Post-TRIPS Patenting Trends in India with Special Reference to USA: A Comparative Analysis

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Received 26 February 2011 revised 10 May 2011

The TRIPS Agreement, it was expected, would prove beneficial for developing countries, as it would foster innovation, stimulate competitiveness, promote transfer of technology and encourage investment and international trade. India being a signatory to the TRIPS Agreement amended its patent legislation to comply with the obligations under it. After having become fully compliant with TRIPS, one now needs to examine how far has TRIPS contributed in fostering inventive activity in India, specially with reference to USA, a strong advocate of the TRIPS Agreement. The patenting data worldwide and the relevant data from USA and India is compared and analysed to interpret trends in various aspects. The study shows that there has been a tremendous growth in patenting in India after the implementation of TRIPS, but no corresponding spurt was observed in inventive activity in India as expected. Majority of the patents in India are owned by foreign inventors mostly from USA, indicating that TRIPS has benefited USA and other developed countries. On the contrary, India has a negligible share in patents granted in USA. The patenting trend in India shows that TRIPS has neither encouraged innovation in India nor has it played any major role in the development of India.

Keywords: Intellectual property, TRIPS, patenting trend, inventions, innovation

Intellectual property (IP) especially patents have acquired considerable significance in the modern era. In order to maintain a consistent rate of development, protection of IP to the maximum is deemed essential. The astounding economic development of the current period recognized the importance of human intellect as a prime and major resource. The exploitation of this resource beyond geographical and political boundaries has thus become a widely accepted principle. The GATT gave shape to such thinking in the form of the World Trade Organization (WTO) and an agreement in the realm of IP, viz., TRIPS (Trade-Related Aspects of Intellectual Property Rights). The TRIPS Agreement aimed at harmonizing IP protection and enforcement standards in Member States.

The USA and other allied developed nations projected TRIPS as beneficial for developing countries, as it would foster innovation, stimulate competitiveness, promote transfer of technology and encourage investment and international trade, and later succeeded in their objective by adopting TRIPS as an annexure to WTO.1 India being signatory to WTO was required to amend its domestic laws in consonance with the requirements of TRIPS, which included adoption of principles like national treatment, most favoured nation treatment, patentability aspects and the enforcement mechanism. The internationalization of IP has opened the doors to the exercise of monopoly and maximum exploitation of benefits to all.

The TRIPS requirements are in favour of harmonizing IP legislation with the domestic legislation in all member states. However, the promoters, particularly USA, are said to have tailored their laws liberally,2 so as to gain utmost protection and achieve maximum exploitation of intellectual and natural resources. Therefore, it becomes extremely essential to examine the progress and position of India, touted to be the ‘fastest developing economy’ in the world with reference to the protection and exploitation of IP vis-à-vis the progress and position of USA, by far the most developed country in the world that has recently passed through an economic recession. The present paper is an attempt to trace out the position of India with reference to protection of intellectual property rights (IPR) world-over and to analyse patenting trends in India as compared to USA.

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The study involves analysis of empirical data related to filing and grant of patents in India and USA from 2000 to 2009.

**Intellectual Property Rights and Development**

The growth of IPR can be explained citing commercial, political, scientific or technological reasons. Historically, letters patent were issued with the intention to buttress the realm’s lagging industrial development by importing new industries and technology, creating trade and employment, ultimately to bring self-sufficiency in the economy. The patent system of a country may be deemed successful and adequate, only if it motivates scientists, innovators, inventors and technologists to develop ideas and products that benefit the society.

Modern states are more or less welfare states and as welfare states they play an active role in regulating human activities in almost all walks of life. In the information age and globalized world, innovation systems play a significant role in determining the winners from the losers. In the words of W R Cornish ‘The anxiety to get IPR protection is ever increasing. The expansion of trade competition since 1950 has brought ever increasing advantages to those in the van of innovation. Intellectual property rights, which help to sustain the lead of those with technical know-how, with successful marketing schemes, with new fetishes for pop-culture, have come to foster immense commercial returns. The increasing number of patents granted and trademarks registered particularly in industrial countries and the upsurge of publishing, record producing, film making and broadcasting stand as some measures of this development’.

