Result

Basis of innovativeness is - **patents filed**. It is because patent filing is complex and expensive and no individual/industry makes such an investment unless there is significant inventiveness, as assessed under Patent Laws globally. The different patent offices globally publish the patents filed after a fixed time, which is generally 18 months after filing/priority date. Time of grant of patent is variable. Patent documents pertain to Applicant as well as Inventor being an Indian. This is established by ensuring that the address contains “India”. During filtering, it was noted that filter “India” also included “Indiana”, which was deleted manually. Thus, wherever the Applicant is NOT Indian, such patent documents are excluded since the research pertains to innovativeness originated by “India” resources and infra-structure.

Following Databases are probed for accessing patents:

1. Indian patent office – an official site of India.
3. US patent office – an official site of the USA.

Patents filed in any and all the domains in four different years are undertaken for this research work. The years selected are – 1995, 2000, 2007 and 2013, the logic being:

- Year 1995 is considered as pre-liberalization period. Phased liberalization policies having been announced in 1991, no change is expected immediately. Also, patent data for earlier years is not available easily.
- Year 2000 is considered as just liberalization year.
- Year 2007 is considered as well liberalized year.
• Year 2013 is considered as recent most mature liberalized year, reason being patents are published after 18 months of filing and thus data of year 2014 is not yet in public domain.

Each patent is studied in full depth and a one-page analytical study report is made by the research scholar. Help of subject matter experts is taken wherever required.

*NB: The essence of this research is understanding, interpreting and analysing patent documents spanning ALL branches of science and technology, thus demanding unprecedented skill and effort to scoop hundreds of techno-legal documents. Challenges encountered and combatted are partially elaborated in Discussions.*

Each invention is segregated into process and product patents as per basic definition of the process and product.

The quality of inventiveness is rated on a scale of 5, 4 being significant, 5 being breakthrough and 1 to 3 being different levels of incremental innovations. Breakthrough is defined as a product or process innovation which has brought significant difference in the society. Example: Bio fuel, wireless communication, higher mortality.

The rating for each invention is arrived at based on

(a) Prior art cited in the patent document: - as a procedure statuted, each patent application needs to mention therein the existing state of art of technology and the problem solved. The researcher analysed this information.

(b) Researcher’s own knowledge consequent to having spent 33 years in core research and development in world class industries, earlier as engineer and now as a consultant.

(c) Opinions of Subject matter experts.

The result of comparison for four selected tenures and for two different macro viz. product and process is analysed.
Preceding few hundred pages are typical analytical study reports. Each analytical study report indicates patent document details, the technology it pertains to, sub-field, an illustrating diagram from the patent document, innovation rating in terms of size and position of a darkened circle, and a short explanation for arriving at the rating.

Each of the three thousand fifty three (3053) patent documents are studied comprehensively, discussed with several industry experts, thus analysed and interpreted.

Other than the diagram, all contents of each and every analytical study reports are original expression of the research scholar.

Following is the break-up of 3053 patent documents

<table>
<thead>
<tr>
<th>Year</th>
<th>No of Patent Documents</th>
</tr>
</thead>
<tbody>
<tr>
<td>1995</td>
<td>64</td>
</tr>
<tr>
<td>2000</td>
<td>344</td>
</tr>
<tr>
<td>2007</td>
<td>1386</td>
</tr>
<tr>
<td>2013</td>
<td>1259*</td>
</tr>
</tbody>
</table>

*As on August 31, 2014. As on January 31, 2015 the number increased to 1685

Based on the analytical study reports, the outcome of each of the above four selected years is compiled for following aspects

(a) Innovation sector – Product or process or both

(b) Level of innovation on a scale of 1 to 5; interpreted as

i. 5 - Breakthrough
ii. 4 - Significant contribution to related domain
iii. 3 - Notable improvement
iv. 2 - Incremental improvement
v. 1 - Negligible improvement

(c) Domain of technology
The four selected years are nomenclatured as (a) pre-liberalization year (b) just liberalized year (c) well liberalized year, and (d) latest and mature liberalized year as per rationale given in the introduction.

The results for above three aspects and four years are presented in the graphical form so as to generate indicators of how the Indian innovation has moved in two decades.

For better understanding while reading and analysing, the researcher also undertook to categorize the patent documents in definable industrial pockets.

It is known that India has certain areas of focus like

- Agriculture,
- IT,
- Pharmaceutical, and
- Biotechnology.

Hence patent documents on these three fields are grouped separately. The subject of “Space” is captured separately to probe this complex domain microscopically.

