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# AGRICULTURAL BIOTECHNOLOGY AND THE MILLENNIUM DEVELOPMENT GOALS (MDGS): REVISITING THE ROLE OF INTELLECTUAL PROPERTY RIGHTS (IPRS)

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## Abstract

The first goal among the Millennium Development Goals (MDGs) is to eradicate poverty and hunger and aims at halving the proportion of the people who suffer from hunger within the period of 1990-2015. Agricultural biotechnology could potentially play a vital role in eradicating hunger by increasing agricultural productivity, improving nutrition, increasing farm yields, facilitating conservation farming by providing soil management tools and the preservation of ecosystems.

Most research tools and processes used in agricultural biotechnology tend to be proprietary and held as intellectual property (IP) by big corporations, usually based in developed countries. Developing countries, notably those in Sub-Saharan Africa (SSA), that rely on public research institutions and nonprofit organizations for agricultural biotechnology innovations may increasingly find it difficult to access biotechnology tools. The challenge for SSA countries is to determine how biotechnology innovations can be accessed and transferred to farmers. This paper is particularly concerned with analyzing the role of intellectual property rights (IPRs) in facilitating or hindering access to biotechnology tools in SSA countries.

## Introduction

At their inception, IPRs were created with the purpose of acting as incentives for innovative behavior and at the same time help diffuse knowledge[i]. Increasingly intellectual property protection is also sought by firms as a source of competitive edge in the marketplace (Mansfield, 1990), as a mechanism for market protection (Davis, 2004) and as a bargaining currency by firms to prevent being locked-out from using technology that is owned and held by competitors (Kingston, 2001).

The impetus towards an increased need for IP protection particularly in agriculture has been driven by 3 main synergistic forces, namely:

- The globalization of agriculture
- The changing nature of “innovation” which has seen an increase in the level of investment in R&D and capacity building for optimal

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exploitation of biotechnology and the developments in the technology which have increased the potential value of genetic resources and the ability to extract those values.

- The effects on international frameworks such as the Agreement on Trade Related Aspects of Intellectual Property (TRIPS).[ii]

Intellectual property (IP) is intricately related to trade, competition, industrial growth and economic development. The creation of the World Trade Organization (WTO) in 1995 and the consequent adoption of the Agreement on Trade Related Aspects of Intellectual Property Rights (TRIPS) have generated new challenges for Sub-Saharan African (SSA) countries, particularly as far as IP is concerned. Developing countries are now faced with the task of formulating policies and laws relating to IPR, which includes considerations of pertinent issues such as the patentability of living organisms/material.

The TRIPS agreement is the most over-arching international instrument on the regulation and protection of all types of intellectual property. The agreement sets minimum standards which all countries signatory to the WTO must comply. This therefore means that SSA countries are faced with the obligation of complying with the agreement and formulating their laws and policies in line with the provisions of the Agreement. Developing countries may however benefit from the transition period before TRIPS comes into full effect. For example, with the exception of the national treatment[iii] requirement and the most favored nation (MFN)[iv] requirement, all TRIPS disciplines come into effect in January 2006 and the requirement for patent protection for pharmaceutical and agricultural chemical products will come into effect in January 2016.

The IP debate has assumed an increasingly significant role in the global arena. This has been occasioned by the emergence of new technologies that are referred to as cross-cutting technologies such as the information and communication technologies (ICT) and biotechnology. The introduction and use of these technologies has revolutionized the application of knowledge, which in most cases is proprietary in fields affecting basic human needs such as health and agriculture. It has been argued that property rights extended to these technologies will increase the costs of accessing these technologies and consequently increase the technological divide between developed and developing countries.

## Conceptualizing Intellectual Property Rights for Agricultural Biotechnology

Generally, IPRs are established to perform two functions namely to create incentives for innovative behavior and to help diffuse knowledge. It is presupposed that the monopoly power created by competition, which in turn improves the appropriability of knowledge through IPRs is what acts as incentive to invent and innovate[v]. The trade off between the incentive to innovate and monopoly power lies in the non-rival nature of knowledge

(Romer, 1990) as an economic asset and the cheap transmission costs of information (Arrow, 1962).

