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INDIA'S PLANT VARIETY AND FARMERS' RIGHTS LEGISLATION: POTENTIAL IMPACT ON STAKEHOLDER ACCESS TO GENETIC RESOURCES

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ABSTRACT

The demand for extending intellectual property protection to agriculture in developing countries has met with counterclaims for granting farmers' rights. Developing countries are currently attempting to fulfill these demands by evolving new IPR regimes that simultaneously protect the rights of breeders and farmers. What are the possible implications of establishing such a system of multiple rights on the utilization and exchange of genetic resources among various actors? Could the attempt to distribute ownership rights to various stakeholders pose the threat of an 'anticommons,' where resources are underutilized due to multiple ownership? The answers to these questions have important implications for the future of agricultural growth in developing countries.

India is one of the first countries in the world to have passed a legislation granting rights to both breeders and farmers under the Protection of Plant Varieties and Farmers' Rights Act, 2001. The law emerged from a process that attempted to incorporate the interests of various stakeholders, including private sector breeders, public sector institutions, non-governmental organizations and farmers, within the property rights framework. India's Act allows four types of varieties to be registered reflecting the interests of actors: New Variety, Extant Variety, Essentially Derived Variety and Farmers' Variety. Although this multiple rights system aims to equitably distribute rights, it could pose problems of overlapping claims and result in complicated bargaining requirements for utilization of varieties. A potential implication is an 'anticommons tragedy' where too many parties independently posses the right to exclude giving rise to underutilization of resources.

India and other developing nations, in seeking to achieve the important goal of recognizing farmers' rights, must not overlook the need for promoting exchange of agricultural resources. India's Plant Variety and Farmers' Right Act is significant both in the domestic and international context as several other countries are trying to establish similar legislations. Advanced nations must recognize that compelling developing countries to grant breeders rights could result in systems that run counter to their interests. Developed and developing countries must make a concerted effort to ensure that emerging IPR regimes do not restrict stakeholder access to genetic resources.

Keywords: Farmers' Rights, Intellectual Property Rights, Plant Breeders' Rights, India.

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Anitha Ramanna[•]

1. INTRODUCTION

India is one of the first countries in the world to have evolved an intellectual property rights legislation simultaneously granting rights to both breeders and farmers. The Protection of Plant Varieties and Farmers' Rights Act, 2001, establishes a unique system by extending the concept of Plant Breeders' Rights (PBRs) currently applied to new varieties of breeders, to varieties held by farmers', NGOs and public sector institutions. The law emerged from a process that attempted to incorporate the interests of various stakeholders, including private sector breeders, public sector institutions, non-governmental organizations and farmers, within the property rights framework. While the Act is based on the important principle of distributing ownership rights in a fair and equitable manner, the assigning of multiple rights could pose several obstacles to useful utilization and exchange of resources. If the system is not carefully structured, a 'tragedy of the anticommons' situation could arise. The tragedy of the anticommons refers to *underuse* of resources arising from multiple ownership or rights to exclude others from use. It occurs when governments grant too many people rights over a resource with no one having an effective privilege of use.

This study attempts to evaluate the potential implications of India's Plant Variety and Farmers' Rights Act on stakeholder access to genetic resources. The study focuses on

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two aspects: firstly, the political economy of India's legislation as an attempt to satisfy various interests, and secondly, the possible implications of this process on utilization and flow of resources between actors. As the law is yet to be implemented and many aspects are subject to interpretation, the study is an exploration of possible outcomes. The potential implications of India's law have global significance as many developing countries are in the process of evolving similar legislations.

The study is divided into the following sections. The first part of the paper provides the background by describing the framework of the study and outlining the international development of Plant Breeders' Rights and Farmers' Rights. The second part focuses on the political economy of the legislation analyzing the role of various actors in shaping the law and describes India's policy change on PBRs and farmers' rights. The final section evaluates the legislation on the basis of its potential impact on stakeholder access and on the flow of resources between actors. It also provides a brief summary of the policy implications.

2. FRAMEWORK

India's policy change on IPRs resulted from a political bargaining process that attempted to appease a number of different interest groups. In so doing, it may have led to the allocation of ownership rights in a manner that focuses on specific interests but overlooks general welfare. One potential implication is an anticommons tragedy. The anticommons tragedy, as measured in nonrealized economic value takes the form of under usage rather than over usage of a resource (Buchanan and Yoon 1998). Decades ago, Garret Hardin introduced the metaphor 'tragedy of the commons' to explain the problem of *overuse* of shared resources. In contrast to the commons model, in the anticommons

situation, too many parties independently possess the right to exclude, giving rise to underutilization—tragedy of the anticommons (Aoki 1998). "Anticommons" is a useful metaphor for understanding how and why potential economic value may disappear into a 'black hole' of resource underutilization, a wastage that may be quantitatively comparable to the over utilization wastage employed in the conventional commons logic (Buchanan and Yoon 1998). Heller and Eisenberg (1998) pointed out the potential for an anticommons situation in patents in biomedical research due to the existence of too many owners holding rights to previous discoveries which could constitute obstacles to future research and lead to fewer useful products for improving public health. The anticommons metaphor is applied in this study to point out that India's new IPR regime grants rights to multiple users and therefore could present impediments to effective utilization of resources.

3. INTERNATIONAL DEVELOPMENT OF PLANT BREEDERS' RIGHTS AND FARMERS' RIGHTS

India's legislation adopts two systems that were developed at the international level: plant breeders' rights and farmers' rights. India borrowed some aspects of these regimes but also modified them within its Act. This section provides an introduction to the emergence of plant breeders' rights and farmers' rights globally.

Plant Breeders' Rights (PBRs): Plant breeders' rights (PBRs) are a special form of IPRs created to provide incentives for the seed industry. Breeders led the move to evolve plant breeders' rights as an alternative to patents (the main form of IPRs for industrial innovations) because of the political opposition to extending patent protection to

plants and legal complexities of defining plant varieties (Rangnekar 1998). The initial move to harmonize plant breeders' rights emerged with the UPOV (Union pour la Protection des Obetentions Vegetales) in 1961. The plant breeders right as defined by UPOV is an exclusive right over the commercial production and marketing of the reproductive or vegetative propagating material of the protected variety. This right was less stringent than patents as it allowed for: 1) research exemption (a protected variety may be used in competing breeding programs as long as subsequently derived varieties do not require the repeated use of the protected variety for its production) 2) Farmers' Privilege: use and exchange of saved seeds allowed but not sale of seeds.

In 1991 UPOV was revised to increase breeders' rights by including the notion of essentially derived variety and making the farmers' privilege optional. Accordingly under UPOV 1991, an "essentially derived variety" (a variety that is predominantly derived from the initial variety itself) which fulfils the normal protection criteria of novelty, distinctness, uniformity and stability, may be the subject of protection but cannot be exploited without the authorization of the breeder of the protected variety. (http://www.upov.int/eng/protectn/derivatn.htm). Through the notion of EDV the breeder can widen the technological territory (Rangnekar 1998). In addition, the exemption granted to farmers in the 1991 has been reduced to an optional clause left to states to decide on its implementation (Rangnekar 1998).

