POLICY BRIEF 10

IPRs AND AGRICULTURAL TECHNOLOGY : INTERPLAY AND IMPLICATIONS FOR INDIA

Backdrop:

Technology will drive future growth in Indian agriculture. In order to push the frontiers of productivity, generation and harnessing of state-of the-art agricultural technology becomes inevitable. A just system of incentives, reward and recognition is characteristic of an effective R&D system. This demands appropriate investment in agricultural R&D. Studies have indicated impressive rates of return to investment in agricultural research. An effective and equitable Intellectual Property Rights (IPR) regime will attract greater investment. IPRs also impact trade relation between countries in myriad ways. Inter alia, technology development and its transfer, foreign direct investment, trade flows and rent transfer are influenced by IPRs. India is taking cautious but steady steps towards heralding IPR regime in agriculture. Various bills governing different IPRs are in place or are in the pipeline. A debate on the interplay between IPRs and agricultural technology and its implications for Indian Agriculture would be relevant at this juncture. The interplay will determine the contours of agricultural R&D in years to come. How this interaction will shape the research portfolio and the implications thereof? Who will be impacted and in what ways? These and other related questions are the focus of this brief.

IPRs and Agricultural Technology: Interplay

Contrary to popular perception, the consequences of according protection are not simple and straightforward. Their manifestations are multitudinous and intricate. Three situations are likely to emerge:

1. Technology development facilitated by IPRs: The onset of protection will lead to the emergence of two distinct investment pathways in R&D. In the first scenario, current research and development efforts will receive a major boost and technology development processes will be accelerated without drastic changes in the research paradigm. Plant breeding efforts to produce hybrids is a case in point, which is likely to spread to newer crops. The second scenario relates to areas in which fresh private investment will be driven just because protection is guaranteed. A case in point is the HYVs, here private investment is bound to take-off especially in pulses. Besides, investment in technology development and transfer in inputs like feed, vaccines, and-pesticides will witness increased activity. While the public sector will concentrate on basic research, the private sector will focus on applied aspects

2. Technology development driven by IPRs: The degree and nature of protection inter alia, will influence investment behaviour in terms of magnitude and pattern. The new regime necessitates a mechanism for regulation, monitoring, and dispute settlement. A class of technologies will emerge; therefore. A good example is the growing awareness and expanded investment in the DMA Finger printing technology, since varietal identification is a pre-requisite for according protection as well as to settle disputes. This can happen either in the public or in the private sector. Currently, in the private sector a paltry 0.5 percent of the net profits are ploughed back into R&D. This figure is likely to be much lower in agricultural R&D. The new IPR regime will influence investment decisions in two ways. First, private firms will be compelled to increase outlays for research, which may lead to innovations. Second, increased technology transfer through joint ventures (read equity participation) and/or mergers and acquisitions between domestic and foreign firms.

3. Technologies that influence 4PR&: An extreme but realistic scenario is one where technologies are developed to overcome operational difficulties in seeking protection. Technologies that are likely to render the very framework of IPRs redundant are in the pipeline. Improvement in crop varieties contributes maximum to growth in productivity and other technologies revolve around this. Considering the enormous investment that goes into variety development, investors target market on a global scale. Therefore, innovators are developing technologies that help overcome operational difficulties in seeking protection for their novel varieties with or without a strong IPR regime. Such technologies are collectively called as Genetic Use Restriction Technologies (GURTs: Box). A number of patents have already been issued for such technologies. Considering the worldwide opposition by NGO's and farmer groups, many countries have placed a moratorium on the introduction and use of such technologies till adequate research data is available. The government of India, has for instance banned the "terminator technology", as reflected in the proposed plant varieties and farmers' rights bill, 1999.

