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The Cartagena Protocol: Implications for Regional Trade and Technology Development in Africa

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The majority of African countries have ratified or acceded to the Cartagena Protocol on Biosafety, and many have received support through the Global Environment Facility and the UN Environment Programme for development of their National Biosafety Frameworks. This article examines the extent to which these frameworks are aligned with the goals of the Regional Economic and Regional Research Communities of which they are members. Many national approaches lack alignment with regional trade, economic, science and technology policies. The strict application of the precautionary principle and the imposition of costly administrative hurdles are likely to hinder intra-regional trade and technology development.

Key words: Biosafety, biotechnology, Cartagena Protocol, genetically modified organism (GMO), living modified organism (LMO), Africa, trade, research

1 Introduction

This article examines the extent to which National Biosafety Frameworks (NBFs) in Africa address issues of regional co-operation and harmonisation; whether they are likely to lead to the facilitation of trade (particularly agricultural trade) within and between regional organisations and individual countries on the continent; and to what extent the biosafety regulatory systems are likely to have an impact on collaborative development of agricultural biotechnology research on the African continent.

Economic and technological development are major goals of the African Union (AU). The objectives of the AU include: the promotion of sustainable development at the economic, social and cultural levels as well as the integration of African economies, and the advancement of the development of the continent by promoting research in all fields, in particular in science and technology (African Union, 2000). In 2005, the AU Conference of Ministers of Trade stated: 'The critical importance of trade facilitation for enhancing the competitiveness of African economies, for promoting intra-African trade and for harnessing the benefits of globalisation cannot be overemphasised' (African Union, 2005). At the Assembly meeting in January 2007, member countries

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were urged towards 'fast tracking the implementation of trade arrangements adopted in the Regional Economic Communities (RECs) through lowering tariff barriers and elimination of non-tariff barriers both technical and non-technical by 2010' (African Union, 2007a).

Africa's Science and Technology Consolidated Plan of Action was developed in 2006 under the auspices of the New Partnership for Africa's Development (NEPAD). In the field of biotechnology, NEPAD and the AU Commission have established a high-level African Panel on Biotechnology (APB) to 'facilitate open and informed regional multi-stakeholder dialogue on, *inter alia*, scientific, technical, economic, health, social, ethical, environmental, trade and intellectual property protection issues associated with or raised by rapid developments in modern biotechnology' (African Union, 2006a).

Biotechnology and biosafety go hand in hand, particularly where the development and application of genetically modified organisms (GMOs) are concerned. Biosafety measures have the potential to influence both trade and technology development, particularly in agriculture. The African strategy on biosafety (African Union, 2006b) urges countries to use the African Model Law on Biosafety prepared by the AU Commission as a basis for drafting their national legal instruments in biosafety, in order to create harmonised systems. Nevertheless, it is questionable whether the African Model Law is in fact aligned with international agreements, in particular the Cartagena Protocol on Biosafety.[1] It is also doubtful whether the majority of countries will in fact adopt the African Model Law (at least in its current form) in framing their own biosafety laws and regulations; in part because it may not be aligned with their own approach to biosafety, and in part because of difficulties in harmonising it with existing national legislation. The AU has embarked on a revision of the African Model Law (African Union, 2007b) but there is as yet no final outcome from this initiative.

2 International agreements and biosafety

African countries are for the most part signatories to a variety of international agreements that would have an impact on the scientific development of, and trade in, GMOs, the most prominent being the Cartagena Protocol on Biosafety (hereafter referred to as the Cartagena Protocol) (Secretariat of the Convention on Biological Diversity, 2000), which focuses on regulation of the transboundary movement of living modified organisms (LMOs) developed through biotechnology, otherwise known as GMOs. Jaffe (2006) provides an analysis of relevant international agreements. These include the Agreement on the Application of Sanitary and Phytosanitary Measures (SPS Agreement), which provides countries with the right to establish appropriate levels of sanitary and phytosanitary protection in international trade, including the areas of food and agriculture, provided that such protection minimises negative trade effects. The SPS Agreement also requires that countries 'avoid arbitrary or unjustifiable distinctions in the level of protection they consider to be appropriate for different situations, if such

1. The biotechnology stakeholder organisation AfricaBio provides an analysis of the AU Model Law on its website. The scope of the Model Law goes beyond that of the Cartagena Protocol, and its full requirements would apply not only to GMOs but also to products derived from them. See http://www.africabio.com/policies/Submission%20OAU%20Model%20Law%20on%20Biosafety%20by%20AfricaBio.htm

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distinctions result in discrimination or disguised restrictions on international trade'. Moreover, the Technical Barriers to Trade (TBT) Agreement requires that countries' technical regulations are not more trade-restrictive than necessary to fulfil a legitimate objective. In addition, the Codex Alimentarius Commission, under the auspices of the UN Food and Agriculture Organization (FAO) and the World Health Organization (WHO), is developing internationally acceptable standards for GMO food quality and safety.

