IPR and Seed Industry

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Intellectual Property Rights (IPR) and Plant Breeders' Right (PBR) are the most discussed and debated issues in the context of present day agriculture and seed industry. PBR is the right of the breeder to enjoy the benefits for a restricted period out of his novel and distinct cultivar. The WTO also provides that plant varieties must be protected by patents or by 

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system such as PBR provided under the UPOV, in which variety must have the novelty, distinction, uniformity and stability. The total cultivated areas under most crops are declining or stagnating and the yield performance of the seeds now used are below the potential. This led to the introduction of hybrid varieties by the government, private sector seed industries and farmers. With the increasing role of private seed companies, the private sector’s share is now more than 60% and the rest is contributed by the public sector. But with the intensification of IPR and PBR issues, the seed industry is moving through merger and acquisition phase to sustain future growth and to adopt new technologies by investing more in the R & D. TRIPS Agreement puts forth a test on PBR as it stipulates: “members shall provide for the protection of plant varieties either by patents or an effective 

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system or by any combination thereof”. UPOV conventions of 1978 dealt with rights of farmers, researchers and breeders, and 1991 convention directed towards breeders and placed restriction on the right to use of farm-saved seeds by farmers. The Indian Plant Variety Act (PVA) has considered both the Acts, in some of the aspects with some additional features. The PBR legislation must be simple and its implementation cost-effective and less-time consuming, as the seed companies in developing countries are typically small. The revised IPR situation may give boost to the scientific community, seed companies and put India in a respectable position in the global business arena as well as encourage inventions to make the Indian scientists competitive.
The most discussed and debated issue in the field of agriculture, science and technology today is IPR, specially patents and PBR. The Indian agricultural scientists, traders and politicians are in dilemma over how to protect our bio-wealth as well as breeders' right on the cultivars developed by him. On the other hand, the global concern is drifting agriculture into the commercial era, which is leading to further concerns for access, trade-related disputes and conventions. According to the WTO agreement, the foreign nationals will have access to our bio-wealth, and India as a member of Convention on Biological Diversity (CBD) has to oblige for providing access to our bioresources on equitable sharing basis to all stakeholders. The bitter experiences of patenting our bioresources by others are due to lack of strong protection strategy in the country. Unless the government formulates proper patenting strategies and promotes public awareness to this reality, we will be loser and the developed countries will exploit our valuable genetic resources.

The major advantage of our country is its varied agro-climatic zones, which helps us in evolving new crop varieties. India already experienced green revolution through increased productivity by developing new high yielding varieties. So, evidence is there that India has strengthened agricultural research through scientific infrastructure and achievements. After all the plant varieties used by the Indian farmers are indigenous, not foreign hybrids. India should use these advantages by developing proper protection system for the developed hybrids and varieties, and push our agricultural system to the status of an industry.

Sustainable agricultural growth cannot be achieved without agricultural research. India's investment in agricultural research has been stagnating at 0.32% of the total agricultural GDP in the last two decades. This does not compare well with 0.56% investment made by 51 other developing countries and an average of 2% by the developed countries. The history has shown that the impact of agriculture research is decisive. In the advanced countries private investment in agriculture research is increasing. Generally, the R&D expenditure of leading crop breeding agribusiness companies ranges from 8.3 to 14.8% of total revenue with an average of 11.5%. In general, it is felt that 5.7% revenue of a company, as minimum investment in R&D, is necessary to ensure an accepted level of competitiveness in the market place. The outlay of Indian seed companies in the R&D is about 2.6% of total turn over.

After green revolution, the increase in area under cultivation slowed down or stagnated, on the other hand the performance of the seeds now used are below their potential. The urgency to produce and procure hybrid and high-yielding varieties is felt by the government, private sector seed industries and the farmers alike. If Indian economy has to grow at 7% per annum, and also, if export base has to be expanded, the value of agricultural output must increase at an annual rate of 4.5% between 1997-2002. It was about 2.77% during the period 1980 to 1994. Growth rate during the 90s (2.4%) has been slower than the 80s (3.2%). There has been a deceleration in yield rate in respect of both food grain and non-food grains. To achieve high economic growth rate, employment opportunities and to remove the incidence of poverty, high growth rate in agriculture has been essential. Yields of crops have risen many folds but still the productivity level in India is much below the global average in most of the crops. We need to raise crop productivity by 200 to 500% to reach regional
benchmarks. Indian farmers can bridge this gap to match the international standards through the use of hybrid seeds and transgenic crops\(^2\). According to estimates, 93\% of the increased food production has to come from increased productivity per unit land.

