A01L			2			21	F01N					1
2	A01N			2			22	F02B	10		3		
3	A47J		9				23	F02C					1
4	A61M		15				24	F02D	14				
5	B01D	10		3			25	F02M	21	8			1
6	B01J			5			26	F03D		16			
7	B23B		7				27	F04B		8			
8	B23K			3			28	F04D		7			
9	B60G	12		2			29	F16D	10				
10	B60H	12				1	30	F16H	12	7			1
11	B60K	24	9				31	F22B	15				
12	B60N	11					32	F24J		19			1
13	B62D			2			33	F25B	25	9			1
14	B63B			2			34	F28D	9	7			
15	B65B		12				35	F28F	13				
16	B65D	14	11				36	F41H			6		
17	C02F			2			37	F42B			2		
18	C10G			2			38	G01N			2	1	2
19	D01B			2			39	G01T					1
20	E05B		6				40	H01Q				2	



**Figure A5: Category wise IPC (number of records) by Company, Individual, Government R&D Organisation, Private R&D Organisation, and Academic**  
**Top Assignees-** Following table A10 shows the Top 20 companies from the Pune area are leading in the patenting activity, filing the patents at Indian Patent Office.



(Assignee Code is for company C1, C2, ... as information is confidential, company name cannot be disclosed)

**Table A10. Top 20 companies and number of patents from Pune and their active IPC area**

Assignee Code	No. of Patents	Active IPC*** area
C1	85	F02M, F16H, F02D, B62D, B60K, F02N, B60G, F16D, F01N, B62K
C2	78	F25B, F22B, F28F, F28D, F24J, F23K, B01D, F23C, B09B, F24H
C3	28	B01J, B01D, G01N, F02B, C10G, D01B, C01B, A01L, B05D, F25D
C4	27	F41H, B63B, A01N, B62D, F41F, B62H, B64C, F42B, A01B, A01L
C5	15	B60K, F02B, A47G, F02G
C6	15	B60K, F02B, F02M, B61D, A61B, F02F, E05B, G01B, B62M, B60R
C7	13	F27B, F23H, F28G, F16K, B23P, F25B, F22B, F28F, B01D
C8	12	B60H, A47C, F24F, F16L, F04D, F28D, B63J, F28B
C9	12	B60N, F02D, B65G, B62J, B23B, B60K, F02B, F16D, H01H, F21L
C10	11	F25D, A47B, A47J, A23B, E06B, A23L, F21V
C11	10	B32B, B65D, B65B, B41N, G09F
C12	10	G06F, B60R, B25B, B60J, G01M, B23K, G01M
C13	8	A01G, F16D, B60W, B60T, A01B, B60K, B66C, F16H
C14	8	B01D, A62B, B60K, F16D, B41F, F02M
C15	8	A47G, B65D, C02F, A61J
C16	8	F02M, F02B, F01L, F02F, F02D
C17	8	F01P, F28D, F28F, B60H
C18	7	F04B, F04C, A01J, B23K, F25B
C19	7	B25B, B26D, B26B, B21D, E03C, G05D
C20	7	B60K, F02D, F02M, F17C

**Individual Inventors (II)**—Inventors are a real asset to any company, in this study, we also try to find out that personnel who are actively working in the mechanical engineering area from the Pune region. The following table A11 shows the Top 15 inventors; this information will be highly useful to find the prolific inventor in the interesting research area in which any company is working or would be proposed to

expand the work in another research direction. (II Code is for Inventor I1, I2, ... as information is confidential ,inventor name cannot be disclosed)

**Table A11. Top 15 individuals and number of patents from Pune and their active IPC area**

II Code	No of patents	Active IPC*** area
I1	32	C02F,B01D,F24H,F27B,F28G,F23H,F22B,F25D,F22D
I2	9	F16H,F01C,F16C,B60K
I3	8	B23B,G01N,B23C,B08B,B62D,F16M
I4	7	A61M
I5	7	A46B,F25D,B26B,D06F,A01M,E06C
I6	7	A47J,A47F,B60K,B65D,F02M,B01D
I7	6	B60K,B65G,F01M,F03G
I8	5	F02D,F02B,F17C,G01M
I9	5	B65B,A44B
I10	5	A47B,E05B,E05C
I11	5	A47K,F25B,F24J,E04B
I12	4	B21D,F25B,F24J,B21C
I13	4	B60T
I14	4	F16B,H01R,E05C,H05G
I15	3	F16N,F01D

\*\*\*The IPC (refer to table A10 and A11 and at other places in this document) are available in all patent documents, and these are assigned by the patent examiner of respective patent offices. These are used in this study as the requirement of analysis. The details are freely available on the WIPO website for the understanding of the invention.

#### **Assignee Network:**

Often we found that there is a collaborative effort between two companies and at times with university/academia to develop new technologies. From this perspective, when we look into this patent data, we found that company C1 has a joint patent with the Academic Institute in the area of internal combustion engine and with company C9 in the area of indicator signal system. However, this kind of collaborative network example is very few.

## **Results and discussion from Secondary Data Part 2:**

The secondary data analysis shows the patenting activity of various companies and individuals in the field of mechanical engineering in and around the Pune region. More patenting activities have started after the year 2000, before that there is hardly any patent that we found. This may be because of more awareness on the patent area after globalization, and more foreign companies have started filing the patent in India after the year 2000.

We also found that firms and solo inventors who are very aggressively following the patenting activity. Nowadays with government initiatives, there are many prospects to these persons from the Pune region; if their innovations brought to the notice of different businesses and investors that will benefit both and also generate employment in the engineering sector.

Patents are the main source of technical information; if it is used properly, it would be the best route for management to accomplish the needs of R&D, business planning, and business strategies.

Nonetheless, it isn't just imperative to document the patent applications yet, in addition, utilize the patent data in the R&D of the organizations with strategy, and it is similarly vital to think of the new creative process/product. When this is made practically operational, it will assist Pune based engineering units and will be highlighting their potential.

The joint collaboration with the company and solo inventors will result in major innovative product development in the engineering sector and will benefit both the company and the individuals.

This study shows a way forward if systematic patent analysis of a particular technology area is done, which will be useful input to the management of any business that may be looking for exploring anew area of business.

*\*This secondary data is based on the patent information, which is publically available to all, through the Indian Patent Office database, we have tried our level best to compute the overall representation on the basis of the data.*

## Annexure 4 - Case Study

### **Bajaj Auto Ltd.**

The Bajaj Group is the top business house in India. Its footprint spreads over a wide range of industries, spanning automobiles (two-wheelers manufacturer and three-wheelers manufacturer), home appliances, lighting, iron and steel, insurance, travel, and finance. The group's flagship company, Bajaj Auto, is ranked as the world's fourth largest<sup>[193]</sup> three and two-wheeler manufacturer, and the Bajaj brand is well-known across several countries in Latin America, Africa, Middle East, South, and South East Asia.

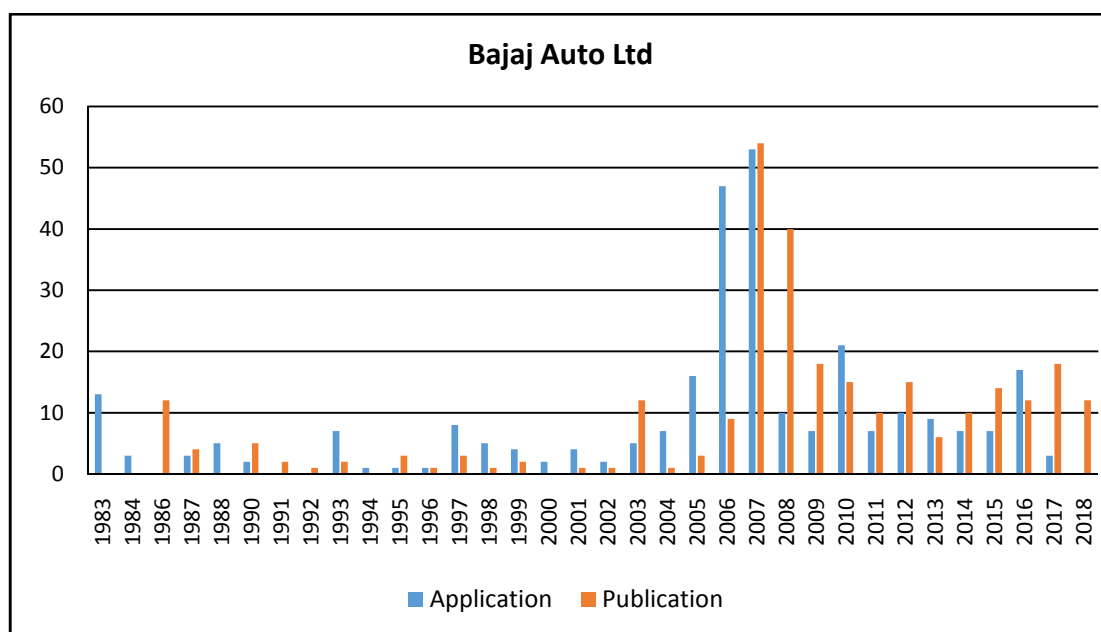
Bajaj Auto Ltd. Pune has a well-established R&D infrastructure. The company has been launching many new products in India for the last many years. Their R&D has been working on improving its operations in a number of areas, expanding its team size in areas of design, analysis, and validation to keep up with the rapidly growing targets of the market requirement. A number of new test facilities and prototyping facilities were added. Their Research and Development spending as a proportion of sales is in the range of 1.5% to 1.7% (app. Rs. 350.00 Cr.) from FY 2015 to 2018 every year.

The company is India's No.1 exporter of motorcycles and three-wheelers. It exports its products to 74 countries. Many units exported by the company (includes Motorcycles + Three-wheelers + Quadricycles) are approximately 18 Lakhs in the years 2015 and 2016. The geographical spread of exports in the year 2016 (in % of Vehicles) is 43% in Africa, 31% in South Asia and the Middle East, 20% in Latin America, and 6% in ASEAN<sup>[194]</sup> countries.

The information that has been analyzed from secondary data related to patenting activity is provided in the following table B1 and figure B1.

**Table B1. Patent Application and Publication Details – Bajaj Auto Ltd.**

Year	Applications	Year	Applications	Year	Publications	Year	Publications
1983	13	2002	2	1983	0	2002	1
1984	3	2003	5	1984	0	2003	12
1986	0	2004	7	1986	12	2004	1
1987	3	2005	16	1987	4	2005	3
1988	5	2006	47	1988	0	2006	9
1990	2	2007	53	1990	5	2007	54
1991	0	2008	10	1991	2	2008	40
1992	0	2009	7	1992	1	2009	18
1993	7	2010	21	1993	2	2010	15
1994	1	2011	7	1994	0	2011	10
1995	1	2012	10	1995	3	2012	15
1996	1	2013	9	1996	1	2013	6
1997	8	2014	7	1997	3	2014	10
1998	5	2015	7	1998	1	2015	14
1999	4	2016	17	1999	2	2016	12
2000	2	2017	3	2000	0	2017	18
2001	4	2018	0	2001	1	2018	12



**Figure B1: Patenting activity – Bajaj Auto Ltd.**

The company aggressively is in the patenting activity which started in 1983; the number of patent applications has been increased from the year 2003 onwards. The company is not only filing the patents in India but also in other countries, such as

Argentina, Austria, Brazil, China, Costa Rica, Germany, Dominican Republic, Ecuador, Egypt, Europe, Spain, Guatemala, Japan, Mexico, Malaysia, Peru, Taiwan, United States, South Africa, Colombia, Chile, Uruguay, Italy, Honduras, Philippines.