Despite the prior existence of these agreements, it is the entry into force of the Cartagena Protocol in September 2003 that has provided the impetus for many African countries to establish national biosafety systems. The objective of the Cartagena Protocol is:

> to contribute to ensuring an adequate level of protection in the field of the safe transfer, handling and use of living modified organisms (LMOs) resulting from modern biotechnology, that may have adverse effects on the conservation and sustainable use of biological diversity, taking also into account risks to human health, and specifically focusing on transboundary movements.

The flurry of activity prompted by the introduction of the Protocol may in large measure be because of the funding that was made available through the Global Environment Facility (GEF) to support its implementation. Help was provided for a large number of countries to develop their National Biosafety Frameworks ('development-phase countries'). In Africa, 42 countries participated in this project with support from the UN Environment Programme (UNEP) as the implementing agency. To date, the NBFs from 31 of these countries have been published on the UNEP website. In addition, another 4 African countries received funding for the further implementation of national frameworks developed under limited pilot-phase projects undertaken from 1997 to 1999 ('implementation-phase countries').

3 Regional co-operation and the Cartagena Protocol on Biosafety

The Cartagena Protocol of 2000 supports and encourages regional co-operation, co-ordination, and harmonisation on biosafety issues. Article 14 on Bilateral, Regional and Multilateral Agreements and Arrangements states that parties 'may' enter into agreements regarding the international transboundary movement of living modified organisms (LMOs). Article 22.1 on Capacity Building specifically requires the parties to 'cooperate in the development and/or strengthening of human resources and institutional capacities in biosafety … including through existing global, regional, sub-regional and national institutions and organisations and, as appropriate, through facilitating private sector involvement'. It is also clear that if the Protocol's provisions regarding illegal and unintentional transboundary movement of LMOs are to be effective, inter-country co-operation will be essential.

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The GEF has facilitated the development of the Protocol from the start of negotiations. An evaluation of the GEF support for biosafety was undertaken during 2005 (Global Environment Facility, 2006), and its report deals quite extensively with the issue of regional collaboration, co-ordination and harmonisation, pointing out that the GEF strategy includes the objective of identification of sub-regional and regional opportunities for harmonising regulatory frameworks.[2] In this context, a number of regional and sub-regional workshops were held as part of the capacity-building activities under the Protocol. Unfortunately, regional activities were not included as part of the work plan for countries participating in implementation projects. Although many participating countries invited neighbouring countries to national consultation workshops on their NBFs, there was little or no discussion on regional implementation of biosafety.

In December 2006 the Conference of the Parties serving as the Meeting of Parties to the Protocol (COP-MOP) adopted an updated capacity-building Action Plan, which identified 'scientific, technical and institutional collaboration at sub-regional, regional and international levels' as one of the priority elements that the parties need to address. In February 2007 a follow-up meeting was held in Zambia to discuss regional and sub-regional approaches to capacity-building and co-operation in biosafety. The report of this meeting cites the rationale for co-operation and harmonisation as being 'to minimise illegal or unintended transboundary movement of LMOs, as well as to support the pooling of resources, sharing of information and experiences and the building of mutual interdependence' (Secretariat of the Convention on Biological Diversity, 2007a). In the meantime, sub-regional activities appear to be gaining ground. In August 2007 an African regional workshop was held to discuss capacity-building and exchange of experiences on risk assessment and risk management; the workshop generated a wide-ranging set of recommendations, including the development of sub-regional biosafety strategies and the creation of a regional technical advisory panel on biosafety (Secretariat of the Convention on Biodiversity, 2007c). As a further example, the GEF has recently approved partial funding towards a World Bank project (World Bank, 2006), the 'West Africa Regional Biosafety Project', involving countries in the West African Economic and Monetary Union (WAEMU) with an interest in transgenic cotton. The project will address both harmonisation of legal frameworks and harmonised methodologies for risk assessment and management. Interestingly, this project arises largely out of concerns regarding regional trade and competitiveness in cotton production.