Plant Breeders' Rights were initially adopted only in industrialized countries and most developing countries did not grant PBRs. The demand for extending PBRs in developing countries arose with the conclusion of the TRIPs (Trade Related Intellectual Property Rights) Agreement in the WTO. Differences between US and Europe led to

confusion over the type of protection for plant varieties that should be found in TRIPs. Therefore TRIPs clause dealing with plant varieties was left vague calling for countries to provide "effective *sui generis* system" for plant varieties. This led to debate on the nature of the plant variety system that developing nations should adopt to conform to TRIPs. Industry wanted the provisions in UPOV 1991 Act to be the founding principles for TRIPs. Industry attempted to interpret the clause as UPOV 1991 as it stated, "ASSINEL recommends that in developing countries the 'sui generis' system agreed upon in the TRIPs agreement should be an UPOV-like system shaped upon the 1991 Act of the UPOV convention". (www.amseed.com). However, enormous protest from NGOs and farmers' lobbies worldwide prevented an interpretation of the 'sui generis' clause as UPOV.

Farmers' Rights: Farmers' Rights have generally been devised as a counter to breeder's rights. Farmers' Rights are based mainly on the idea that farmers also contribute to agricultural innovations and deserve recognition and rewards just as breeders do. The notion of farmers' rights' is particularly relevant in developing countries, as the traditional division between breeders and farmers doesn't exist as it does in advanced countries. In most developing countries, farmers are a main source of seed supply and a large amount of the seed requirements are met through farmer-to-farmer exchange. NGOs and farmers' lobbies have been able to raise significant protest against adopting plant breeders' rights as found in advanced countries due to this role of farmers in developing nations.

The definition of Farmers' Rights' has not been clearly articulated and has undergone several changes. There are three basic aspects of Farmers' Rights:

1. Farmer's Privilege: Referred to as the farmers' exemption under UPOV 1961, it essentially provides an exemption for farm saved seeds by farmers under plant breeders' rights. Originally, plant breeders' rights under UPOV was only for

'commercial' production and marketing and since the use and exchange of saved seeds was considered non-commercial, the activity was considered outside the scope of PBRs (Rangnekar 1998). It thus allowed farmers to save, use and exchange seed but not sell seed without penalty under plant breeders' right systems. In the 1991 UPOV revision, the farmer's exemption was reduced to an optional clause leaving it to states to decide on the extent of farmers' rights to save and exchange seed.

2. Benefit Sharing: With the conclusion of the Convention on Biological Diversity, the concept of benefit sharing emerged and was applied by some to farmers' rights. The Convention on Biological Diversity was concluded in 1992 and led to a shift in viewing genetic resources not as common heritage (shared by all) but rather as the sovereign right of nations. Benefit sharing was formulated as a means to assert this sovereign right. Benefit sharing refers to the compensation to farmers/communities who contribute to the creation a new variety or the development and conservation of existing varieties. It essentially refers to the rights and rewards that farmers deserve for contributing to agricultural innovation and growth.
3. Farmers' Rights as Ownership: Farmers' Rights here refer not to exemptions or to benefits but to the rights of farmers to claim ownership over their varieties in a similar fashion as breeders. It represents the extension of the ideology of intellectual property rights to farmers' varieties. The difficulty however arises with regard to the criteria for registering farmers' varieties. The criteria of distinctness, uniformity and stability used for breeders' rights is not appropriate for the myriad of relatively heterogeneous, locally-adapted and locally recognized farmers' varieties, which are often constituted by a continual process of seed introduction, mixing and exchange within and among communities. (Personal communication, Dr. Melinda Smale; See also Wright and Turner (1999) who point out that "diversification in the local gene pool is primarily a function of farmer abandonment of varieties and rapid change within varieties is only likely if a mutation has a strong competitive advantage or if it is actively selected out and multiplied"). The ideology of IPRs is to promote innovation through providing incentives for investing in R & D. In the case of ownership rights applied to farmers' varieties, in addition to promoting innovation for on farm maintenance of diversity, there is also the parallel aim of collecting payment for past innovations and conservation practices.

These three aspects of farmers' rights are still in the process of being applied and interpreted in developing countries. Developing countries in the FAO passed a resolution

in 1989 that led to the birth of farmers' rights defined as, "rights arising from the past, present and future contributions of farmers in conserving, improving and making available plant genetic resources, particularly those in centers of genetic diversity. These rights are vested in the international community as trustees for present and future generations." (FAO Resolution 1989 quoted in Sarkar 1996)

NGOs and developing countries promoted farmers' rights as a legitimate interpretation of the 'sui generis' clause under TRIPs. They pointed out that as TRIPs allows countries to develop unique legislations and doesn't mention UPOV, it would be possible to formulate national laws that allow for farmers' rights under TRIPs. The exact scope of farmers' rights (i.e., the three aspects of farmers' rights) are still in the process of being defined, but most developing countries are trying to include some aspect of farmers' rights in their legislations. India's Act attempts to apply and expand the three aspects of farmers' rights.

4. INDIA'S POLICY ON PBRS AND FARMERS' RIGHTS

India's policy on IPR protection in agriculture has largely been governed by the following factors: (1) "common heritage", or the principle of free exchange based on the view that the major food plants of the world are not owned by anyone and are a part of our human heritage (Kloppenburg 1998, p. 152). (2) A focus on ensuring access to technology and promoting economic development. India did establish IPR laws to protect the rights of innovators, but attempted to balance this with the need for access to resources at reasonable prices (3) A majority of agricultural research in India has largely been

conducted by the public sector. India's seed policy until the 1980s restricted the role of the private sector in agriculture.

These factors promoted a system where India did not provide for plant breeders' rights as there was no real demand for such a system for decades. The absence of PBRs also meant that there was no requirement for farmers' rights as a counter to IPRs. Farmers were free to use, share and exchange seeds and since breeders could not acquire PBRs, there was no system of benefit sharing or compensation. Prior to the conclusion of the Convention on Biological Diversity, genetic resources were considered 'common heritage,' freely used and accessible to all.

5. POLICY CHANGE

India's existing policy is undergoing substantial changes with the adoption of the Protection of Plant Varieties and Farmers' Rights Act. The law in India evolved through the incorporation of the interests of various actors and an analysis of this process provides the key to understanding its potential implications for stakeholder access. The enormous opposition against granting PBRs was overcome in India when mechanisms were created for assigning ownership rights over farmers' varieties and protection of resources with the public sector.

The Debate on PBRs in India The initial demands for IPRs in agriculture arose with the change in policy that allowed private sector entry into the seed sector with the New Seed Policy of 1988. The Seed Association of India, formed in 1985, first actively promoted the need for plant breeders' rights in India. In 1989 it held a seminar that brought

together actors from the ministry and industry to emphasize the need for IPRs. (Seshia 2002) With the conclusion of the TRIPs agreement there was also external pressure on India to establish PBRs in India.

The private sectors' demand for plant breeders' rights led the public sector and government to initiate study and discussion of IPRs in agriculture. (ICAR 1990). Previously, the public sector had objected to PBRs partly because it would enable private companies to take advantage of breeding material developed by the public sector (Seshia 2001). With the changing role of the private sector and the relationship between the public and private sectors, the stance on PBRs underwent changes. The Indian Council of Agricultural Research pointed out that, "With the commencement of the New Seed Development Policy in 1988, deliberations for undertaking legislation in terms of Plant Variety Protection/Plant Breeders' Rights and Gene Patenting were initiated at the instance of the Private Sector who wanted legislation for protecting their rights on Plants. The Seed Association of India accordingly initiated a National Conference in 1989 and subsequently the matter was discussed at various platforms/forums including constitution of an Advisory Group under the auspices of the FAO for submitting its report to DAC, GOI for undertaking a decision on this vital issue" (ICAR 1990). The FAO report suggested that India should formulate PBRs in accordance with UPOV but should also recognize Farmers' Rights (FAO 1993). The ICAR sub-committee recommended PBR for hybrids in India and noted that if it was provided for other varieties the farmers right to save seed must be protected (ICAR 1990).