This shows that the company is very keen on its R&D activity and protecting the IPR, due care of patent protection is taken care of while exporting the product to the respective countries.

The area in which company is doing the patenting activity as seen from the patent data is arrangement of signaling or lighting devices; arrangements or adaptations of heating, cooling, ventilating; controlling combustion engines; cooling of machines or engines; couplings for transmitting rotation; dashboards for vehicles; dynamo-electric machines; electrically-propelled vehicles; elements of crankshaft mechanisms; gas-flow silencers or exhaust apparatus for machines or engines; gearing; internal-combustion piston engines; locks integral with vehicles; lubricating internal-combustion engines; making gears or toothed racks; manipulators; mounting of propulsion units; pistons; piston-rods, cylinders; pressure vessels ; sealing's; processes for the electrolytic or electrophoretic production of coatings; propulsion of electrically-propelled vehicles; springs; shock-absorbers; means for damping vibration; starting of combustion engines; supplying combustion engines with combustible mixtures or constituents; vehicle brake control systems; vehicle suspension arrangements

### **Kirloskar Brothers Limited**

Kirloskar Brothers Limited (KBL) is a world-class pump manufacturing company with expertise in engineering and manufacture systems for fluid management. Established in 1888 and incorporated in 1920, KBL is the flagship company of the \$2.1 billion Kirloskar Group. KBL, a market leader, provides complete fluid management solutions for large infrastructure projects in the areas of water supply, power plants, irrigation, oil & gas, marine, and defense. KBL engineer and manufacture industrial, agriculture and domestic pumps, valves, and hydro turbines.

With the mission to keep KBL at the technological forefront in the fluid management business, the company's Research and Engineering Development wing was

vigorously and continuously engaged in various innovation and product up-gradation and related activities.

KBL undertook a series of initiatives to develop an extension for KBL's existing products like the lowest life cycle-cost split case pump and canned motor pump. For irrigation applications, the R&D wing also developed a bi-directional pump for customers looking for a pumping solution with very high discharge and a low head.

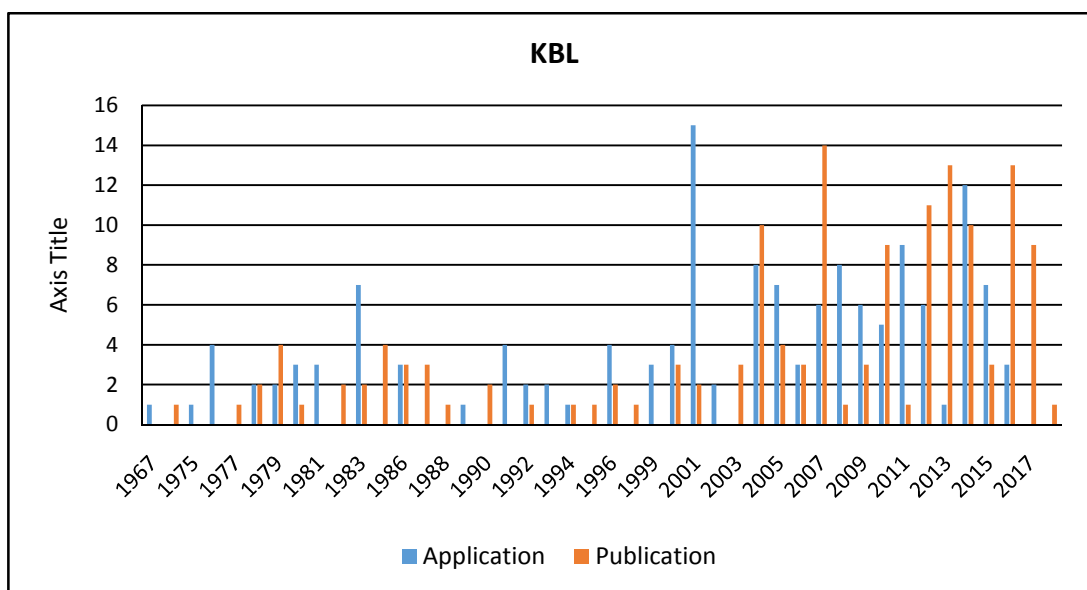
KBL also developed pumping solutions to meet highly customized requirements by upgrading the design patterns of KBL's existing product line, including metallic volute pumps, vertical turbine pumps, multi-door non-return valves, and turbine inlet valves.

India Design Council (IDC), an autonomous body of the Government of India, affirmed KBL's position as the pump industry's design and innovation leader by awarding its prestigious India Design Mark (IDM) to five products of KBL. This is the largest number of awards given to any engineering company in one year.

As detailed in table B2 and figure B2, the KBLs focus of R&D and patenting area includes combined heating and refrigeration systems; control or regulation of electric motors, generators, or dynamo-electric converters; controlling transformers, couplings for transmitting rotation; devices, apparatus or methods for life-saving hydraulic engineering; installations or methods for obtaining, collecting, or distributing water (drilling wells, obtaining fluids from wells; liquefaction, solidification, or separation of gases or gaseous mixtures by pressure and cold treatment; lubricating; machines or engines, or of positive-displacement type, e.g. steam engines; machines, devices, or processes for grinding or polishing; magnetic or electrostatic separation of solid; mixing, e.g. dissolving, emulsifying, dispersing; physical therapy apparatus; positive-displacement machines for liquids; pumping of fluid by direct contact of another fluid or by using inertia of fluid to be pumped; pumps; refrigeration machines, plants, or systems; rotary-piston or oscillating-piston machines or engines; steam engine plants.

**Table B2. Patent Application and Publication Details - KBL**

Year	Application	Publication	Year	Application	Publication
1967	1	0	1996	4	2
1969	0	1	1997	0	1
1975	1	0	1999	3	0
1976	4	0	2000	4	3
1977	0	1	2001	15	2
1978	2	2	2002	2	0
1979	2	4	2003	0	3
1980	3	1	2004	8	10
1981	3	0	2005	7	4
1982	0	2	2006	3	3
1983	7	2	2007	6	14
1984	0	4	2008	8	1
1986	3	3	2009	6	3
1987	0	3	2010	5	9
1988	0	1	2011	9	1
1989	1	0	2012	6	11
1990	0	2	2013	1	13
1991	4	0	2014	12	10
1992	2	1	2015	7	3
1993	2	0	2016	3	13
1994	1	1	2017	0	9
1995	0	1	2018	0	1



**Figure B2: Patenting activity – KBL**



**Welmade Locking Systems Pvt. Ltd Pune.**

Dr. Joshi, after studying in Germany, in the year 1984, founded the Company Welmade Locking Systems Pvt. Ltd Pune. Since then, the company has engraved itself in a respected position in the Indian Market. Continuous growth based on innovative Product Engineering and strategic thinking has made the Company the Brand Leader, giving the EUROPA Brand its excellent reputation. The brand EUROPA has been repeatedly appreciated with Awards by MCCIA, Pune for outstanding product design and locking systems.

Backed by world-class technology and driven by a dedicated team of over 400 dynamic professionals (25% involved in Design & Development), the company manufactures international standard products which have been appreciated in trade fairs like the Koln Trade Fair<sup>[195]</sup> held in Germany.

The company believes in constantly Innovate to design and manufacture locks with best-in-class features meeting global standards.

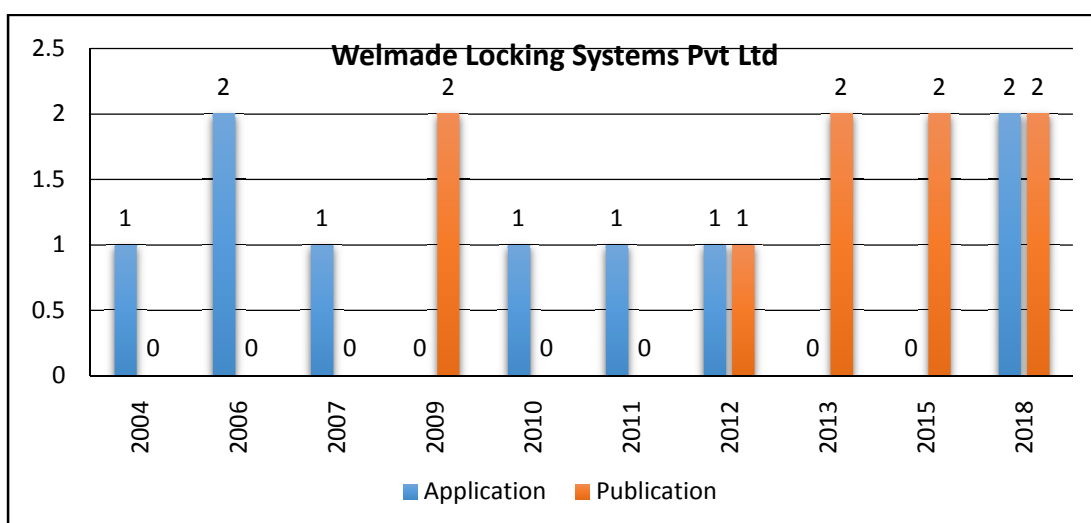
The company has a fully integrated in-house manufacturing facility at Pune. State-of-the-art R&D facility with a qualified, dynamic, and dedicated team. Europa aims to be a global provider of customized anti-theft products and solutions for every house & institution.

Since its inception, EUROPA has achieved many milestones in the fields of Patents and Design registrations. Their products have been protected under different arms of the IPR like Patent and Design registrations. The company holds 11 patents in its name.

This shows that the development of the company is based on the proper innovation and patenting strategy. It is described in table B3 and figure B3.

**Table B3. Patent Application and Publication Details - Welmade Locking Systems Pvt. Ltd**

Year	Application	Publication
2004	1	0
2006	2	0
2007	1	0
2009	0	2
2010	1	0
2011	1	0
2012	1	1
2013	0	2
2015	0	2
2018	2	2



**Figure B3: Patenting activity - Welmade Locking Systems Pvt. Ltd.**

The focus of the invention area in which the patent protection is applied includes Locks; Accessories, Bolts or Fastening Devices for Wings, Especially For Doors or Windows, Fastening Devices Structurally Or Operatively Combined or Having Significant Cooperation With Locks

(Ref- <http://europalocks.com>)

### **Vanaz Engineers Limited**

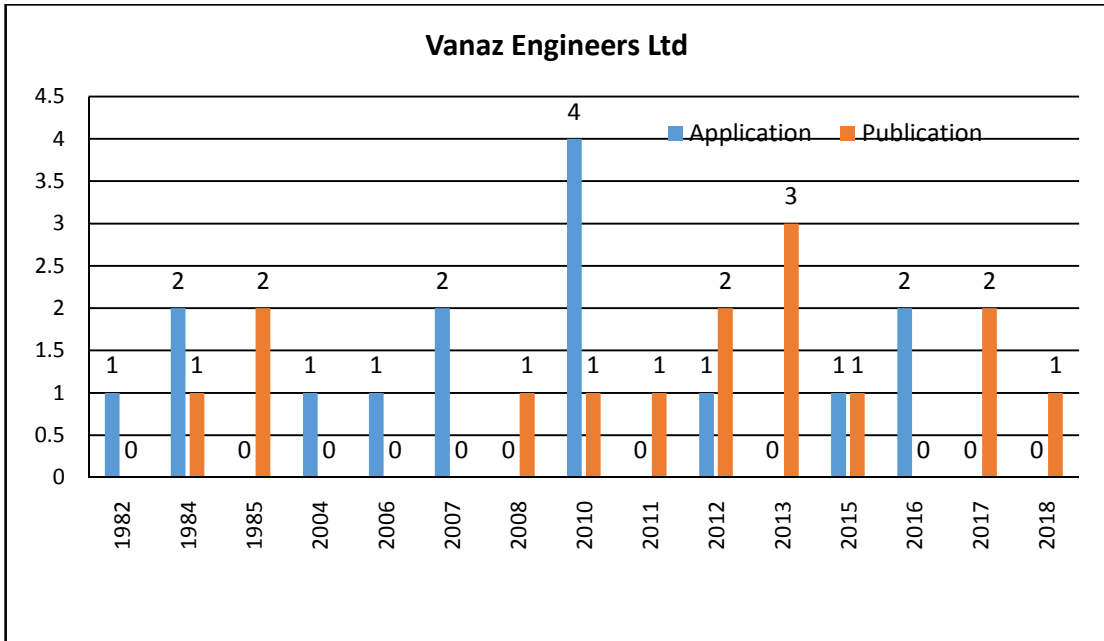
Vanaz Engineers Ltd. has the main manufacturing unit & registered office in Pune and has its Unit No 2 at Deorukh. Vanaz Engineers Ltd. was established in 1948 and is a well-known Exporter and Manufacturer of Valves, Boilers, Components & Spares, etc. Vanaz Engineers Ltd. is well known for the best quality products and services from Pune.