Although the rationale for the WAEMU project is trade-related, the main focus of the Cartagena Protocol is the protection of biodiversity and the environment. Facilitation of trade and support of regional biotechnology research initiatives are less important under the Protocol as reasons for countries to adopt a regional or sub-regional approach to biosafety. Indeed, as pointed out by Gruère (2006), trade-related measures

2. The GEF strategy states 'Sub-regional co-operation in information sharing and harmonizing legal and regulatory instruments is crucial for effective management of transfer of LMOs across borders. Information to assist countries in decision making is not necessarily available within a single country. Maximizing the use of institutional, financial, technical and human resources within a region will enhance a country's ability to implement the Protocol and will facilitate an exchange of best practices and experiences' (Global Environment Facility, 2000).

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in the Cartagena Protocol are discussed only in the context of environmental risks, and trade or agricultural consequences of strict information requirements may be totally omitted from the considerations, despite their probable negative economic impacts.

Respecting the autonomy of the individual countries involved, the new GEF strategy towards regional co-operation recommends the adoption of a demand-driven approach; regional co-operation should not be imposed by any external entity. 'Countries will move from isolation to collaboration at their own pace, and out of their own needs and understanding of the possible benefits of sharing with trusted partners'. This suggests a somewhat reactive rather than proactive approach at the level of the GEF. Advocating a more proactive approach towards regional harmonisation from a legal perspective, Jaffe (2006: 33) emphasises that:

> while some people might argue that each country needs to get its own biosafety regulatory system established and running before it can consider efforts at coordinating with its neighbors, the best time to begin a regional harmonisation effort is before the biosafety regulatory systems are fully functioning under an authorised legal mandate. If the biosafety system is to be based on detailed legislation, once that legislation is passed by Parliament, a later regional effort at harmonisation might require additional legislative activity in particular countries.

This argument alone might suggest that countries should be encouraged in their efforts towards co-operation and harmonisation from an early stage in the development of their biosafety frameworks, despite potential hurdles that can arise in the absence of a national agency mandated to take responsibility for biosafety.

Irrespective of the need for harmonisation at the legal level, the potential exists for co-operation between countries at the technical level, for instance through the sharing of expertise on risk assessment. This could be particularly valuable for countries that lack sufficient expertise in biotechnology and risk assessment.

With this in mind, this article seeks to assess the importance that individual countries are placing on regional co-operation and harmonisation, from both a legal and a scientific/technical perspective, taking the information in the NBFs as a reference point.

4 Regional Economic Communities (RECs) in Africa

Africa has a plethora of regional economic and political groups, many of which overlap with each other. As pointed out by Iyoha (2005), overlapping memberships may cause complications and inconsistencies due to conflicting obligations and divided loyalty. This appears to be a phenomenon that is peculiar to Africa. Nevertheless, certain of these RECs have achieved a measure of success. The focus of the current study will be on the major RECs, particularly those that have expressed an interest in a common approach to the stimulation of agricultural growth and environmental sustainability, or in developing regional approaches to food security issues. Some of these groups are also developing common approaches to activities in research and development, but in most

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cases R&D activities are the focus of consortia that are only partially aligned with the RECs.

Some relevant policies of the RECs considered in this article are outlined below. Membership of the RECs is shown in Table 1. At present most of the RECs include a few countries that have not yet acceded to the Cartagena Protocol.

4.1 AMU: African Maghreb Union

The five countries that make up the AMU are all water-scarce, and, with the exception of Morocco, are net importers of agricultural products. In 1992 a Maghrebian charter on environmental protection and sustainable management was agreed, and subsequently a sub-regional action plan to combat desertification was developed, which calls for joint programmes for the sustainable management of transboundary natural resources, and bilateral and multilateral mechanisms, as appropriate (Arab Maghreb Union, 1999). It also calls for 'development of policies in fields, such as trade, which have impact upon affected areas and populations, including policies for the co-ordination of regional marketing regimes and for common infrastructure'. Political differences have hampered the development of the AMU; implementation of a free trade zone amongst the Maghreb countries has not yet been finalised, and intra-regional trade accounts for a bare 3% of the total.