Enormous protest against implementing TRIPs, and introducing PBRs, arose from non-governmental organizations and farmers' lobbies in India. Their most effective and

forceful argument was that the IPR system as outlined in TRIPs recognizes only agricultural innovations of breeders and corporations, but ignores informal innovations of farmers and communities, especially in developing countries. They asserted that TRIPs and western IPR regimes promote 'bio-piracy' as they only recognize formal innovations and ignore indigenous knowledge systems. Bio-piracy refers to the utilization of traditional knowledge or resources by industrialized nations to create profitable products without compensation. Vandana Shiva, one of the most prominent activists, articulated the issue as follows: "Western IPR systems are diametrically opposed to indigenous knowledge systems. PBRs negate the contribution of Third World farmers as breeders and hence undermine farmers' rights. Patents allow the usurpation of indigenous knowledge as a western invention through minor tinkering or trivial translation." (www.vshiva.net).

NGOs in India were able to effectively promote their view through events at the international level. Within TRIPs, the relevant article that dealt with agriculture became the subject of an intense debate. The conclusion of the Convention on Biological Diversity, which shifted the common heritage regime to one of sovereign rights over genetic resources, also provided momentum to their protest. The issue of farmers' rights within the FAO and other forums was another factor in shaping the debate. NGOs in India used these developments to make the case for protecting traditional knowledge. They argued that the 'sui generis' clause in TRIPs could be utilized to formulate a unique system in India that upheld farmers' rights. NGOs developed alternate systems such as 'Community Intellectual Rights' (Shiva 1993) and demanded that India must be paid for use of genetic resources and that there must be formal recognition of farmers' varieties (Sahai 2001).

Industry/NGO Clash: First Draft of the Bill In the background of this debate on plant breeders' right in India, the government formulated a draft of a bill to grant PBRs in 1993/94. The draft led to enormous controversy in spite of the government's attempts to take into account the various demands of the actors while framing the bill.

The bill provided for plant breeders' rights through provisions based on UPOV. The bill also evolved a provision to protect the interests of the public sector through allowing registration of extant varieties. The provision for registering extant varieties did not exist in UPOV or in any other legislation on plant breeders' rights. Extant varieties were defined in the bill as those notified under the Seeds Act. The 1966 Seeds Act provides for notification, certification and labeling of seeds in order to control the quality of seed production and distribution in India. It is largely the public sector that notifies varieties under this Act(Seshia 2002). Private seed companies are reluctant to go for formal release as the procedures are time-consuming and industry avoids certification for their own lines to keep the parentage secret. (Singh, et al. 1990).

The first draft of the bill also contained a clause on community rights and farmers' rights. The farmers right under this draft was defined as 1) Farmers' privilege: right to save, use, exchange, share and sell propagating material of seed except sale of branded seed 2) Benefit sharing: the Authority under the Act could require the breeder to pay reward/compensation to communities. There was no concept of farmers' rights as ownership rights or rights to register their varieties.

Inspite of attempts by the government to take into account the various interests, the bill was opposed both by NGOs and industry. The Seed Association of India (SAI) criticized the bill stating that, "the very purpose of plant variety protection would be

defeated if farmers start selling seed of a protected variety…. If not amended this provision will be a disincentive to invest in research and development." (Submission of the SAI to the Ministry of Agriculture, 1994 quoted in Weidlich 1996). SAI protested against several aspects of the bill and felt that the very purpose of plant variety protection would be defeated if farmers start selling seeds of a protected variety and suggested an almost complete removal of farmers' rights (Dhar et al. 1995).

Various NGOs voiced strong opposition against the bill mainly for not providing strong farmers' rights. The reasons they felt that farmers' rights was weak included: 1) the farmers' privilege did not apply to seeds. Sahai made the assertion that farmers must have the right to sell seeds 2) The Benefit sharing was vague as it was left to be determined by the Authority and there was no provision for claiming compensation 3) There was no farmer's representatives in the Authority 4) The aspect of Farmers' Rights as ownership was not found in the bill. There was no system for registering farmers' varieties and therefore the farmers' right was not adequately protected. At this stage there was a deadlock between the Industry and NGOs on the shape of the legislation.

The Process of Accommodation and Compromise With the impasse between industry and NGOs the government began the process of revising the draft. The Ministry of Agriculture prepared a second draft in 1996 and a third one in 1997. The third draft added the words 'Farmers' Rights' in the title and was labeled the Plant Variety Protection and Farmers' Rights Act. NGOs, however, criticized both of the bills for not providing adequate protection to farmers.

The process of accommodating the interests of various actors began with another draft introduced in Parliament in 1999 (Protection of Plant Varieties and Farmers Rights

Bill) and sent to a Joint Committee of Parliament (JPC). The Joint Committee traveled across the country gathering the views of NGOs, industry, scientists and farmers lobbies on the bill. Incorporating the demands of various actors, the Joint Committee redrafted the bill in 2000 and the new version was introduced in Parliament. In 2001, the bill was passed and made into a law.

The JPC made various revisions taking into account the interests of various groups. The main revision of the Joint Committee was adding a new chapter on farmers' rights. The new chapter attempts to provide some mechanism for registration of farmers' varieties thereby incorporating the third aspect of farmers' rights as ownership. The provision for allowing farmers' to register varieties was incorporated under two mechanisms: Firstly, the definition of extant variety found in the previous drafts was expanded to include: farmers' variety, variety in the public domain, and variety about which there is common knowledge. In prior drafts extant varieties were defined only as those notified under the Seeds Act. Secondly, a clause providing for registration of farmers' varieties was also added. The Farmers Rights definition in the Act adopted and expanded all three aspects of Farmers' Rights: 1) farmers privilege as a right not only to save and exchange seeds but also to sell seeds (except branded) 2) Benefit sharing based on compensation and operating through a mechanism where communities/farmers can make claims for such compensation 3) Farmers Rights as ownership: the idea that farmers must be able to register their varieties.

The criteria for registration of extant varieties and farmers' varieties, however, is not entirely clear in the Act. The Act proposes that it would be based on distinctness, uniformity and stability *as defined by the Authority*. The Authority is yet to provide such

definitions and this will be a crucial factor in determining whether farmers would actually be able to register their varieties.

The final version of the bill was largely accepted by the major stakeholders and could be passed into law. Industry understood that the concept of farmers' rights as seen as an alternative IPR system actually reinforces their position on IPRs and enables them to gain plant breeders' rights in India. During the process of development of the legislation, industry began to adopt a more favorable stance towards farmers' rights. For example during the Madras Dialogue, MD of seed company ITC Zeneca Ltd., stated that, "we must allow farmers to save seed, use seed and exchange it commercially over the fence, but not become entrepreneurs by selling seed." (quoted in Weidlich 1996). The international positions of seed industry also began to change as there was an enormous global movement for promoting farmers' rights. Industry also slowly began to accept various aspects of farmers' rights as this was in tune with the logic of IPRs in general and would enable the passage of the legislation. Partha Dasgupta, India representative of seed company Syngenta, for example, stated about the provision in India's law allowing farmers to sell generic seeds, "This seems OK to me." (Jayaraman 2001). NGOs accepted the bill as it provided for a mechanism for granting protection for farmers' varieties on par with breeders' varieties.