**Global Patenting Trends**

Since 1995, the worldwide filing of patent applications has grown at an annual rate of 4.5 per cent. China, Japan, European Patent Office, Republic of Korea and USA amount for 77 per cent of all patents filed and 74 per cent of all patents granted. These three countries were the largest applicants of patents in other countries, i.e. 57 per cent of the worldwide patent filings were by non-residents. China and the USA account for more than half of the growth in patent filing between 1995 and 2008 (ref. 4). Patent filing by residents has increased at an annual average of 6.6 per cent and that of non-residents by 7.6 per cent.

**Economic Crisis - Slowdown in Patent Grants Worldwide**

The economic recession had a strong impact on patenting activity throughout the world, causing a decline in patent filing and grants. Worldwide filing of patent applications grew at an annual rate of 8.1 per cent in 2005; but went down from 5.7 per cent in 2006 to reach 2.6 per cent in 2008. The long-term trend showed that the number of applications filed worldwide was stable between 1985 and 1995, at around one million applications per year. Since then, it marked a sustained upward trend, except in 2002. The slowdown in the growth of patent applications in 2008, when global economic activity began to decline, was largely due to zero growth in patent applications in the US and a drop in the number of applications filed in Japan and the Republic of Korea. Despite the slowdown, the overall growth rate of patent applications continued to be positive, reflecting strong growth in China’s, which is one of the world’s biggest spenders on R&D. Between 2000 and 2008, Gross domestic Expenditure on Research and Development (GERD) leapt from 89.6 billion Yuan (US$ 10.8 billion) to 461.6 billion Yuan (US$ 66.5 billion), at an average annual growth rate of 22.8 per cent.

**Utility Model Patent Activity**

Though economic recession had a strong impact on patenting activity, the utility model patent activity continued to grow. Worldwide, the numbers of utility model applications and grants grew by 15.3 per cent and 12.2 per cent, respectively in 2008. The majority (around 96 per cent) of utility model applications were filed by and granted to resident applicants. As far as patents in force are concerned, residents of Japan (1.85 million) and the USA (1.35 million) owned around 48 per cent of the patents in 2008.

**Liberal Patent Practices in USA**

The USPTO issued an average 56,500 patents a year during the period between 1975-76 and 1984-85. The Indian Patent Office on the other hand, received an average of about 3000 applications a year and issued an average of less than 2000 patents a year. Hence, India issued only 3.5 per cent of the patents issued by the USPTO. It may be argued that the liberal patenting criteria and minimal restrictions on patenting in the US are reasons for a large number of patent filings by the USA. Although, this cannot be denied in totality, they are not the only reasons for the huge patent volume. Patent applications from USA
are being filed throughout the world and undergo different international and national (domestic) procedures until the grant of patent, and yet successfully maintain the top position; implying huge research activity and inventive growth in USA. The most obvious reason for more patenting is USA’s positive attitude towards research and its unapologetic, precisely directed policies to derive maximum commercial gains from intellectual achievements. Other reasons could be the implementation of the Bayh-Dole Act of 1980, which allows public-private research collaborations between universities and the government. A brief review of R&D input and output in USA is given below:

The USA consistently invests more money in R&D than the other G8 countries. Its share of expenditure on R&D has fluctuated between 48 per cent and 53 per cent over the past 25 years and has exceeded 50 per cent since 1997. GERD in the USA has continued to rise since two decades. It approached US$ 265 billion in 2000, an increase of 74 per cent in a decade. It reached an estimated US$ 368.1 billion in 2007, of which the private industry contributed approximately 67 per cent of the total and the federal government 27 per cent. In 2007, the ratio of GERD to GDP in the USA was 2.67 per cent. The universities in the USA contribute a lot to R&D. After the Second World War, universities in USA have emerged as major research centres. In 2006, they performed 57 per cent of the country’s basic research. Between 1995 and 2002, the number of patents granted to universities increased substantially and peaked at 3300 in 2002 before declining to about 2700 in 2005. The royalties from university-held patents grew from approximately US$ 600000 in 2002 to over US$ 900000 in 2005.

