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Simonetta Zarrilli

Abstract:

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Introduction

Biotechnology is a revolutionary technology.[2] It offers humanity the power to change the characteristics of living organisms by transferring the genetic information from one organism, across species boundaries, into another organism. These solutions continue the tradition of selection and improvement of cultivated crops and livestock developed over the centuries. However, biotechnology identifies desirable traits more quickly and accurately than conventional plant and livestock breeding and allows gene transfers impossible with traditional breeding. The use of biotechnology in sectors such as agriculture and medicine has produced a growing number of genetically modified organisms (GMOs) and products derived from them. A GMO can be defined as "an organism, with the exception of human beings, in which the genetic material has been altered in a way that does not occur naturally by mating and/or natural recombination".[3]

Bio-technological improvements present significant opportunities for agriculture and farmers. At present, the perceived benefits of genetically modified crops are better weed and insect control, higher productivity and more flexible crop management. These "first generation" GM crops are mainly benefiting the producers who can obtain higher yields and/or lower costs. The broader and long-term benefits, however, would be more sustainable agriculture and better food security that would benefit everybody, and especially the developing countries. For instance, breeding for drought tolerance could greatly benefit tropical crops, which are often grown in harsh environments and in poor soils. Increasing the amount of food produced per hectare could be a way to feed the world's growing population, without diverting land from other purposes such as forestry, animal grazing or conservation. There are a number of examples of food products that are being developed to act as edible vaccines and have raised hopes of solving many of the problems associated with the

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[2] The Convention on Biological Diversity defines biotechnology as "any technological application that uses biological systems, living organisms, or derivatives thereof, to make or modify products or processes for specific use".

[3] See Directive 2001/18/EC of 12 March 2001 of the EC on the deliberate release into the environment of genetically modified organisms and repealing Council Directive 90/220/EEC, OJ L 106, 17.04.2001, Article 2(2).

delivery of safe, effective vaccines in developing countries.[4] A shift is, therefore, occurring from the current generation of "agronomic" traits to the next generation of "quality" traits, from which consumers, more than producers, would to able to benefit.

While GM crops may offer great benefits to agriculture and farmers and, potentially, to consumers, in particular to poor people in developing countries, biotechnology does not come without risks and uncertainty. There are many fears linked to perceived threats of biotechnology to human, animal and plant life and health, to the conservation of biodiversity and to the environment at large. Although there is not yet any definite scientific evidence of harm to humans, animals or the environment, it is submitted by many that adverse effects may be revealed in the future by more extensive research. The fear is that GMOs may change the toxicity and allergenicity of food, thus fostering allergic reactions or altering antibiotic resistance. A major environmental concern relates to potential consequences of gene flow from GM to non-GM individuals of the same species and to the possibility of unpredictable crosses with other species. Some claim that crops modified to be tolerant to herbicides could foster the development of "super weeds". Another related concern is that GMOs could threaten the world's biological diversity and lead to excessive dependence on few crop varieties, thereby increasing the vulnerability of crops to diseases. Economic preoccupations have also been voiced. They relate to the fact that a large number of patents have been issued in the sector. If the results of plant research continue to be patented, there is a risk that they may become too expensive for poor farmers, especially in developing countries. Moreover, the private sector invests in areas where there are hopes of a financial return; as a consequence, private science may focus on crops and innovations that are of interest to rich markets and put less emphasis on those of interest to poor countries. It is also argued that biotechnology may change the nature, structure and ownership of food production systems by consolidating control in the hands of a few large firms. This could aggravate food security problems that are allegedly caused not so much by food shortages as by inequity, poverty and concentration of food production. Finally, modern biotechnology techniques may raise ethical and religious concerns.