6. STAKEHOLDER INTERESTS AND THE NEW REGIME

The main feature of the Act is the provision to claim IPRs over varieties through a system of registration. The Act allows four types of varieties to be registered reflecting the interests of actors: New Variety, Extant Variety, Essentially Derived Variety

and Farmers' Variety. The definition, criteria and term of protection of each of these varieties as elaborated in the Act are outlined in Table 1.

Table 1--Varieties protectable under India's PVPFR Act

Type	Definition	Criteria	Right Granted	Duration
New Variety	'Variety' means a plant grouping except microorganism defined by certain characteristics under the Act. It is new if it meets specified criteria	Novelty Distinctness Uniformity Stability	Exclusive right for the breeder to produce, sell, market, distribute, import or export the variety	Initially 9 years renewable up to total of 18 years for trees and vines Initially 6 years renewable up to total of 15 for other crops
Extant Variety	A variety available in India which is notified under Section 5 of the Seeds Act, 1966; or a farmers' variety; or a variety about which there is common knowledge; or any other variety which is in the public domain	Distinctness Uniformity Stability As specified under the regulations	Exclusive right to produce, sell, market, distribute, import or export the variety if claimed by the breeder and in cases where not claimed by breeder, the Central Government or State Government shall have the right	15 years from the date of notification of that variety by the Central Government under Section 5 of the Seeds Act, 1966
Farmers' Variety	A variety which has been traditionally cultivated and evolved by the farmers in their fields; or is a wild relative or land race of a variety about which the farmers possess the common knowledge	Unclear if Distinctness, Uniformity and Stability would be the criteria or not	Unclear	Unclear

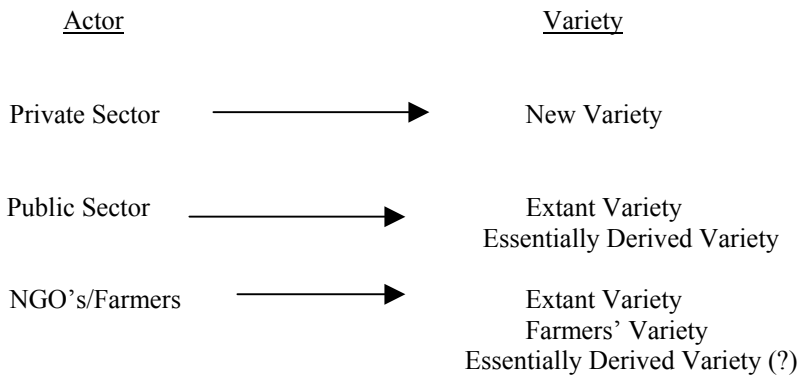
Table 1--Varieties protectable under India's PVPFR Act (continued)

Type	Definition	Criteria	Right Granted	Duration
Essentially Derived Variety	A variety predominantly derived from such initial variety, or from a variety that itself is predominantly derived from such initial variety, while retaining the expression of the essential characteristics that result from the genotype or combination of genotypes of such initial variety; is clearly distinguishable from such initial variety; and conforms (except for the differences which result from the act of derivation) to such initial variety in the expression of the essential characteristics that result from the genotype or combination of genotypes of such initial variety	Genera or species specified by the Central Government and tests to determine if it is an EDV	Same rights as a breeder of a new variety provided that the authorization by the breeder of the initial variety to the breeder of essentially derived variety may be subject to terms mutually agreed upon by both the parties	Initially 9 years renewable up to total of 18 years for trees and vines Initially 6 years renewable up to total of 15 for other crops

Source: Adapted from "The Protection of Plant Varieties and Farmers' Rights Act, 2001", Act No. 52 of 2001) New Delhi: Akalank Publications.

The four types of varieties correspond with the interests of specific actors as illustrated and described in further detail below (Note: legally any actor can apply for any type of variety. This represents only the type of protection that each actor could most likely benefit from):

Diagram 1: Likely benefits to actors from various types of protection



New Variety: Protection of new varieties is the type of right demanded by breeders and generally refers to varieties protected under existing plant breeders' rights systems. The criteria for new varieties in India's Act are borrowed largely from UPOV and it would be mainly private sector breeders who could apply for protection of their innovations. Public sector institutions and universities could also claim protection under this clause if they can innovate and produce new varieties.

Essentially Derived Variety: The concept of essentially derived variety first emerged when UPOV was revised in 1991. In India's legislation, the concept is modified to suit certain interests. The concept of EDV emerged in UPOV 1991 to ensure breeders greater protection by extending the scope of the initial breeder's right to varieties that are essentially derived from the protected variety. In India's legislation, the provision seems to have been adopted with the view that it could provide some protection to varieties held with the public sector. The Head of Seed Science Technology at the Indian Agriculture Research Institute pointed out that the provision was intended to 'provide protection for varieties developed by the public sector that have been acquired by the private sector and

modified slightly' (quoted in Seshia 2001). It is also interesting to note that some NGOs have also been supportive of the EDV provision, in spite of the fact that it actually emerged to grant greater rights to breeders. M. S. Swaminathan at one point stated that, "We should include in the 'essentially derived' concept the parent genetic material contributed by rural and tribal men and women, although the concept was not included in the draft produced by the Swaminathan Foundation (Swaminathan 1994). This definition of EDV was also not included in India's Act. NGOs that have the capacity to modify varieties could perhaps utilize the provision and gain protection for them under the Act, and it could also be used to make claims for varieties that are used as initial varieties in breeding programs.

Extant Variety: Protection for extant varieties is a new criteria not found anywhere in the world. It is an attempt to extend protection to existing varieties rather than for newly developed innovations. Such protection facilitates the 'extraction of rents from old innovations' (Srinivasan 2001 quoted in Seshia 2001). The provision for granting protection to *extant varieties* in India's plant variety legislation does not have a parallel in history and doesn't fit into the theoretical framework governing IPP (Economic and Social Commission for Asia and the Pacific 2001). The following are defined as extant varieties in India's Act: 1) varieties notified under the Seeds Act 2) Farmers' Variety, variety in public domain, variety about which there is common knowledge. The extant variety need not show novelty and the criteria of distinctness, uniformity and stability (DUS) will be determined as specified under the regulations made by the Authority (Gopalakrishnan 2001). These specifications have not yet been formulated. The ability of farmers' to actually register their varieties in practice depends on the definition of DUS that would be adopted. If the Authority adopts the same criteria applied to breeders' rights, then very few

farmers would be able to register their varieties. It is clear that the public sector would be able to utilize the provision as it includes varieties notified under the Seeds Act. An official with the Indian Council of Agricultural Research stated that ICAR has over 200 varieties that it plans to apply for protection (Personal communication with ICAR officials 2001).

