

# Benefiting from Biotechnology: Pro-poor IPRs and Public-Private Partnerships

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## Abstract

The Green Revolution has contributed to the alleviation of poverty and hunger for hundreds of millions of people, but it remains technically and institutionally limited. It has largely bypassed small farms located in dry agro-ecological regions and its institutional 'top-down' approach was not equipped to address social, economic and environmental variations at the local level. However, with new developments in biotechnology, including genetic engineering, unprecedented possibilities for addressing the needs of smallholders in developing countries have arisen. Yet, there are new challenges too. The new technology is driven by the private sector, which is not attracted to investing in research on developing biotechnology specifically addressing the needs of small farms. Moreover, the accessibility of the existing technologies to small farms is arguably impeded by the intellectual property rights (IPRs) leading to monopoly prices and hindering technology diffusion. In this context, this paper analyses how IPRs can be domestically tailored within the existing international commitments so as to encourage the development of technologies that favour and are accessible to small-scale farmers in developing countries. In particular, it proposes, for the first time, a special IPRs regime designed for public-private partnerships (PPPs), which would go beyond contractual arrangements and provide a more favourable institutional climate for the development of pro-poor and pro-small-scale biotechnology.

## Key Words

Biotechnology - Intellectual Property - Agriculture - Small Scale Farms - Developing Countries - Least Developed Countries - TRIPs - WTO - Innovation - Public-private Partnerships

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## 1 Introduction

The agricultural sector in developing countries is dominated by around 500 million small farms, with the labour force working at low levels of productivity. Based on the database of the Food and Agriculture Organisation of the United Nations (FAO), 85 per cent of these farms are small-scale, operating on less than 2 hectares (Nagayets, 2005, p.356). Hence, there is an urgent need to boost the competitiveness of small-farm agriculture and its contribution to poverty alleviation through science and technology. In this context, new biotechnology, including genetic engineering, may have a historic role to play. Some advanced developing countries have already made significant progress in fostering technological innovation and knowledge transfer. For those lagging behind, designing an institutional framework to promote small-scale agriculture is essential.

An effective intellectual property rights (IPRs) regime can play an important role in such an institutional design – as the accessibility of any existing technology to farmers is equally as important as its technical availability. However, there are concerns that small-scale farmers in poor countries are by and large being excluded from the benefits of new biotechnology. This is of particular importance because the biotech companies leading in research and innovation have substantial market dominance in the field. Hence there is a situation whereby a highly sophisticated private industry investing heavily in research and innovation in agriculture does not seem to be addressing the technological needs of the majority of farmers in developing countries. From the legal and institutional perspectives, this paper addresses some of the reasons why smallholders in developing countries, particularly in least developed countries (LDCs), seem to have been left out of the process of technological development. It also evaluates the importance of public-private partnerships (PPPs) offering new possibilities for making biotechnology available to small farms.

This leads the paper on to an analysis of the WTO's Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS) which obliges Members to implement a patent system. The paper will assess the extent to which the protection requirement is flexible enough in its essence and content to leave some room for Members to develop their own IPR regimes. We argue that the institutional challenge for developing countries is to design an efficient framework that is compatible with multilateral (and in some cases regional and bilateral) IPR regimes, but more importantly is capable of offering incentives specifically for pro-small scale biotechnology research and innovation in agriculture. Given the wide heterogeneity of farming systems and variations in domestic institutional capacities, countries should design their own IPR frameworks promoting both home-grown innovation and technology transfer. In this context, we attempt to assess the possibility of designing a special IPRs regime for public-private partnerships aimed at developing pro-poor biotechnology tools and products in developing countries.

This paper is organised as follows. It begins with an analysis of some of the new opportunities that new biotechnological applications offer to small-scale farmers in developing countries. Second, it provides an overview of the physical, technical and institutional factors affecting the accessibility of biotechnology to smallholders. Then, the focus moves on to the flexibilities that the international patent law provides to allow developing countries to design their own IPR regimes. Finally, the paper draws attention to alternative institutional approaches, namely PPPs, and discusses the possibility of a specially tailored intellectual property rights regime for PPPs which would provide a more effective legal framework for pro-poor innovation in developing countries.

## **2 Pro-poor technology**

The Green Revolution has left large numbers of poor farmers located in dry agro-ecological regions untouched, especially in Africa ([Hazell](#) and C. Ramasamy, 1991).

Since both the availability and the timing of water supplies are vital for chemical fertilisers and semi-dwarf seeds to work effectively, the impact of the Green Revolution in dry regions without irrigation has been small. Mainly in sub-Saharan Africa and large areas in Asia, there are now an estimated 1 billion people living in rain-fed dry and cold ecological regions (Dixon, et al., 2001, p. 310), which have hardly been affected by the Green Revolution. Both poverty and malnutrition are prevalent in these regions. Hence, in rainfed agricultural areas in developing countries which are also facing the potential impacts of climate change, the ecological performance of staple food production needs to be improved and the existing crop patterns need to be diversified.

New biotechnological developments promise to offer plant varieties with higher photosynthetic efficiency and enhanced resistance to abiotic stress, such as drought, excessive cold and heat. It is now possible to identify the network of genes that is associated with tolerating abiotic stress whereas conventional breeding technology would only identify them as a result of a far larger number of target traits (Garg, et al, 2002, p. 15898). For instance modifying rice to overproduce trehalose - a compound that exists in certain organisms such as bacteria, yeast, and resurrection plants, which stabilises biomolecules under stress conditions - proved to improve its tolerance to salt, drought and cold stresses (Garg, et al, 2002, p. 15898). Similarly, research on frost tolerant potatoes in Bolivia, salt tolerant wheat in Egypt and cold tolerant tomatoes in China has been undertaken (FAO, 2002). Using genetic engineering to improve pest and disease resistance in East African bananas also offers higher productivity gains than does conventional breeding (Smale, et al. 2006). Biotechnological tools, such as marker-aided selection, have also been used to improve the efficiency of conventional breeding techniques, for instance in identifying traits in drought tolerant maize to be bred with other varieties, such as African maize, which has improved the crop's biomass efficiency (i.e. higher proportion of seed development compared to overall vegetation) (Nuffield Council on Bioethics, 2003, p. 21; Bruce, et al., p. 13).

Another major challenge facing smallholders in developing countries is diversifying their production from staple foods to higher value cropping patterns with an increasing share of vegetables, fruits and livestock. Since these commodities have higher income elasticity for demand, they provide new opportunities for competitive farmers in developing countries experiencing population growth and increasing urbanisation with a widening middle-income class. However, the conventional applications of the Green Revolution in the 1970s and 1980s focused only on staple food products, mainly wheat and rice, paying little attention to horticultural crops and livestock products. Hence, farmers in developing countries now need scientific research and technological innovation in a wide range of high-value farm products.

Molecular biotechnology in horticultural crops has the potential to offer improvements both in terms of cost reduction and higher standards. However, the vast diversity of varieties in horticulture covering relatively small acreages makes it difficult to achieve economies of scale attractive enough for the private sector to undertake extensive biotechnology research (Alston, 2004, p. 86). Some varieties with genetic traits have been developed, such as herbicide tolerant tomato and lettuce, pest-resistant broccoli and potato, and virus resistant raspberries and plums (Clark, et al., 2004, p. 89-94). Similarly, tomato with a silenced gene associated with fruit softening was developed with the effect of improving taste and lengthening shelf life (Clark, et al., 2004, p. 90).<sup>1</sup> Although the marketing of genetically modified horticultural crops is not yet feasible given the unfavourable perception of consumers, biotechnological tools, such as marker-aided selection, could be used to improve the efficiency of conventional breeding techniques in horticultural crops. Nevertheless, the new technology remains underutilised and the vast majority of the new varieties remain uncommercialised (Clark, et al., 2004, p. 89).