Trends

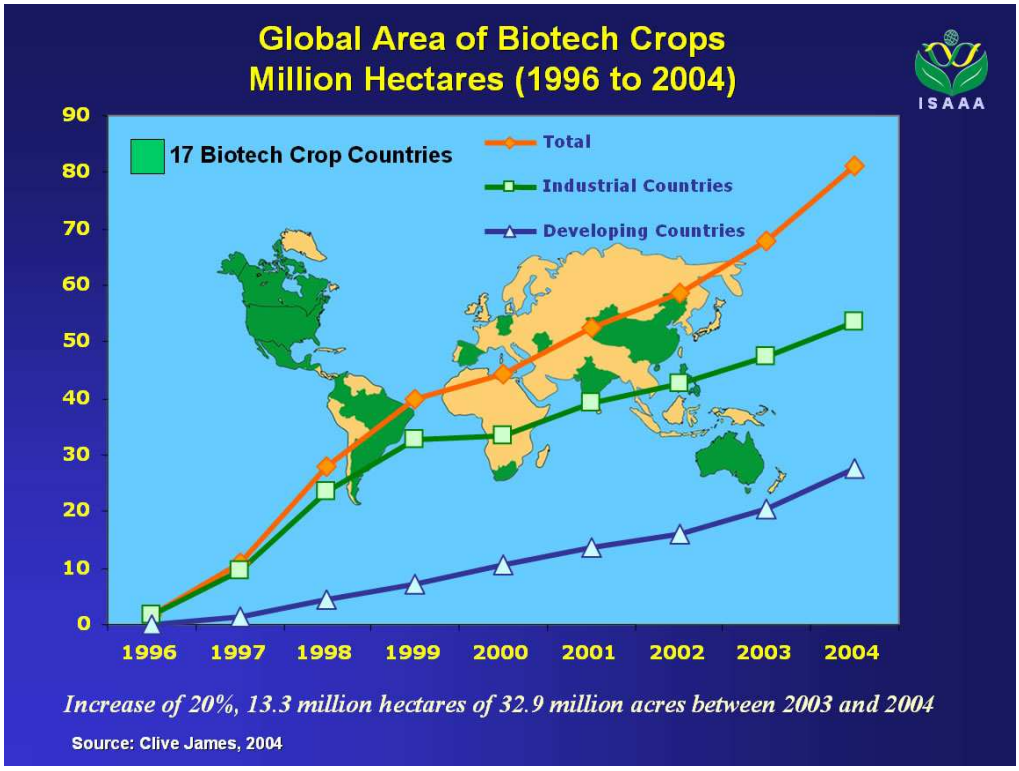
According to figures from the International Service for the Acquisition of Agri-biotech Applications (ISAAA), the global area of GM crop plantation has grown 47-fold since 1996, and the estimated global GM crop area in 2004 was 81 million hectares, cultivated by approximately 8.25 million farmers in 17 countries. Herbicide-tolerant soybean was the dominant transgenic crop, followed by Bt maize[5], Bt cotton, and herbicide-tolerant canola. 14 countries grew 50,000 hectares or more of biotech crops; the eight leading biotech crop countries being the United States, representing 59 per cent of global transgenic

[4] MacKenzie, D.J. and M.A. McLean (2004) "Agricultural Biotechnology: A Primer for Policymakers", in *Agriculture and the WTO – Creating a Trading System for Development*, World Bank, pp.237-253.

[5] Bt plants produce their own pesticide through a gene borrowed from the bacterium *Bacillus thuringiensis*.

crop area; Argentina, 20%; Canada and Brazil, 6% each; China, 5%; Paraguay, 2%; and India and South Africa, 1% each. Plantings were also found in Uruguay, Australia, Romania, Mexico, Spain, the Philippines, Honduras, Colombia, and Germany. More than one-third of the global transgenic crop area in 2004 was grown in developing countries (see figure 1).

Figure 1



Although continuously expanding, GM crop plantings are still confined to a rather small number of countries. Apart from suspected health or environmental hazards, the reason for the restricted global uptake of GM crops may find its rationale in fear of export loss due to the political and regulatory environment in many countries outside the Americas that oppose GMOs.