4.2 CEN-SAD: Community of Sahel-Saharan states

CEN-SAD was established in 1999 and has since grown rapidly in terms of membership to include 23 states. Its first objective is the establishment of a comprehensive economic union, but this may be difficult to implement because of the overlap with other more established RECs such as the Economic Community of West African States (ECOWAS) and the Common Market for Eastern and Southern Africa (COMESA). CEN-SAD's strategy includes investment in the agricultural, industrial, social, cultural and energy fields. Freedom of movement of goods is supported, and, according to the website, there is an intention to co-ordinate educational systems, including in the scientific and technical fields (http://www.cen-sad.org/aboutcensad.htm). At the meeting of Heads of State in 2006, the chairman of CEN-SAD, President Muammar Ghadaffi of Libya, urged that 'actions be identified and launched within the Community to fight against the encroachment of the desert which threatens the environment, so as to consolidate food security, develop agricultural production, supply of potable and farming water both in urban and rural centres and to be conscious of the risks of GMOs'. This followed from statements made at the preceding Executive Council meeting, when the importance of rural development, food security, and the environment was raised. The Libyan delegation referred to a seminar on GMOs held earlier in 2006 in collaboration with the General Secretariat of CEN-SAD, recommendations from which were reported to include: technical and infrastructural capacity-building of the member states and the sub-regional organisations working in agricultural research and extension; strengthening of regulatory frameworks for the management and exploitation of plant genes; and the establishment of a special fund to support agricultural research

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and the development of biological agriculture. The establishment of a regional body for seed improvement was also discussed at the meeting.

4.3 COMESA: Common Market for Eastern and Southern Africa

Agriculture is considered to be the engine for economic development in the COMESA region. The sector accounts for more than 32% of COMESA's gross domestic product (GDP), provides a livelihood for about 80% of the region's labour force, accounts for about 65% of foreign-exchange earnings and contributes more than 50% of raw materials to the industrial sector. COMESA has endorsed the principle of moving from a national to a regional approach in dealing with food security issues based on two major strategies. The first is to open up the region to a freer flow of agricultural trade by removing all barriers to such trade to ensure that, as needed, commodities move from surplus to deficit areas in the region driven primarily by demand and market forces. This policy shift is enshrined in the Declaration of the Second Meeting of the Ministers of Agriculture (COMESA, 2004). According to the COMESA website, the other strategic approach is to put in place policies, systems, regulations and procedures which are harmonised across the region so as to create a transparent and facilitative environment for conducting regional agricultural trade with forward and backward linkages across the region from the farmer to the market. A study funded partly by USAID identified the potential of GMOs to impact on trade in the COMESA region, and the Association for Strengthening Agricultural Research in Eastern and Central Africa (ASARECA), together with the African Centre for Technology Studies (ACTS), has embarked on a project 'towards a regional approach to biotechnology and biosafety policy in Eastern and Southern Africa' (the RABESA initiative) on behalf of COMESA (Wafula and Sikoya, 2005).

4.4 ECCAS: Economic Community of Central African States

ECCAS was set up in 1983 but has made somewhat erratic progress on the policy front, and was inactive through much of the 1990s due to sub-regional conflicts. Given this background, it is not surprising that its main focus has been on peace and security in the region. From information provided on its website, ECCAS aims to set up a common market of Central African states and promotes harmonisation of national policies to encourage regional activities in the domains of agriculture, natural resources, trade and science and technology, amongst others. Agricultural production accounts for 38% of exports from ECCAS countries, making this an important area for collaboration. Angola has the largest economy in the ECCAS region, and Cameroon is also an important regional power. In 2002 a regional food security programme was adopted. Cameroon is the only country in this group to have implemented a National Biosafety Framework.

4.5 ECOWAS: Economic Community of West African States

The ECOWAS agriculture policy focuses on food security for the region and promotes the introduction of an intra-community trade scheme (ECOWAS, 2004). The policy

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Table 1a: Some regional affiliations of African countries that have ratified or acceded to the Cartagena Protocol

	Regional economic community							Regional research community							
	COMESA	AMU	SADC	ECCAS	ECOWAS	CEN-SAD	CORAF/ WECARD	ASARECA	AAB	BecA	CILSS	SanBio	WABNet	NABNet
Algeria		X							X					X
Benin					X	X	X						X	
Botswana			X									X		
Burkina Faso					X	X	X		X		X		X	
Cameroon				X			X		X	X				
Cape Verde					X		X				X		X	
Chad				X		X	X				X			X
Congo				X			X			X				
Congo, Dem. Rep.	X		X	X			X	X		X				
Djibouti	X					X			X					
Egypt	X					X			X					X
Eritrea	X					X		X		X				
Ethiopia	X							X	X	X				
Gabon				X			X		X	X				
Gambia					X	X	X				X		X	
Ghana					X	X	X		X				X	
Kenya	X							X	X	X				
Lesotho			X									X		
Liberia					X	X								X