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<sup>1</sup> Development of new technologies extending the shelf life of horticultural crops that have short post-harvest lives such as banana, mango and papaya is very important. Biotechnology has been used in several flower varieties, such as carnation, rose and gerbera for the purpose of modifying a greater variety of flower colours (currently produced in South America for markets in north America) (Clark, et al., 2004, p. 93).

In the field of livestock products, scientific research and innovation is also crucial for smallholders in developing countries. Livestock plays a critical role in rural livelihoods by providing farmers with a vital source of protein, asset base and income. Similar to horticultural crops, markets for livestock products have been growing in developing countries. Biotechnological tools such as molecular markers and quantitative trait loci (QTL), where genes associated with desirable traits are identified, and methods like artificial insemination, embryo transfer and in vitro fertilisation that are used to disseminate superior germ plasm offer potential benefits for the poor. Productivity growth through these scientific innovations is expected to come from enhanced breeding scheme designs, improved quality and welfare of offspring, higher productivity and increased nutritional value of milk and meat production. Biotechnology is also used to improve the nutrient efficiency of livestock by modifying either the feed to improve its digestive productivity or the animals to improve their metabolic productivity to make better use of existing feedstuffs (higher weight-gain and milk production per unit of feed intake) (Madan, 2005, p. 133). Finding more effective ways of fighting animal diseases is also crucial in the vast majority of developing countries, which lack good veterinary services.

The development of animal biotechnology, however, has been slow compared to crop biotechnology due to higher costs, inefficiencies in gene transfer techniques and the low rates of reproduction in animals (Madan, 2005, p. 130). Performance traits such as growth are associated with many genes, making research more complicated and potentially more expensive (Van Eenennaam, 2006, p. 136). Apart from transgenic research animals, few genetically modified animal products have been commercialised for the world's agricultural markets. Moreover, the private sector has shown no interest in investing in pro-poor livestock biotechnology. As a result, although reproductive techniques such as artificial insemination and embryo transfer are used in developed countries, developing countries are lagging behind. For instance, more than 60 per cent of all embryo transfers (around 450,000), mainly in dairy cows, in 2001, were undertaken in North America and Europe, while only

11 per cent took place in Asia (Madan, 2005, p. 131). Since many animal species are unique to their local environment, each with its own nutrient efficiency, disease resistance and development productivity (Madan, 2005, p. 133), there is an increasing need for specifically designed biotechnology applications addressing the needs of farmers developing countries. The East Coast Fever Vaccine project, coordinated by the International Livestock Research Institute (ILRI) in Kenya, is a good but rare example of such applications.

The new biotechnology can also play a major role in alleviating malnutrition and diseases affecting hundreds of millions people around the developing world. New varieties – such as the well known example of Golden Rice, and millet with the ability to produce high levels of beta-carotene, a source of vitamin A – have the potential to save millions of children from vitamin A deficiency-related blindness each year (Nuffield Council on Bioethics, 2003, p. 37). The use of biotechnology to produce biopharmaceuticals, such as vaccines and therapeutic proteins would also benefit the poor. Experiments have been undertaken with plants like banana – with the aim of developing a vaccine against hepatitis – and tomatoes and potatoes modified to protect against diarrhoea which is estimated to kill 2.2 million people each year (WHO, 2007). Both of these diseases are widespread in developing countries due to poor sanitation and the shortage of clean drinking water. Similarly, animal biotechnology offers transgenic proteins produced through the milk, blood, urine and semen of livestock (Madan, 2005, p. 137). Transgenic cows and goats producing milk with various therapeutic proteins have been successfully developed. Such potential benefits through both animal and crop biotechnology may offer breakthrough innovations to help the poor overcome serious nutrition and health problems.

### **3 Knowledge Gap**

The widespread success of the Green Revolution in the alleviation of poverty and hunger was mainly due to the technology being widely ‘accessible’. It was available

to small farms – as international and domestic public research institutions offered it as a public good. The technology was developed mainly through the Consultative Group on International Agricultural Research (CGIAR) and National Agricultural Research Systems (NARS); it was also adapted by national research centres to fit various local conditions. Then, domestic extension services extended its user-base to include large numbers of small farms. However, the new biotechnology can be problematic when it comes to supporting small-scale farming in developing countries. On the one hand, there is an increasing knowledge gap between developed and developing countries (Rausser, et al., 2000, p. 512). On the other hand, the knowledge gap between public and private research institutions is also widening. The research and development activities and subsequent technological adaptations have been dominated by the private sector which holds key methodological knowledge necessary for further innovation (Timmer, 1998). Some experts even argue that the increasing scientific gap between developing and developed countries and the dominance of the private sector is creating ‘scientific apartheid’ (Serageldin, 2001).

The fact that the new biotechnology has become increasingly sophisticated and that scientific research and trials requires heavy investment is excluding many developing countries with limited resources to spend on R&D. The US, the UK, Sweden, Australia and Switzerland are leading countries in the field, while only a few developing countries are making significant progress. Developing countries are lagging far behind developed countries in their investment in agricultural research. As shown in Table 1, the total spending on agricultural research in developing countries was around US\$ 14 billion in 2000, as compared to US\$ 23 billion in developed countries. The level of spending has been rising at the aggregate level, but only a few advanced developing countries account for this overall trend. Four major developing countries – India, China, Brazil and South Africa – account for more than half of the total spending by developing countries on public agricultural research. By contrast, Sub-Saharan Africa has a dismal record. Africa’s total public spending increased from US\$ 1.37 billion in 1991 to US\$ 1.46 billion in 2000, a growth of less than 1 per cent per annum. Even such a low level of growth was mainly due to the efforts of a few relatively large countries such as South Africa,

without which the total level of spending would have declined significantly (Alston and Pardey 2006). Hence, in addition to the resource gap for agricultural research between developed and developing countries, there is also a widening gap between low income developing countries and advanced developing countries.

The private sector plays an increasingly dominant role in the field of agricultural research; however, its role in developing countries is not prominent. In 2000, only 8 per cent of spending on research in developing countries, amounting to around US\$ 1 billion, was by the private sector. In developed countries, on the other hand, the private sector was responsible for 55 per cent of the total spending, amounting to almost US\$ 13 billion (Alston and Pardey, 2006). Hence, the increasing level of private sector investment in agricultural research seems to be concentrated in developed countries.

As for agricultural biotech research in particular, the increasing knowledge gap is even more apparent. The world's top ten multinational crop-science companies spend around US\$ 3 billion per year on agricultural biotech research. Although there is no reliable data on private sector investment in biotechnology research in developing countries, its total volume is estimated to be in the range of US\$ 90–460 million (Pingali and Raney, 2005, p.6), substantially lower than private sector spending on biotech research in developed countries. Similarly, the amount of public resources devoted to biotech research at the international level is far from adequate. The CGIAR, undertaking research activities with the aim of benefiting farmers in developing countries, invest around US\$ 30 million for biotechnology, amounting to only 7 per cent of its annual budget (World Bank, 2008, p 178).