Countries' positions on agro-biotechnology

Countries' positions on agro-biotechnology depend on many factors, such as their policy awareness, the level of risk they are willing to accept, their capacity to carry out risk assessments in the sector and implement adequate legislation, their perception of the benefits they could gain from biotechnology, their dependence on agricultural exports and the consequent need to satisfy the rules and expectations in the export markets; their reliance on food aid, and the investments they have already made in the sector. Countries' positions can be classified into three main categories:

(i) the position of those countries that have adopted the equivalence principle, have authorized most GM products for production and consumption,

and strive for easy and reliable access to foreign markets for their biotechnology exports;

(ii) the position of those countries that have mainly adopted the precautionary approach and are imposing strict rules on approval and marketing of GMOs and GM products; and finally

(iii) the position of those countries that are still in the first phase of evaluating the risks and benefits that agricultural biotechnology may imply for them, that are striving to develop comprehensive regulatory systems on the issue, and whose main trade-related preoccupation at present is to preventing GM-related regulations and concerns having negative repercussions on their agriculture exports, including exports of conventional products. Many developing countries fall into the third category.

GMO regulations are based on scientific assessment of the actual or potential risks that those products may bring about. Such assessment can be a "conventional" risk assessment or a risk assessment based on the precautionary approach. The former is about relevant scientific evidence, which means that there is sufficient scientific evidence for the perceived risks underlying the measure. The large GM producers, such as the United States, Canada and Argentina, rely on this approach. Conversely, the "precautionary approach" to risk assessment is concerned with scientific uncertainty, where there is no "adequate theoretical or empirical basis for assigning possibilities to a possible set of outcomes".[6] Three basic conditions may thus trigger application of protective measures: uncertainty, risk, and lack of proof of direct causal link.[7]The EU legislation is based on this approach.

Many developing and least developed countries, especially in Africa, still lack, or are in the process of developing, comprehensive regulatory systems to deal with the challenges of agricultural biotechnology. Developing a regulatory framework concerning GMOs may be a costly and lengthy process. Areas for regulation include: (a) research and development (R&D), for example conditions under which laboratory experiments take place and conditions for testing in contained facilities or in the field; (b) approval processes for commercial release, including prior scientific assessment of risks to human and animal health and the environment, the minimum distance from organic agriculture or non-GM fields, labelling, post-commercialization monitoring, and liability; and (c) import regulations.[8]

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[6] Christoforou, Th., "The Precautionary principle in European Community Law and Science", in J.A. Tickner (ed.), *Precaution, Environmental Science, and Preventive Public Policy* (Washington, DC: Island Press, 2003), pp. 241-257, at 246.

[7] *Ibid.*, at 243.

[8] ISNAR and FAO, in consultation with UNEP/GEF, have developed a web-based "Decision Support Toolbox for Biosafety Implementation" (http://www.isnar.cgiar.org/ibs/biosafety/regulatory.cfm), while the UNEP-GEF Projects on National Biosafety Frameworks (NBF) are implementing the GEF Initial Strategy in Biosafety to assist: (i) 123 countries in developing their NBFs, (ii) 8 countries in setting up a fully operational NBF and (iii) Parties to the Biosafety Protocol building capacity for effective participation in the Biosafety Clearing House (BCH). For details see www.unep.ch/biosafety.

In setting up domestic legislation, developing countries seem to be paying increasing attention to international trade concerns. On the other hand, developed countries are increasingly getting involved in how the issue of biotechnology is going to be settled in developing countries.

The EU, for instance, has stressed that GMOs are not the panacea likely to solve famine in Africa, since the real causes for hunger and famine in Africa have to do with ethnic feuds and regional wars that displace populations. Moreover, the EU has noticed that most of present GMOs are herbicide-resistant or pest-resistant, however most African producers do not use herbicides or pesticides in their crops. The kinds of GMOs that would benefit African producers, such as GMOs that are drought and soil-acidity resistant, are however still confined to laboratories. GMO crops, to be efficient, need extensive farming land and involve fewer farmers. The reality in Africa is the opposite: small fields and many farmers. Moreover, if Africa were to adopt biotechnology, it would become completely dependent on Western companies that hold the patents.[9]

On its side, the United States has claimed that the delay on accepting shipment of US maize might jeopardize the life of millions people in African countries which refuse food aid which may contain GMOs.[10] The United States insists that only by using GM crops will Africa be able to feed its burgeoning population. US companies are exercising pressure on some African countries to adopt GM crops.