**Transformation of Seed Industries**

The introduction of hybrid development in all the major food crops and vegetables has led the private seed industry to grow and mature. At present, hybrids account for 40-50\% of the sales of total commercial seeds and return most of the profit to private seed industry. The profitability of the hybrids was realized long back when double-cross maize hybrid was commercialized in the USA as early as 1930s. They were priced at approximately 10-12 times the price of the commercial varieties\(^3\). The introduction of single-cross hybrid in maize during 1960s pushed the price further, which led private seed industry to concentrate on hybrid development in key crops of agricultural importance.

During 1980s, due to the commercialization of hybrids leading to high profit margin in seed business, several agrochemical companies including Sandoz, Ciba-Geigy, Dupont, Monsanto and Unilever started acquiring small seed companies. But it did not work well, and again during 1990s they started diverting them towards seed and biotech business.

Genetic engineering is a technique to transfer a gene from one species to another and the outcome is transgenic product. This technique includes identification and isolation of DNA, its purification, cloning, vector construction, multiplication in stable host, transfer to target species, expression of target genes, stabilization of gene products in genetically-modified organism (GMO). The path from inception of agricultural biotechnology industry to field production of commercial products was full of obstacles, ranging from scientific and technological challenges, to legal and regulatory hurdles, to economic factors and social concerns. Slowly, the agrochemical-cum-seed companies are getting into biotechnology research as the transgenic product starts entering into market, and this convergence has changed the structure of the traditional seed business and product pricing. Therefore, attempts are being made to separate the value of technology from the value of seed in the form of a 'technology premium' to be paid by farmers when they purchase a product improved by biotechnology\(^3\). Getting IPR in case of transgenic plant product is very easy for a company and to block the development of a product to maximize value recovery, minimize litigation and access the technology such as Bt-based insect protection in cotton, maize, etc.

The new competitive strategies\(^3\) that likely to focus these areas in seed industry, in view of IPR and PBR, are as follows: (i) pricing based on separating the value of the technology from the values of the seed, (ii) market segmentation, (iii) product development — using classical breeding and genetic engineering, and (iv) sales and market distribution.

Between 1996 and 1999, 12 countries have contributed to more than twenty fold (23.5) increase in the global area of transgenic crops(Table 1). Transgenic crops were cultivated in an area of 39.9 million hectares during 1999. Adoption rates for transgenic crops are unprecedented and are highest for any new technologies by agricultural industry standards. Seven transgenic crops were grown commercially. The four principal
Table 1—Global area of transgenic crops (1996-1999)\(^1\)

<table>
<thead>
<tr>
<th>Year</th>
<th>Area (million ha)</th>
<th>Increase in Area (million ha)</th>
<th>Percentage</th>
</tr>
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<tbody>
<tr>
<td>1996</td>
<td>1.7</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>1997</td>
<td>11.0</td>
<td>9.3</td>
<td>547</td>
</tr>
<tr>
<td>1998</td>
<td>27.8</td>
<td>16.8</td>
<td>153</td>
</tr>
<tr>
<td>1999</td>
<td>39.9</td>
<td>12.1</td>
<td>44</td>
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</tbody>
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Table 2—Indian seed market\(^8\)

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<tbody>
<tr>
<td></td>
<td>Market size (Rs million)</td>
<td>%</td>
<td>Market size (Rs million)</td>
</tr>
<tr>
<td>Public sector</td>
<td>4,000</td>
<td>40</td>
<td>5,520</td>
</tr>
<tr>
<td>Private sector</td>
<td>3,500</td>
<td>35</td>
<td>11,170</td>
</tr>
<tr>
<td>Organized</td>
<td>2,500</td>
<td>25</td>
<td>3,500</td>
</tr>
<tr>
<td>Unorganized</td>
<td>20,190</td>
<td>22,000</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>10,000</td>
<td></td>
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</tbody>
</table>