Most innovations got pocketed in following branches of engineering:

(a) Automobile
(b) Chemical
(c) Civil
(d) Communication
(e) Electrical
(f) Electro-mechanical
(g) Electronics
(h) Mechanical
(i) Mechatronics
(j) Metallurgy
Patents found under “Agriculture And Farming” are notably on animal husbandry, consumption, insecticide, fertilizers and soil there are patents on beverage production, biogas, biomass, brown rice, chilli powder, citrus peel, coconut, dehydrated ginger powder, dehydrated juice powder, dried cheese, fatless products, nutritional food, oil blend, pulses flakes, soya butter, soyabean, rabbit fur for leather.

Under Biotechnology, the patents could be grouped into apiculture, bio fuels, cosmetics, genetics, genome sequencing, haematology, herbals, insecticide, medicines, waste management, pharmacognosy, oncology, pesticide, dug preparation.

Only three patent documents were noted on Geography on pollution and ground water.

Information technology spanned ATM switches, digital networks, GSM, voice mail, dvb/dmb systems, social networking, mobile devices, telecommunication, transport protocols, e-commerce, vehicle utility device, altitude encode, biometric devices, payment platforms.

Patent documents on Pharmaceutical had a wide spectrum, covering cancer treatment, contraceptives, tuberculosis treatment, anti malaria, nutrition supplement, drug delivery system, anti-inflammatory, meal poisoning treatment, laxatives, antibiotic, antiviral, etc.

A handful of patent documents are on Space, encompassing rocket propellant, antenna, reflector, hypersonic flight, radar technology and aviation gasoline.

The spectrum of Engineering touches all walks of life like IC engine, water soluble bags, packing film, ceramic composites, insulating bricks, planetarium, concrete tiles, audio communication, phase lock system, moisture sensor, organic optoelectronic device, milk analyser, plasma generation, spectral images, anti surge system, solar light, domestic appliances.

The subject of “Utility” is created wherever the invention could not be pocketed in above core domains and which include personal and domestic things which are not eatables.
Cross-section of Innovation in Product, Process and Combination

PRE-LIBERALIZATION YEAR

JUST LIBERALIZATION YEAR

WELL LIBERALIZATION YEAR

LATEST & MATURE LIBERALIZATION YEAR
<table>
<thead>
<tr>
<th>Year</th>
<th>Level 1</th>
<th>Level 2</th>
<th>Level 3</th>
<th>Level 4</th>
<th>Level 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>1995</td>
<td>46</td>
<td>18</td>
<td>NIL</td>
<td>NIL</td>
<td>NIL</td>
</tr>
<tr>
<td>2000</td>
<td>48</td>
<td>182</td>
<td>104</td>
<td>10</td>
<td>NIL</td>
</tr>
<tr>
<td>2007</td>
<td>111</td>
<td>1150</td>
<td>97</td>
<td>28</td>
<td>NIL</td>
</tr>
<tr>
<td>2013</td>
<td>38</td>
<td>944</td>
<td>264</td>
<td>13</td>
<td>NIL</td>
</tr>
</tbody>
</table>
Cross Section of domain of Technology

PRE-LIBERALIZATION YEAR

1995

JUST LIBERALIZED YEAR

2000
WELL LIBERALIZED YEAR

LATEST & MATURE LIBERALIZATION YEAR
The level of innovation on a scale of 1 to 5 for the selected years exhibits marginally improving distribution. Furthermore, only 46 innovations out of more than 3053 patent applications barely qualify to be significant, and only 2 out of 46 are possibly at breakthrough level, which are:-

1. **239/MUM/2013** - Generation of electric power from human urine—a possible breakthrough once commercialized.
2. **3055/MUM/2013** - Generation of electric power from portable “wind” turbine, driven by artificial wind created due to moving turbine – an intelligent use of known technology by miniaturizing and using pseudo wind energy.

Innovations which scored 4 pertain to following fields:

<table>
<thead>
<tr>
<th>Field</th>
<th>No. of Patents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture and Farming</td>
<td>03</td>
</tr>
<tr>
<td>Biotechnology</td>
<td>14</td>
</tr>
<tr>
<td>Engineering</td>
<td>07</td>
</tr>
<tr>
<td>Information Technology</td>
<td>04</td>
</tr>
<tr>
<td>Pharmaceutical</td>
<td>15</td>
</tr>
<tr>
<td>Space</td>
<td>01</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>44</strong></td>
</tr>
</tbody>
</table>