Farmers' Variety: The provision for protecting farmers' variety is most unique aspect of India's law. It is clear that this provision emerged to satisfy the interests of NGOs and farmers' lobbies who demanded that farmers should be treated on par with breeders and allowed to register their varieties. The provision for protecting farmers' varieties represents the extension of private property constructs first developed for new varieties to varieties held by farmers and communities. It represents the expansion of farmers' rights from farmers' privilege and benefit sharing to granting ownership rights for farmers. Confusion however persists on the criteria that would be used for registering such varieties, and it is not clear if the distinctness, uniformity and stability criteria would be required or not. The Act states that "any farmer or group of farmers or community of farmers claiming to be a breeder of the variety" can apply for registration of their varieties. Various NGOs also have plans to register varieties on behalf of communities. The Swaminathan Foundation has expressed that it plans to register its varieties in the names of communities (Personal Communication, researcher with Swaminathan Foundation 2001).

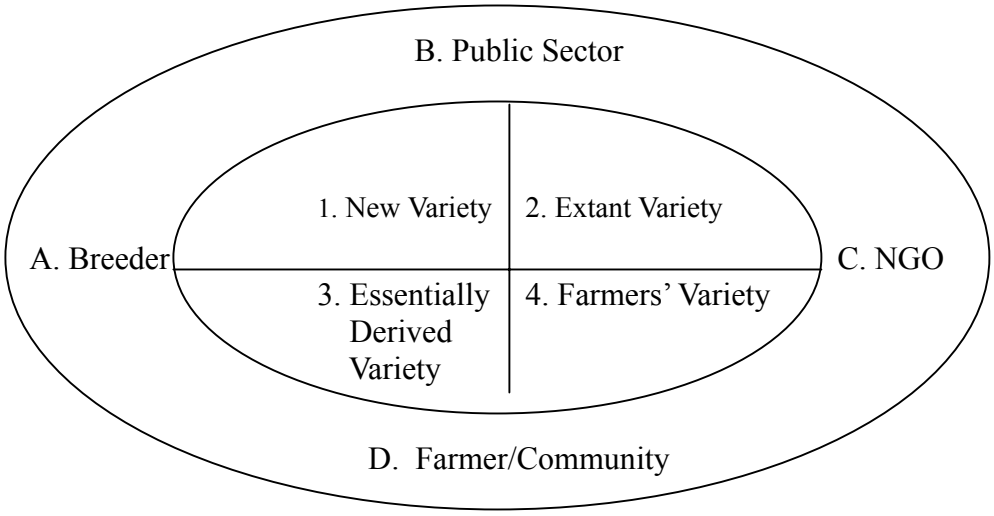
The legislation also establishes various other provisions for protecting traditional varieties such as benefit sharing and a National Gene Fund. The new law sets up a system of benefit sharing based on claims made by persons/NGOs in India to the Authority and determined by the Authority. Compensation can be claimed if person/community has contributed significantly to the evolution of a variety registered under the Act. The amount

of benefit sharing would be deposited in the National Gene Fund and would be recoverable as an arrear of land revenue by the District Magistrate.

7. ANTICOMMONS?

The new regime, in its attempts to equitably distribute rights, raises the possibility of an "anticommons" situation taking shape. The tragedy of the anticommons refers to the obstacles that arise when a user needs access to multiple protected inputs to create a single useful product (Heller and Eisenberg 1998). A complex series of bargaining with several actors may be required for development of new products under the new scenario. The following diagram illustrates the various levels of bargaining that may arise:

Diagram 2--Stakeholders and varietal protection under India's law



The quadrants represent the four types of varieties that can be registered and the various stakeholders. The actors in the outer circle can claim rights on varieties in any of the quadrants. An application for any type (New Variety, Farmers' Variety, Extant Variety,

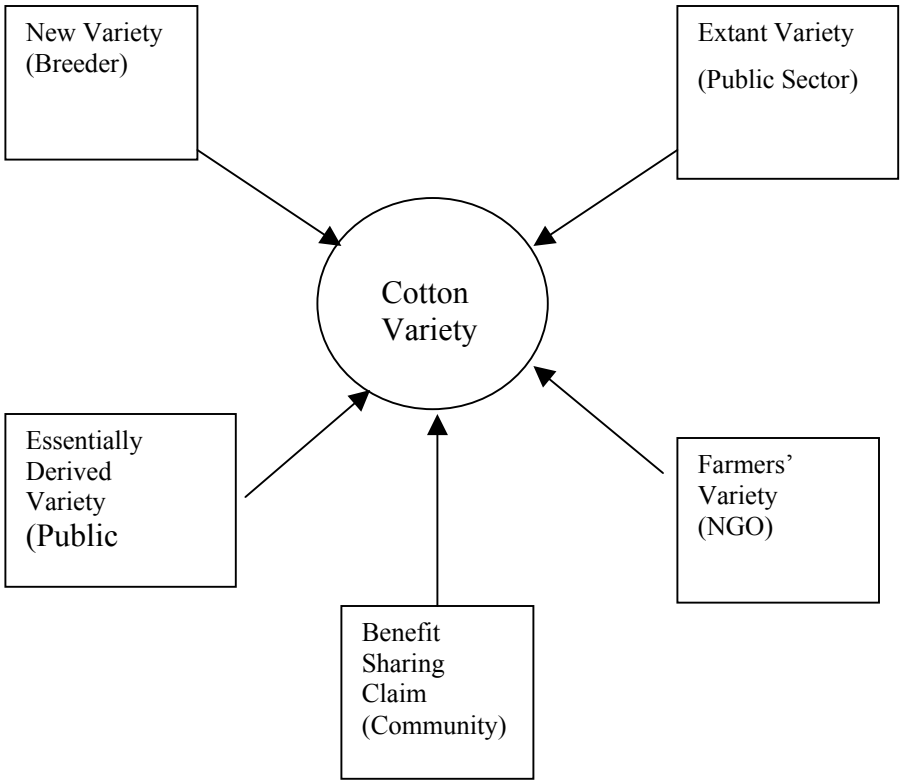
EDV) that requires use of a variety protected under another type would require payment and bargaining for commercialization. This creates a number of possibilities in terms of negotiations that may be required for creating the product. For example, let us take the breeder who applies for registration of a New Variety. If breeding this variety requires use any of the other materials (varieties) in any of the other quadrants, he/she must bargain with that actor who has registered that variety and pay for use of that variety. Taking one actor (breeder) and one variety (new variety), based on one other registered variety, the following combinations may be possible:

Actors	Varieties
A, B	1, 2 (New variety based on extant variety registered by public sector)
A, C	1, 3 (New variety based on EDV registered by NGO)
A, D	1, 4 (New variety based on Farmers' Variety registered by community)

The breeder would have to bargain with the actor if he/she intended to commercialize the variety. If the bargaining fails, the result could be lack of investment and production of that commodity (i.e., anticommons tragedy). Here we have taken only one actor and one variety based on another variety, but this becomes much more complex when we consider that actually there could be more than one variety used in creating the new variety or that many more actors may have gained ownership rights over the other varieties. Potentially, a specific agricultural resource could be protected under a number of mechanisms, and various actors could claim ownership over a particular aspect relating to the resource. An actor interested in utilizing a resource may have to gain permission from several actors and negotiate on a number of levels that may not be practically feasible. The result could be under utilization of the resource.