**Table 1. Public and Private-sector expenditure on agricultural research, 2000\***

	Expenditure (million 2000 international dollars)			Share of Total Expenditure (%)	
	Public	Private	Total	Public	Private
<b>Developing</b>	12,909	1,108	14,089	91.6	8.4
<b>Industrialised</b>	10,191	12,577	22,767	44.8	55.2
<b>Total</b>	23,100	13,756	36,856	62.7	37.3

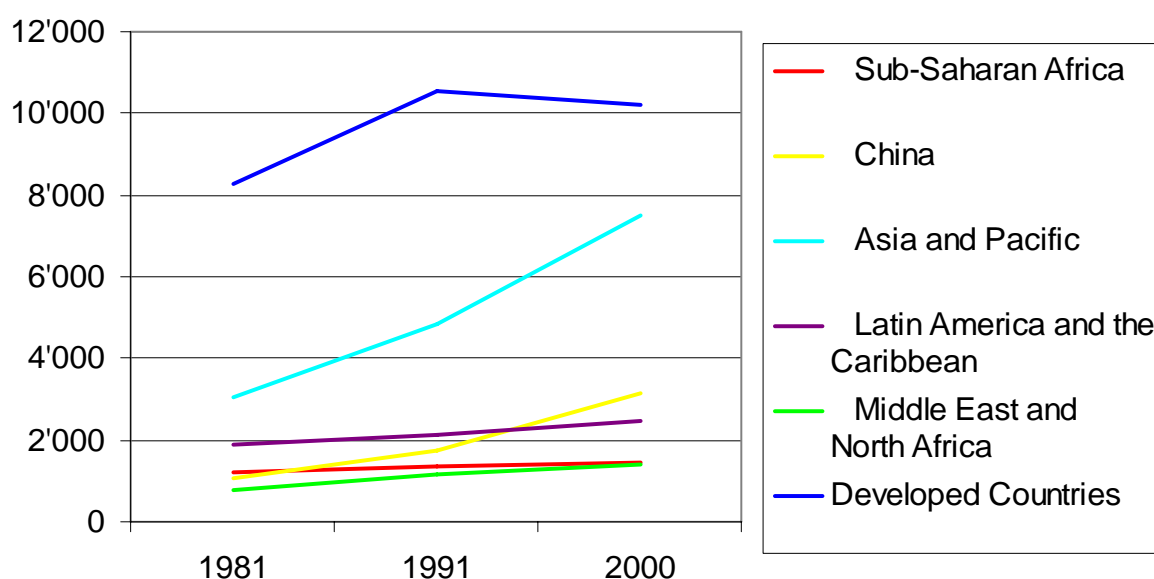
Source: Alston and Pardey 2006, p.22. \*Data are provisional estimates. See the source for details.

**Table 2. Global public spending on agricultural research, 1981–2000\***

Expenditures (million 2000 international dollars)	1981	1991	2000
<b>Developing countries</b>	6,904	9,459	12,819
<i>Sub-Saharan Africa</i>	1,196	1,365	1,461
<i>China</i>	1,049	1,733	3,150
<i>Asia and Pacific</i>	3,047	4,847	7,523
<i>Latin America and the Caribbean</i>	1,897	2,107	2,454
<i>Middle East and North Africa</i>	764	1,139	1,382
<b>Developed countries</b>	8,293	10,534	10,191
<b>Total</b>	15,197	19,992	23,010

Source: Alston and Pardey 2006, p.19.

\* Data are provisional estimates and exclude Eastern Europe and countries of the former Soviet Union. See the source for details.

**Figure 1. Developing countries public spending on agricultural research by region, 1981–2000\*(million 2000 international dollars)**

Source: Based on Alston and Pardey 2006, p.19.

\* Data are provisional estimates and exclude Eastern Europe and countries of the former Soviet Union. See the source for details.

Small-scale farmers in developing countries are particularly disadvantaged by the emerging knowledge gap – as leading biotech companies dominating the field are inclined to design their products to meet the needs of large-scale farms in developed countries. There are a number of reasons for this. First, given the limited

purchasing power of small farms, it is only natural that a profit-propelled industry is interested in serving the interests of those high-income farms with a propensity to buy new technologies. The fixed costs of biotech research are often too high to recoup in small markets (Byerlee and Fisher, 2001, p. 7). Second, since large farms are the main target of the industry, the companies invest more in capital and labour saving technologies, such as pesticide and herbicide resistant varieties, than they do in water-efficient and extra-nutritious varieties which are more relevant for small-scale farms in developing countries. Third, in developed countries, there has been a trend towards shifting research priorities from productivity to quality attributes, reflecting the preferences of affluent consumers (organic products, functional foodstuff etc.) (Pardey, et al., 2006). Fourth, major biotech companies tend to protect the potential gains of their innovations through contract farming rather than investing in so called 'terminator' technologies which are not always technically possible and/or economically feasible. Transaction costs associated with contract farming are extremely high for small-scale farms as compared to large ones, a problem which is exacerbated by weak IPR laws and ineffective enforcement mechanisms in developing countries.<sup>2</sup> Hence it is easier for biotech companies to deal with medium- and large-scale farms in developed countries with strong IP protection.

#### **4 International Intellectual Property Law and Agricultural Patents: Overview of Obligations and Flexibilities**

Intellectual property rights (IPRs) have a strong effect on the accessibility of smallholders to products and services developed using new biotechnology tools. IPRs in fact have a dual impact on accessibility of inventions: on the one hand, they encourage private investment in innovation by granting limited monopolies and thus high returns on investments. On the other hand, they then hinder access to

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<sup>2</sup> There is a major exception for hybrid seeds, which allows the private sector to protect its research and development investment through trade secrets. Since the first-generation hybrid seeds have substantial yield advantages over those harvested from subsequent generations, they must be purchased frequently (World Bank, 2008, p166.).

these inventions by the IP-holder charging monopoly prices to third persons. In fact, the top ten multinational life science corporations, including Monsanto Co., DuPont, Syngenta AG, Bayer AG and Dow Chemical Co. own a large proportion of the agro-biotech patents registered mainly in developed countries.<sup>3</sup> However, the effects of IPRs on investment and innovation can differ significantly from one country to another as territoriality of IPRs still prevails despite international efforts to harmonise the matter. This takes the issue into the realms of the WTO Agreement on Trade Related Aspects of Intellectual Property (the TRIPS) and its impact on innovation and technology transfer in developing countries. Hence in this section we deal with the legal implications of the TRIPS agreement on developing country IP-legislation in the field of biotechnology.