countries that grew the majority of transgenic crops in 1999 were: USA (28.7 million ha.), Argentina (6.7 million ha.), Canada (4.0 million ha.) and China (0.3 million ha.). The balance was grown in Australia, South Africa, Mexico, Spain, France, Portugal, Romania and Ukraine. The global market for transgenic crop products has grown rapidly from $75 million in 1995 to $2.1 to $2.3 billion in 1999\(^1\). The global market for transgenic crops is projected to reach approximately $3 billion in 2000 and $8 billion by 2005\(^1\). As expansion of transgenic crops continues, a shift will occur from the current generation of "input" agronomic traits to the next generation of "output" quality traits to satisfy high value-added market.

**Indian Seed Business**

The major fallacy in Indian agriculture is that most of the farmers use the previous years farm-saved seeds rather than buying new seeds. With the increasing role of private seed companies the composition of Indian seed industry has reached a ratio of 60:40 between private and public sector by turnover\(^4\), though National Seed Corporation (NSC) has led the development of network for quality seed multiplication and supply. Consumption of seed, including farm saved seed, rose by as much as 7% in the last four years, although trends differ from region to region\(^5\). Seed market can be divided into three main categories—seed from government institutions, commercial seed, and farm-saved seed(Table 2). Each category accounts for roughly similar proportions of the total seed volume\(^6\). Presently, the seed industry is passing through a crucial phase of mergers and acquisitions to sustain future growth and to adopt new frontier technologies. The merger tendency of Indian seed
companies with big multinational corporations is mainly driven by need to invest more in the R&D and remain competitive in the race of developing genetically modified crops. The other reason forcing Indian seed companies to join up with MNCs is that the latter have enormous marketing muscle power.

Asia has become the world's largest seed consumer in 1990, and in 1994 the consumption was 43.2 million tonnes with an increase of 1.3 per cent/year. US companies are the largest foreign investors but the European investors are also trying to catch up the Asian seed market. The agrochemical companies of Europe are expanding their business into seed to capture the whole Asian market. European seed companies are also trying for joint ventures with the Indian seed companies for research and development, production, and marketing of these products in India.

The Indian private seed industry is also undergoing major changes in its organizational, functional, and operational structure to underline the emerging dynamism in responding to modern science and biotechnology-based innovations in seed development. The seed industry is dominated by the government policy that excludes farmers and seed producers, and the potentiality of Indian seed industry is held up by bureaucracy-scientist-politician syndrome. Though from market place the growth of Indian seed industry is seen vigorous, this growth has been achieved against heavy odds. From the industry side the complaint is wide spread—both the seed industry and farmers, the two vital links in the chain, are not parties to policy decisions.

**Merger Mania**

Indian seed industry is going through one of its greatest periods of change. They are scratching their heads to develop strategic tie-ups with MNCs to survive in the business. Why is this happening around the globe? The present combination of several life science activities into a single company is leading towards the strategic decisions for tie-ups. Life science companies (LSC) are the firms that use their knowledge of living organisms to produce seeds and agrochemicals for plant production, veterinary products for animals and therapeutic products for human health care. LSCs have invested heavily in biotech activities to combine application of knowledge derived from various life science disciplines. The earlier pharmaceutical sectors of creating chemical compounds have become biological industry with the growth of biological industry and biological knowledge through genomics. The knowledge of...
genomics is playing a key role in developing synergy between LSC and the technology, which can be used across the species boundaries. The genomics perspective developed the synergy to work in agriculture and pharmaceutical sectors, as there is scope for service in both the sectors. Now the competition between the seed companies is basically the competition between genes. Because of the genomics research the major game in the LSC is about the sequencing of the plant genome of important crops and the patenting of these newly discovered genes through functional genomic studies.

**IPR and PBR**

IPR provides the legal ownership to a person or company for a discovery or an invention and their exclusivity for commercial exploitation as well as right to protect the intellectual property like tangible property owned by one over a prescribed period of time. In Uruguay Round (1994) with these objectives of IPR, Trade-Related Aspects of Intellectual Property Rights (TRIPS) was established. TRIPS Agreement also no longer permits the free exchange of resources and restricts the unauthorized copying or imitation. TRIPS formulated the minimum standards for IPR about the patentable subject matter. TRIPS Agreement came into effect on 1 January 1995 and has to be implemented in phases by developed and developing nations.