The research and Development Department is the innovative powerhouse of VANAZ, which has helped the company to grow over the period and pioneer new products.

Their product includes CNG / LPG Kits Auto Components Cylinder Valves Pressure / Flow Control Devices Pressure Reducing Systems / Gas Trains Forging Die Casting Vanfog.

**Table B4. Patent Application and Publication Details – Vanaz Engineers Ltd.**

<b>Year</b>	<b>Application</b>	<b>Publication</b>
1982	1	0
1984	2	1
1985	0	2
2004	1	0
2006	1	0
2007	2	0
2008	0	1
2010	4	1
2011	0	1
2012	1	2
2013	0	3
2015	1	1
2016	2	0
2017	0	2
2018	0	1



**Figure B4: Patenting activity – Vanaz Engineers Ltd.**

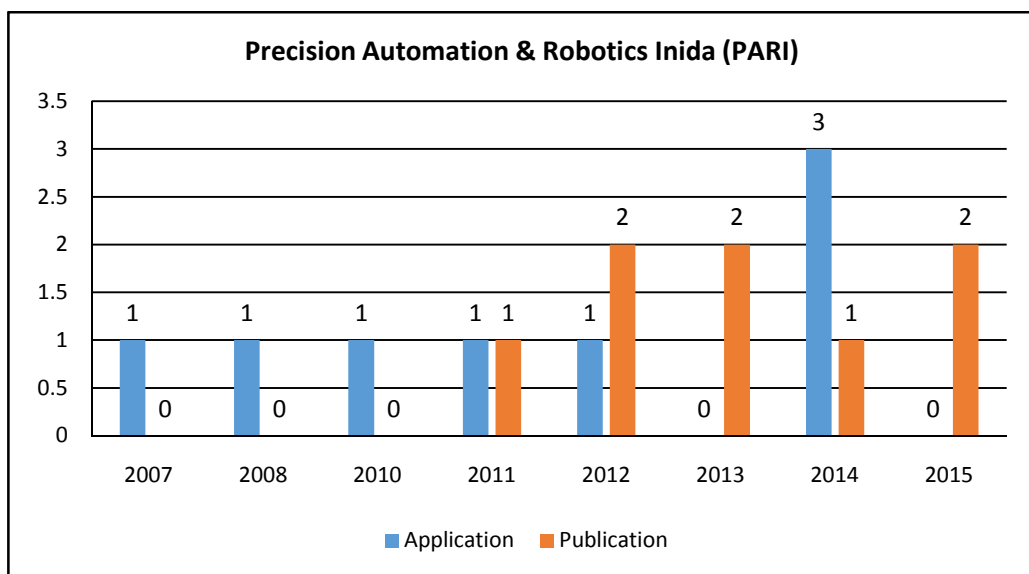
The R&D and patenting area includes actuating-floats; cables or protective tubing; cocks; controlling combustion engines; devices for venting or aerating; fixed-capacity gas-holders; fluid-pressure actuators; internal-combustion piston engines; positive-displacement machines for liquids; taps; valves; vessels for containing or storing compressed, liquefied, or solidified gases. It is described in table B4 and figure B4.

#### **Precision Automation & Robotics India (PARI)**

PARI has been providing global turnkey installations for over the last 25 years, executing projects in more than 25 countries. PARI's range of services provides support, lower operating costs, and a faster return on investment. Some of the projects include automated processes such as parts loading, unloading, turning, milling, and grinding. PARI also has expertise in material handling solutions, from glass handling to working with molten metal. They also employ robots, gantries, conveyors, and other solutions to meet the customer's needs.

**Table B5. Patent Application and Publication Details – PARI**

Year	Application	Publication
2007	1	0
2008	1	0
2010	1	0
2011	1	1
2012	1	2
2013	0	2
2014	3	1
2015	0	2



**Figure B5: Patenting activity - PARI**

Patenting area includes articulating arm for a robotic surgical instrument, cargo handling system; wheelchair with commode for patients; an automated system for retrievably housing multiple vehicles in a concise footprint.

The above case studies also support the hypothesis that Liberalization and Globalization led to increased R&D by Indian companies as represented by patent filing by them. It is described in table B5 and figure B5.

## **MAHLE Behr India Private Limited, Pune**

MAHLE is represented on five continents. The company operates around 170 production locations and 16 major research and development centers across the world and employs around 78,000 people in total.

Mahle Behr India Private Limited is a joint venture between MAHLE Behr GmbH & Co.KG, Germany & ANAND, India. The company was incorporated in 1997 as a systems partner for the Indian automobile industry and is the leading manufacturer and supplier of thermal management systems to the passenger car and commercial vehicle segments.

At its new Pune-Chakan facility, MAHLE Behr produces HVAC and engine cooling modules as well as heat exchangers, including radiators, charge air coolers, condensers, and fans for the auto industry.

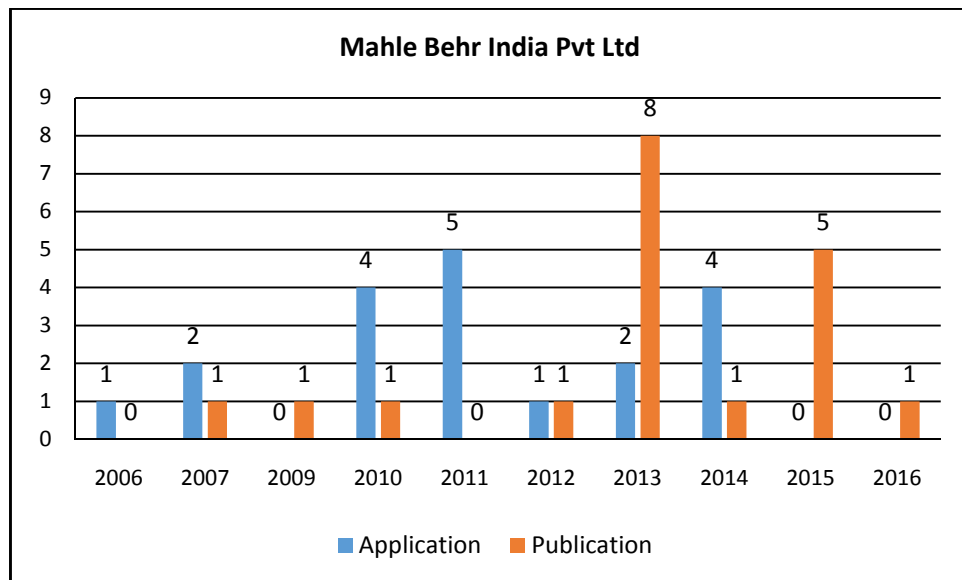
The company has expanded its group-wide research and development activities, in 2017, by investing EUR 748 million in this area, a figure that corresponds to 5.9 percent of sales. The company's first filing of patents totaled 369. In addition, there were around 600 records of inventions. Overall, the company operates 16 major research and development centers around the world.

The company is systematically pursuing a dual strategy for research and development. On the one hand, further optimization of the combustion engine, and on the other, working intensively on the development of alternative drive concepts. This is supported by R&D and reflected in the number of patents filed by them.

The company is doing more R&D related to the combustion engine, as it continues to offer great potential for the reduction of CO<sub>2</sub> emissions. It is described in table B6 and figure B6.

**Table B6. Patent Application and Publication Details - Behr India Private Limited**

<b>Year</b>	<b>Application</b>	<b>Publication</b>
2006	1	0
2007	2	1
2009	0	1
2010	4	1
2011	5	0
2012	1	1
2013	2	8
2014	4	1
2015	0	5
2016	0	1



**Figure B6: Patenting activity - Behr India Private Limited**

It can be seen from the patent data that the Behr India Private Limited, Pune/India is filing the patents at Indian Patent Office; they are in the area of air conditioning apparatus in line with the manufacturing operations of the company (thermal management systems to the passenger car and commercial vehicles segments).

## **Bilcare Limited**

Bilcare Ltd. is a global leader and pioneering packaging solutions provider for the pharmaceutical industry and its products. They offer Packaging Solutions encompassing an extensive array of Polymer Films and Aluminum Foils mainly used for the packaging of tablets.

They also cater to various industries, such as ID cards, Food packaging. Their R&D facilities on Innovative Pharma Packaging Solutions are located across the world - Europe, the USA, and Asia. Due to their R&D efforts, they have reached and serve customers in more than 100 countries.

Bilcare Ltd. continuously seen at pharma wrapping from a systematic, study approach, which not only helped them to be a pioneer in several drug-dispensing technologies but also protected these innovations with many patents in different countries, which in turn helped them to be ahead of the curve. This has resulted in creating a large patent portfolio with unique solutions. As of March 31, 2014, Bilcare Ltd. has filed for over 198 patents worldwide and they are at various stages of granting.

Optima™, which was launched in 2011, provides not just optimal packaging research solution based on Bilcare Ltd. patented model but also strengthen the relationship as a partner in the early phases of R&D.

When the patents for several drugs expire, the market becomes increasingly competitive with the flood of generics entering the market. Production of the number of pharmaceutical products increases, hence increasing the number of packaging types required.

As race steepens, many pharmaceutical companies' mainly original patent owners, are turning to package as a vital point of difference. Packaging technology that can improve appropriateness and advantage, challenge duplicating, can set a pharmaceutical product apart.

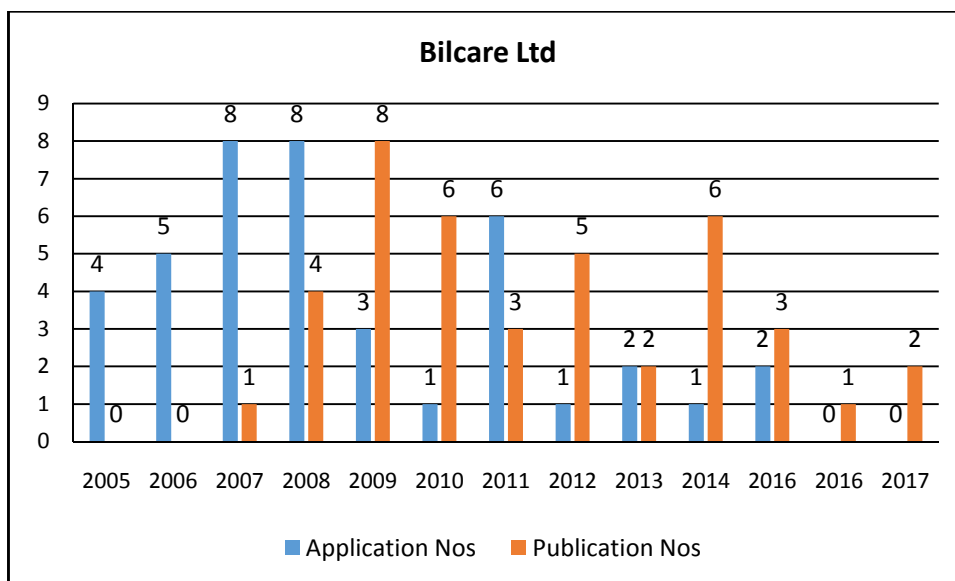


Bilcare Ltd. continues to invest in R&D activities with its 5 C thinking of innovation has differentiated it as a pioneer in several developing ultramodern trends in packing to position as a market leader. They have R&D and Operations in India, Singapore, Germany, and the USA.