**Patenting Trends in India and USA**

Patent filing in India increased only slightly from 2000 to 2004, but post the amendment of 2005 there has been a significant increase in the rate of filing. In the years 2005 and 2006, there was 38 per cent and 40 per cent growth, respectively. But the filing rate started to decline from 2007 onwards to reach 4.53 per cent in 2009. This slowdown reflects the impact of economic recession. As countries are in the process of recovering from the recession, the figures are expected to be better in the coming year. This trend clearly indicates that after the amendment in 2005, there has been a substantial increase in filings in India. In case of USA, patent filing decreased in 2002 and 2003 as compared to 2001 while there has been an average of 8.8 per cent growth in filing of patents from 2005 to 2007. But the economic recession which hit USA hard, pulled down the patent filing to a negative in 2009. With reference to the rate of filing of patents in India and USA, although there is an increase in the filing rate in both the offices, the growth rate has been much higher in India as compared to USA (Figs 1 and 2).

Figure 3 is indicative of the fact that there has been a gradual increase in the number of applications filed in USA by Indian inventors and a subsequent rise in the number of patents granted by USA to Indian inventors. But the number is negligible when compared to the total number of applications and grant of patents in USA; only 0.1 to 0.6 per cent of the total patents granted by USA have been to Indian inventors (Fig. 3 and Fig. 4).

Figure 5 deals with the number of applications filed in India by inventors of US origin. Undoubtedly, the applications from USA are higher in India as compared to any other country during all the years i.e. average 30 per cent of the total applications filed in India are from USA alone. The growth of applications filed by USA in India is more or less steady when compared to the total applications filed in India, but it is significantly high when it is compared to the applications of Indian origin in USA. 

![Graph](image-url)

Source: Annual reports, Office of the CGPDTM; All technologies (utility patents) reports, USPTO

Fig. 1 – Number of patent applications filed in India and USA

![Graph](image-url)

Source: Annual reports, Office of the CGPDTM; All technologies (utility patents) reports, USPTO

Fig. 2 – Growth rate in patent filing in India and USA
The mailbox applications (product patent applications in the field of pharmacy and agriculture filed during 1995-2004 towards TRIPS compliance) were opened in 2005. The Indian patent office received 8926 mailbox applications, out of which majority (7520 applications, 84.25 per cent) were from foreign entities and 1406 (15.75 per cent) were from India. Out of 1406 Indian applications, 1300 were from pharmaceutical sector. The mailbox applications from USA were the highest, in all 2324 (26 per cent) applications, of which 2096 were pharma-related. The percentage of foreign applications in case of mailbox (filed from 1995 to 2004) is higher at 84.25 per cent than foreign applications in regular patent filings in the year 2005 (79 per cent) after TRIPS implementation. Product patents in case of food, medicine, and chemical were not allowed in India since 1972. Only process patent was available for the limited period of five years till 2002, allowing manufacture of identical products using different methods. This was the main concern for US drug industry. When the gates for entry of product patents into India opened, pharmaceutical industries rushed to gain monopoly.

In Table 1, the first two rows indicate the number and percentage of applications filed in India by foreign inventors and subsequent grant of patents by India to such foreign applicants. It must be noted that the number has been steadily increasing and on an average 76.52 per cent applications filed in India are by foreign inventors; while 69.12 per cent patents are granted to foreign applicants.

The patent applications of foreign origin in USA have increased slightly but continuously by about 6 per cent till 2009 to reach 50.69 per cent of the total applications filed in USA. On an average 46.94 per cent applications in USA are from foreign inventors; whereas the grant of patents to foreign inventors stands at 48.54 per cent.

The above analysis shows that the rate of filing by foreign inventors has significantly risen in India from 55 per cent in 2000 to 83.27 per cent in 2009 leaving only 16.63 per cent for Indians, much less than that in 2000. Though the number of applications and grants in India by inventors of Indian origin seem to be increasing, it is much lower as compared to the rate in USA. The applications filed by Indian inventors mostly relate to chemical, pharmaceutical, mechanical and electrical fields. Dr Reddy’s Laboratories, Ranbaxy Laboratories Ltd, Cipla and Samsung India are major contributors. CSIR is at the top in the research organization category of applicants followed
by BHEL, while IITs secured the highest rank among the educational institutions. Out of the 300 universities in India only 8 to 9 are in the list of patent applicants and that too with a very low rate of contribution.