Overlapping claims are a distinct possibility within this system. It is possible to envisage a situation where various actors could gain protection in different forms on aspects of the same resource. Here we take the example of cotton variety but almost any resource could be substituted:

Diagram 3: Forms of protection over resources in India's law



A breeder could obtain a plant breeders' right for a new variety of cotton, for example, Bt cotton. A public sector organization could claim protection for an extant variety of cotton and an essentially derived variety of cotton. An NGO that is able to meet the criteria of DUS through some innovation of a cotton variety could claim it as a

farmers' variety. A community could also claim some aspect of benefit sharing because of use of the local variety in any of the other rights granted.

Here, only one actor within each category (private, public, etc.) is shown, but we could imagine a scenario where several private and public sector institutions could claim rights. Each actor would claim a different variety of cotton so why should this create an anticommons situation? Although each actor claims rights over specific aspects of the resource it is clear that at least at some point of time, the actor would most probably have utilized the variety belonging to at least one of the other actors. In order to gain access to that variety a complex system of bargaining and payment would have to be initiated. In addition, any one actor who wants to utilize the resource would have to initiate bargaining with a number of actors. The transaction costs of such bargaining may lead to underutilization of the resource.

The enforcement of the law will also influence the scope of an anticommons situation. An anticommons situation perhaps may not arise if farmers/NGOs are unable to assert rights over farmer's varieties. Yet there is scope for an anticommons situation not only because of the extension of rights to farmers, but also due to the nature of varieties that can be protected under this law. India's law differs from western IPR systems in allowing for various forms of protection such as extant varieties. Even if only the public and private sectors are able to actually enforce their rights leaving out farmers/NGOs, an anticommons situation could take place with overlapping claims on new varieties, extant varieties, and EDVs. Considering the existing patterns of exchange between public and private sectors in India, there is enormous scope for such overlapping claims. NGOs are already preparing for the new regime and have documented a number of resources that

could be registered under the law. The inability of small farmers to enforce their rights may lead to a situation where public sector, private sector and NGOs are engaged in a tussle to claim rights. In the middle of this struggle, farmers may themselves be denied access to their own varieties. The result could be underutilization of the resource both due to anticommons tragedy (if NGOs, public sector and breeders are claiming various rights over the same resource) and lack of access to the resource for farmers.

8. IMPACT ON FLOW OF RESOURCES

The impact of the new legislation on flow of resources between actors is not easy to determine, but it is clear that it would significantly alter existing patterns of exchange. One school of thought points to the increase in access to the best and recently bred foreign varieties with the extension of PBRs in developing countries. (Arora quoted in Weidlich 1996). The logic is that MNCs would introduce new varieties in India with the protection afforded by IPRs against copying of their material. The introduction of new varieties by private firms is dependent on several factors apart from intellectual property protection and would therefore require deeper study. However, it is clear that the new IPR regime would alter the existing patterns of exchange dramatically. It is important to analyze these changes and their implications:

Public Sector ⟶ CGIAR

Indian public sector institutions currently transfer material freely to the CGIAR and also receive such material from the International Agricultural Research Centers. (For

illustrations of how dependent yield gains and maintenance are dependent on a continual exchange of public breeding materials in the case of wheat see Smale (2001)). Under the new regime, however, India's public sector institutions would have the ability to charge for the use of material that could be registered under the Act. Since CGIAR centers currently operate on the basis of free exchange, there may arise greater incentives to transfer material to actors who would pay for the resource rather than to the international agricultural centers. This would also depend to some extent on the implementation of FAO's recently concluded International Treaty on Plant Genetic Resources. India could also charge for exchanges between countries that do not go through the CG system. Foreign actors would also be able to register their varieties in India and charge for use.

Public Sector ⟶ Private Sector

Under India's system, the public sector has freely transferred material to the private sector. With the capacity to protect both new varieties and extant varieties under the Act, there could be certain changes to this practice of free exchange. The access of small seed companies to this material may be reduced if these firms would not be able to afford payment for the use of this material. Large seed companies may not be hindered from access for monetary reasons but would have to negotiate the terms for such access. If the bargaining fails or is not easily facilitated, the exchange of resources may be restricted.

Public Sector ⟶ Farmers

The public sector institutions in India transfer many seeds and varieties to farmers and this constitutes an important system of free exchange. Under the new regime, if the public sector finds it can earn revenue from the private sector for use of its varieties, it may rather charge for use of its varieties from the private sector rather than giving it away freely to farmers.

Farmer ⟶ Farmer

The importance of farmer-to-farmer exchange of seeds has been stated as one of the reasons for upholding farmers' rights under any breeders' legislation in India. According to Suman Sahai of the Gene Campaign, "Over 85% of the seeds amounting to roughly 52 *lakh* tons, that are planted in Indian fields every year are supplied by the farming community." (Sahai 2000). The new legislation ensures that farmers have the right to exchange seed and would not be prevented from sharing seeds with other farmers provided he/she does not sell the seed as a brand name (the breeders registered name). However, the incentive to share seeds would also be influenced by the ability to claim ownership rights over farmers' varieties provided under the Act. If it becomes possible for farmers to register their varieties under the act, they would have a greater incentive to charge for use of the variety rather than giving it away freely to other farmers.

The direct exchange between farmers to farmers may also be mediated by a relatively new actor—NGOs—in the system. It is not yet clear what would be the impact of NGOs on exchange of plant genetic resources between the stakeholders, but it is important to note that they would play a significant role in the new regime.

9. PRELIMINARY EVIDENCE

At this point it is difficult to find conclusive evidence of the impact of this legislation as it is in the process of being implemented. However, it is possible to see from several developments, the future implications for stakeholder access. Firstly, several actors have already begun the process of asserting rights over resources that were in the public domain. The process of documenting genetic resources in India has taken on an enormous momentum. Registers to document such resources are being taken up by various actors including: governments at the national, state and local level, public sector institutions, and non-governmental organizations. These registers are being developed in an ad hoc manner, and there is a great deal of duplication of efforts and overlap not only in terms of resources but also regions covered. It is clear that those documenting resources would seek to apply for registration under the new Act wherever possible under the four types of varieties protectable under the Act. The number of documenting activities and their scope reveal the complexities that may arise when actors would attempt to acquire rights under the Act. The following table outlines the number of documentation activities in India:

Table 2--Documentation of genetic resources/traditional knowledge

Activity and Year Launched	Agency	Description
National Biodiversity and Strategy Action Plan, 1999	Ministry of Environment and Forests, UNDP, Kalpraviksh and Biotech Consortium India Limited	Assessment and stocktaking of biodiversity-related information at national, local and state levels
National Innovation Foundation, 2000	Department of Science and Technology and IIM, Ahmedabad	Register and support grassroots innovations
Biodiversity Plan	Government of Karnataka	State laws regarding biodiversity
Biodiversity Plan	Government of Kerala	State laws regarding biodiversity
Mission Mode Project on Collection, Documentation and Validation of indigenous technical knowledge	Indian Council of Agricultural Research	Documentation and registration of traditional knowledge
Traditional Knowledge Digital Library	Council of Scientific and Industrial Research	International Library on traditional knowledge
People's Biodiversity Registers, 1995	Foundation for Revitalization of Local Health Traditions	Records the status, uses and management of living resources
Honeybee Network, 1996	Sristi	Document innovative practices of farmers/artisans
Database	Swaminathan Foundation	Document contributions of tribal groups for securing benefits
Documentation	Research Foundation, Green Foundation, Gene Campaign	Documenting and collecting traditional knowledge/resources
Village Registry, 1997	Pattuvam Village, Kerala	Produced a registry of genetic resources within their village and declared it their property

Source: Compiled from various sources including: www.sristi.org, Gadgil et al, "New Meanings for Old Knowledge: The People's Biodiversiy Registers Programme, paper for Ecological Applications; Government of India, 2000, National Biodiversity Strategy and Action Plan: Guidelines and Concept Papers; Government of Karnataka, Biodiversity Plan.