IPRs make it possible for innovative firms to appropriate the benefits of their innovative activity and are thus commonly viewed as stimuli for invention and innovation. However they are not the only appropriation method available to firms, other methods such as lead-time advantages and technological complexity can be used. It therefore becomes a policy question to ensure that an innovation system adopts an optimal IPR regime. An optimal IPR regime would be one that achieves both goals of encouraging innovative activity and at the same facilitate knowledge diffusion without breeding an unhealthy monopoly that interferes with the diffusion of new knowledge and innovations.

With respect to agriculture there exist two[vi] main IPR mechanisms, namely patents and plant variety protection through plant breeders' rights (PBRs)[vii]. A *patent* is generally considered the most powerful tool in the IP system, providing patent holders a monopoly of limited duration (usually 20 years) and excludes all others from making, using, selling, or offering to sell the invention in the country that granted the patent right, or importing into its market. In exchange for their exclusive market rights, patent holders are required to fully disclose their inventions in a manner sufficiently clear and complete for the invention to be reproduced by another person skilled in the art. Patent laws may provide a *research exemption* clause which allows others to study the protected subject matter without reproducing it for profit.

The international legal framework governing the protection of *plant breeders' rights* (plant variety protection) is the International Union for the Protection of New Variety of Plants (UPOV) Convention. PBRs are a form of intellectual property protection granted by governments to plant breeders to exclude others from producing or commercializing material of a specific plant variety for a specified period (normally 20 years.) While countries differ in how they implement PBRs, the law usually grants protection to varieties that are novel, distinct, uniform and stable. The holder of a plant breeder's right has a legal monopoly over commercialization of that variety over a prescribed length of time. Under UPOV (1991), the use of material of a protected variety for creating new varieties, and the commercial exploitation of these new varieties is to an extent free. This is under the *breeders' exemption* clause, which is the core principle of the PBR system. However, under UPOV (1991) this is not automatic as it must be provided for explicitly in national legislation and must be qualified. Of the two IP institutions, patents provide stronger exclusive rights.

As the biotechnological revolution unfolds, copyrights are becoming important in agriculture biotechnology because of databases that hold information about plant genes can be copyrighted, provided they contain a creative element. Trademarks are used for the protection of brand names such as Monsanto's Roundup Ready™ technology, or Aventis's Liberty® and LibertyLink® technologies. Trademarks though only protect the names and symbols denoting products or technologies, not the technologies themselves. Other forms of "indirect" legal protection may be through contractual provisions used

to extend or establish IPRs to 3rd parties. These include material transfer agreements between technology developers and 3rd parties, bag label contracts between the manufacturer and the buyer of seed, technology use agreements and licenses.

Another channel through which innovators impose technical limits on farmers is by using genetic restriction technologies (terminator technologies), which confer sterility on replanted seeds. It is noteworthy to mention that terminator technology is not an IPR mechanism as such but is in effect a technical circumvention of the IPR system in that it dos away with the rights and ability of states to regulate it. The section below discusses in detail the effects of these types of IPR on agricultural development in SSA countries.

**The Patent and Agricultural Biotechnology Debate**

IPRs have now become a means through which biotechnology firms can safeguard returns on R&D investments. There exists paucity of literature on the effects of IPR and their relationship to welfare and development. Indeed it has been argued that the knowledge of the scope, standards and effectiveness of IPR in developing countries is seriously inadequate (Gold et al. 2004; Fink & Maskus, 2005) and that patent protection may not necessarily work in the same way it does in developed countries (assuming that IPRs still function as incentive to invent and innovate). This is because developing countries might not afford the cost of absorbing this knowledge e.g. investing in developing the necessary human capital (UNCTAD-ICTSD, 2003). In addition, developing countries experience IPRs as a development cost and barrier to global markets (Correa, 2000) because patents are increasingly used as a means for consolidating restrictive trade monopolies, a restrictive function, which extends far beyond the exploitation of the patented inventions (Drahos with Braithwaite, 2002).