Table:
Categorisation Matrix of Interplay and Implications

Technologies	**Intellectual Property Rights applicable**	**Investors/Actors**		**Implications**		
		Public	**Private**	**Social**	**Economic**	**Ecological**
A. Crop Improvement Technologies						
Conventional Breeding	Patents. PBRs, TM, TS	***	*	++	++	-
Agricultural Biotechnology	Patents, PBRs, TM, TS	**	***	++	++	--
Agro-chemicals	Patents, TM. ID	***	*	++	++	---
Knowledge Based Technologies	Patents & CR	***	*	++	+	+
B. Crop Protection Technologies						
Conventional Breeding	Patents. PBRs, TM	***	*	+	++	++
Agricultural Biotechnology	Patents, PBRs, TM	*	***	+ -	++ -	+ -
Agro-chemicals	Patents & TM	*	***	- +	-M- -	---
Kknowledge Based Technologies	Patents & CR	***		+	+	+
C. Natural Resource conservation technologies						
Soil & Water conservation	Patents & CR	***	*	++	++	+++
Genetic resources conservation	Patents. Geographic appellation	***	*	++	++	+++
D. Machinery-based technologies						
Farm Machinery & Power	Patents. ID & TM	•	***	- +	++	+ - -
Post-Harvest Technologies	Patents. ID & TM	••	•	++	++	++
E.. Livestock and Fisheries	Patents. PBRs. ID. CR. TM	**	••	++ -	++	--

Source: Authors

NOTE: 1. Number of asterisks denotes the magnitude of impact.
2. Number of +'s and -'s represents the magnitude of positive and negative impacts.

Read: crop improvement (that enhance yield) and crop protection (that prevent yield loss).

BOX: Genetic Use Restriction Technologies (GURTs):

Products of GURTs are crop varieties with traits whose expression is under the external chemical control. The traits may be germination, viability of seeds, flowering, nutritional and flavour qualities, resistance to diseases, pests and herbicides, sterility and fertility restoration (for hybrid production) etc.... Seeds in possession of the farmers will be useless, if they don't buy the prescribed chemicals and use in the appropriate time, thus producing their seeds every year on their own but compelled to buy the chemical season after season. GURTs 3C not try to prevent unauthorised use o? seeds, but ensures profits from every user of the seeds, authorised or unauthorised. Foolproof biological protection that is embodied within the product renders the legal protection of the ownership completely redundant. Due to its controversial nature, the subject has been discussed already at various international forums viz.. Food & Agricultural Organisation commission on Genetic Resources for Food and Agriculture, Rome, Consultative Group on International Agicultural Research, Beijing, United Nations Commission Trade and Development; Subsidiary Body on Scientific, Technical and Technological Advice of the Convention on Biological Diversity, Montreal and is slated to be a major issue during the Trade Related Intellectual Property Rights review in World Trade Organisation.

Canvas of the Interplay:

The above table attempts to categorise agricultural technologies in the scenario of protection. One or more types of IPRs govern agricultural technologies. Hence, their grouping according to nature of protection is relevant to understand and appreciate probable stakeholders and the plausible impacts. Here, agricultural technologies are grouped under different heads and we explain the heuristic table by taking up two examples. One from the crop improvement and the other from the crop protection head.