These documentation activities would obviously be aimed at securing some protection either through plant variety or farmers rights protection. In addition, the resources being documented here extend beyond plant genetic material and also include

indigenous practices and traditional knowledge. It is unclear how such claims would be treated as traditional knowledge is not defined in this law explicitly and the law is mainly focused on varietal protection. There are serious demands in India for establishing another law to deal exclusively with traditional knowledge, with some efforts being made to draft legislation in this regard.

Table 3--Resources under documentation

Program	Resources Being Documented	Area
National Biodiversity and Strategy Action Plan	Distribution of endemic and endangered species, site-specific threats and pressures, social/political/economic issues, ethical concerns, and ongoing conservation initiatives by various sections of society.	20 local-level action plans, 30 state-level plans, 10 inter-state eco-regional plans 13 national thematic plans, all of these building into an overview national plan, but also remaining independent action plans.
National Innovation Foundation	Grassroots innovations	not specified
People's Biodiversity Register	Documents folk ecological knowledge and wisdom through decentralized institutions of governance, and with the help of local level educational institutions.	First initiative: 24 sites covering 10 states, second phase: 10 sites in 4 states, third phase: 56 sites in 7 states. 75 plant biodiversity registers covering 10 states of India produced by mid-1998.
Sristi	Surveyed about 4500 villages and documented more than 10,000 innovations related to agriculture, livestock health and management, farm implements and machinery, poultry keeping, leather tanning, herbal medicine, vegetable dye, etc	As of 1996, 5376 innovative practices (from about 3500 farmers and artisans of about 2300 villages) had been documented. Currently there are about 8,000 innovations and about 10,000 practices that have been recorded. Database on medicinal plants of about 256 plants found and locally used by farmers.

Source: Compiled from various sources including: www.sristi.org, Gadgil et al, "New Meanings for Old Knowledge: The People's Biodiversiy Registers Programme, paper for Ecological Applications; Government of India, 2000, National Biodiversity Strategy and Action Plan: Guidelines and Concept Papers; Government of Karnataka, Biodiversity Plan.

The extent of these documentation activities indicates that a number of actors documenting a variety of resources could file claims both for benefit sharing and for registering of varieties under the Act. These could be done under the following provisions of the Act: 1) Extant Variety if it meets the criteria of DUS as specified by the Authority 2) Farmers' Variety depending on the criteria that it would be based on. It may also be possible to file an application under the other two types if some actors are able to innovate on existing varieties to produce a New Variety or an EDV. There could also be many claims for benefit sharing if any of these materials are used in the production of any type of variety.

Recent patent applications in India relating to some agricultural commodities compared with the documentation activities taking place point to the type of overlapping claims that could arise. Since applications for registering varieties under the Act are yet to made, patent applications are used as an indication of the type of agricultural resources that may be the source of new innovations leading to creation of new varieties that can be protected under the Act. The following table lists the number of patent applications filed in India on some selected commodities:

Table 4--Patent applications related to specific agricultural products, January 1995-June 2000

Commodity	Number of Applications
Rice	60
Cotton	51
Neem	47
Wheat	6
Sunflower	2
Tomato	4
Maize	4
Cauliflower	1
Sugarcane	14
Corn	5

Source: Calculated from TIFAC (1998 updated 2001). Database on Patent Applications Filed in India

To analyze the means by which various actors could attempt to file applications relating to the same resources we focus on potential overlapping between patent applications and documentation activities. A search in just one of the documentation databases, the National Innovation Foundation shows that registration relating to neem, rice and cotton exists in this database. The Sristi database illustrates even more sharply the nature of duplication that could occur. The following table illustrates the large number of references found to three products: neem, rice and cotton in the Sristi database:

Table 5--Sristi database

Commodity	**No. of Entries**
Neem	95
Rice	105
Cotton	94

Source: www.sristi.org

The number of references to these resources illustrates that duplication of ownership claims that could occur not only between different types of protection systems (patents, plant breeders' rights, farmers' varieties, extant varieties and EDVs) but also

between various actors filing for claims relating to the same product. This would create not only serious administrative difficulties, but could also lead to situations where bargaining and negotiations would be required to commercialize a product from many actors who each make claims to specific aspects of the resource. In the extreme case, an anticommons tragedy could result where resources remain underutilized due to the existence of multiple ownership rights.

10. POLICY IMPLICATIONS

The danger of a situation arising where resources remain underutilized cannot be ignored. One may argue that market mechanisms would evolve to ensure that an 'anticommons' situation does not arise in India. However, several obstacles seem to prevent the emergence of market mechanisms to facilitate collaboration in this case (for obstacles in the case of agricultural biotechnology see Heller and Eisenberg 1998. This section draws from their observations, applying similar analogies). High transaction costs of bargaining appear to be a major impediment to overcoming the anticommons tragedy in India. Firstly, many of the owners in the new IPR regime will be actors that have limited resources for absorbing transaction costs and limited competence in market-oriented bargaining. These include public sector institutions, local communities, non-governmental organizations and farmers. Secondly, since the rights cover such a vast arena of resources and practices, comparing values would make it difficult to evolve a standard distribution scheme. Thirdly, costly case-by-case negotiations may be required since there are no standard license terms for such collaborations. Fourthly, licensing transaction costs are likely to arise in the early stages as the outcome or gains from use of the resource are speculative.

One of the major factors that may present the anticommons tragedy in this case is the interests of actors. Firstly, there are a variety of actors with different goals involved. The goals of the public and private sector may vary, and certainly the interests of non-governmental organizations and firms may prevent collaboration. Secondly, the terms of negotiations of these actors would not be on the same level. A farmer may seek a totally different outcome than a breeder or firm. Thirdly, an actor may perceive the collaboration

to be against his/her interest. For example the public sector may not be interested in giving materials to a company that would be its competitor on a particular technology. Some communities may be interested in keeping their knowledge secret, especially if the incentive (monetary) may not be of much value to them. Under the new regime, actors may overvalue their assets preventing smooth bargaining. When it is not clear what the value of a genetic resource is, and under a competitive environment, actors may place too much value on their assets. If each owner overestimates the value of their resource, the actors may not be able to reach consensus on a sharing agreement leading to the product not being developed.

In addition, it is also important to understand the possible effects of the legislation on benefits. Some firms and analysts claim that India's law provides weak protection for plant varieties and therefore not much incentive to private breeders (Personal Communication, Dr. Derek Byerlee 2002). If that is the case, the law may not have the desired effect of introducing new varieties in India, while simultaneously restricting current forms of exchange.