It is within this backdrop that SSA countries should conceptualize the role of IP and particularly patents in biotechnology innovations and understand that patent protection does not necessarily serve the role of encouraging inventive and innovative behavior in developing countries. It is argued that patent protection of biotechnological innovations may have the adverse effect on SSA countries of hindering biotechnological research, affecting agricultural trade and disenfranchising poor small scale farmers who depend on agriculture as a source of livelihood by restricting easy and cheap access to biotechnology products.

Most enabling technologies (research tools) used in the production of agricultural biotechnology end-products such as promoter gene[viii] techniques and marker gene[ix] techniques are under patent protection. As such it has been argued that intellectual property protection affects the use of biotechnology research tools.

There is an emerging consensus that innovations are characterized by a cumulative nature. This means therefore that while some innovations are radical, others are incremental. Incremental innovations build upon previous

innovations, thus in the case of agricultural biotechnology this means that most modern methods used to develop new crop varieties depend on a wide range of component innovations, the rights of which might be held by many competing parties (IP owners or others such as licensees). The number of separate rights needed to produce a new innovation will only escalate as biotechnology patents become more prevalent. It becomes even more complicated if the ownership of these rights is diffuse and uncertain, it can be difficult or impossible for potential users to successfully negotiate with all the relevant parties (Heller & Eisenberg, 1998). The golden rice[x] case is exemplary in showing that most times research may not necessarily be hindered as much as development and commercialization of products. The development of this rice variety was slowed down by a complex tangle of close to 70 patents owned by some 32 companies.

Patent protection affects agricultural trade if crop breeders produce crop varieties that cannot then be legally exported to countries where the tools and processes used in developing the crop varieties fall under IP protection (Pardey *et al*. 2000). This essentially locks out developing countries from accessing global markets and thus seriously impacting their agricultural industries. This is of particular concern to those countries whose economies are heavily dependent on agriculture and horticultural produce.

**UPOV, Plant Breeders' Rights and Appropriate Frameworks for Protecting Agricultural Innovations**

The UPOV Convention came into effect in 1961 but has since undergone various amendments in 1971, 1978 and 1991. Under the TRIPS Agreement the adoption of UPOV by WTO member countries is not compulsory. TRIPS only requires members to protect new plant varieties by either of 3 means: patents, an effective *sui generis* system or a combination thereof. A *sui generis* system means "of its own kind." Therefore countries can design and implement plant variety protection laws by themselves according to their national interests and local realities, which in practical terms means protecting both the breeders' and farmers' rights. However the word effective is ambiguous. Developed countries tend to refer to UPOV as the only effective *sui generis* model for PVP.

There are some developmental problems embedded within the provisions of UPOV. UPOV convention restricts the saving, exchanging, reusing and reselling seeds by farmers. UPOV revisions have progressively strengthened the protection afforded to plant breeders. For example under the 1978 UPOV provisions under the *farmers privilege* clause farmers were not allowed to sell seeds obtained from protected varieties however, there was no bar on them to store these seeds for cultivation, replant them and develop new plants from them.

Under Article 15.2 of the 1991 UPOV Convention farmers are only allowed to reuse protected material only if the "legitimate interests of the breeders are taken care of". This limits the ambit within which farmers can operate and requires as of necessity that farmers pay royalties to breeders before they can

use the protected material. Under UPOV 1991 farmers are permitted the use of the protected varieties only with respect to acts done, privately and for non-commercial purposes; for experimental purposes and for the purposes of breeding varieties other than those which are "essentially derived varieties"[xi]. *Vide* Article 15.2 of UPOV 1991 this includes saving of seeds and the re-use of seeds by farmers on their own holdings. This exemption is only optional under UPOV 1991 and must be specifically be provided for in the national legislation, unlike under UPOV 1978 where it was mandatory.

Developing countries do not have big seed companies therefore the application of UPOV provisions do not work in a beneficial way as they would work in a developed country. In developing countries almost all of agricultural research and plant breeding activities are financed by taxpayer's money. Public institutions play a big role and as such the knowledge produced here has public good characteristics. Logically then laws in developing countries should be tailored towards protecting farmers more than breeders.