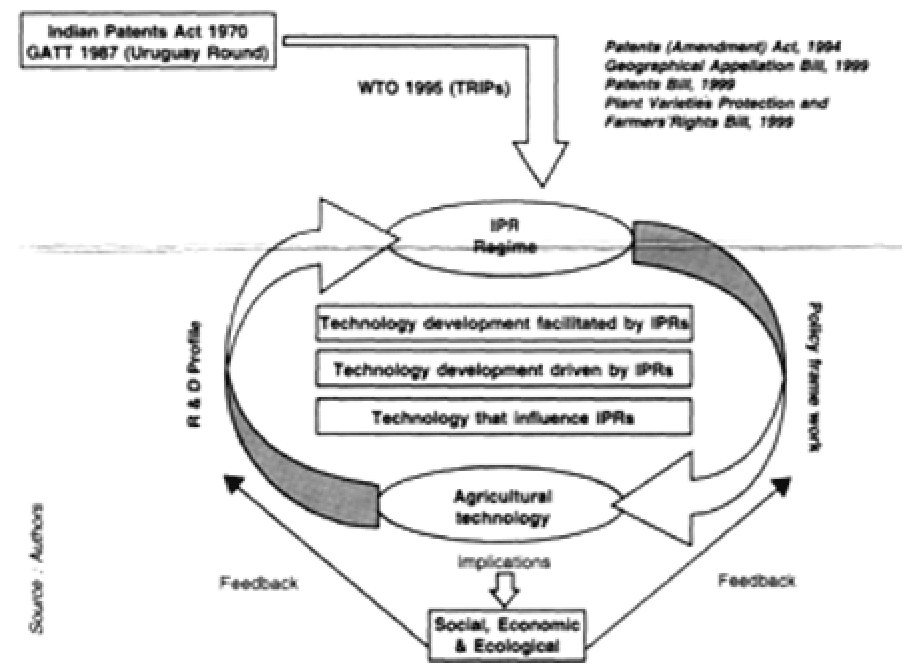
Plant Breeding and Agricultural Biotechnology : The nucleus of green revolution was HYVs resulting from conventional breeding techniques. Later, hybrids signalled the arrival of modem breeding. Agricultural biotechnology, a frontier area, has the capability to stretch the yield potential further. This can be achieved either through complementing crop breeding or by plant genetic engineering per se. Conventional breeding and agricultural biotechnology are good examples of embodied technology. Patents, Plant Breeders Rights (PBRs), trade secrets (TS) and trademarks (TM) govern protection of processes and products of breeding and biotechnology. Patents are often issued to plant varieties, genetic engineering techniques, isolated DNA sequence, gene constructs and newly transformed plants in the industrialised countries. This scenario is unlikely to evolve in our situation. PBRs will be the predominant instruments through which protection will be awarded to propagating materials of plant varieties. Trade secrets are accorded for plants for therapeutic purposes and for parental lines of hybrids. Trademarks go along with the other three forms of IPRs especially in the marketing of products like improved seeds and other inputs. The introduction of IPR regime will not alter the predominant role of the public sector in crop improvement programmes. New players are unlikely to venture into basic breeding programs as this entails access to Plant Genetic Resources (PGRs), huge investments (read infrastructure like farms and trained work force) and long gestation periods (on returns to investment). However, trans-boundary transfer of such products is a distinct scenario. Introduction of protection will kick-start private investments in activities relating to agricultural biotechnology. Returns to investment here are faster, higher and assured in relation to conventional breeding. Private sector will be interested in crop protection technologies rather than crop improvement technologies. Techno-economic feasibility is the criterion that determines such investment behaviour. The protection regime will therefore strengthen the role of private sector in agricultural biotechnology research. The proposed bill provides protection only to plant varieties and not to microbes, genes and DNA constructs.

Agro-chemicals: Higher production and better income can also be achieved by the application of external inputs like fertilisers, insecticides, pesticides, weedicides and growth regulators. Patents, trademarks and industrial designs (ID) protect processes and products relating to agrochemicals. Concerning fertilisers, the public sector will continue to dominate the scenario even after the introduction of IPRs regime. This is because of the regime's control over the raw materials, pricing and existing market structure. The reverse holds true for insecticides and pesticides because of the nature of the products and market potential. The rate of innovation concerning bio-fertilisers and bio-pesticides will be faster in the private sector. The table is self-explanatory and similar inferences can be drawn for other technologies under different groups.

Implications of IPRs and Agricultural Technology:

The dynamics and interplay of IPRs and technological innovations have multiple impacts. These can be categorised into social, economic and ecological. Due to peculiarities of Indian agriculture, the magnitude of these impacts will be manifold. The IPR regime not only influences research portfolio but also the contours of technology development. Primarily, the underlying motive of protection is to share profits with innovators. Therefore, the economic implications are not only predominant but also most obvious. The other two implications of access to newer technologies are on social and ecological dimensions. These three impacts are not mutually exclusive and often overlap.