From patent data, it can be seen as the R&D focus and protection is in the area of adhesive processes; coating metallic material; coating material with metallic material; displaying; advertising; signs; labels or name-plates; seals; electric digital data processing; layered products; machines/apparatus or devices for, or methods of, packaging articles or materials; unpacking; printing plates or foils; producing decorative effects; producing particular articles from plastics or substances in a plastic state; It is described in table B7 and figure B7.

**Table B7. Patent Application and Publication Details – Bilcare Ltd.**

<b>Year</b>	<b>Application</b>	<b>Publication</b>
2005	4	0
2006	5	0
2007	8	1
2008	8	4
2009	3	8
2010	1	6
2011	6	3
2012	1	5
2013	2	2
2014	1	6
2016	2	3
2016	0	1
2017	0	2



**Figure B7: Patenting activity – Bilcare Ltd.**

### **Faurecia**

Faurecia is present in 35 countries<sup>[196]</sup> around the world, with a network of 300 production sites and R&D centers (the base year 2016). Through these working services at the heart of the world’s main automotive markets, the Group has become the ideal partner for a wide diversity of automakers who need engineering and production backing across the globe for their business operations.

As global leaders, they work hand in hand with automakers to develop cars that are cleaner, lighter, more comfortable, and easier to customize.

In any car, the seating facility plays an important role in the chauffeur and traveler’s experience. Faurecia maintains a continual stride of improvement to offer automotive seating that is more efficient and inviting than ever: intelligent seat adjustment, customized comfort, and new features without compromising on safety.

The overall development of the company continued, in particular, the opening of several new industrial sites and research and development centers in India, a new research and development center in Pune, whose teams are contributing to the development of car seats. Now, this Pune site has become a full-blown R&D Center; it covers all engineering activities, innovation, design, development, testing, geometry, and prototyping.

More than 6,000 engineers and technicians based in 30 centers represent the Group's global R&D community. Five hundred patents were filed in 2016.

Faurecia's proactive research and development policy allow the Group to be at the root of its own innovations and control the patents protecting them. Where possible and when justified by strategic technological considerations, Faurecia applies for patents to protect the intellectual property relating to innovations and developments from Group's research.

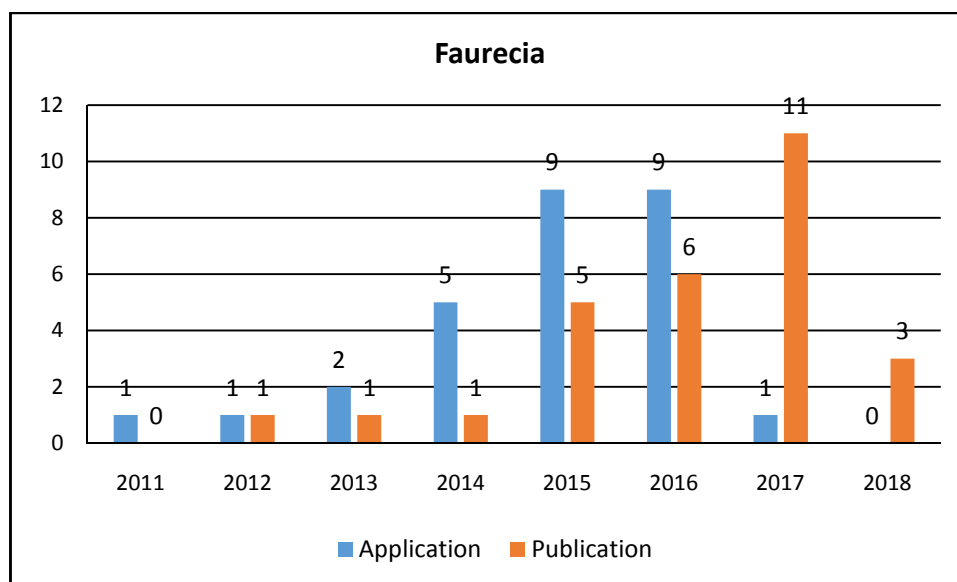
In 2016, the continuous innovation work resulted in the filing of 501 patents. Of these 501 patents, 27% were filed by Faurecia Seating, 55% by Faurecia Interiors, and 18% by Faurecia Clean Mobility. This result confirms Faurecia's commitment to innovation. These patents pertain to products (approximately 80% of the filings), materials, and manufacturing processes, demonstrating the efforts made to optimize the entire product value chain.

Faurecia's strategy is to focus on an improved and supportable driving experience and includes emerging growth opportunities for Sustainable Mobility and Smart Life on Board. For this continuous R&D, hard work followed by protection through patents to protect the product is being carried out.

The R&D focus area seen from patent data is control of moving parts by computers in which a part of it is effected hydraulically or pneumatically; electric digital data processing; furniture especially adapted for children, patients, disabled person; hinges or other suspension devices for doors, windows, or wings; shaping or joining of plastics; transport, personal conveyances, or accommodation specially adapted for patients; vehicle passenger accommodation; vehicles adapted for load transportation or to transport, to carry, or to comprise special loads or objects windows, windscreens, non-fixed roofs, doors, or similar devices for vehicles. It is described in table B8 and figure B8.

**Table B8. Patent Application and Publication Details - Faurecia**

Year	Application	Publication
2011	1	
2012	1	1
2013	2	1
2014	5	1
2015	9	5
2016	9	6
2017	1	11
2018		3



**Figure B8: Patenting activity - Faurecia**

### **INA Bearings India Pvt. Ltd. (Schaeffler)**

INA Bearings India Private Limited was incorporated in 1997. Industriewerk Schaeffler INA Ingenieurdienst GmbH of Germany has launched its new plant in Pune as part of its strategy to establish a manufacturing base in India. The new plant has been set up by the company's subsidiary, INA Bearings India Pvt Ltd (IBI)<sup>[197]</sup>.

Incorporated in 1962, renamed as Schaeffler India Limited in 2017, listed and traded on Bombay Stock Exchange and National Stock Exchange, a manufacturing facility in

Maneja and Savli near Vadodara, Gujarat; Manufacturing units are certified by ISO 9001, TS 16949, and ISO 18001; Presence in automotive and across all core industrial segments and the team size of 1,534 employees. In agreement with the Schaeffler Group's overall corporate philosophy, the Company has changed its name from FAG Bearings India Limited to 'Schaeffler India Limited' with effect from July 7, 2017.

The Schaeffler Group is a global automotive and industrial supplier. Top-quality, outstanding technology, and exceptionally innovative spirit form the basis for the continued success of the Group. With over 88,000 employees, the Schaeffler Group is one of the leading global technology companies. Its network of manufacturing locations, research and development facilities, and distribution networks are spread over 170 locations across 50 countries. The Group's 74 production facilities are the cornerstone of its operations. The Schaeffler Group is actively contributing to the shaping of technological progress with its 18 R&D centers in 24 countries.

Its 2,316 patent registrations, filed with the German Patent and Trademark Office, make the Schaeffler Group one of the most innovative companies. Schaeffler AG, the Group's lead company, is a publicly listed stock corporation incorporated under German law with its registered office in Herzogenaurach.

In line with the Group's strategy of "Mobility for Tomorrow," Schaeffler India has progressively emerged as a futuristic organization, constantly innovating and striving for operational excellence.

Recently, the Company has unveiled the strategic initiative of 'One Schaeffler India' entity and has announced the merger of two of the Schaeffler Group entities in India viz. INA Bearings India Private Limited and LuK India Private Limited. INA Bearings India Private Limited has engaged in the manufacture of Needle/linear bearings, engine, transmission, and chassis precision components for Automotive and Industrial applications. It has its manufacturing facility at Talegaon, Pune, and employs around 663 employees.

LuK India Private Limited is engaged in the manufacture of Clutch and transmission components and systems for automotive applications, has its manufacturing facility at Hosur, in Tamilnadu, and employs around 757 employees.

With the strengths of the two entities being clubbed with the leadership position of the Company in the Ball, Roller, and other special bearings, the merged entity – One Schaeffler India entity will become a major manufacturer and supplier of some of the most important products for the Automotive as well as Industrial Sector.

The “Mobility for Tomorrow” strategy has four focus areas, namely Eco-friendly drives, urban mobility, Inter-urban mobility, and Energy- chain. Schaeffler’s strategic approach combines long-term thinking with proven success factors of Quality, Technology, and Innovation to form robust and systematic organizational orientation towards the future.

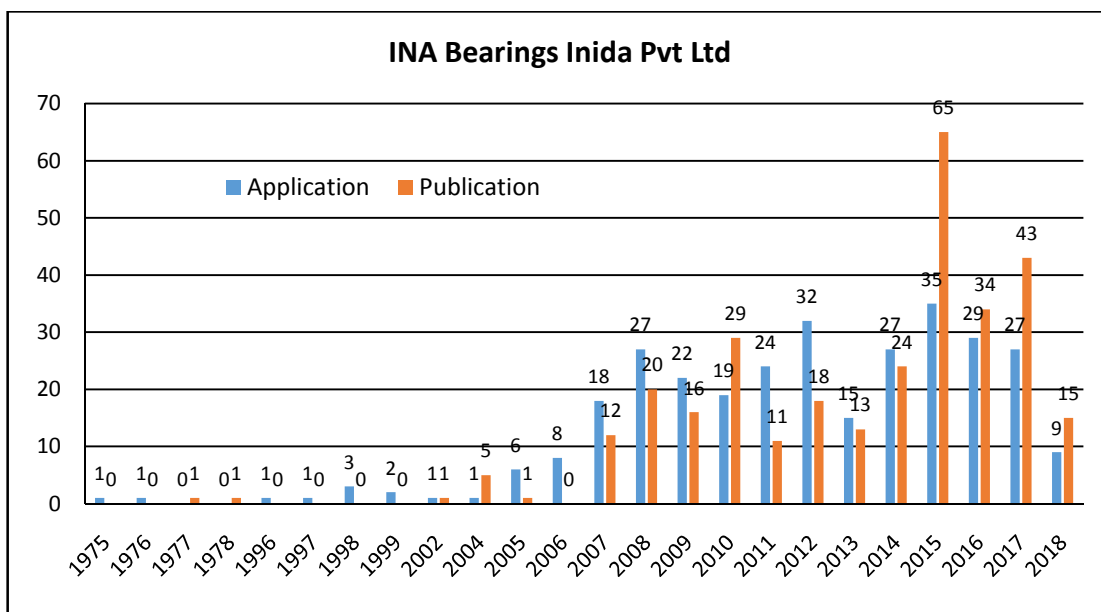
As a member company of Schaeffler Group, it focuses on quality, technology, and innovation as cornerstones of its long-term strategy. The company continues to invest in the expansion of manufacturing and engineering capabilities in the country. The customer is at the center stage of all actions and gets involved in customer projects at an early stage of development.