Bureaucratic procedure for obtaining access may prohibit sharing of resources. This is a serious problem under India's new regime. The new Act establishes an Authority to administer the legislation. The emergence of a new bureaucratic organization to regulate ownership rights in areas that were in the public domain creates possibilities for delays and hindrances in the free flow of resources between actors. It must also be viewed in the context of the new IPR regime being established in India with greater role for the Patent Office and the plans for setting up another Authority under the Biological Diversity Act, recently passed in India. The emergence of new authorities to regulate ownership rights,

benefit sharing and access to genetic resources presents the danger of an anticommons tragedy. Two new central boards are planned: 1) Protection of Plant Varieties and Farmers' Rights Authority 2) National Biodiversity Authority. In addition several State Biodiversity Boards would also be established and the powers of the Patent Office would be expanded. Securing rights and negotiating licenses may involve numerous agencies and actors. This could be an impediment to sharing and effective utilization of resources.

These factors point to a clear need for public policy interventions to promote the utilisation and flow of resources. There are some policies that could be pursued towards this goal. Firstly, devising clear-cut MTA (Material Transfer Agreements) is essential. MTAs determine the basis on which negotiations can take place between actors. Public sector organizations, NGOs and private sector firms need to set down guidelines for negotiations on transfer of material. Secondly, it would be necessary to devote some attention to ensuring that there are adequate resources in the public domain. India has recently ratified FAO's International Treaty on Plant Genetic Resources which attempts to set up a multilateral system of exchange of crops. It would be important for India to closely study the implications of this treaty and establish mechanisms for ensuring that certain crops remain in the public domain (Ramanna 2001). Thirdly, it would be necessary to limit the extent of protection available under the Act. This could be done through exemptions in the Act based on public interest or more specifically by establishing more stringent criteria for gaining protection. Finally, there must be some attention to creating incentives for sharing resources other than monetary gain through proprietary rights. India's public sector agricultural research has witnessed a number of successes largely due to the ability to freely exchange resources. The important flow of resources between the public sector and

farmers and farmers themselves must continue. In order for this to occur, actors must be provided incentives to share rather than only gains from asserting exclusionary rights through the Act.

India's Plant Variety and Farmers' Right Act is significant both in the domestic and international context. The possibility of a domestic anticommons situation arising takes on even greater proportions at the international level. Several developing countries are currently formulating legislations to simultaneously conform to TRIPs, while regulating access to genetic resources and grant some form of farmers' rights. Developing nations are not implementing straight-jacket fitting rules found in TRIPs, but are creating structures that reflect provisions found in the Convention on Biological Diversity, the international movement on farmers' rights, and applying property right constructs to resources found in their territories. Advanced nations must recognize that compelling developing countries to grant breeders rights could result in systems that run counter to their interests. Developing nations, in seeking to achieve the important goal of recognizing farmers' rights, must not overlook the need for promoting exchange of agricultural resources. Developed and developing countries must make a concerted effort to ensure that emerging IPR regimes do not restrict stakeholder access to genetic resources.

REFERENCES

Aoki, K. 1988. Neocolonialism, anticommons property, and biopiracy in the not-so-brave new world order of international intellectual property protection. *Indiana Journal of Global Legal Studies*, 6, 11-58.

Burch, B.K. et al. 2000. Divergent incentives to protect intellectual property: a political economy analysis of north-south welfare. *Journal of World Intellectual Property* 3 (2), March.

Buchanan, J.and Y. Yoon. 2000. Symmetric tragedies: Commons and anticommons, *Journal of Law and Economics*, XLII, April.

Dhar, B. et al 1995. Farmers' Interests recognized in Indian PBR bill, *Biotechnology and Development Monitor*, 23, June.

Economic and Social Commission for Asia and the Pacific, Institutional Capacity-Building to Deal with the Implications of TRIPs for Industrial and Technological Development: Case Study of India, 2001.

Gadgil, M., et al. New meanings for old knowledge: The people's biodiversity registers programme Submitted as an invited paper for *Ecological Applications*.

Gopalakrishnan, N.S. 2001. An 'effective' *Sui Generis* law to protect plant varieties and farmers' right in India—A critique. *Journal of World Intellectual Property*, January.

Government of India. 2001. *The protection of plant varieties and farmers' rights act, 2001*. Act No. 52 of 2001 New Delhi: Akalank Publications.

Government of India 2000. Report of the joint committee on the protection of plant varieties and farmers' rights bill, 1999.

Gupta, A. 1998 *Postcolonial developments: Agriculture in the making of modern India* Durham: Duke University Press.

Indian Council of Agricultural Research. 1990. *Plant breeders' rights in India.*

Heller, M. and Eisenberg, R. 1998. Can patents deter innovation? The anticommons in biomedical research. *Science* 280.

Jayaraman, K.S. 2001. Indian seed bill forges new ground, *Nature Biotechnology* 19, October.

Kadilal, S. 1997. Subject-matter imperialism? Biodiversity, foreign prior art and the neem patent Controversy, *Idea: The Journal of Law and Technology*, 37.

Kerr, W. 2000. *Transitions in agbiotech: Economics of strategy and policy, food marketing policy center*, University of Connecticut.

Kloppenburg, J. 1988. *Seeds and sovereignty: The use and control of plant genetic resources.* North Carolina: Duke University Press.

Ramanna, A. 2001 India's policy on IPRs and agriculture: relevance of FAO's new international treaty. *Economic and Political Weekly*, Commentary 36 (51), December 22.

Rangnekar, D. 1998. Trip'ping in front of UPOV: Plant variety protection in India, *Social Action*, 48 (4) October-December.

Sahai, S. 2000. Farmers' rights and food security. *Economic and Political Weekly,* Commentary, March 11-17.

Sahai, S. 2001. India: plant variety protection, farmers' rights bill Adopted, www.twnside.org

Sarkar, D. D. 1996. Farmers rights a reality. *Terra Viva* (3) June 19. Leipzig.

Sell, S. K. 1995. Intellectual property protection and antitrust in the developing world: crisis, coercion and choice, *International Organization*, 49 (2), Spring.

Seshia, S. 2001. Plant variety protection and farmers' rights in India: Law-making and the cultivation of varietal control. M.Phil.dissertation. Sussex, England: University of Sussex.

Seshia, S. 2002. Plant variety protection and farmers' Rights: Law-Making and cultivation of varietal control *Economic and Political Weekly*, July 6.

Shiva, Vandana and Holla-Brar Radha, Protection of Plants, People and Intellectual Rights: Proposed Amendments to the draft Plant Varieties Act, 1993, Research Foundation for Science Technology and Natural Resource Policy, 1993.

Singh, G. Asokan and Asopa 1990. *Seed Industry in India: A Management Perspective* New Delhi)

Smale, M. et al. 2001. Benefits from giving and receiving genetic resources: the case of wheat. *Plant Genetic Resources Newsletter*, 127.

Swaminathan, M.S. 1994. *Reaching the unreached: Dialogue 5 on farmers' rights" Methodologies for recognizing the role of informal innovation in the conservation and utilization of plant genetic resources.* M.S. Swaminathan Research Foundation, January.

TIFAC, 1998 , Database on Patent Applications filed in India.

Weidlich, S. 1996. The Discussion About Plant Breeders' Rights in India, ASA Paper, CDG Carl Duisberg Gesellschaft. Draft for Comment.

Wright, M. and Turner 1999. Seed management systems and effects on diversity. In, Agrobiodiversity: Characterization, Utilization and Management, ed. D. Wood and J. M. Lenne, CABI.

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