In developing countries farmers play a significant role as breeders of new varieties of plants. They often are the custodians of tacit knowledge on how to breed successful varieties by crossing and selection from their fields. These varieties are then in most cases taken up by agricultural research stations as breeding materials for producing other varieties. Such farmers/breeders would not be able to participate in an expensive system like UPOV. The UPOV system works well in rich economies where farmers do not also play the role of breeding plant varieties. In developed countries this is mainly done by big multinational companies. Developing countries therefore need to develop appropriate frameworks under the *sui generis* provision for adequately protecting both farmers' and breeders' rights and as such should invest in training lawyers who can develop effective *sui generis* systems. For example the Namibian government has introduced a *sui generis* legislation.

The Namibian legislation was based on the Organization for African Unity (OAU now AU) African Model Law for the Protection of the Rights and Local Communities, Farmers and Breeders, and for the Regulation of Access to Biological Resources. The Access to Biological Resources and Associated Traditional Knowledge (ABTRACK) Act provides for the grant of farmers' rights and plant breeders' rights while recognizing the rights of the local communities over their biological resources and associated knowledge, innovations and practices.

**Table 1. Summary of the main differences between the patent protection under TRIPS and the UPOV Conventions (1978 & 1991).**

| **Provisions** | **UPOV 1978** | **UPOV 1991** | **Patents under TRIPS** |
|---|---|---|---|
| **Subject matter** | Plant varieties of nationally defined species | Plant varieties of all genera and species | Inventions |
| **Requirements** | • Distinctions<br>• Uniformity | • Novelty<br>• Distinctness | • Novelty<br>• Non- |

| | | | |
|---|---|---|---|
| | • Stability | • Uniformity<br>• Stability | obviousness<br>• Utility |
| **Length** | Minimum 15 years | Minimum 20 years | Up to 20 years. |
| **Scope** | Commercial use of reproductive material of the variety | Commercial use of all the material of the variety | Commercial use of the protected subject matter |
| **Breeders' exemption** | Yes | Not for essentially derived varieties | No |
| **Farmers' Privilege** | Yes | Have to be articulated by national PVP laws | No |

**Proposal for Way Forward**

Developing countries have traditionally relied on public sector institutions and their collaboration with the international agricultural research system, notably the Consultative Group on International Agricultural Research (CGIAR), to provide inputs necessary for agricultural growth. As such, agricultural innovation is viewed as a public good. With the enforcing of stronger IPRs as promulgated by the TRIPS Agreement, SSA countries need to identify other policy mechanisms through which learning and national capabilities to engage in advanced agricultural research can be achieved. This paper proposes that following ways in which SSA countries can work to overcome the challenges confronting them as a result of strengthened IPRs,

- Through the creation of agricultural innovation systems.
- Through the formation of effective partnerships between the public and private sectors in agricultural research
- Developing negotiation strategies for exemption for the poor and grant of access.
- Increased investment in R&D and in developing scientific skills

*1. The Creation of Agricultural Innovation Systems*

The innovation system concept enables us to understand the evolutionary and systemic way through which learning and innovation can take place. This approach provides a much broader way than that provided by a focus on IPRs since it helps us identify the types of actors in biotechnology research and the types of interactions (by nature and intensity) needed for knowledge transfer between producers and users. This concept also enables us identify and design the institutions and policies which create and shape the patterns of interactions and linkages required for innovation.

An agricultural policy that embraces the innovation systems framework (Freeman, 1987; Lundvall 1992; Lundvall *et. al*. 2002, Hall *et. al.* 2004) moves beyond the traditional view of agricultural systems and brings to the fore the realization that innovation is becoming central to the ability of farmers, agro-enterprises and countries to cope, exploit and compete in rapid evolving

technical and economic conditions. Innovation process involves a wide range of other activities, actors and relationships associated with the creation and transmission of knowledge and its productive use (Mytelka, 2000). The concept of an innovation system is potentially a valuable tool to help rethink the role of IPRs in agricultural biotechnology and the role of biotechnology in agricultural systems.