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Libyan Arab Jamahiriya	X	X				X								X
Madagascar	X		X					X		X				
Mali					X	X	X				X		X	
Mauritania		X					X				X			X
Mauritius	X		X						X			X		
Mozambique			X									X		
Namibia			X									X		
Niger					X	X	X						X	
Nigeria					X	X	X		X		X		X	
Rwanda	X			X				X		X				
Senegal					X	X	X		X		X		X	
Seychelles	X											X		
South Africa			X									X		
Sudan	X					X		X		X				
Swaziland	X		X									X		
Tanzania			X					X		X				
Togo					X	X	X						X	
Tunisia		X				X			X					X
Uganda	X							X		X				
Zambia	X		X									X		
Zimbabwe	X		X						X			X		

Note: A list of parties to the Protocol is available at **http://www.cbd.int/biosafety/parties/list.shtml**

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Table 1b: Some regional affiliations of countries that have not yet ratified or acceded to the Protocol

	Regional economic community							Regional research community						
	COMESA	AMU	SADC	ECCAS	ECOWAS	CEN-SAD	CORAF/ WECARD	ASARECA	AAB	BecA	CILSS	SANBio	WABNet	NABNet
Angola														
Burundi				X				X	X	X				
Central African Republic				X		X	X			X				
Comoros				X										
Cote d'Ivoire					X	X	X		X				X	
Equatorial Guinea				X						X				
Guinea					X		X						X	
Guinea-Bissau					X	X	X				X		X	
Malawi			X									X		
Morocco		X				X			X					
São Tomé and Principe										X				
Sierra Leone					X	X	X						X	
Somalia						X				X				

Note: all the countries listed except Morocco are also members of the African Union. The website of the World Bank provides information on membership of the RECs. See http://web.worldbank.org/WBSITE/EXTERNAL/COUNTRIES/AFRICAEXT/EXTREGINI/EXTAFRREGINICOO/0,,contentMDK:20626083~menuPK:1589456~pagePK:64168445~piPK:64168309~theSitePK:1587585,00.html. Information on membership of the RRCs has been derived from a variety of sources.

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stresses the need for a regional approach to agricultural research, to facilitate rationalisation and the sharing of resources. This currently falls within the ambit of the West and Central African Council for Agricultural Research and Development (CORAF/WECARD), but needs to be articulated within the framework of the agricultural policy of ECOWAS. Regarding the development of biotechnology and the introduction of GMOs, the policy states that national and regional research is confronted with a new challenge. The governments of the region seem anxious to see these innovations applied in a cautious manner, and seek a real benefit for the economies and populations. It is stated that a regional approach is essential to bring together sufficient human and material resources in order to develop research independent of the private companies. According to the policy, this is one of the most crucial areas in which ECOWAS should be making rapid investments.

ECOWAS' commitment to biotechnology was enhanced when the Ministers of Agriculture, Environment, Science and Technology met to discuss the issues surrounding biotechnology in agriculture at a meeting in March 2007. They adopted a regional action plan for biotechnology and biosafety development for 2006-10 (ECOWAS, 2007), which stresses the use of public-private partnerships to increase investment in biotechnology, and the need to put safety measures in place at national and regional levels. The plan calls for a network of biotechnology experts to be established, and the promotion of networking between centres of excellence in biotechnology and the West and Central African Biosciences facility (WABNet) planned by NEPAD.

The West African Economic and Monetary Union (WAEMU) represents a subset of 8 countries in ECOWAS. As mentioned above, these countries intend to embark on a regional biosafety initiative through a World Bank project.

4.6 SADC: Southern African Development Community

Agriculture contributes 35% to the gross domestic product of the SADC regional economy, and about 70% of its people depend on it for food, income and employment. Moreover, it contributes around 13% of total export earnings and about 66% of the value of intra-regional trade. The SADC Protocol on Trade came into force in January 2000. Its objectives include the liberalisation of intra-regional trade, and the establishment of a free trade area in the SADC region. The Protocol addresses the need to harmonise phytosanitary measures for agriculture in the region.