The international trade dimension and developing country special concerns

Assessments of the risks and benefits related to agro-biotechnology vary substantially between countries and regions, and so do the regulatory approaches (rules on GM approval, marketing, import, labelling, documentation). When GM products are commercialized internationally, as has been the case since the second half of the 1990s, the diverging domestic requirements may hamper international trade in agro-biotechnology products and further complicate an already difficult regulatory trade system in the agricultural sector.

From an international trade perspective, the major preoccupation of GM producing and exporting countries is to have easy and reliable access to foreign markets for the GMOs and GM products that they have already developed or may develop in the future. For countries, like the EU, that have adopted a "no-risk" approach, the main preoccupation is to establish strict production and import measures that would guarantee that the chosen high level of health and environmental protection is indeed achieved.

[9] European Union in the US, EU Newsweb, Commentary, *The case of Africa and GM crops: The European View*, 13 June 2003, found at: http://www.eurunion.org/newsweb/commentary/GMOCommentary.htm

[10] PlanetArk, *Starving Africa should accept GMO food, US say*, 29 July 2002, found at: http://www.planetark.com/avantgo/dailynewsstory.cfm?newsid=17051.

Developing country preoccupations have several facets. While some developing countries produce GMOs for domestic consumption, very few export them. However, many developing countries are exporters of conventional agricultural products. Those countries find themselves in a particularly difficult situation: in order to preserve their export opportunities, especially towards markets that are sceptical about bio-engineered products, they may need to be "GM-free" countries. This means not only that they should not be exporters of GMOs, but also that they should not be producers of GMOs for domestic consumption and not even importers of GMOs. Losing "GM-free" status is perceived by some countries as having negative repercussions for their export opportunities for all agricultural products. This is due to the perception that consumers, especially in Europe, may react negatively towards products that could be linked even remotely to genetic modification. Some trade-diverting effects are apparently already taking place because companies substitute some inputs with others (which do not bear the risk of being genetically modified) or use inputs coming from alternative countries, which are supposed to be "GM-free", to avoid cumbersome documentation and traceability requirements, as well as to meet consumers expectations, especially in Europe.

While South Africa is striding ahead with the cultivation of GM maize and cotton, many other African countries prefer to keep away from biotechnology fearful of environmental damage and reduced exports to Europe. A handful of other African countries, including Kenya, Nigeria and Tanzania, are looking at creating new laws to allow planting of GM crops. Kenya and Nigeria are looking at making their own GMO variants, while cotton-producing countries in West Africa may move into GMO production (see Table 1).[11]

The perception of possible reduced exports to the EU has been among the reasons why some African countries have refused food aid that includes genetically modified commodities. In 2002, Zambia declined a US offer of maize, some of which contained GM products. Main Zambian concerns related to uncertainty regarding the safety of GM maize for human consumption, as well as the possible contamination of local varieties which could allegedly imply a rejection by EC countries of Zambian food exports. In July 2002, the Zimbabwean Government agreed to allow into the country food aid that contained genetically modified maize, provided it was milled immediately upon arrival to avoid any possible contamination of local varieties. Previously, Zimbabwe had rejected GM food aid due to concerns that it might supposedly threaten beef exports to the EU and local maize varieties.[12] Uganda recently announced that GM crops could be imported into the country, but that they should be used strictly for consumption and not for cultivation. At the same time, a draft law that would regulate both research into GM crops and the release of GM organisms into the environment is under consideration.[13]

[11] L'Express, *South Africa leads on GMO crops*, 1 March 2005, found at: http://www.lexpress.mu/display_article_sup.php?news_id=36906.
[12] See *Bridges Trade Biores*, 11 July 2002, available at http://www.ictsd.org/biores/02-07-11/inbrief.htm
[13] "Uganda gives cautious approval to GM food", *Science and Development Network*, 2 March 2004, available at: http://www.scidev.net/News/index.cfm?fuseaction=readNews&itemid=1257&language=1