The GDP of India is on an upward swing since the last few years and therefore India is a great market for products. Implementation of TRIPS has as expected, helped foreign inventors, mostly from the US. The trend of rising foreign applications in India and the consequent fall in the number of Indian applications in the Indian Patent Office demands a concentrated focus on R&D within the country.

The number and percentage of patent applications filed by Indian residents in India and USA and vice versa is depicted in Table 2. The table indicates a remarkable trend; patent filing by Indian residents in USA is continuously growing and crossed beyond 50 per cent of the total resident applications filed in India in 2009. On an average 40 per cent of the total resident applications of India have filed applications in USA. On the contrary, only 4.88 per cent of the total resident applications filed in USA have filed applications in India in 2009 (having once been 1.63 per cent in 2001).

Though Indian patenting position seems better in USA, India is not even one of their top twenty patenting countries. The higher filing ratio by Indians in USA may be due to the liberal patenting criteria in the US as compared to India. There are various provisions in the US that are different from those in India. For instance, absence of pre-grant opposition, wider scope of patentable subject matter, identical definitions of invention and discovery and liberal and favourable interpretations by the judiciary.

Under the US Patent Code 35, patent may be granted for business methods, software, discovery of new use of known substance, etc. Software is patentable subject matter in the US. In India, however, software is not patentable, although it is copyrightable. The

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<th>Year</th>
<th>2000</th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>Average</th>
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<tbody>
<tr>
<td>Foreign origin applications in India (% of total)</td>
<td>2618</td>
<td>6324</td>
<td>8221</td>
<td>8772</td>
<td>9395</td>
<td>13836</td>
<td>19984</td>
<td>23626</td>
<td>29178</td>
<td>30651</td>
<td>76.52%</td>
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<td>Granted patents of foreign origin in India (% of total)</td>
<td>(55)</td>
<td>(74)</td>
<td>(77)</td>
<td>(76.6)</td>
<td>(74.5)</td>
<td>(79)</td>
<td>(81)</td>
<td>(82)</td>
<td>(83)</td>
<td>(83.27)</td>
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<tr>
<td>Foreign origin applications in USA (% of total)</td>
<td>131131</td>
<td>148997</td>
<td>150200</td>
<td>153500</td>
<td>167407</td>
<td>182866</td>
<td>204183</td>
<td>214807</td>
<td>224733</td>
<td>231194</td>
<td>46.94%</td>
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<tr>
<td>Granted patents of foreign origin in USA (% of total)</td>
<td>(44.3)</td>
<td>(45.6)</td>
<td>(44.9)</td>
<td>(44.8)</td>
<td>(46.9)</td>
<td>(46.8)</td>
<td>(47.9)</td>
<td>(49.3)</td>
<td>(50.69)</td>
<td></td>
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<td>Applications from residents in India</td>
<td>2206</td>
<td>2179</td>
<td>2371</td>
<td>2694</td>
<td>3218</td>
<td>3630</td>
<td>4521</td>
<td>5314</td>
<td>6040</td>
<td>6161</td>
<td></td>
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<tr>
<td>Applications from residents in USA</td>
<td>438</td>
<td>643</td>
<td>919</td>
<td>1164</td>
<td>1303</td>
<td>1483</td>
<td>1923</td>
<td>2387</td>
<td>2879</td>
<td>3110</td>
<td></td>
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<tr>
<td>Indian applications in USA (% of total)</td>
<td>(19.85)</td>
<td>(29.5)</td>
<td>(38.76)</td>
<td>(43.20)</td>
<td>(40.49)</td>
<td>(40.85)</td>
<td>(42.53)</td>
<td>(44.91)</td>
<td>(47.66)</td>
<td>(50.47)</td>
<td></td>
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<tr>
<td>Applications from residents in USA</td>
<td>164795</td>
<td>177513</td>
<td>184245</td>
<td>188941</td>
<td>189536</td>
<td>207867</td>
<td>221784</td>
<td>241347</td>
<td>231588</td>
<td>224912</td>
<td></td>
</tr>
<tr>
<td>US resident applications in India (% of total)</td>
<td>2916</td>
<td>3292</td>
<td>3055</td>
<td>3600</td>
<td>5265</td>
<td>8048</td>
<td>8389</td>
<td>10653</td>
<td>10978</td>
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Source: Annual reports, Office of the CGPDTM, All technologies (utility patents) reports, USPTO
A comprehensive list of non-patentable inventions (Section 3) under the Patent Act, 1970 includes discovery of a mere new use of a known substance, computer programme, business method, traditional knowledge, method of treatment, mere arrangement and rearrangement of devices, a substance which is admixture of two or more substances, etc. This reduces the scope of patentable subject matter in India to a large extent as compared to that in the US. Further, absence of pre-grant opposition protects the applicant from annoying litigations early on. Post-grant revocation suits are a costly affair, and are possible only if the disputed invention involves high commercial value. Patent is granted only after administrative proceedings and opposition allowed only after grant of patent. Other reasons may be better market opportunity and business prospects and high returns because of higher product price. A growing trend being observed is that most Indian patents filed in USA are utility patents in chemistry-related areas, and a majority granted to foreign companies located in India, based on R&D projects carried out in India.