The Schaeffler technology center develops a comprehensive understanding of customers' business and processes. Deep knowledge of key equipment and applications helps the company in designing and providing efficient and sustainable solutions far beyond a mere supply of products to customers.

The company's views about innovation refer to an idea that can be put into practice and an approach, which can solve an existing problem. Breakthrough ideas are not created every day. When bright people collaborate with an open mind, work in detail, overcome obstacles, they gradually develop deeper insights and ultimately come out with a game-changing solution. With this systematic approach to innovation, the company developed over 145 new products during the year 2015.

**Table B9. Patent Application and Publication Details -  
INA Bearings India Pvt. Ltd.**

<b>Year</b>	<b>Application</b>	<b>Publication</b>
1975	1	0
1976	1	0
1977	0	1
1978	0	1
1996	1	0
1997	1	0
1998	3	0
1999	2	0
2002	1	1
2004	1	5
2005	6	1
2006	8	0
2007	18	12
2008	27	20
2009	22	16
2010	19	29
2011	24	11
2012	32	18
2013	15	13
2014	27	24
2015	35	65
2016	29	34
2017	27	43
2018	9	15



**Figure B9: Patenting activity - INA Bearings India Pvt. Ltd**

The patenting activity of the company has increased from the year 2005. The company R&D and patenting area includes Bearings; boring; cooling of machines or engines in general; couplings specially adapted for railway vehicles; crimping or curling fibers; crushing, pulverizing; cyclically operating valves for machines or engines; fluid-pressure actuators; joints or fittings for pipes; making articles from leather, canvas; making forged or pressed products; stamping or numbering apparatus; starting of combustion engines; systems acting using fluids in general; transmissions in vehicles; turning; vehicle brake control systems; vehicle wheels; wind motors; working or processing of sheet metal or metal tubes. It is described in table B9 and figure B9.

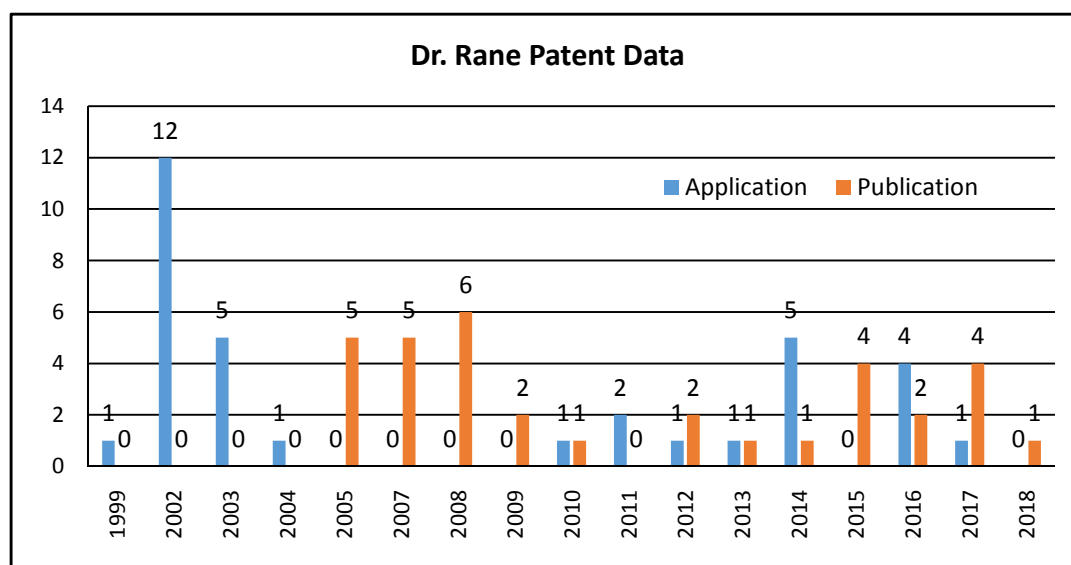
**Inventor Rane and Others (about Objective 4)**

Following table B10 and figure B10 give the details of the patenting activity by the inventor. The focus of the invention is related to Separation techniques; the Sugar Industry; Thermal Insulation in General; Washing or Drying of Gases; Heat-Exchange Apparatus, Heat-Transfer Medium



**Table B10. Patent Application and Publication Details –  
of Inventor Rane and others.**

Year	Application	Publication
1999	1	0
2002	12	0
2003	5	0
2004	1	0
2005	0	5
2007	0	5
2008	0	6
2009	0	2
2010	1	1
2011	2	0
2012	1	2
2013	1	1
2014	5	1
2015	0	4
2016	4	2
2017	1	4
2018	0	1



**Figure B10: Patenting activity – Inventor Rane and Others.**

(Source: In all Case Studies, the Company's Annual Reports, their websites in addition to patent databases were referred for Technical / Business / Product / Patent filing information. The patent databases are searched for the respective companies to find out the patents filed by them.)

## **Annexure 5 –Objective 3 - Practical Application**

For example, a company wants to enter the drying area business, and before the start, they want to know who is the active player from Pune and in which technology/applications area they are working.

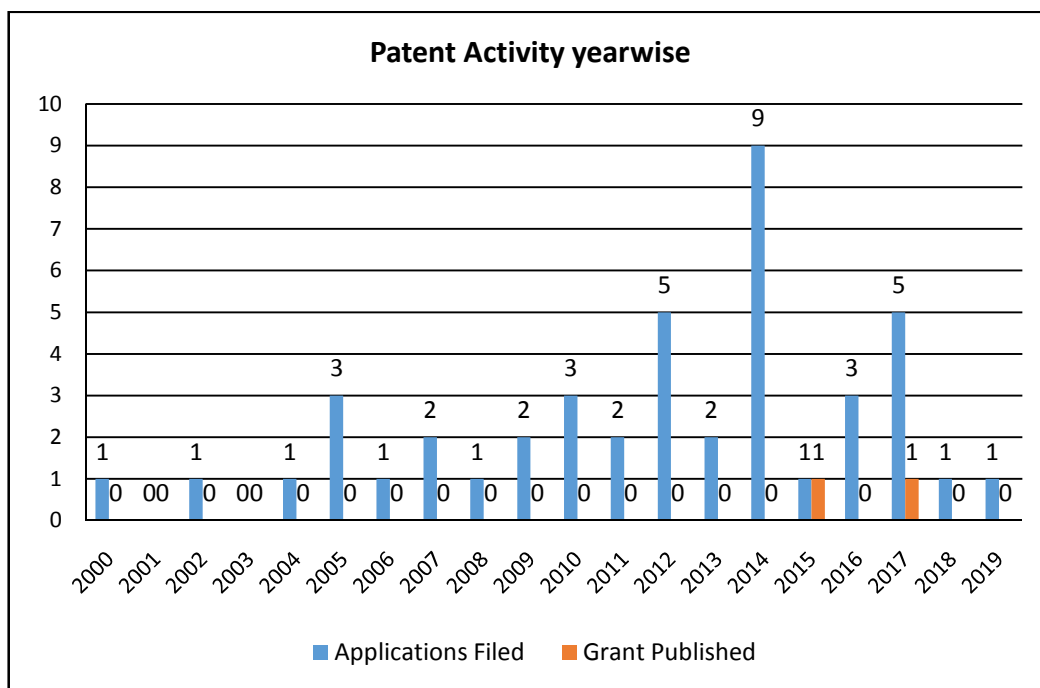
We articulate the problem definition in a simple term as (as explained in the framework)

- Searching keywords – drying – and the entities from - Pune –
- There are 45 results
- Explained as follows: table C1 shows the details of the companies and individuals working in the drying domain from the Pune region.

**Table C1. Assignee / Applicant from Pune, working in drying technology.**

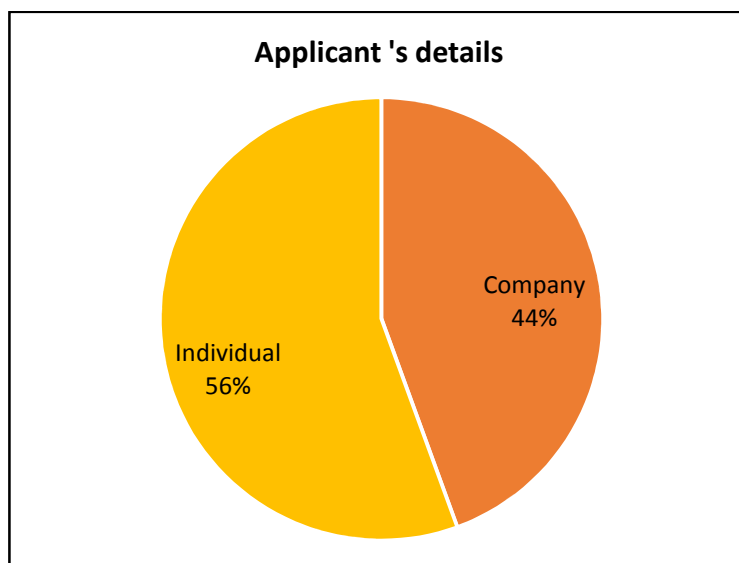
<b>Sr. No.</b>	<b>Assignee / Applicant</b>	<b>Sr. No.</b>	<b>Assignee / Applicant</b>
1	Transparent Technology Pvt Ltd	19	Kalpana Keshav Joshi
2	Emcure Pharma Ltd	20	Knorr Bremse System for Commercials Vehicles India Pvt Ltd
3	Praj Ind Ltd	21	Kpit Technology Ltd
4	Atre Ashok Dattatray	22	Maharashtra Cosmopolitan Education Society
5	Gangotree Eco Technology Pvt Ltd	23	Mojj Engineering System Ltd
6	Hindura Infrastructure Pvt Ltd	24	Mr Navale Sainath Ramnath
7	Kirloskar Pneumatic Co Ltd	25	Pearl Engineering Polymers Ltd
8	Mr.Badgujar Vinayak Ramesh	26	Pratap Shriram Marathe
9	Praesto Life Science Private Ltd	27	Rao Perampalli Neckar Ramamurthi
10	Ajay Kumar Dasgupta	28	Richardson Kate
11	BASF	29	Rusheet Deepak Shah
12	Bilcare Ltd	30	RaturajShahaji Gore
13	Deepak Kumar Sharma	31	Sarsar Karan R
14	Dr. Ashwin Porwal	32	Shrikant Prabhakar Athavale
15	Dr Kakasaheb Chandrakant Mohite	33	Siddhesh Valmik Kapse
16	Gangotree Eco Technologies Private Limited	34	Syed Fasihuddin
17	Harshal Mohan Zambre	35	Uday Gundu Bhatkande
18	JP Lab Inc	36	Vishal Prakash Shah

The year-wise patenting activity is explained in the following figure C1.



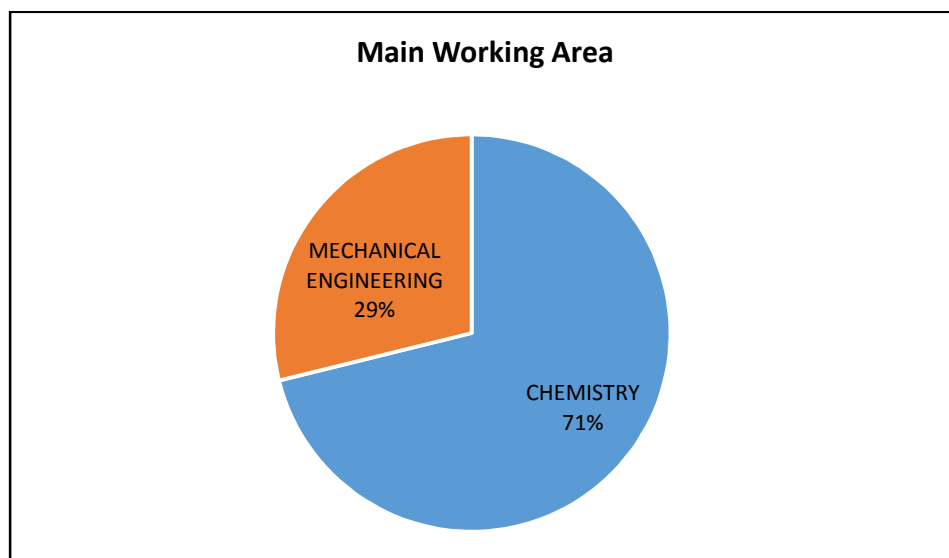
**Figure C1: Year-wise patenting activity in drying technology from Pune.**

Further analysis shows that 56% are individuals, and 44% are companies as given in figure C2.