The traditional argument is that IPRs only favour economic prosperity in countries after achieving a certain stage of development. Below that level, they might hinder infant industries from developing (Spence, 2001, p. 270). For example, European industries at the beginning of the 20<sup>th</sup> century and Japanese industry until a few decades ago were able to develop their innovative hi-tech, car and pharmaceutical industries by using patent protected knowledge and copying technologies disclosed at foreign patent offices. Indeed, as part of the trade-off between the society and the patent holder, balancing excludability to enable investments to be recoup against the diffusion of knowledge to the public domain; it is required fully disclose the invention if applying for patent protection. A patent monopoly is only allowed to the extent that the inventor does not keep his or her invention secret. Hence, the Swiss chemical industry, Dutch audio fabrication and Swedish car production were all formed during periods when there was no active patent law in

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<sup>3</sup> A recent study examining ownership of more than 14,000 international patents for agricultural plant biotechnologies granted (between 1981 and 2001) in the United States, Europe and Japan and the International Patent Cooperation Treaty indicates that public research institutions (universities, government institutions etc) owned 24 per cent of all patents in agricultural biotechnology. This is higher (33 per cent) in Patent Cooperation Treaty filing. On the other hand, the private sector, which is dominated by multinational life science corporations, owns 74 per cent of agricultural biotech patents. For instance, 40 per cent of agro-biotech patents in the US are owned by the top five corporations. Monsanto and DuPont own the biggest individual shares with 14 and 13 per cent respectively (Graff, et al., 2003, pp. 990-991).

their territories. As patents have a strictly territorial effect, industries in these countries could take the information out of patents as disclosed at foreign patent offices and use it freely as these technologies were not patented in their own territories. Once these industries had achieved a certain level of development and were able to shift towards innovative activities themselves, these countries became active proponents of strong patent protection. Hence, until they reach that stage of development, countries are argued to have little or no interest in IPRs in general and patents in particular, but rather an interest in free riding as described above.

For biotechnology, however, this might be different. Indeed, not only is this field more investment sensitive than any other, and there is a strong need for local biotechnology development, but IP laws and patent laws in general seem to offer greater flexibility in relation to biotechnology than to any other field of technology. Indeed, poor countries might have a greater interest in (adjusted) IPRs that incentivise the home-grown local innovation of useful biotechnology products than they have in the possibility of freely copying technologies as developed and disclosed at foreign patent offices, which they lack the capacity to do. Hence, they need capacity building through private sector development and PPPs for which an effective form of IP-protection may play an important role together with other necessary institutional incentives. Hence, it comes down to implementing an IP system that securely protects investments, while using the flexibilities allowed under the TRIPS Agreement<sup>4</sup> and regional patent conventions<sup>5</sup> to adjust the system

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<sup>4</sup> Agreement on Trade Related Aspect of Intellectual Property Protection, Annex IC to the Agreement Establishing the World Trade Organization, Marrakesh, 15 April 1994, 33 *International Legal Material* 1197 (1994).

<sup>5</sup> For African countries for instance, two regional intellectual property organizations and their conventions must be taken into account. On the one hand the African Intellectual Property Organisation (AIPO) brings together French speaking African countries, mainly playing a role of simplifying the administrative procedure for patent applications by its member states. On the other hand, English speaking African countries are grouped by the African Regional Intellectual Property Organisation (ARIPO) which incorporates a similar simplified application procedure, but also rules substantial patent law provisions. As for biotechnology and the patentability of plants and animals, AIPO's Bangui Agreement establishes an exclusion from patentability for plant varieties, animal species and essentially biological processes for the breeding of plants or animals other than microbiological processes and the products of such processes, under its Article 6 (c).

to local needs. This applies not only to a flexible use of patent laws, but also to sui generis possibilities.

The TRIPS Agreement makes patents – enshrining the right to prevent third persons from using the patented invention without the consent of the patent holder<sup>6</sup> – available for any type of new, inventive and industrially applicable inventions;<sup>7</sup> whether products or processes; in all fields of technology; for a minimum term of 20 years;<sup>8</sup> and without discrimination as to the field of technology, the place of invention, or whether products are imported or locally produced. As the Agreement is embedded in the WTO dispute settlement system, it enjoys a strong enforcement mechanism. In fact, for the first time in history, disputes over IPRs can be brought before an international court. However, based on this foundation, the agreement allows for high levels of flexibilities and exclusions, particularly in the field of biotechnology.

First, there is flexibility in the date of final implementation of the TRIPS agreement depending on a Member's level of development. While developed countries had to implement the Agreement by 1 January 1995, developing countries<sup>9</sup> enjoyed an extended period of implementation up to 1 January 2005.<sup>10</sup> For LDCs,<sup>11</sup> the period of transition lasted until 1 January 2006,<sup>12</sup> except for pharmaceutical patents which are

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<sup>6</sup> Article 28 § 1 (a) TRIPS Agreement (as regards product patents) & Article 28 § 1 (b) TRIPS Agreement (as regards process patents).

<sup>7</sup> Article 27 § 1 TRIPS Agreement.

<sup>8</sup> Article 33 TRIPS Agreement

<sup>9</sup> The classification as either a developed or a developing country does not depend upon strict WTO criteria, but on (challengeable) self designation.

<sup>10</sup> Article 65 TRIPS Agreement.

<sup>11</sup> As regards LDCs, WTO follows the UN categorization of LCDs which sets three cumulative criteria for their identification. According to Article 11 § 2 of the WTO Agreement (Agreement Establishing the WTO, Marrakesh, 15 April 1994, 33 *International Legal Material* 15 (1994), available at: [http://www.wto.org/english/docs\\_e/legal\\_e/04-wto.pdf](http://www.wto.org/english/docs_e/legal_e/04-wto.pdf) (Accessed 7 October 2007).

<sup>12</sup> Article 66 TRIPS Agreement.

excludable from patent protection until 2016.<sup>13</sup> However, the Council for TRIPS had the power, upon duly motivated request, to extend this period. In 2005, the Council decided to extend the general transition period until 1 July 2013.<sup>14</sup> However, it is important to note that laws, regulations and practice made during the additional transitional period may not result in less consistency with the provisions of the TRIPS Agreement. This means that the rules which had already been established before the extension of the period may not be changed in the direction of a lower level of protection.

Second, within the patentability criteria of novelty, inventiveness and industrial application, Members are free to interpret these terms and define the thresholds of these criteria. Limited exceptions to the rights<sup>15</sup> are possible so long as they do not unreasonably conflict with the normal exploitation of the patent and they do not unreasonably prejudice the legitimate interests of a patent owner.<sup>16</sup> Also, the possibility of implementing limitations aimed at allowing the use of patented inventions without the patent holder's consent (e.g. compulsory licences) is fully accepted.<sup>17</sup> Moreover, the need for patentability exclusions for inventions whose commercial exploitation would go against the *ordre public*<sup>18</sup> and/or *morality*,<sup>19</sup> is for the Members to decide for themselves.<sup>20</sup>

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<sup>13</sup> WTO, *Doha Ministerial Declaration on the TRIPS Agreement and Public Health*, 14 November 2001, WT/MIN(01)/DEC/2, at § 7, available at: [http://www.wto.org/english/tratop\\_e/dda\\_e/dda\\_e.htm](http://www.wto.org/english/tratop_e/dda_e/dda_e.htm) (Accessed 7 October 2007).

<sup>14</sup> TRIPS Council, *Decision of the extension of the transition period under Article 66 § 1 for least developed countries*, 29 November 2005, available at: [http://www.wto.org/English/news\\_e/pres05\\_e/pr424\\_e.htm](http://www.wto.org/English/news_e/pres05_e/pr424_e.htm) (Accessed 7 October 2007).

<sup>15</sup> As guaranteed under Article 28 of the Agreement.

<sup>16</sup> Article 30 TRIPS Agreement. See on the concrete content of these criteria: WTO Dispute Settlement Body, Panel Report *Canada – Patent Protection of Pharmaceutical Products*, WT/DS114/R, 17 March 2000.

<sup>17</sup> under Article 31 of the TRIPS Agreement.