Figure 6 represents the overall trend of patent filing in India wherein a steady growth in filing of patent applications by residents can be observed. This growth went on to reach 24.5 per cent in 2006; but later, in line with global trends, showed a slight decline from 2006 to 2009. On the other hand, the growth rate in case of filing of applications by non-residents was huge in 2001 i.e. 141.6 per cent; which reduced substantially to 42.3 per cent and 44.4 per cent respectively in 2005 and 2006. The growth of applications by residents appears to be highest in 2006, but when considered in terms of total number of applications in that year, only 4521 applications were filed by residents as against 19,884 applications by non-residents, which is more than four times higher. This is indicative of the fact that applications from non-residents have flooded India in 2001 and acquired momentum since 2005.

Figure 7 is a graphical representation of the rate of grant of patents by India to both, resident applicants and non-resident/foreign applicants. Till 2005, the rate seems to be highly irregular; but the rate of patents granted in the case of non-residents shot up manifold from 2006 onwards. The ratio of patents granted to resident and non-resident which was 1:2.3 in 2000 became 1:5.3 in 2009, a record growth in grant of patents to non-residents.

On the other hand, when the rate of patents granted to residents and non-residents in USA was compared, a gradual decline from 2000 was observed, with a crossing of the line in 2007, when patents granted to non-residents have sharply increased. The ratio of patent grants to residents and non-residents in USA was 1: 0.85 in 2000 and increased to 1: 1.17 in 2009 (Fig. 8).

Innovation Landscape in India

It has been acknowledged that India’s GDP is booming. India has emerged as the fastest developing country in the world after China. However, India’s inventive growth is not up to the mark. According to EIU (2009), India’s rank in the Economist Group’s Global Innovation Index for 82 countries was 56 in
2008 (ref. 15) and the country’s overall research intensity has remained constant at about 0.78 per cent.\(^7\) In China, on the other hand, the GERD/GDP ratio has more than doubled to 1.54 per cent.\(^7\) In the USA, the ratio of GERD/GDP was 2.81 per cent in 2003, which reduced to 2.67 per cent in 2007, and was an estimated 2.70 per cent in 2008 (ref. 13).

Domestic R&D investment is considered most crucial for innovation and development in a country. R&D in India, over the years, has mostly been funded by the government. About 75-80 per cent of the domestic R&D is undertaken by the public sector, 20-25 per cent by private enterprises and around 3 per cent by universities\(^16\) in contrast with the situation in USA. The typical R&D expenditure in countries belonging to Organization for Economic Co-operation and Development (OECD) is 69 per cent by private enterprises, 18 per cent by universities, 10 per cent by government R&D labs, and 3 per cent by private non-profit institutions. The R&D by private sector would be more productive than by the government institutions. More involvement of private sector in R&D through encouragement by funding, public-private partnership and incentives is essential for better innovative growth in India. The government of India has initiated various schemes under the 11th Five Year Plan, which are still in the process of initiation and it would require some more time to assess their impact.