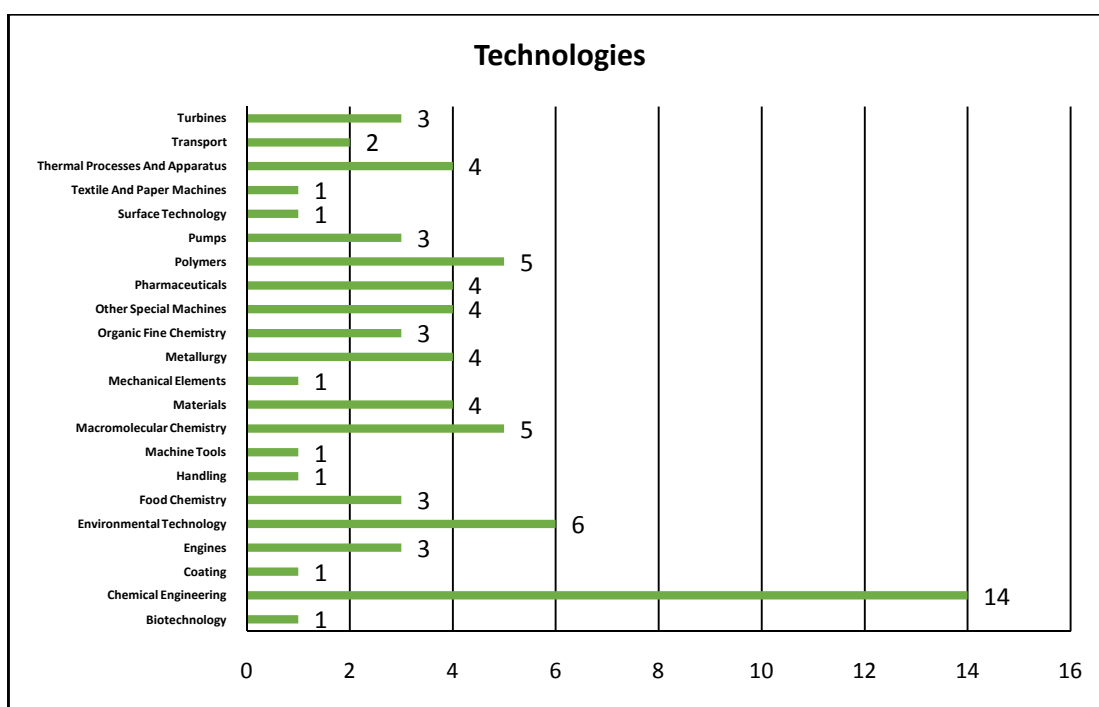
**Figure C2: Applicant's category details in drying technology from Pune.**

Further analysis shows that 29% belongs to the Mechanical domain, and 71% belongs to the Chemistry domain as given in figure C3.



**Figure C3: Main working area in drying technology from Pune.**

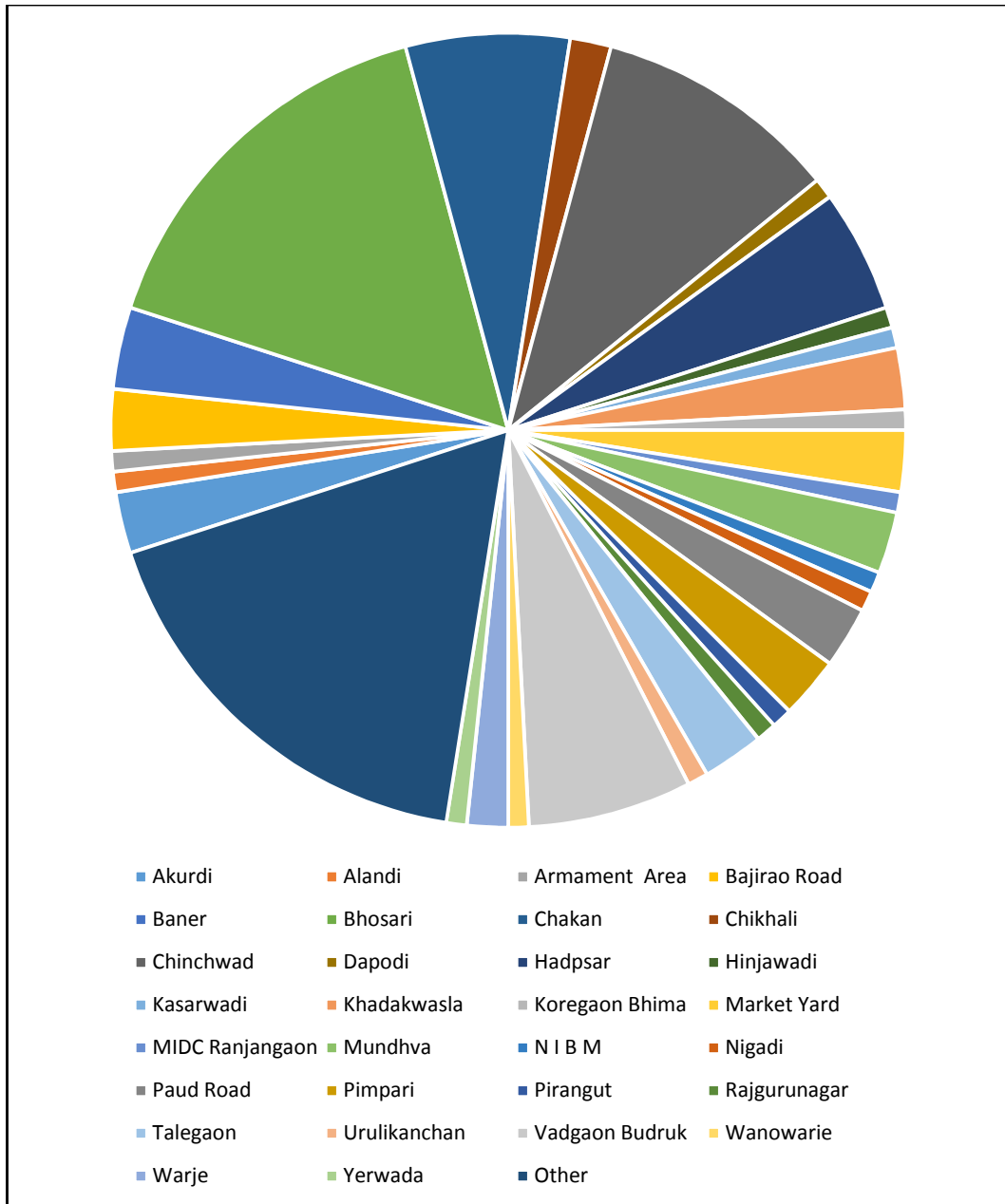
Following figure C4 shows these technologies are having applications in various areas.



**Figure C4: Sub technology/application details in drying technology from Pune.**

This example shows the way how one can use the framework to use patent information for strategic business planning.

## Annexure 6 – Sample geographical distribution



S. No.	Company	S. No.	Company	S. No.	Company	S. No.	Company	S. No.	Company
1	Accurate Sales & Service Pvt Ltd	26	Datsons Engineering Works Pvt Ltd	51	Jaya Hind Sciaky Ltd	76	Pack-Age Systems	101	Shreerenuka Industrial Corporation
2	Accusharp Cutting Tools Pvt Ltd	27	Dehu Boilers Pvt Ltd	52	JCB India Limited	77	Precimax Engineers	102	Shriniwas Engineering Auto Components
3	Accusonic Controls PvtLtd	28	Dellorto India Pvt Ltd	53	JIS Tools Company	78	Precision Automation & Robotics India Pvt Ltd	103	Simmonds Marshall Ltd
4	ACME Process Systems	29	Desai Electronics Pvt Ltd	54	Kalyani Maxion Wheels Pvt Ltd	79	Precision Transmatic Devices Pvt Ltd	104	Spaco Technologies (India) Pvt Ltd
5	Advandes	30	Elpro International Ltd	55	Kay Bouvet Engineering Limited	80	Premier Ltd	105	Supremo Profiles Pvt Ltd
6	Ambupod	31	Emerging Technologies &Engineering Solution	56	Keihin Fie Pvt Ltd	81	Premium Transmission Ltd	106	Tata Motor
7	Anand Teknow Aids Engineering India Ltd	32	Envicare Technologies Pvt Ltd	57	Kirloskar Oil Engines Ltd	82	Prime Controls	107	Tbk India Pvt Ltd
8	Arkalite Speciality Lamps Ltd	33	Eureka Engineering Enterprises	58	Kistler	83	Proton Metal Crafts Pvt Ltd	108	Technymon Technology India Pvt Ltd
9	Autolone Industries Ltd	34	Fenix Process Technologies Pvt Ltd	59	Kraft Powercon India Pvt Ltd	84	Psquare Technologies Pvt Ltd	109	Tenneco Automotive India Pvt Ltd
10	Bajaj Auto Ltd	35	Ferrocare Machines Pvt Ltd	60	Kwality Products	85	Pune Energy Control Devices Pvt Ltd	110	Thermotech Engineering Pune Pvt Ltd
11	Bartakke Electrofab Pvt Ltd	36	Finepac Structures Pvt Ltd	61	Lenze Mechatronics Pvt Ltd	86	Pune Techtrol Pvt Ltd	111	Trinity Engineering Pvt Ltd
12	Bekaert Industries Pvt Ltd	37	Fristam Pumps (India) Pvt Ltd	62	Mahale Filter System (India)	87	Push Engineering Pvt Ltd	112	Ultra Engineers
13	Bhagyashree Accessories Pvt Ltd	38	Gartech Equipments Pvt Ltd	63	Maharashtra Fasterners Pvt Ltd	88	PVSS Cranes & Components	113	Unique Tools & Presscomps Pvt Ltd
14	Bharat Forge Ltd	39	Get My Solutions	64	Mahindra Two Wheeler Ltd	89	Quality Pattern Works Pvt Ltd	114	Vaibhav Automation & Systems
15	Bhavyam Engineering Technologies Pvt Ltd	40	h2e Power systems Pvt Ltd	65	Manman	90	Radiant Enterprises	115	Vanaz Engineers Ltd
16	Bright Engineering Works	41	Hi-Chem Technology	66	Mark Enterprises	91	Ratna Gear Pvt Ltd	116	Venkatesh Industries
17	Caravan Engineers	42	Hindustan Engineering Company	67	Mather & Platt Pumps Ltd	92	Richcam Auto Engineering(I) Pvt Ltd	117	Vimal Industrial system
18	Cerulean Enviro Tech Pvt Ltd	43	Hodek Vibration Technologies Pvt Ltd	68	Maval Technologies	93	Rinder India Pvt Ltd	118	Vishwadeep pressparts Pvt Ltd
19	Cikautox India Pvt Ltd	44	HRS Process System Pvt Ltd	69	Mechatronics Solution Pvt Ltd	94	Sahayog Tools	119	Vishwakarma Engineers
20	Cleantech Systems Pvt Ltd	45	Iec Air-Tools Pvt Ltd	70	MIKROTECH	95	Saj Test Plant Pvt Ltd	120	Wheels India Ltd
21	Compair Accessories	46	Indus Robotics & Automation Research Pvt Ltd	71	Mist Ressonance Engg Pvt Ltd	96	Saki Auto products PvtLtd	121	Williams Control India Pvt Ltd
22	Consolidated Hoist Pvt Ltd	47	Institute of Applied Research	72	Movetech Conveyors	97	Sanjeevani Diaster equipment PvtLtd	122	Wise Vehicle Testing Solution Pvt Ltd
23	Continental / Emitec Emission Control Technologies	48	Interpack Machines Pvt Ltd	73	National Engineering Company (NENCO)	98	Shailesh Industries Pvt Ltd	123	X-trans Enterprises
24	Cooling People (Pune) Pvt Ltd	49	IOT Mechatronics Technologies Pvt Ltd	74	Omkar IEngineering	99	Sheetal Rubber Products (P) Ltd	124	Xytel India Pvt Ltd
25	Cooper Corporation Pvt Ltd	50	IWIS engine systems India Pvt Ltd	75	Ossian Agro Automation Pvt Ltd	100	Shreeji Aqua Treatment Pvt Ltd	125	YMK Solutions

## **Annexure 7 – Details on Research Methodology**

Research methodology describes the conceptual framework for the study.