<sup>18</sup> This concept is generally linked to safety issues. In fact, the Technical Board of Appeal of the European Patent Office established the principle that claimed subject matter that is likely to seriously prejudice the environment should be excluded from patentability for being contrary to the *ordre public* (Technical Board of Appeal of the European Patent Office, *Plant cells/PLANT GENETIC SYSTEMS*, 21 February 1995, T 356/93, Official Journal of the European Patent Office (1995) 545, § 18). Obviously, issues of biosafety and biodiversity immediately come to mind (See for instance: G. VAN OVERWALLE, *Influence of Intellectual Property Law on Safety in Biotechnology*, in World Congress on

Third, for flexibilities specifically addressing biotechnology and living matter, the TRIPS Agreement allows for the exclusion of plants and animals from patentability, provided that an effective *sui generis* system<sup>21</sup> is established for the protection of plant varieties.<sup>22</sup> As regards living matter, the Agreement requires only micro-organisms, non-biological processes for the production of plant and animals, and microbiological processes to be patentable.<sup>23</sup> It seems that plant and animal related inventions, other than non-biological processes and micro-organisms, can be excluded from patentability without infringing the basic TRIPS principle that all inventions in any field should be patentable.

Furthermore, the TRIPS Agreement offers several portals for flexible interpretations of its provisions. Although it aims to secure effective IPR protection mechanisms provided that 'measures and procedures to enforce intellectual property rights do not themselves become barriers to legitimate trade', the agreement also recognises in its preamble 'the underlying public policy objectives of national systems for the protection of intellectual property, including developmental and technological objectives.' This is further strengthened by Article 7, ruling that the TRIPS Agreement is to contribute to the promotion of technological innovation and the transfer of technology in a manner that is 'conducive to social and economic welfare, and to a balance of rights and

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Safety of Modern Technical Systems, Saarbrücken 2001, TÜV-Verlag, pp. 664–670). Yet it remains to be seen to what extent patent examiners can assess safety.

<sup>19</sup> Under EPO case law, the concept of morality is a belief about whether a certain behaviour is right or wrong, based on the totality of norms that are deeply rooted within European society and civilization (see Technical Board of Appeal of the European Patent Office, *Plant cells/PLANT GENETIC SYSTEMS*, 21 February 1995, T 356/93, Official Journal of the European Patent Office (1995) 545, § 6).

For a deeper analysis of both the concepts of *ordre public* and morality in relation to biotechnology, see: M. Temmerman, *The Patentability of Animal Genetic Systems*, Berne, NCCR Working Paper 2007/04, pp. 76-105, available at [www.nccr-trade.org](http://www.nccr-trade.org) (Accessed 24 September 2007).

<sup>20</sup> Article 27 § 2 TRIPS Agreement.

<sup>21</sup> This basically refers to IP systems of a different nature from those categorized under the TRIPS Agreement (Patents; Trademarks; etc.)

<sup>22</sup> No such obligation has been incorporated as regards *animal* varieties, however.

<sup>23</sup> Article 27 § 3 (b) TRIPS Agreement.

obligations.’ Furthermore, Article 8 provides a portal through which to adopt measures necessary to protect public health and nutrition, as well as to ‘promote the public interest in sectors of vital importance to their socio-economic and technological development’ – however, only to the extent that such measures are consistent with the provisions of this Agreement. This latter limitation would mean such concerns can only be taken into account within the confines of the TRIPS obligations and scope of rights; rendering the Article 8 possibility quite marginal. However, in the literature, Article 8 has been interpreted fairly widely to eventually even serve as a legitimate portal to exclude certain inventions in the pharmaceutical or agricultural sector from patentability, if this would otherwise make the cost of access prohibitive or cause economic harm (Llewelyn, 2003, p. 330). Furthermore, Article 8 also may allow the taking of actions aimed at preventing the abuse of IP-rights (by the right holders) that would adversely affect the international transfer of technology.

Plants and animals can be excluded from patentability under the TRIPS Agreement, provided an effective *sui generis* system is established for plant varieties.<sup>24</sup> The most widely established system of *sui generis* protection, the UPOV system,<sup>25</sup> provides IP protection for plant varieties that are found after a two-year period of testing to be new, distinct, uniform and stable.<sup>26</sup> This is very different to the patent system which requires the disclosure of the invention for which patent protection is being applied and also works with a requirement of non-obviousness; both lacking under the UPOV system. Hence it is argued that while the patent system is meant to protect *innovation*, the UPOV system protects *investment* (Llewelyn, 2003, p.316). Furthermore, in terms of the scope of the rights conferred, the UPOV system

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<sup>24</sup> The distinction between *plants* as a generic term and plant *varieties* as a taxonomical rank has been extensively discussed in the case law of the European Patent Office; see: Enlarged Board of Appeal of the European Patent Office, *Transgenic Plant/NOVARTIS II*, 20 December 1999, G1/98, Official Journal of the European Patent Office (2000) 125.

<sup>25</sup> Union Internationale pour la Protection des Obtentions Vegetales, *International Convention for the Protection of New Varieties of Plants*, 2 December 1961, as Revised at Geneva on 10 November 1972, on 23 October 1978, and on 19 March 1991, 1861 United Nations Treaty Series 281, available online at: <http://www.upov.int/en/publications/conventions/1991/act1991.htm> (Accessed 2 October 2007), ‘UPOV Convention 1991’.

<sup>26</sup> Article 5 of the UPOV 1991 Convention.

provides for a so-called farmer's privilege, enabling farmers to save and re-use harvested seeds, and embodies a breeder's exemption, allowing the development of new plant varieties based upon an existing, protected, variety.

The possibility of establishing a *sui generis* system for the protection of new plant varieties, however, does not necessarily mean that countries must join the traditional UPOV-system of plant variety protection. They may choose to design a system specifically tailored to their local needs and interests.<sup>27</sup> Indeed, the UPOV system does not address the protection of nucleic ('gene') sequences, nor any processes. In this context, it should be noted that it remains unclear to what extent countries can refuse the patenting of plant and/or animal gene sequences under the TRIPS Agreement, which only allows WTO member parties to exclude 'plants' and 'animals'.<sup>28</sup> Here, the major uncertainty is whether or not such systems would comply with TRIPS by providing effective protection mechanisms. Before WTO judicial bodies, their effectiveness is likely to be judged upon sufficient strength of the rights conferred (Llewelyn, 2003, p. 310).

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<sup>27</sup> See in relation hereto: P. Cullet, Intellectual Property Rights and Food Security in the South, 7 *The Journal of World Intellectual Property* 3 (2004). Also, as regards protection of 'traditional knowledge': T. Cottier and M. Panizzon, A New Generation of IPR for the Protection of Traditional Knowledge in PGR for Food, Agricultural and Pharmaceutical Uses, in T. Cottier & S. Biber-Klemm, *Rights to Plant Genetic Resources and Traditional Knowledge: Basic Issues and Perspectives*, Swiss Agency for Development and Cooperation and World Trade Institute, Cabi Publishing, 2006, pp. 203-238; and also: G. Dutfield and J. Posey, *Indigenous Peoples and Sustainability: Cases and Actions*, Utrecht, IUCN International Books, 1997.

In law, see the Costa Rican 'Ley de Biodiversidad' (1998) and the Andean Community's Common System on Access to Genetic Resources (1996).

