Patent portfolio in terms of geographic distribution

Patents are a reflection of the technological capability and in a sense depict the scientific and industrial strength of a nation. To measure the proficiency of states in terms of patent filing for a three-year period, data was extracted from the respective year's annual reports of the Indian Patent Office. Gangan Pratap[1] has presented the relative performance of academic research in the states and Union Territories (UTs) of India with respect to GDP. In the same context, if the number of ordinary patents emanating during the same period is considered (2006–07, 2007–08, 2008–09), then the picture slightly changes.

Table 1. Share of patent output and GDP for various Indian States/Union Territories during 2006–2009

State/Union Territories	Total number of patents filed	Percentage share of patents	GDP US$ (billions)	Percentage share of GDP	Leverage
Andhra Pradesh	1,210	6.91	85.7	7.94	0.87
Assam	45	0.26	18.6	1.72	0.15
Bihar	45	0.26	32.7	3.03	0.08
Chandigarh	83	0.47	4.1	0.38	1.25
Chhattisgarh	42	0.24	22.7	2.10	0.11
Dadar and Nagar Haveli	1	0.01	0.1	0.01	0.62
Delhi	2,815	16.08	36.1	3.34	4.81
Goa	9	0.05	4.2	0.39	0.13
Gujarat	918	5.24	80.1	7.42	0.71
Haryana	342	1.95	44.2	4.09	0.48
Himachal Pradesh	35	0.20	8.9	0.82	0.24
Jammu and Kashmir	12	0.07	7.6	0.70	0.10
Jharkhand	328	1.87	17.5	1.62	1.16
Karnataka	2,282	13.04	62.9	5.82	2.24
Kerala	358	2.05	41.2	3.82	0.54
Madhya Pradesh	134	0.77	37.3	3.45	0.22
Maharashtra	5,533	31.61	175.3	16.23	1.95
Meghalaya	4	0.02	2.1	0.19	0.12
Mizoram	1	0.01	0.8	0.07	0.08
Nagaland	0	0.00	1.5	0.14	0.00
Odisha	53	0.30	31.8	2.94	0.10
Puducherry	3	0.02	2.8	0.26	0.07
Punjab	179	1.02	40.5	3.75	0.27
Rajasthan	120	0.69	46.3	4.29	0.16
Tamil Nadu	1,493	8.53	80	7.41	1.15
Daman	1	0.01		0.00	
Uttar Pradesh	481	2.75	103.5	9.58	0.29
Uttarakhand	71	0.41	9.9	0.92	0.44
West Bengal	905	5.17	76.9	7.12	0.73
Sikkim	1	0.01	0.6	0.06	0.10
Manipur	1	0.01	1.4	0.13	0.04
Tripura	1	0.01	2.6	0.24	0.02

The results of the ordinary patents filed from various states and UTs are given in Table 1. Maximum number of patents was filed from Maharashtra (31.61%) during the mentioned period, which also has a maximum GDP share of 16.23%. However, the leverage ratio of these percentages is just 1.95. Nevertheless, Maharashtra is the hub of many industrial units as well as academic institutions; yet the ratio puts it in the third place. Delhi which has many institutes of repute lies at the top on the leverage basis. Karnataka ranks second. All the larger states with higher GDP perform above this average, except Uttar Pradesh which was however not observed with the academic research output. Compared to the academic output, it seems that the patent output has a bearing on the vicinity of the patent office as well as the presence of patent-oriented industries. The states housing patent offices are among the top rankers as well, with West Bengal being an exception.

1. Prathap, G., *Curr. Sci.*, 2011, **101**, 715.

AVINASH KSHITIJ[1,*]
KIRTI JOSHI[2]

[1]*National Institute of Science, Technology and Development Studies, K.S. Krishnan Marg, New Delhi 110 012, India*
[2]*Uttarakhand State Council for Science and Technology, 6 Vasant Vihar, Phase I, Dehradun 248 006, India*
**e-mail: padainas*h*@gmail.com*

Future energy needs and renewable resources

The detailed analysis by Sukhatme[1] and the conclusions drawn are valuable and can be a good reference from time to time in future.

However, when looking at biomass power, we must keep in mind the alternative uses. The nexus between food, water and energy has to be viewed in detail. A country like India produces nearly 500 million tonnes of agro waste annually[2]. Such agro wastes are used (or wasted) in the following ways:

(i) Farmers have the tendency of burning such agro wastes and clear the farm for the next sowing. (This practice plays havoc with the soil microflora and environment.)

(ii) A small quantity as rural fuel wood.

(iii) Gasification for power generation.