At the beginning of May 2004, more than 60 groups representing farmer, consumer and environmental organizations from 15 African countries sent a letter of protest to the World Food Programme (WFP). These groups are protesting against the alleged pressure exerted by the WFP and USAID on Sudan and Angola over their respective decisions to impose restrictions on GM food aid. Sudan has requested that GM food aid be certified "GM-free" (though the Sudanese Government has put in place an interim waiver on GM food restrictions until January 2005), and Angola will accept GM food aid only on condition that all GM grain is first milled. According to the organizers of this initiative, non-GM alternatives exist at national, regional and international levels, and donors should make these available to Sudan and Angola.[14] According to the WFP, on the other hand, the requirement imposed by the Government of Angola would imply substantial extra costs and cause shipment delays of up to two months. This decision is going to further aggravate an already serious funding situation where the WFP has received only 24% of the funds it asked for under its current operation in the country. As a consequence, WFP is to halve the food rations given to the majority of the 1.9 million people it assists in Angola.[15]

Table 1 Current status on use and imports of GM products in some SSA and Biosafety Protocol's Membership[16]

Country	Legal regime	Additional information	Membership Biosafety Protocol
Angola	Import ban introduced in April 2004 on all GM products, except for food aid providing it has already been milled.	According to the WFP, the additional cost of milling has put off some food donors.	No
Benin	A five-year moratorium was introduced in March 2002 on the importation, commercialisation and use of GM products to give the country time to effectively debate, develop and implement national biosafety legislation.	The country is under constant pressure from agro-biotechnology companies to introduce Bt cotton.	Yes
Burkina Faso	Field trials of GM-cotton started in 2003. The tests are expected to last several years before any decision on whether to go ahead with large-scale planting may be taken.	Concerns about potential harm to the environment.	Yes
Ethiopia	Import ban on GM products, because they would allegedly undermine farmers who have developed traditional practices for fighting pests and weeds.	Debate continues over whether GM crops could help fighting serious food shortages that the country has been experiencing for several years.	Yes♣
Kenya	Import ban on GM products, but government in the final stage of drafting pro-industry legislation on agro-biotechnology.	Research is going-on to develop GMOs variants of cotton, maize and tuber. Field trials of GM sweet potato.	Yes
Lesotho	Import ban on GM products unless	Concerns about potential harm	Yes

[14] *African countries 'forced' to accept GM food aid*, Mail&Guardianonline, 5 May 2004.

[15] *Food Rations to Be Halved in Angola Amid Funding Crisis and GM Ban*, 2 April 2004, World Food Programme, In Brief, available at: www.wfp.org/newsroom/in_brief/Africa/angola/angola-040402.html

[16] The information on GM utilization and import is based on: PlanetArtk, FACTBOX – Genetically Modified Crops in Africa, 1 March 2005, found at: http://www.planetark.com/avantgo/dailynewsstory.cfm?newsid=29767. Biosafety Protocol's membership as of 10 March 2005.

♣ Ethiopia is not a Member country of the WTO.

	already processed or milled.	to the environment.	
Madagascar	Import ban on GM products.	Concerns about potential harm to human health and to the environment.	Yes
Malawi	Import ban introduced in 2002 on GM products unless already processed or milled.	Concerns about potential harm to the environment.	No
Mali	Field trials of GM cotton started in 2004.	Concerns about potential harm to human health and to the environment, as well as about dependence on foreign producers of GM seeds. Research agreement between the National Agricultural Research Institute and USAID, Monsanto, Syngenta and Dow Agrosciences to develop transgenic cotton.	Yes
Nigeria	Draft law authorizing the planting of GM crops under consideration. GM imports allowed.	Research is going-on to develop GMOs variants.	Yes
Rwanda	The government is awaiting conclusions from a government biotechnology committee before adopting a national policy.		Yes
South Africa	Cultivation of GM crops widespread, especially for maize, soybean and cotton. South Africa is among the eight world leading biotech crop countries, with 1% of global transgenic crop area.	The environmental group Biowatch won in March 2005 a court case forcing the government to disclose data about all GMOs and GM products imported, exported or manufactured in the country.	Yes
Sudan	Import ban introduced in May 2003 on GM products. A series of temporary waivers were issued enabling food aid shipments to the country to continue while alternatives were found.		No[♣]
Swaziland	Imports of GM products allowed.		No
Uganda	The government began in 2004 hearings over whether or not to authorize the planting of GM crops. GM crops can be imported, but they should be used strictly for consumption and not for cultivation.	Ugandan scientists are working on the development of GM bananas.	Yes
Tanzania	Draft law authorizing the planting of GM crops under consideration. Field trials of GM-cotton will start by October 2005.		Yes
Zambia	Import ban on GM products.	Concerns about potential harm to human health and to the environment, as well as about losing export markets.	Yes
Zimbabwe	Import ban on all GM products, except for food aid providing it has already been milled.	Concerns about potential harm to human health and to the environment, as well as about losing export markets.	Yes