### **Scope**

The scope of the study is limited to Pune region engineering companies. The period considered for this study is before and after 2005.

### **Research Design**

Research Design is a logical and systematic planning or scheme of work to be undertaken. This is a Study of Impact of Patent Filing Trends in respect of Engineering Companies in Pune.

### **Reliability of the questionnaire:**

The questionnaire includes the first seven demographic questions, the next 17 questions (27 Sub-questions) related to the study & the last seven open-ended questions.

The reliability of the questionnaire using 17 questions along with sub-questions related to the study is calculated as follows.

The reliability of the questionnaire, i.e., the Cronbach alpha is given as

<b>Reliability Statistics</b>	
Cronbach's Alpha	N of Items
.765	27

Since the Cronbach alpha value is more than 0.7, therefore the reliability of the questionnaire is good.

### **Selection of Sample**

Calculation of sample size for the main study:

We have considered the MCCIA directory for engineering companies from Pune under Auto & Ancillary, Engg. M/c and M/c tools for the study, there are 739

companies under this classification. The data is categorical. Hence, Cochran's sample size formula for categorical data is used.

The minimum sample size is given by,

$$n_0 \geq \frac{Z_{\alpha/2}^2 s^2}{d^2}$$

Where Z value at a half alpha level can be obtained from the statistical table; s is an estimate of standard deviation in the population that is an estimate of standard deviation for 5 point scale & d is the acceptable margin of error the researcher is willing to expect.

Here the error d decided is 5\*0.015 for 5 point scale.

Std = 0.5614 (Standard deviation of all five-point scales which is evaluated from the data collected for pilot study) & s = 5\*std/6 = 0.4678

$Z_{0.025} = 1.96$  [from statistical table].

$$n_0 \geq \frac{1.96^2 * 0.4678^2}{(5*0.015)^2}$$

$$n_0 \geq 149.45$$

Hence, the population size is 739 & the required sample size is 150. Since this sample size exceeds 5% of the population size (739\*0.05= 36.95); Cochran's (1977) correction formula should be used to calculate the final sample size.

$$n_1 \geq \frac{n_0}{\left(1 + \frac{n_0}{PopulationSize}\right)}$$

$$n_1 \geq \frac{150}{\left(1 + \frac{150}{739}\right)} = 124.69$$

Hence, the minimum sample size is 125. We have collected responses from 125 respondents.



Reference for the calculation of sample size

1. Organizational Research: Determining Appropriate Sample Size in Survey Research - James E. Bartlett, II, Joe W. Kotrlik, Chadwick C. Higgins, [Information Technology, Learning & Performance Journal, Vol. 19, No. 1, Spring 2001]
2. Statistical Methods – Dr. S.P. Gupta, Sultan Chand & Sons Educational Publishers, New Delhi. Page No.83

### **Secondary Data**

The Pune region has an active auto and engineering components industry ranging from micro, small, and medium scale units to large companies.

For this study, it is also felt that the actual patent filing data at the Indian Patent Office is also required. This is termed as secondary data. This data was collected from the Indian Patent Office portal through appropriate search queries. Further, this data is also analyzed in support of the present study.

Mostly, all the data is from Patent databases available worldwide on an electronic database of country-specific government patent websites

In this study, the secondary data is collected in two parts.

- 1 Patents filed at Indian Patent Office by the companies/individuals from all over the world. As we have seen, there is a constant increase in the number of applications under the Mechanical field of invention from the year 2002-03 onwards; however, it is more particularly observed from 2008 to 2013.

To find the patents in this area, we have used the value-added patent database. The database was searched for patents for the years between 2008 and 2013 using selected keywords and by using the IPC field.

The following search query was used.

CC = (IN) AND (PY> = (2008) AND PY<= (2013)) AND CC = (IN) NOT ICR (IPC Current) = (A OR B OR C OR D OR E OR G OR H) ----> resulting into

10808 patents. The search was restricted by IPC as F denotes mechanical engineering; to consider the patents under Mechanical Engineering sector only.

The dataset was further cleaned and analyzed to find out Yearly breakup, Application and Granted Patents, Assignee, Assignee Type, Country of Origin, Inventor, IPC, R&D Partnership, Use, etc.

2 Patents filed at the Indian Patent Office in the field of mechanical engineering area by the Pune based engineering companies.

In this study, the Indian Patent Office database *in PASS* (Indian Patent Advance Search System) is used.

This database has various filed for search, and they are very useful. We mainly searched this database based on the Applicant Address – as ‘Pune’ and Field of Invention – as ‘Mechanical Engineering’ and time period - from 1980 till 2015 in the application and grant field.

The scope of the study is limited to find the patenting activities of companies/individuals who have filed the patent application OR having the granted Indian Patent in their name in and around Pune.

There are approximately 1200 results, which are further categorized, and analyzed. There are many methods and techniques for analyzing patent data. We have used relevant methods in this study.

There are three steps in the process

- (i) Searching the patent database with an appropriate search strategy to find the relevant patent documents with respect to the research problem.
- (ii) The analysis emphasizes the contents of patents or relationships between patents.
- (iii) Discover knowledge. The goal is to apply quantitative and qualitative techniques to analyze patent information. It outlines different modes of visualizing research results, e.g., using a patent mapping techniques.

## Annexure 8 – Expert’s views

Experts’ views and opinion on patenting are presented below; this information is collected from the publicly available sources such as newspapers, research papers, talks on television etc.

Grouping	Chairman/President of Companies OR Top management
Organization	Tata Consultancy Services
Name	Mr. Santosh Mohanty
Designation	VP and Head of Components Engineering Group in TCS
Views about IPR	<p>The IPR strategy of a large organization needs to maintain a fine balance. It should enhance the environment for serendipitous discovery and at the same time, create intellectual property that aligns with the organization’s business goals.</p> <p>The bigger and more diverse a company is the greater the challenge. Ensuring process rigor is also important in creating high quality IP that generates value and reduces risk.</p> <p>Generating IPR is effort-intensive. Therefore, scaling operations with a small team requires ingenuity.</p> <p>TCS’ steadily growing IP portfolio outlines the company’s business strategy, innovation and areas of expertise.</p> <p>TCS’ approach of ‘Safe to Create, Safe to Protect, and Safe to Use’ sensitizes all associates to IPR.</p> <p>For creating the sustainable and optimized IP portfolio, they employ a decision support methodology of screening patents and compatible key players, matching criteria based on an Identify-Analyze-Position model sequence.</p>
Source	<a href="https://www.tcs.com/content/dam/tcs/pdf/research-innovation/IP%20Safe%20Organization.pdf">https://www.tcs.com/content/dam/tcs/pdf/research-innovation/IP%20Safe%20Organization.pdf</a>

Grouping	Chairman/President of Companies OR Top management
Organization	BananaIP
Name	Mr. Somashekar Ramakrishna
Designation	Senior Partner
Views about IPR	Patents provide exclusiveness in the marketplace, helps grow the financial valuation of the organisations, provides opportunities to accumulate licensing fees and provides different opportunities for development of business as well as advantages that help in marketing owing to the exclusivity tied with the patent ownership.
Source	<a href="https://www.electronicb2b.com/eb-specials/leading-organisations/why-filing-patents-is-important-for-startups/">https://www.electronicb2b.com/eb-specials/leading-organisations/why-filing-patents-is-important-for-startups/</a>

Grouping	Chairman/President of Companies OR Top management
Organization	Effectual Services
Name	Mr Amit Aggarwal
Designation	Co-Founder and Director
Views about IPR	<p>Filing patents in such a profitable (IoT) industry can be valuable. The Research revealed, approximately 40,000 patent applications have been filed on IoT worldwide in past 10 years. The patent activity seems to have exponentially increased since the year 2015. India seems to be way behind, compared to other countries, in terms of patent filing in IoT domain.</p> <p>The patent filing in India runs into hundreds, whereas the patent filings in other countries such as China run into thousands. Further, between 70-80% of the patents filed in India for IoT seem to be filed by foreign multinational companies.</p>
Source	<a href="https://www.dqindia.com/importance-patents-iot-enabled-devices/">https://www.dqindia.com/importance-patents-iot-enabled-devices/</a>

Grouping	Chairman/President of Companies OR Top management
Organization	Mahindra and Mahindra
Name	Anand Mahindra
Designation	Chairman of Mahindra and Mahindra
Views about IPR	India needs patents to make India the innovation leader.
Source	<a href="https://twitter.com/anandmahindra/status/1109344832445513729?lang=en">https://twitter.com/anandmahindra/status/1109344832445513729?lang=en</a> <a href="https://twitter.com/anandmahindra/status/1190853642900799488?lang=en">https://twitter.com/anandmahindra/status/1190853642900799488?lang=en</a>

Grouping	Top officials from Patent Office/s
Organization	Mr. Francis Gurry
Name	World Intellectual Property Organisation
Designation	Director General
Views about IPR	“Innovation is a critical component of all competition and intellectual property is one of the key tools to protect competitive advantage arising from that innovation,” said Mr. Gurry, who congratulated India on its economic dynamism. He added: "The good news is that India's IP system is aligning with the international IP ecosystem more than ever before, positioning the economy as a promising global innovation hub."
Source	<a href="https://www.wipo.int/about-wipo/en/dg_gurry/news/2019/news_0001.html">https://www.wipo.int/about-wipo/en/dg_gurry/news/2019/news_0001.html</a>

Grouping	Top officials from Patent Office/s
Organization	Patent office Mumbai, DIPP
Name	Mr. P.H. Kurian
Designation	Controller General of Patents Design and Trademarks of India
Views about IPR	<p>Mr. P.H. Kurian, granted a compulsory licence for manufacture of an important anti-cancer drug. It is the first step towards making available essential life-saving drugs at a fraction of the cost that is currently charged by manufacturers of the patented drugs.</p> <p>It is the first such use of the provision of compulsory licensing under Section 84 (1) of the Patents Act, 1970, P H Kurian, the first bureaucrat to hold the post of controller-general (patents), has shown the way to his successors on how the law can be interpreted to benefit the public.</p> <p>The immediate impact is that Sorafenib, developed by Bayer Corporation, USA, under the label Nexavar costing Rs 2.8 lakh in India for a packet 120 dosage that covers a month's use will be available for those suffering from cancer of kidney and liver at only Rs 8,800 a month once manufactured by Natco.</p> <p>Hundreds of cancer patients who never had access to this medicine can now actively consider buying it till such time that the American company does not get an adverse decision in court against the order.</p>
Source	<a href="https://www.newindianexpress.com/opinions/editorials/2012/mar/14/work-towards-making-more-drugs-affordable-348967.html">https://www.newindianexpress.com/opinions/editorials/2012/mar/14/work-towards-making-more-drugs-affordable-348967.html</a>