India lags behind other countries such as Korea, China, Russia, etc., in utilizing its existing local, global knowledge and technology resources. India can improve its productivity through the effective absorption of existing knowledge, increase in FDI, national and international collaborations and technology licensing. Despite liberalization of FDI in 1991, there is lesser investment compared to other countries, primarily due to the lack of basic infrastructure and cumbersome bureaucratic processes. Failure to absorb global knowledge through technology licensing, severe paucity of skilled workers, an educational system that is not compatible with changing industry requirements are the main causes for the not-so-promising situation in India.\(^18\) The higher education sector in India has not become a source of technology for industry as the cases of actual technology generation are very few and far between, and much of R&D relates to basic research. Non-productive research in universities and higher education institutions is another cause for lower percentage of patents. The higher education sector constitutes only a fraction of R&D performed in India.\(^7\) Lack of research culture in companies, government departments, higher education institutions, research centres and organizations may be a basic obstacle in inventive progress. It is clear that unless and until the Indian inventors, corporate and the government awaken from their slumber and overcome the temporarily high but short bursts of patenting activity; there are rare chances of the benefits of a growing economy and enhanced development being realized in India.

**Conclusion**

Domestic patenting is generally regarded as an indicator of local inventing activity. On the other hand, foreign patenting across countries could be motivated either by the urge to patent their inventions in countries that are most likely to imitate their innovations or transfer their technologies to different countries.\(^17\) Patenting trends thus show the status and progress of inventive activity in a state, and should act as an eye opener and a torch bearer for future action.

The analysis has shown that there is a tremendous growth in the patent filings and grants in India after the implementation of TRIPS, but inventive activity in India seems to have decreased. Most of the patents in India are owned by foreign inventors, mostly from USA, which seems to indicate that the US has been the major TRIPS beneficiary rather than India. One positive trend observed has been the continuously increasing patent filing by Indian residents in USA. However, the patent filing rate is much below than compared to 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 major role in development as expected. 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 USA. The growing GDP rate of India at present is independent of innovation and patenting. Even though the Indian economy seems to be on an upswing, the real benefits may well bypass Indians. In order to gain some real benefits, concrete steps including administrative/legislative actions on the lines of United State’s Bayh-Dole Act (The
Protection and Utilization of Public Funded Intellectual Property Rights, 2008 though introduced in the Parliament is still with the Parliamentary Standing Committee) and the Government Performance and Results Act (GPRA) are extremely and urgently necessary to encourage inventions and innovations. 78 There is an urgent need to cultivate a research culture in private and public companies, higher education institutions, research centres and organizations, through various means including training, research incentives, recognition and motivation of research work along with the increase in funds for R&D and most importantly, effective and fruitful utilization of such funds. These institutions should adapt a ‘success sharing policy’ instead of ‘possessive ownership policy’ in case of inventions by its employees. The institutions/departments responsible for R&D should take proactive steps to bring the innovation process at par with developed countries. Private individuals having potential to invent should be encouraged by creating a support system, to guide, provide technical and financial help and ensure conversion of an idea into an invention and invention into a product. Inventive growth is not only a matter of success but a matter of survival, for the corporate sector, public sector and nation at large.

References
2. Diamond v Chakrabarty, 447 US 303 (1980), the United States Supreme Court regarding the scope of the original legislation, held that, in choosing expansive terms such as ‘manufacture’ and ‘composition of matter’ modified by the comprehensive ‘any’ Congress plainly contemplated that the patent laws would be given wide scope. Further the Congress had intended patentable subject matter to include anything under the sun that is made by man.
9. 35 U.S.C. 102 (b) provides dual criteria for public use of an invention in US and in other countries while considering novelty.
20. Mowery David, Nelson Richard, Sampat Bhaven and Ziedonis Arvids, Ivory Tower and Industrial Innovation: University-Industry Transfer before and after the Bayh-Dole Act (Stanford University Press, USA), 2004; Abramson Bruce, India’s journey towards an effective patent system, Policy research working paper 4301, The World Bank, 2007, p.67-69, elibrary.worldbank.org/deliver/4301 (11 January 2011). Tremendous growth has been seen in R&D and in patenting after the enactment of Bayh Dole Act, 1980 in the US. The Bayh-Dole Act, 1980, let public and private universities and research institutions retain IPRs on patentable innovations devised partly or wholly with government-funded research. The Bayh-Dole Act of 1980 enabled universities to license patents to companies and collect royalties on sales, even when the original projects were funded, in whole or in part, by government grants.