In August 2003, the Southern African Development Community (SADC) approved a set of recommendations formulated by the SADC Advisory Committee on Biotechnology and Biosafety as interim measures aimed at guiding the region on those issues. The recommendations are divided into four main sections: Handling Food Aid; Policy and Regulations; Capacity Building;

[♣] Sudan is not a Member country of the WTO.

and Public Awareness and Participation. Under "Handling Food Aid", donors providing GM food aid should comply with the Prior Informed Consent principle and with the notification requirements in accordance with Article 8 of the Biosafety Protocol. Food aid consignments containing GM grain should be milled or sterilized prior to distribution to beneficiary populations. The sourcing of food aid should be within the region, and the region should develop and adopt a harmonized transit information and management system for GM food aid designed to facilitate transboundary movement in a safe and expeditious manner. GM food aid in transit should be clearly identified and labelled in accordance with national legislation. In the absence of it, it is recommended that countries make use of the requirements under the African Union model law on biosafety. The recommendations encourage SADC countries to develop national biotechnology policies and strategies to exploit the benefits of biotechnology, to establish national biosafety regulatory systems, and to sign and ratify the Biosafety Protocol and the Convention on Biological Diversity.[17]

Following those recommendations, in May 2004, at the summit on agriculture and food security, SADC approved guidelines on handling GM food aid. The guidelines fully endorse the recommendations of the SADC Advisory Committee on Biotechnology and Biosafety.[18]

Another specific area of concern in Africa is cotton. Cotton is grown principally for the fiber, although a small quantity of the seed is used as a source of food, feed and oil for humans and animals. Globally, 28% of the 32 million hectares of cotton were biotech crops in 2004, up from 21% in 2003.

Although Africa is not the largest cotton exporter (10-15% of world exports), cotton is of critical importance in West and Central Africa (WCA). For several WCA countries, cotton is the largest source of export receipts. The cotton sector is also key to rural poverty reduction, with cotton-related activities accounting for a large share of rural employment (about 6 million people are involved in the cotton industry in WCA).[19]

In WCA, plans are being finalised to convert some cotton crops into transgenic cotton varieties over the next years. In Mali, for example, the government signed in 2004 a research agreement with USAID, Monsanto, Syngenta and Dow Agrosciences to develop and commercialise transgenic cotton by 2009, starting with field-testing in 2004.[20] Field-testing of Bt cotton started in Burkina Faso in 2003. The trials aim to assess the viability of Bt cotton and to develop varieties resistant to the caterpillars (which affects approximately half of the country annual cotton output). A question is therefore whether GM cotton will be able fulfilling its promises of increased profits for

[17] The Recommendations are available in the SADC web site: http://www.sadc.int/fanr.php?lang=english&path=fanr/agrres&page=sadc_biotechnology_gmo.
[18] "SADC Sets Guidelines for Gm Food", *Zambezi Times Online*, 14 May 2004.
[19] Cotton accounted for about one third of Benin's exports, 40% of Burkina Faso's exports and 35% of Mali's exports and cotton is also critical to livelihood. Cotton employs about 45% of rural households in Burkina Faso and 40% of rural households in Mali.
[20] GRAIN, *Bt Cotton on Mali's doorstep*, April 2004, found at: http://www.grain.org/seedling_files/seed-04-04-4.pdf.

farmers. The major problem that Western African cotton producers face seems to be international low prices, which are mainly due to inequitable trading practices, more than low productivity due to pests. Therefore, according to many, those trade practices should be targeted and dismantled to redress the situation of cotton producers in Western Africa. Some concerns have also been voiced about the economic soundness of breaking the traditional scheme of seeds supply and switching to a system where seeds have to be bought every crop year from multinational companies.