Grouping	Officials of the Government Ministry
Organization	Department of Science and Technology, GoI
Name	Dr Ashutosh Sharma
Designation	Secretary
Views about IPR	<p>In India, many patentable inventions are not being commercialised -- not because they do not work, but because the inventor is unable to exploit it commercially primarily due to lack of enhancing mechanisms.</p> <p>Hence, there is a need for inclusive IP mechanisms in the country.</p> <p>There is a need, and the responsibility lies on all, for making researchers aware about patent filing and the advantages of collaboration with the industrial sector for commercialising their innovations.</p>
Source	<a href="https://www.newindianexpress.com/thesundaystandard/2018/jul/01/indias-profile-in-global-medical-fraternity-rich-in-research-poor-in-patents-1836169.html">https://www.newindianexpress.com/thesundaystandard/2018/jul/01/indias-profile-in-global-medical-fraternity-rich-in-research-poor-in-patents-1836169.html</a>

Grouping	Officials of the Government Ministry
Organization	Department of Industrial Policy and Promotion, GoI
Name	Rajiv Aggarwal
Designation	Joint Secretary
Views about IPR	<p>A nation-wide campaign has been launched for furthering IPR awareness in educational institutions and industry, along with training programmes for police, customs officials and the judiciary.</p> <p>There has been significant augmentation of manpower in the IP offices across the nation, resulting in direct impact on the pendency of IP applications.</p>
Source	<a href="https://www.newindianexpress.com/thesundaystandard/2018/jul/01/indias-profile-in-global-medical-fraternity-rich-in-research-poor-in-patents-1836169.html">https://www.newindianexpress.com/thesundaystandard/2018/jul/01/indias-profile-in-global-medical-fraternity-rich-in-research-poor-in-patents-1836169.html</a>

Grouping	Officials of the Government Ministry
Organization	Cell for IPR Promotion and Management (CIPAM), DIPP, Ministry of Commerce and Industry
Name	Aditya Kumar
Designation	
Views about IPR	IP especially patent filings yield benefits to Start-up companies.
Source	<a href="https://www.freepressjournal.in/cmcm/road-show-held-on-ipr-national-ip-policy">https://www.freepressjournal.in/cmcm/road-show-held-on-ipr-national-ip-policy</a>

Grouping	Officials of the Government Ministry
Organization	Ministry of Electronics and Information Technology (MeITY), GoI
Name	Mr. Ajai Kumar Garg
Designation	Director
Views about IPR	<p>MeiTY Director Ajai Kumar Garg said a "sea change" in this direction came after the Centre brought the National IPR Policy in 2016.</p> <p>"The number of IPR filings in India has increased significantly. Earlier there used to be 4,000 to 4,500 IPR filings annually six to seven years ago but today this number has nearly doubled in India,"</p> <p>"The governments, both central as well as states, are supporting start-ups and MSMEs on how to create better footprint around IPR. We should not work only for others, but also create IP for ourselves. Start-ups are the only way to do it and if we do not support it then we will forever remain dependent on technology. IPR is the only way to have ownership of technology,"</p>
Source	<a href="https://www.theweek.in/wire-updates/business/2020/02/20/des43-ncr-startups-ipr.html">https://www.theweek.in/wire-updates/business/2020/02/20/des43-ncr-startups-ipr.html</a>

Grouping	Officials of the Government Ministry
Organization	Patent office Mumbai, DIPP
Name	Mr. Pinkesh Jain
Designation	Assistant Controller of Patents and Designs
Views about IPR	IP especially patents are important for small-scale industries.
Source	<a href="https://www.freepressjournal.in/cmcm/road-show-held-on-ipr-national-ip-policy">https://www.freepressjournal.in/cmcm/road-show-held-on-ipr-national-ip-policy</a>



Grouping	Chambers of Commerce
Organization	NASSCOM- Centre of Excellence, Gurgaon
Name	Mr. Sudhanshu Mittal
Designation	Head
Views about IPR	Noting that India still has a long way to go in IPRs, stressed on the need for start-ups to work on more patents which protect technical inventions that can be an asset for new firms. Identifying the challenges in the domain, Mittal said, "IPRs are largely not in the focus area of start-ups who concentrate more on products and services instead of patents."
Source	<a href="https://www.theweek.in/wire-updates/business/2020/02/20/des43-ncr-startups-ipr.html">https://www.theweek.in/wire-updates/business/2020/02/20/des43-ncr-startups-ipr.html</a>

Grouping	Chambers of Commerce
Organization	Secretary
Name	Shri Ramakanth Nidgurgi
Designation	Hyderabad Karnataka Chamber of Commerce and Industries, Gulbarga, Karnataka
Views about IPR	Patented inventions can help boost economic and technological developments in the country
Source	<a href="https://www.kscst.org.in/patent_awareness.html">https://www.kscst.org.in/patent_awareness.html</a>

Grouping	Academic
Organization	Law College, Shimoga
Name	Mohan Ram
Designation	Professor
Views about IPR	It is imperative that patent awareness is created among all technocrats and local level innovators in order to get economic benefit out of inventions and, thereby, help improve the economy of the nation
Source	<a href="https://www.kscst.org.in/patent_awareness.html">https://www.kscst.org.in/patent_awareness.html</a>

Grouping	Academic
Organization	Pune University
Name	Nitin Karmalkar
Designation	Vice-chancellor
Views about IPR	"Often, researchers and faculty just publish

	<p>research papers in journals. There is a severe lack of knowledge about the need for patenting prevailing in the academic community.”</p> <p>To improve on this scenario, “hold workshops and improve awareness among faculty and researchers, plan to tackle this matter through the Research Park, a dedicated centre for this purpose.”</p>
Source	<a href="https://indianexpress.com/article/education/severe-lack-of-knowledge-about-patenting-among-researchers-faculty-sppu-v-c-6067832/">https://indianexpress.com/article/education/severe-lack-of-knowledge-about-patenting-among-researchers-faculty-sppu-v-c-6067832/</a>

Grouping	Academic
Organization	Savitribai Phule Pune University
Name	Vasudeo Gade
Designation	Former Vice-chancellor
Views about IPR	<p>“Once a patent is granted, the faculty or students are often not keen to take up further studies. A patent granted comes with its own benefits and faculties and students enjoy certain returns, including in the form of promotion. It is very unfortunate that research teams do not want to further develop their ideas.”</p> <p>Lack of support from industry partners for academicians is another cause of worry in India. “In foreign universities, research is undertaken with the goal of getting the work patented and convert it into a commercial product. Industries there work with academicians’ right from the start of research. Unfortunately, there are very few industries willing to work with academicians in India.”</p>
Source	<a href="https://indianexpress.com/article/education/severe-lack-of-knowledge-about-patenting-among-researchers-faculty-sppu-v-c-6067832/">https://indianexpress.com/article/education/severe-lack-of-knowledge-about-patenting-among-researchers-faculty-sppu-v-c-6067832/</a>

Grouping	Academic
Organization	
Name	Dr. Aniruddha Digraskar,
Designation	Intellectual Property Rights Expert
Views about IPR	The importance of intellectual property rights is unique and needs to be understood by everyone from the student days
Source	<a href="https://epaper.esakal.com/FlashClient/Client_Panel.aspx#currPage=5">https://epaper.esakal.com/FlashClient/Client_Panel.aspx#currPage=5</a>

Grouping	Chairman/President of Companies OR Top management
Organization	Automotive Division, Mahindra & Mahindra.
Name	Mr. Velusamy R
Designation	Chief of product development
Views about IPR	<p>One reason why researchers are shy of patenting their ideas in India is the time taken to get a patent. In 2017, India on an average took 64 months to grant a patent, compared with 22 months each in China and the European Patent Office and 24 months in the US, according to WIPO.</p> <p>“The issue with the delay in grant is that the technology might actually move on or become less relevant by the time the patent is granted.”</p>
Source	<a href="https://economictimes.indiatimes.com/tech/internet/pending-patents-key-to-bridge-vast-tech-gap-with-us-china/articleshow/71458600.cms?from=mdr">https://economictimes.indiatimes.com/tech/internet/pending-patents-key-to-bridge-vast-tech-gap-with-us-china/articleshow/71458600.cms?from=mdr</a>

Grouping	Academic
Organization	IIT Mumbai
Name	Prof. Milind Atrey
Designation	Dean R&D
Views about IPR	<p>Working in Basic Science, Applied Research; Government, outside companies/ universities approaches them with problem statements for a solution.</p> <p>They provide technical solutions to the problems and in the last year approximately 264 IPs were generated out of which (164 are patents). In the last year, 25 to 30 technologies were transferred to industries.</p> <p>Impart training on Entrepreneur and IP education.</p> <p>His views on engineering education - Many engineering colleges are available, but need to have quality engineers from these colleges. Some of the colleges are doing best but need to increase their percentage.</p> <p>In our country, a lot of importance is given to the engineering field, but equal importance is needed to be given to Commerce and Arts filed as well.</p> <p>In education, more practical work is required and to carry out research, the problem has to come from Industry or the researcher's work is required / needed by Industry. As far as possible, the industry and the researchers should be collaborating from the start of the research.</p> <p>Industry may also approach and tap the knowledge from research institutes for their technical problems; Simultaneously, the research institutes should proactively approach the industry to understand their problems.</p> <p>Institute that has technical solutions and the patents can help industries in need of the same and also enquiring about the industry problems to which the group of</p>

	<p>experts from institute can be connected to industry.</p> <p>Many researchers are not patenting their work but publish them, though they have technology and know-how.</p> <p>Looking to work with agency for match making between research institute and industry.</p>
Source	<a href="https://marathi.abplive.com/tv-show/majha-katta-tv-show/mumbai-iit-researcher-dr-milind-atre-on-majha-katta-show-986661">https://marathi.abplive.com/tv-show/majha-katta-tv-show/mumbai-iit-researcher-dr-milind-atre-on-majha-katta-show-986661</a>

Grouping	Top officials from Patent Office/s
Organization	Indian Patent Office
Name	Mr. O. P. Gupta
Designation	Controller General of Patents, Designs and Trade Marks
Views about IPR	<p>The Patent office has been speeding up the process. “The grant period in 2015 was 84 months.</p> <p>In the next two years, plan to bring it down to 36 months.”</p>
Source	<a href="https://economictimes.indiatimes.com/tech/internet/pending-patents-key-to-bridge-vast-tech-gap-with-us-china/articleshow/71458600.cms?from=mdr">https://economictimes.indiatimes.com/tech/internet/pending-patents-key-to-bridge-vast-tech-gap-with-us-china/articleshow/71458600.cms?from=mdr</a>

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**Honey Bee Network (HBN)** was established in the year 1986 by Prof Anil Gupta and it works towards gathering, protection and dissemination of innovations originating at the grassroots level.

**National Innovation Foundation (NIF)** was set up by government of India in the year 2000 to help Indian innovators in commercialization of their inventions. NIF through its program called Grassroots Innovations Augmentation Network (GIAN) helps individual innovators by providing support to them in the areas of technical, finance as well as marketing for transforming their inventions into innovations

<http://tcleadership.org/the-honey-bee-network/>