<sup>28</sup> In Europe for instance, plant, animal or even human genetic sequences are not considered to fall under the definition of 'plants', 'animals' or 'humans' but are instead equated to chemical substances. However, the scope of a patent on a gene sequence might be wider than covering merely the gene sequence in its isolated laboratory form and might instead extend to the (plant-) organism in which the gene sequence has been inserted and is performing its function, regardless of whether the organism itself is patentable. In this context, moreover, the possibility of excluding plants and animals is severely limited by the fact that non-essentially biological processes (e.g. processes of genetic engineering) must be patentable and that the 'product obtained directly by that process (regardless of whether this itself is patentable or not) (which can very well be a plant or an animal) has to fall under the scope of protection of such process patents under Article 28 § 1 (b) of the *TRIPS* Agreement.

If they exclude plants from patentability as discussed above, WTO Members are obliged to provide a sui generis system for plant variety protection. However, this is not the only case in which Members are allowed to establish sui generis protection systems. Once excluded from the patent system, inventions seem free to be protected under sui generis systems. As animals can be excluded from patent protection, it seems perfectly possible to establish sui generis systems for the protection of animal breeds, for instance. LDCs,<sup>29</sup> in particular, having until 2013 to implement a TRIPS-compliant patent system, could fully exploit sui generis options.

For instance, so called 'petty patents' or 'utility models' can constitute a valuable sui generis option either in cooperation with an existing traditional patent system or as an IP right functioning in a system that does not apply patents. In Australia, for example, petty patents function together with the traditional patent system, offering less but cheaper and easier-to-obtain protection. The criterion of novelty is only assessed within Australia, as opposed to worldwide as for traditional patents, but a petty patent will only last for six years, as opposed to the traditional twenty-year patent protection term. However, petty patents, in much the same way as UPOV, are mostly meant to protect low-tech innovation and may not always be well suited to biotechnological inventions.<sup>30</sup>

Many developing countries and especially least developed countries do not have effective IPR regimes, partly as a result of a general lack of strong institutional capacity, and partly due to the suspicion that establishing a strong IPR regime would benefit only the multinational companies that dominate the field (Kameri-Mbote, et al., 2001, p.22). However, they fail to make full use of existing flexibilities

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<sup>29</sup> In fact, of a list of 50 LDCs, 32 are WTO Members. As regards Africa, this includes Angola, Benin, Burkina Faso, Burundi, Central African Republic, Chad, Congo, Democratic Republic of the Dribouti, Gambia, Guinea, Guinea Bissau, Lesotho, Madagascar, Malawi, Maldives, Mali, Mauritania, Mozambique, Niger, Rwanda, Senegal, Sierra Leone, Tanzania, Togo, Uganda, and Zambia. Furthermore, Cape Verde, Ethiopia, Sao Tome & Principe, and Sudan are in the process of accession ([http://www.wto.org/English/thewto\\_e/whatis\\_e/tif\\_e/org7\\_e.htm](http://www.wto.org/English/thewto_e/whatis_e/tif_e/org7_e.htm)) (Accessed 7 October 2007).

<sup>30</sup> Two versions of the UPOV Convention can be adhered to: UPOV 1978 and UPOV 1991.

in international patent laws. In fact, they tend to implement patent laws more or less copied from developed countries' patent acts and their patent offices tend simply to follow the patentability decisions of major patent offices (United States Trademark and Patent Office; European Patent Office; Japanese Patent Office). They also seem reluctant to implement sui generis systems for protection of plant varieties. Although, many developing countries are pressured to join the UPOV system in bilateral free trade agreement-negotiations, the majority of African countries, for instance, have not adhered to UPOV or benefited from the possibility of implementing sui generis systems tailored to their local needs.<sup>31</sup>

There is a need to design new institutional frameworks tailored to resolve the trade-off between ensuring high accessibility for the poor while providing adequate incentive to the private sector to invest in innovation and technology transfer. This requires new policy approaches designed to provide more institutional incentives that would enhance the role of the private sector, both local and international, to invest in biotechnology. However, without a sound legal framework providing adequate protection to investments/innovations, biotechnological industries are hardly likely to flourish. Hence, rather than copying intellectual property laws from the developed countries, low-income developing countries should benefit from the flexibilities provided under TRIPS, UPOV and regional intellectual rights conventions to tailor IPR frameworks to their local specificities. These frameworks should not only be sophisticated enough to promote home-grown biotechnological innovation and technology transfer, but also conducive to PPPs which are becoming increasingly common in advanced developing countries.

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<sup>31</sup> UPOV adherence is limited to a few African countries which have mostly joined the weaker 1978 version of the UPOV Convention.

## 5 Pro-Poor Public-Private Partnerships

Following the era of the 'welfare state' in the 1970s and early 1980s and that of 'neo-liberalism' during the 1990s, there has been a significant shift in the political and policy approaches to institutional development. The state-led centralist approach to scientific research and technological innovation of the Green Revolution is no longer considered feasible. In many developing countries, public research institutions, which were never designed to be competitive, find it increasingly difficult to obtain adequate resources and expertise to innovate in a rapidly developing field of technology. They lack the market knowledge and entrepreneurial drive to respond to today's world of extremely diversified and sophisticated agricultural markets. Furthermore, the original design of these institutions was based on the conventional neo-classical assumption that there is a linear path from investment and research to innovation and its subsequent adoption by farmers (Hall, et al., 2001, p. 785). This reasoning has been called into question as being simplistic and infective. The more recent 'process' approach proposes that the technological innovation is affected by many dynamic factors leading to setbacks and irregularities requiring micro-management and extensive farmer participation (Hall, et al., 2001, pp 785). Hence, there is an increasing need for developing countries to move away from the conventional institutional approaches that consider scientific research and technological innovation as explicit 'public goods' achievable through linear pathways which the welfare state has the sole responsibility to provide.

On the other hand, the neo-liberal approach, namely, 'let the market decide' has also proven problematic. There are serious asymmetry problems causing market failures, indicating that freeing market mechanisms does not automatically create welfare gains. Especially in the context of poor developing countries, the market-led reform of the 1980s and 1990s resulted in the privatisation of many state-run agricultural organisations, such as producer cooperatives, credit, purchasing and storing agencies, and research and extension institutions, providing major services

to smallholders. In remote rural areas where poverty is particularly prevalent, the withdrawal of the state has left a large vacuum that the private sector is unable or unwilling to fill (IFAD, 2001, p. 168). Thus, it is argued that the neo-liberal approach to agricultural services, including scientific research and extension, as indiscriminate 'private goods' that should fall within the realm of the private sector, has failed to stimulate technological innovation in developing countries.

PPPs offer new institutional opportunities for enhancing biotechnological research. There are various types of institutional design for PPPs. In general, public institutions and the private sector pool their resources for research which should then benefit both the private sector and the general public. The private sector usually provides its methodological knowledge, financial resources and marketing expertise while the public sector provides institutional and infrastructural support, including supportive legislation and the use of testing facilities and germ plasm varieties. In this way, private biotech companies can gain access to large domestic agricultural markets. For large multinational biotech companies, this approach is also considered to be a good tool for building a pro-developmental public image (Kameri-Mbote, et al., 2001, p. 12). PPPs can also help public institutions to convert their research outputs into end-user oriented products. They can also promote private sector development in countries with agricultural sectors dominated by state-owned monopolies (Spielman, et al, 2007, p. 34).