At present, international trade in GMOs and products thereof has to take place according to the rules contained in the WTO Agreements, in particular those spelt out in the Agreement on the Application of Sanitary and Phytosanitary Measures (SPS Agreement), the Agreement on Technical Barriers to Trade (TBT Agreement) and the General Agreement on Tariffs and Trade (GATT) 1994. Disciplines regarding transboundary movement of GMOs, however, have been developed in a specific multilateral agreement being negotiated outside the purely trade context, the Cartagena Protocol on Biosafety. The rules included in different legal instruments may not be fully consistent with each other.[21] In developing national schemes to deal with agro-biotechnology, countries have to make sure that those schemes do not infringe the multilateral trade obligations they have subscribed.

Conclusions

While developed countries have established their national frameworks to deal with agro-biotechnology and biosafety focusing primarily on domestic priorities and strategies, most developing countries are doing so under less flexible circumstances. Instead of enjoying the freedom to assess risks and benefits that agro-biotechnology may bring about and act accordingly, developing countries increasingly seem to be expected to set up their national regulatory schemes based on the requests and expectations of the developed countries and their companies. Political, economic and trade-related pressures exercised on developing countries may compromise their ability to find balanced and development-oriented solutions that would fit their environmental and food needs.

As a general rule, domestic regulations should be scrutinized in the light of multilaterally agreed trade rules, if they are likely to have an impact on international trade. The two main legal frameworks applying to trade in agro-biotechnology products are the WTO framework – which is not specific to biotechnology and was actually developed at a time when biotechnology was not an issue – and the Biosafety Protocol which, on the contrary, is a more recent multilateral instrument specifically targeted at GMOs and GM

[21] The Cartagena Protocol on Biosafety was adopted on 29 January 2000 and entered into force on 11 September 2003. As of 10 March 2005, 117 countries, including the EC, had ratified or acceded to it. The Protocol provides rules for the safe transfer, handling and use of "living modified organisms" (LMOs). Its aim is to address the threats posed by LMOs to biological diversity, also taking into account risks to human health. The Protocol does not cover consumer products derived from LMOs, such as corn flakes, flour, starch, seed-oil, tomato paste or ketchup.

commodities. Considering that the rules included in the WTO Agreements and in the Biosafety Protocol may not be fully consistent to each other, developing countries in general and African countries in particular have to be particularly careful in putting in place their nations regimes for agro-biotechnology in order to avoid infringing their multilateral trade obligations.

Agro-biotechnology is a particularly challenging issue for developing countries. Their main concern seems to be to find the appropriate balance between pursuing their development objectives and at the same time complying with their multilaterally agreed obligations. The preoccupations that many developing countries may have as exporters of agricultural and food products must be balanced against their role as producers and their responsibility for improving the quantity and quality of agricultural and food products made available to the population, as well as with commitment to environmental preservation. Making these goals mutually supportive is not an easy task, especially for countries in Africa that still face major difficulties in dealing with the scientific aspects of biotechnology.

The decision of the big and highly populated developing countries, such as India, Brazil and China, to embark on agro-biotechnology may have an impact on African countries. Different options are possible. Some African countries may take the option of keeping their "GM-free" status, differentiate themselves from other providers that have become GM-producers, and target markets that prefer to stay away from agro-biotechnology. Conversely, African countries could take advantage of the biotechnology advances of other developing countries and try to get from those countries technology and support.

Some additional capacity-building efforts on agro-biotechnology and biosafety seem to be required, including efforts to strengthen developing country ability to deal with the international trade dimension of the issue. Efforts may also be needed at the international level to set up a global strategy to deal with new phenomena in a more coherent and systemic manner and avoid *ad hoc* solutions. Bio-engeneering is a recent phenomenon, but the rapid evolution of science and technology will inevitably lead to new scenarios that may be challenging for all countries, but particularly for developing countries.