1. Social implications: Social impact of new technologies is manifested in terms of its influence on equity. Other important issue pertains to "scale effect". These issues can be explained by the illustration of Green Revolution. This seed-fertiliser technology was predominantly applicable in the areas with assured irrigation. These technologies contributed to the widening of the regional disparity. Viewed from a macro-perspective however the revolution was a great success that helped realise cherished goal of self-sufficiency in food grains. Therefore, the magnitude and nature of social implications vary according to the category of the technology (Table). Knowledge based technologies and technologies concerning conservation of natural resources have positive impact on the society. Because of their nature (public good), the net social welfare increases manifold. Certain technologies like HYVs and hybrids require intensive input use and therefore have a mixed impact on the society. The predominant positive impact (++ -) clouds the negative effects. Yield enhancement by conventional breeding is an ideal example.



By the same yardstick, if conventional breeding aims at preventing yield loss (pest and disease resistant varieties) it becomes cost-reducing and has no negative impact (+). There are technologies where the negative component impact is marked (- +). Current levels of technologies (and its costs) in farm machinery and power precludes their accessibility to small and marginal farmers. There is a distinct possibility that in the near future farm machinery is tailor-made to suit smallholdings?

2. Economic Implications: Most technologies, excluding agricultural biotechnology and crop protection chemicals have a net positive impact on the economy. There are also implicit benefits like savings from potential losses due to pests and diseases. Newer techniques invariably shift production functions thereby improving income of individuals and that of the nation. Research in the public domain will concentrate in cost-reducing technologies that are helpful to the weaker sections. Conservation of genetic resources have huge positive externalities (both intra and inter generational). Considering the market structure of crop varieties and crop protection chemicals and the nature of potential technologies; the scope for market malpractice such as monopoly and cartelisation is real. Generally embodied technologies are likely to have relatively more apparent impacts. Active presence of the public sector is vital for the provision of disembodied technologies.

3. Ecological Implications: Increased use of agrochemicals will accelerate environmental degradation (- - -). Though biotechnological innovations minimise the use of agrochemicals to some extent (+ -), they are feared for their contribution to gene pollution (- ??). Development of such resistant varieties by conventional breeding has no negative impacts (++). Any technology encouraging the use of improved varieties is likely to contribute to narrowing of genetic base (-). Increasingly, the use of antibiotics, hormones, unconventional feeds and genetic engineering in livestock and fisheries have raised questions about health hazards and animal biodiversity (- -). Destruction of soil structure and groundwater depletion are serious ecological risks associated with the excessive use of technologies associated with farm machinery and power. Technological advancements in the conservation of soil, water and genetic resources have profound positive impacts on the ecology (+++).Being locally evolved and practice based, Knowledge based technologies optimise resource use thereby imparting positive externalities to the environment.

Parameters of the Debate

In the new millennium, the research paradigm will undergo significant transformation. The interplay of IPRs, technology development and transfer will determine the research contours and portfolio. This interplay is a dynamic process with one to one, one to many and many to one interaction. There is no deterministic "cause and effect" relationship in this process. Availability of protection inter alia is a crucial determinant of technology development and transfer. The magnitude of investment, kind of technology, pace of technology development and transfer and possible actors will be influenced by the nature of the IPR regime. In order to visualise the likely scenario in the agricultural R& D, gaining more insights into the IPRs and related aspects is inevitable. A realistic speculation of plausible scenarios attempted is however, subject to and dependent on the policy framework. While, the patents (amendment) and plant varieties & farmers' rights bill have been referred to a select committee of the parliament; the geographic appellation bill has been approved. Adequate clauses to safeguard the interests of the society in general and farmers' and researchers in particular have been included in the plant varieties & farmers' rights bill. Another highlight of the bill is the provision of "compulsory licensing" and the clause relating to the "protection of the security of India". The plant varieties & farmers' rights protection authority is the institutional response to the new regime. Constitution of a national gene fund to address issues of benefit sharing and the conservation and sustainable use of genetic resources is another feature. Food security-in terms of availability and accessibility continues to be a national priority. Rapid technological advance holds promise to break productivity barriers. Against such a backdrop the dynamics of the interplay between the protection regime and agricultural technology needs thorough understanding (Diagram). IPRs is one of the important determinants of technology development, transfer and dissemination. Institutional arrangements to keep pace with the developments of the new regime are necessary. Appreciation and understanding the intricacies in its manifold dimensions is the first in a series of steps to equip us in addressing the process of change.

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