*2. Formation of effective partnerships between the public and private sectors*

Sub-Saharan African countries need to put in place institutional arrangements that facilitate effective partnerships between the public and private sectors in agricultural research. These types of partnerships can enable the sharing of expertise through linking various knowledge stocks in the different sectors, along with allowing knowledge flows which necessitate product and process innovation in agriculture. The CGIAR is a leading example in striving to enforce partnerships with multinational firms and with national research centres in developing countries.

It is proposed that in the case of such partnerships IP management should be dealt with both at the institutional level and then at the partnership level (Krattiger, 2002). These dual levels of IP management provide a channel through which IP ownership is clearly negotiated by the partners and ensures that all actors from different sectors (private and public) reach their respective goals. Such IP management office often also known as technology transfer office facilitates the joint development of agricultural innovations through R&D and capacity transfer by building on the comparative advantage residing with the partners. This may be in the form of collaborative research agreements, material exchange agreements and license agreements.

*3. Developing Negotiation Strategies for Exemption for the Poor and Market Segments*

Another approach through which SSA countries can circumvent the IP quagmire would be through working with the holders of IP to allow for the exploitation of their inventions in areas it does not pose a challenge to their markets. A good example where such a strategy has been applied is the transgenic sweet potato (Wambugu, 1996). This virus-resistant sweet potato was developed by Monsanto, who came into agreement with the Kenya Agricultural Research Institute (KARI) to allow unrestricted use by small scale farmers in Central Kenya.

*4. Increased Investment in R&D and in Developing Scientific Skills*

SSA countries need to take proactive steps towards strengthening national public R&D and scientific capacity. Developing scientific capacity implies the human capacity to assess, regulate, absorb and modify the technology. Scientific capacity in developing countries is necessary to enable them tap into the available knowledge and consequently product development. This can be done if facilitated through government policies. Governments can develop coherent national biotechnology policies, which specify various

funding opportunities and at the same provide incentives for R&D (mostly tax incentives).

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Endnotes

[i] See Generally Penrose, E. T. (1951) "The Economics of the International Patent System" The John Hopkins Press.

[ii] TRIPS Agreement constitutes Annex 2C to the Marrakech Agreement establishing the World Trade Organization (The WTO Agreement)

[iii] National treatment under GATT Article 3 requires that members of the WTO must not accord discriminatory treatment between imports and like domestic products with the exception of the imposition of tariffs.

[iv] The most-favored-nation-treatment (MFN) requires contracting parties to accord the most favorable tariff and regulatory treatment given to the product of any one contracting party at the time of import or export to "like products" of all other contracting parties, is one of the bedrock principles of the WTO. If a country gives most-favored-nation treatment to one country regarding a particular issue, it must handle all other countries equally regarding the same issue.

[v] This presumption is based on the neo-Schumpeterian economics of innovation

[vi] According to Article 27.3(b) of the TRIPS Agreement, WTO members can exclude plants and animals from patentability but "…shall provide for the protection of plant varieties by

either patent or by an effective *sui generis* system or any combination thereof." (the protection of plant varieties under UPOV is an example of a *sui-generis* method) or through a combination of both systems.

[vii] Other forms of intellectual property rights include trademarks, trade secrets, utility models, designs, geographical indications , copyrights among others

[viii] Promoter genes control or modify the action of other genes

[ix] Marker genes when discovered in an organism facilitate the identification of an associated trait that is otherwise not detectable

[x] The brief facts about Golden Rice are as follows: It was invented in 1999 by Dr. Ingo Potrykus and Dr. Peter Beyer. This rice contains beta-carotene which is a precursor for vitamin A produced by introducing 2 genes from daffodil and one gene from bacterium into a japonica rice variety (Taipei 309).

[xi] UPOV 1991 defines an "essentially derived variety" as a variety predominantly derived from another (initial) variety which retains the expression of the essential characteristics from the genotype or combination of genotypes of the initial variety.