There have been important examples of PPPs in developing countries. The International Service for the Acquisition of Agri-Biotech Applications (ISAAA) is a significant example of PPPs at the international level. Through its regional operations (in Africa, Asia and Latin America), it acts as an intermediary between developed country companies and public institutions in developing countries (Kameri-Mbote, et al., 2001, pp. 11-12). It focuses on horticulture technology which is also promising for smallholders. By bringing together the public and private sectors, it was able to establish a tissue culture laboratory for work on banana in Kenya. It also played the role of intermediary between British and Egyptian

institutes enabling the transfer of virus resistant tomato technology in Egypt (Kameri-Mbote, et al., 2001, p. 12).

The Consultative Group on International Agricultural Research (CGIAR) has also entered into some partnerships with the private sector. For example, its collaboration with a Japanese private company produced the first Bt cassava variety developed in Africa (Rausser, et al., 2000, pp. 503-505). The group has also established around 20 partnerships with the top 10 crop-science companies around the world (see Table 3). However, only 4 per cent of the CGIAR's aggregate financing (2001-2005 average) was dedicated to PPPs (Speilman, et al, 2007, p. 29). And, its existing partnerships with the private sector are not usually designed for the purpose of conducting cutting edge research with the explicit goal of end-user oriented innovation (Speilman, et al, 2007, p. 32).

**Table 3. Public-private partnerships in the crop-science sector between CGIAR centres and the 'Big 10s' in the crop-science and agri-food sectors, c. 2004**

Sector/firm/country of headquarters	Sales (million US dollars)	Number of partnerships with CGIAR centre
Syngenta, Switzerland	7,270	7
Pioneer Hi-Bred International, US	4,830	5
Bayer Crop-Science, Germany	7,390	4
Monsanto, US	5,220	2
BASF, Germany	4,170	2
Grupo Limagrain, France	965	1

Source: Spielman, et al, 2007, p. 37

Effective partnerships have been established at the regional and country levels too. The collaboration between some Indian research institutes and four Swiss partner institutes to insert insect-resistance genes into sweet potato is one of the early examples of PPPs dating back to the 1970s. In this case, a private company from the

UK obtained funding from the public partners in return for providing the Overseas Development Administration (ODA) with a non-exclusive royalty-free licence for the technology (Kameri-Mbote, et al., 2001, p. 14). Similarly in Latin America, the International Centre for Tropical Agriculture collaborated with Novartis to conduct research on transgenic maize developed for its resistance to the corn stem borer. In Africa, Monsanto and the Kenyan Agricultural Research Institute (KARI) established a partnership based on the agreement that Monsanto would provide a royalty-free non-exclusive licence to KARI for virus-resistant technologies in sweet potato; in return, KARI would undertake the marketing of the technology in Africa (Rausser, et al., 2000, pp. 503-505). These examples show that innovation-driven PPPs can play a major role in making technology both available and accessible to smallholders in developing countries.

## **6 The Public/Private Goods Dichotomy**

PPPs, however, raise questions about the current applicability of the conventional definitions of public and private goods, which constitute the underpinnings of the present IPR regimes. Public goods are generally considered to be non-rivalry (or indivisible) – as one entity's consumption does not reduce the amount that others might like to consume. Similarly, they are considered to be non-excludable – as one cannot exclude others from consuming public goods. On the other hand, private goods are traditionally seen as rivalry and excludable. Although information and knowledge are, in theory, non-rivalry (or indivisible), like public goods, they become excludable through IPRs and trade secrets. This is particularly true for information driven sectors such as information technology or biotechnology. The dichotomy becomes even more confusing when acknowledging that public institutions no longer produce goods free from IPRs, but are using the possibilities of the patent system to generate a return on investments, just as the private sector does. As such, the growing diffusion of knowledge and information technology into the field of agricultural economy blurs the relevance of conventional

institutional settings based on the traditional distinctions between public and private goods.

IPRs in general and patents in particular are designed to serve as an incentive to stimulate investment in the private sector aiming at creating 'private goods'. However, when the public sector is involved in an innovation process with potential commercial use, there is a fundamental problem of identifying the right holder. Although the public sector uses public resources to create an innovation, implying that the right owner should be the 'public', the concurrent product that comes under patent protection becomes excludable and thus 'private'. Hence, there is a need to re-assess the balance between the right holder and public domain interests for inventions produced by the public sector or in a PPP. However, the existing IPR regimes are not designed to address this fundamental dilemma that arises from a combination of the information-driven biotechnology and the new institutional arrangements involving PPPs in biotechnology research in agriculture. Therefore, we argue that at the conceptual level, there is a need for special IP-regime for innovations coming out of PPPs.

There are three major stages and two legal levels through which IP issues come into play in relation to PPPs. First, as just mentioned, intellectual property issues come into the game at the very beginning of the PPP and play a role in its establishment, affecting the decision of the potential partners to accept a partnership deal. The choice of the concrete private actor may depend on patent landscapes, need for licences and cross-licensing opportunities. Second, IPRs and licensing requirements need to be evaluated throughout the existence of the PPPs – as right holders might change and patents might either appear or elapse. Third, and most importantly for this paper, is the issue of which partner will have the IPRs on the end-product, how it will be licensed, and how strongly it will be protected. All these issues can be addressed at both the contractual and law level. Both of these levels are linked in defining the strength of the partnership incentive that will be provided and the strength of protection foreseen, and hence affect the post-development accessibility of inventions made through the PPP.

## 7 Special IPRs for PPPs

Having argued for a special IP-regime for PPPs from a conceptual point of view, there is also a need to address this idea at the institutional and practical levels. IP-related accessibility issues can be resolved on a purely contractual or free will basis, as has been shown in the case of Monsanto's royalty-free non-exclusive licence to the KARI. However, we argue that PPPs simply based on contractual arrangements lack a systemic, harmonised and transparent legal framework. Disagreements between partners on commercialisation and royalty sharing could make PPPs fail in enabling their research products to reach their potential users. Moreover, dealing with complex licensing and contractual issues in each PPP results in high transaction costs (Byerlee and Fischer, 2001, p.10). Hence, at the institutional and practical levels, a special IP-regime tailored for PPPs could provide a more effective and efficient framework ensuring a greater incentive for private actors and better access for smallholders. Focussing on developing and least developed countries, this section will investigate how a specially tailored IP-regime could be suited to the specific needs of PPPs and the target market of poor farmers; and what would be the international legal limitations in designing such an IP-regime.

The rebalancing of patent rights or the establishment of a *sui generis* system tailored for PPPs may involve several options:

- An IP-regime tailored for PPPs could entail a mechanism for market segmentation between the public and private partners. It would involve an exclusion that would allow smallholders initially to have free or low-cost access to new seeds developed through PPPs for use on their own land, avoiding further trade or entering into competition with the IP-right holder. This would be ensured by the public partner keeping the right to make the invention freely available to poor smallholders. On the other hand the private partner would keep the monopoly power for the higher income segments of the market. There is a need for 'proxy' criteria defining the boundaries of such market segmentation (Byerlee and Fischer, 2001, p.14). However, given that such an IP-regime should be based on simple and

measurable parameters, farm size – which is generally considered to be a good indicator of farm income – could be used for market segmentation. This would require that information on land distribution patterns is accurate and up to date.