Agreement on TRIPS puts forth a test on PBR as the TRIPS Agreement stipulates: "members shall provide for the protection of plant varieties either by patents or by an effective sui generis system or by any combination thereof". Thus, PBR system defined by the International Conventions for the Protection of new Varieties of Plant (UPOV) is presently the effective sui generis system for protecting plant varieties. The purpose of UPOV to ensure PBR is to have an exclusive property right on new plant varieties in order to provide incentive to the development of agriculture and to safeguard the interests of plant breeders and seed industries. The earlier Act of 1978 or revised Act of 1991 or both will be considered ‘effective’ is presumably subject to interpretation within the WTO.

The IPR laws are different in different countries; this creates obstruction in the international trade. Therefore, to solve the trade problems TRIPS Agreement was signed in the Uruguay round of GATT summit. In 1995, PBR legislation was enforced by 27 countries that were the members of the UPOV. India is not a member of the UPOV neither it has developed any sui generis system to protect the rights of the breeders. WTO provides that the plant varieties must be protected either by patents or by sui generis system such as Plant Breeders’ Right (PBR) provided under the UPOV. The model and guidelines are available in UPOV for a sui generis system for Plant Breeders’ Right (PBR) in which variety must have the novelty, distinctness, uniformity and stability. The lack of sui generis system or legal regime for PBR in India has kept her vast reservoir of natural genetic resources open to biopiracy.

The UPOV conventions of 1978 dealt with rights of farmers, researchers and breeders. It was revised in 1991, and most of the contracting countries are now on their way to implement the 1991 Act into their national laws. The 1991 UPOV convention directed towards breeders and placed restriction on the right of the farmers regarding use of the farm-saved seeds. The fourth convention of Germany endorsed the farmers’ right and
enabled the member countries to enact their own PBR according to their interest. Even though many countries are considering the PBR system, knowledge about its socio-economic implications is meagre. So far there are only a few studies carried out in the USA. The impact of PBR on socio-economic context has to be studied on the following aspects:

- Investment by seed companies in technology development and crop breeding.
- Access to the public germplasm collections/banks.
- International transfer of germplasm.
- Exchange of seeds among farmers.

The IPR issue has become a new element in the seed industry as all the transgenic seeds make use of several technologies for their development. Even in cases where a technology is novel and patented, it may be dependent on earlier developments, therefore, cannot be freely used even by the inventor. The IPR issue in case of transgenic is so called “freedom to operate” which can be defined as legal access to all technologies required to launch a product. As the progress is on for the development of transgenic crops having both input and output traits, the IPR issues will become much more complicated. The development of transgenics involves the rights related to PVR, plant patents; patents related to transformation technology, selectable marker employed, the target gene, the promoter, the regulator proteins, etc. Any single event can block the commercialization of the product and increase the cost for developing the seed business. The current restructuring of the seed industry is being technology-driven and influenced by IPR issues, the winner will be those companies who are able to deal with IPR issues and can quickly bring new quality products in the market.

**PBR—the Indian Version**

The Indian Plant Variety Act (PVA) includes elements of both the UPOV Acts (earlier 1978 Act and revised 1991 Act) with some new features (Table 3).

**Special Features**

(a) Protection of “essentially derived varieties”

The Indian PVA has considered both the Acts, in some of the aspects with some additional features, such as PVA also covers the protection of “essentially derived varieties”. This clause restricted the marketing of a newly developed variety if it is genetically similar to a protected source variety and demands authorization from the breeder who has protected it. Introduction of this principle of ‘essential derivation’ strengthens the protection of existing protected variety. Then the question came how to determine the “essentially derived variety”, which needs clarification further.