(iv) Cellulose to ethanol. Superbug[3,4] using recombinant DNA-produced enzyme to break apart cellulose to produce sugars from straws of wheat, maize, etc.

The cellulose produced from such a biorefinery process is used to make greener versions of ethanol and plastics. Such a breakthrough will mean that a farmer could harvest two crops from every field, a grain crop and a biomass crop.

Agro wastes can be used as soil improver/fertilizer. For this, the post-harvest residue of cotton, castor, sugarcane trash, banana stems, etc. can be chopped *in situ* and sprayed with a microbial mixture. The consortia of microbes decompose it and convert it to useful soil nutrient, and also supply the much needed organic carbon for which our soils are hungry. Our chemical fertilizer utilization efficiency and economics are already badly affected due to lowering organic carbon in the soils of most of the states. Such an emphasis on agro waste use in farms will also help water-use efficiency.

We therefore need a much greater emphasis on this aspect as in the long run, even when we consider the aspects of sustainability, food will be of greater priority.

Lastly, though the author[1] arrives at the 'inevitable conclusion that renewable energy sources stretched to their full potential can at best contribute 36.1% of the total need' (by 2070), we must not forget the likely breakthroughs which can change the picture more favourable. Just two examples:

(i) Microalgae, as distinct from seaweed or macro-algae, can potentially produce 100 times more oil per acre than soybean or other crops, will be non-competitive with agriculture and can give much the needed breakthrough.

(ii) Another big hope will be organic/polymer solar cells. This is relatively a novel technology, but holds promise of a substantial price reduction and faster return on investment. These cells can be processed from solution and can be produced by roll-to-roll printing process, leading to inexpensive, large-scale production. With newer materials, their efficiency can dramatically increase.

Such new developments can hopefully raise the potential of renewable energy use more substantially than what is being predicted as 36%.

1. Sukhatme, S. P., *Curr. Sci.*, 2011, **101**(5), 624–630.
2. Mehta, M. H., *Curr. Sci.*, 2011, **96**(10), 1297.
3. Clinton, B., Bio-2006, Chicago, USA, 2006.
4. Mehta, M. H., *Agriculture Today*, August 2007.

M. H. MEHTA

The Science Ashram,
Gujarat Life Sciences,
Vadodara 390 016, India
e-mail: chairman@glsbiotech.com

Conservation of chironji and cultivation of off-season rainfed tomato

Sonbhadra District, a part of the Vindhyan zone, is one of the most backward districts of Uttar Pradesh[1]. Most of the people in this district belong to tribal communities/schedule caste. Their major sources of income are farming and collection and selling of minor forest-based products (as about 55.73% of the area is under forest; www.sonbhadra.nic.in.). Major crops are rice and wheat, but due to the lack of irrigation facilities, agriculture depends entirely on the monsoon leading to poor productivity of crops. Collection and selling of minor forest-based produce, especially chironji (one of the important multipurpose forest species) brings income to the local inhabitants. Chironji (*Buchnania lanzan* Spreng syn. *B. latifolia* Roxb), also known as char, piyal or achar belongs to the family Anacardiaceae (Figure 1). It is a subtropical, underutilized/underexploited nut fruit and is considered to be native to India. This multipurpose tree provides food, fuel, fodder, timber and medicine to the local community. It is a popular and edible nut fruit, eaten raw or roasted and also used in making dessert. Its kernel is rich in fat (59.0 g), protein (63–72%), starch (12.1%), minerals like calcium (279 mg), phosphorus (528 mg), iron (8.5 mg) and vitamins like thiamine (0.69 mg), riboflavin (0.53 mg), niacin (1.5 mg) and vitamin C (5.0 mg). It also contains 34–47% oil and provides nutrition to the local inhabitants[2]. During summer when green fodder becomes unavailable, local inhabitants use its leaf as green fodder for their animals, especially buffalo, goat and sheep. Its dried wood is utilized as a fuel. The timber of chironji is slightly resistant to termite and is utilized for making furniture, boxes and crates, desks, fine furniture, match boxes, mill work, moulding, packing cases, stools, tables and agricultural implements. Some parts of the plant are also used to cure diseases, for instance roots in diarrhoea, leaves for skin diseases and healing wounds, gum/resins in diarrhoea, and fruits in asthma and cough. Locals also earn money by collecting gum/resins and lac by rearing *kussumi* strain of lac on the chironji tree.

At present the plant is grouped as an underexploited and non-nationalized minor forest produce. It is free for collection, as a result of which the local inhabitants, traders and greedy merchants destroy the branches/whole trees during collection of its fruits without bothering about new plantations. This has led to the destruction of chironji plants in the forests. There is an urgent need to develop a

Figure 1. Foliage of chironji.