- It may also include a special farmer's privilege making the (re-)use of harvested seeds from patented plants for next year's (re-)planting possible without requiring retribution for *small* farms specifically.<sup>32</sup>
- It may allow the private partner to patent and freely commercialise the end-product in other countries (in the case of co-ownership). This would increase the incentive for the private partner. In return, it may provide research exemption exclusively for the public sector.
- A specially tailored 'sui generis' IPR-system for PPPs may be designed with a shorter duration than the 'traditional' twenty-year term of patent protection, depending on the scale of public sector investment. Here, a specific scale could be thought of linking public sector investment to term of IP-protection. Similar to the petty patent example given above, it may last less than 10 years, for instance, to enhance competition and free use of knowledge sooner than would be possible under a conventional patent regime.
- It may include an obligatory licensing mechanism which could be installed in the case that the private actor gets the IP-rights (which might be likely as it is mostly the private partner that takes the basic research results of the public sector to create commercial end-products). It may also involve a compulsory co-inventorship (PPP), allowing further flexibility to the public partner.

Further options and flexibilities can be introduced under special IPRs for PPPs; this is a matter of institutional creativity. However, developing country Members of the WTO are obliged to have a patent system within the TRIPS minimum standards. Therefore, any form of specifically tailored IPRs must first be evaluated against this obligation. As discussed above, least developed countries have until 1 July 2013 to install such a TRIPS-compatible system. Yet, until then, regulations and practice

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<sup>32</sup> A remarkable example in this field is the European UPOV system which establishes a mechanism of farmer's privilege. It makes a distinction between 'small' farmers, who are allowed to invoke the right without having to make a financial contribution, and larger scale farmers who need to remunerate 'equitably' the UPOV right holder.

may not result in a lesser degree of consistency with the provisions of the TRIPS Agreement: i.e. existing standards of protection may not be lowered.<sup>33</sup> Hence, options differ between developing and least developed countries as well as between least developed countries themselves.

For developing countries, a sui generis option for inventions that are products of PPPs can a priori only result in dual protection patents/sui generis rights. Since the TRIPS Agreement requires patents to be available for any inventions without taking into account how or by which association they were developed, one will not be able to specifically exclude inventions developed in PPPs from patentability to include them in a specially tailored sui generis system of IP-protection without also allowing their patenting. A form of dual protection, however, carries the risk of ruling out the weaker system of IP-protection, in this case the sui generis rights.

For biotechnology inventions specifically however, it is possible to go further in tailoring special IPRs without having to take into account the TRIPs non-discrimination provision and the limits of Article 30. As under Article 27 § 3 of the TRIPS Agreement one is able to exclude 'plants' and 'animals' from patentability; one is a priori free to re-include them in an IP-protection system specially tailored for 'plants' and 'animals'. There is no clause in the TRIPS Agreement indicating that it is forbidden to design specific IP protection rules for subject matter excluded from patentability, e.g. plants and animals. In other words, when plants and animals are set patentable they must be so according to the TRIPS minimum standards; but when they are excluded from the patent system there are no further prescriptions or restrictions. Taking this option, compliance with TRIPS would boil down to knowing the exact scope of the terms 'plant' and 'animal'. Although the decisive factor would be to know whether these terms could cover an important range of biotechnology inventions such as nucleic 'gene' sequences and cell lines,

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<sup>33</sup> TRIPS Council, *Decision on the extension of the transition period under Article 66 § 1 for least developed countries*, 29 November 2005, available at: [http://www.wto.org/English/news\\_e/pres05\\_e/pr424\\_e.htm](http://www.wto.org/English/news_e/pres05_e/pr424_e.htm) (Accessed October 2007).

we argue that by excluding 'plants' and 'animals' from patentability, developing countries could design a special IP-system for PPPs in the field of agricultural biotechnology.

In sum, a special and sophisticated sui generis system for PPPs could offer a better approach to promote innovation and access to pro-poor technology in developing countries. It would solve the conceptual problem of the increasingly blurred distinction between 'public' and 'private' goods and 'excludability' in an era of increasingly information-driven biotechnology research through PPPs. It would also provide a harmonised institutional framework with the potential for lowering transaction costs, as compared to exclusively contract-driven PPPs. It would offer legal guidance for public institutes which are often not equipped to deal with IP-related issues. More importantly, through its embedded market segmentation structure and enhanced smallholder privileges, as well as its flexible term and increased incentive for the private sector to invest and participate in PPPs, it would strike a better balance between the tasks of promoting research investment and diffusion of pro-poor technology.

## 8 Conclusion

New biotechnology offers new opportunities to promote pro-poor agricultural growth in developing countries. It can address the needs of small farms in unfavourable agro-ecologies where ecological frontiers have been reached and the marginal benefits of conventional technology have been exhausted. Through more robust staple varieties, which are tolerant to abiotic stresses, it offers farmers in ecologically unfavourable areas opportunities to improve their productivity. Research in high-value agricultural commodities such as horticultural crops and livestock, which are becoming increasingly more important sources of income for smallholders is also promising. The advances in technological applications

addressing malnutrition and disease would also represent a major breakthrough in the fight against poverty. New biotechnology is rapidly pushing back its technical frontiers to harness innovation for the potential benefit of small farms in developing countries.

The technical availability, however, is no guarantee of physical availability and accessibility which can be established only with the right economic incentives and effective institutional structures in place. Given the agricultural research spending figures discussed above, there is a widening knowledge gap between developed and developing countries on one hand and between the public and private sectors on the other. Furthermore, the multinational companies currently dominating the biotechnology market are inclined to design their products based on the needs of large-scale farms, ignoring smallholders powering developing countries. Hence, there is a need for new institutional frameworks tailored to ensure good accessibility for small farms and to provide adequate incentives for the private sector to invest in local innovation and technology transfer.

In this context, establishing an effective IPR regime can play an important role as a part of a wider institutional environment conducive to innovation. IPRs, in particular patents and *sui generis* rights for biotechnology protection, could be implemented in a manner that fits the rights and obligations of the right holders to the local circumstances. However, as shown in the analysis above, low income countries have not used the numerous flexibilities – provided under both International and Regional patent law treaties – to design their own IP-regimes according to their local circumstances. We have argued that developing countries need to design new institutional frameworks for IP protection exclusively in the field of biotechnology. A specially designed IPR regime should be a patent-type protection system (rather than a UPOV-type system) sophisticated enough to cover nucleic ('gene') sequences and methodological processes.

We have also put forward the new idea of a specially tailored IPRs regime for PPPs. Since the conventional distinctions between public and private goods and excludability need to be redefined, such a specially tailored regime becomes a conceptual necessity. On the other hand by providing a harmonious and uniform and transparent legal framework, which lowers transaction costs, it is an institutional and practical necessity too. Given its technical possibility under the international IP law, developing countries should be able to design a special IP-system for PPPs in the field of agricultural biotechnology, by excluding 'plants' and 'animals' from patentability, as allowed under the TRIPS agreement. We have argued that such a specially tailored IP-system could have an inherent market segmentation mechanism allowing for free access for the poor through the public partner, as well as granting a return on investment for the private partner. It could have a flexible term of application allowing for higher level competition and knowledge diffusion in the medium and long term.

Enhancing accessibility of and increasingly incentivising the production of pro-poor biotechnologies through sound IP systems is certainly not enough to result in effective *use* of pro-poor biotechnologies in developing countries. However, PPPs together with a suitably adapted IPR system setting legal standards for contractual negotiations; creatively using public domain possibilities; and a proper contractual balance might be critical in making agricultural biotechnology pro-poor.

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