(b) Community and Farmers’ Right

The term farmers’ right has been coined to recognize the rights of farmers over their contribution to conservation and crop development and the sharing of their knowledge on adaptive traits. The concept of farmers’ right is defined by FAO Commission on Plant Genetic Resources for Food and Agriculture as: “rights arising from the past, present and future contributions of farmers’ on conserving, improving and making available plant genetic resources, particularly those in the context of origin and diversity.” PBR under UPOV excludes the farmers from producing and exchanging the seed material except only with the permission of
Table 3—Comparison of Indian PVA with the UPOV 1978 and 1991 Acts

<table>
<thead>
<tr>
<th>Features</th>
<th>UPOV 1978</th>
<th>UPOV 1991</th>
<th>Indian PVA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breeders’ scope</td>
<td>Production and marketing of propagating material</td>
<td>Production, marketing, export, import and stocking of propagating material</td>
<td>Production, marketing, export, import and stocking of propagating material</td>
</tr>
<tr>
<td>Extent of coverage</td>
<td>Minimum of 24 species</td>
<td>Minimum of 15 species</td>
<td>All species</td>
</tr>
<tr>
<td>Protection period</td>
<td>15 Years</td>
<td>20 Years</td>
<td>15 Years</td>
</tr>
<tr>
<td>Exception to right</td>
<td>Farmers’ privilege in practice</td>
<td>Farmers’ privilege optional and under conditions</td>
<td>Farmers’ Right specially recognized</td>
</tr>
<tr>
<td>Compulsory licensing</td>
<td>Not defined</td>
<td>Not defined</td>
<td>In case of public interest, defined as reasonable availability of seeds and supply of export marketing</td>
</tr>
</tbody>
</table>

the concerned breeders. Therefore, in adoption of PBR, the farmers’ practices of seed multiplication would be illegal and can be considered as theft. In 1978 Act, this is allowed as farmers’ privilege, but in the revised Act (1991), this privilege was made optional for the member States because of the interest of private seed industry. One condition henceforth is that “legitimate interests of the breeder,” i.e. the royalty that should be paid to the breeder, are taken care of. The implications of UPOV 1991 became visible in USA on this aspect and the US Congress restricted the farmers’ privilege by amending the US Plant Variety Act, 1994.

The Indian PVA goes beyond, and allows the farmers’ privilege since it explicitly recognized community and farmers’ right by including a specific clause on this issue. The violent oppositions from farming community in some parts of the country against IPR forced to include this clause. The draft legislation for PVP and Farmers’ Rights Act and Biodiversity Act has been developed for adoption. India will be the first country to legalize these Acts and this will be a distinct sui generis system for IPR when it will be implemented. India will be the first country, which will facilitate the breeders in terms of PBR legislation in which support for and rights of farmers and farming communities are specifically provided for. Consequent upon this clause, the main problem for India will be that there is no international agency duly-acknowledged by the Food and Agriculture Organization (FAO) to oversee the functioning of these legislation world wide.
nities where seed is the property of the community and does not belong to any individual. If IPR is given to any individual, it should not lead to exploitation of the germplasm identified by the farming community. To be able to respect farmers’ right, operational procedures to recognize and reward the contributions of the farming communities need to be developed.

Need for PBR

The plant breeders work for step-wise improvement of existing varieties, through crossing and selection, to attain the desired properties. The recent molecular tools help in more efficient selection of the desirable traits. Otherwise, the process of plant breeding is time-consuming and difficult. Plant breeding is a form of technical advance that is particularly natural, and it is proper for a society to encourage it by providing protection by IPR. In the next 40 years the world population will be 8.5 billion and to feed it the world must triple the agricultural output to meet the inevitable demand. Without higher yields and new developments, tripling farm output would not leave any room for wild lands and habitats. Tripling and quadrupling the yields per unit in a short span will require breakthroughs in plant breeding, pest control methods, and post-harvest management and preservation.

For long time, the IPR is already there in inventions of software, music, movies and books as an incentive for the creator of these products. The world must protect the IPR in agriculture effectively enough to encourage major new investments in the R & D by the private sector. The world must marshal all of its agricultural potential if it wants to save its wild habitats in the 21st century especially through effective protection for IPR in agricultural research.

The plant breeders need protection for their varieties because of their effort and the ease with which varieties developed and can be multiplied. In the developing countries like India the budgetary constraints in public sector encouraged plant-breeding research in private sector. Unless their right is protected the survival of private seed companies in seed research, development and distribution will be difficult. It is also important for the government to protect its own investment in the public sector R & D. The breeders’ exemptions should be maintained in IPR legislation as progress in plant breeding has been possible because of free exchange of germplasm and its restrictions will adversely affect further breeding progress. The farmers’ privilege is also essential because for centuries farmers have selected and conserved the land races, which serve as basis for modern crop breeding. The PBR legislation must be simple and its implementation cost-effective and fast as the seed companies in developing countries are typically small, family-owned business, the costly system will not allow them to compete with MNC. Without proper protection of the genetic material no private sector seed company is going to put its effort and money in the R & D because in that case the return cannot be assured.

In view of India’s commitment to TRIPS Agreement, implementation of new patent act was a must before the deadline fixed by WTO, i.e. 22 October 1999. The amendments in the Patent Act are product patenting provisions from 1 January 1995, and exclusive marketing rights (EMR) to the applicant for a period of five years. So far, the country’s patent laws are not in tune with the TRIPS nor accepted by the Dispute Settlement Board. The implementation date of TRIPS (19 April 1999) for India has already
Table 4—Apprehensions on IPR

<table>
<thead>
<tr>
<th>Misconceptions</th>
<th>Realities</th>
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<tbody>
<tr>
<td>- Farmers would lose the right to use and exchange</td>
<td>- Farmers will have complete freedom to do</td>
</tr>
<tr>
<td>seeds</td>
<td>so</td>
</tr>
<tr>
<td>- Breeders would not have free access to the gene</td>
<td>- ‘Breeders’ exemption’ will have access to</td>
</tr>
<tr>
<td>pool of patented varieties</td>
<td>the protected variety or genes</td>
</tr>
<tr>
<td>- It will lead to higher prices of food</td>
<td>- Price mechanism is controlled by government</td>
</tr>
<tr>
<td>- Shifts in cropping system</td>
<td>- It is based on farmers prerogative &amp; natural</td>
</tr>
<tr>
<td>- MNCs will drive out domestic industries</td>
<td>conditions</td>
</tr>
<tr>
<td></td>
<td>- Domestic companies have home advantage</td>
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expired which has put it in an odd situation. Now, the country has no choice except accepting the amended Patent Law and to abide by the WTO guidelines. Apprehensions on IPR are listed in Table 4.

**Conclusion**

The growth of biotechnology has enormous implications for developing new varieties and technologies, which have an impact on agriculture and medicine. Transgenic crop will play a major role for food and nutrition security of the developing countries in the new millennium. The private sector has to play the vital role to bring down the technology to the poorest farmers to reap the benefits of this technology. Until and unless the rights of the product are protected, private sector will not take any initiative. If India wants to take advantage from it, the proper protection system and a clear understanding of the policy on what is and what is not patentable are needed. The future of agriculture depends on the development of biotechnology and eco-friendly products such as biopesticides, biofertilizers, etc. and this is the area where India needs much more attention regarding research and development as well as its proper protection strategy. These technologies should be used to complement the traditional methods for enhancing productivity and quality rather than to replace the conventional methods. This technology will encourage the private sector to motivate research on the so-called ‘forgotten crops’ and traditional open-pollinated varieties and pure lines as most of the farmers use these seed and save them for next season sowings. It may lead competition among the companies to invest more in the research on these open-pollinated varieties and pure lines. It will also stimulate a diverse and competitive market place of more improved varieties for farmers to choose from. It will ultimately benefit the farmers and the nation in terms of food security.

The revised IPR situation may give boost to the scientific community, private seed industries and put India in a respectable position.
in the global business arena by providing equal platform with the developed nations. In the long run, the better protection of patent encourages inventions and makes the Indian scientists competitive by exposing them to new challenges. Patenting is one way to measure the efficiency of our research and development. The absence of proper patent protection system may be one of the major limitations to get benefits in future. The probable benefits are easier accessibility of latest technology and products of word standard, better employment opportunities and proper utilization of scientific community as well as increase in investment by foreign companies and the private sector. The biggest incentive that the policy framework could provide is the removal of excessive multiplicity of legislation and regulations, which causes delay, increased unethical practices and adds cost to the detriment of the farmers’ interest. The fact is that India must avoid taking extreme decisions if it has to integrate itself with the world economy, otherwise we will be alienated in the global economy.

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