The SADC region has adopted three strategies to achieve its food security aims, namely, improvement of food availability, improved access to food, and improved nutrition. This last aspect encompasses the need to address food safety issues. The Regional Indicative Strategic Development Plan of SADC outlines the need for greater co-operation in the area of GMOs, partnerships in the area of agricultural research and training, and addressing issues of the environment and sustainable development.

Already in 2003, a meeting was convened under the auspices of the SADC Food, Agriculture and Policy Analysis Network (FANRPAN) and the International Food Policy Institute (IFPRI) to discuss regional issues on biotechnology, agriculture and food security in Southern Africa (FANRPAN/IFPRI, 2003). At this meeting the question was raised as to whether countries should be worried about the impact of

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biotechnology on trade activities, and whether adoption of a particular product could undermine trade relations.

SADC is one of the RECs that has drafted biosafety guidelines at the sub-regional level, through the SADC Advisory Committee on Biotechnology and Biosafety. However, although these guidelines were drafted and adopted in 2003, there does not appear to have been any follow-up on their implementation.

5 Regional and sub-regional trade in Africa

Data from the International Monetary Fund indicate that intra-regional trade in Africa operates from a low base (International Monetary Fund, 2006). At the upper end, intra-regional trade in organisations such as SADC and COMESA varies from 5% to more than 10% of total trade, whereas at the lower end intra-community trade in the CEMAC (International and Monetary Community of Central Africa) is about 1.5% of total trade. Longo and Sekkat (2001) provide a figure for intra-African trade of 11.4% of total trade flows in 1998, although this may well be an underestimate due to the relatively high levels of unrecorded trade. This may be compared with 60% of intra-regional trade within the European Union. Although transportation difficulties may be a large causative factor behind the low levels of intra-regional trade, other trade barriers (including tariff barriers and administrative barriers) have a major impact.

Cernat (2001) has demonstrated, using the regional organisations COMESA, ECOWAS and SADC as examples, that South-South regional trade agreements have an overall positive effect, leading to increased trade with both regional partners and third countries. He postulates that this might be explained by the removal of 'invisible' trade barriers as a result of the introduction of trade facilitation measures. This is in spite of the potential negative impact on intra- and extra-regional trade through trade diversion, including the replacement of cheaper imports from the rest of the world with more expensive intra-regional products from less efficient suppliers.

Agriculture and oil remain the mainstays of most African economies. Agricultural exports from the African continent were buoyant in the 1950s and 1960s, but the volume of traditional agricultural exports declined sharply in the 1970s. Eicher (1999) stated that 'beginning in 1973, Africa became a net food importer' (p. 9). He also remarked that 'most governments in Africa are treating long-term agricultural development as a secondary activity. There are only a few countries in Africa today where there is political commitment to mount and sustain a disciplined long-term effort to increase broad-based agricultural growth' (p. 24).

Despite a lack of agricultural growth, intra-regional agricultural trade in Africa grew on average almost 6% per annum during the 1980s but, in contrast with other regions of the world, this growth slowed in the 1990s to only a little more than 3% per annum to reach $US1.9 billion by 1997 (Food and Agriculture Organization, 2001). A study by Diao et al. (2003) indicated quite high figures for intra-regional trade in food crops, accounting for a large share (44%) of sub-Saharan Africa's food exports: 52% of maize exports and 77% of other cereal (mainly rice) exports are imported by other sub-Saharan Africa countries. Moreover, these authors state that sizeable unrecorded, 'informal' intra-regional trade in maize, cassava, and some other food crops (as well as livestock products) probably takes place.

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The RECs all have a focus on the elimination of trade barriers within their communities, which would further stimulate intra-regional agricultural trade, and yet many obstacles remain. Trade barriers may consist of formal tariff barriers as well as more informal barriers created through national legislative requirements, bureaucratic red tape, and simple inefficiencies. As an example, and according to estimates by the UN Conference on Trade and Development (UNCTAD), an average customs transaction in Africa involves 20-30 different parties and 40 documents (United Nations Economic Commission for Africa, 2004: chap. 5). Frequently, documentation requirements are ill-defined. The development of national legislation for transboundary movement of GMOs and their products, with regard to food and environmental safety, as required under the Cartagena Protocol, is likely to add to this complexity, and generate additional paperwork, be compounded by poor technical understanding and may well have a negative impact on sub-regional trade. A sub-regional approach to the handling of GMOs could potentially assist in minimising the impact of implementing the Protocol, especially since traded goods may need to cross several countries within the continent to reach their final destination.

6 Regional Research Communities and the Cartagena Protocol

The draft report of the High-Level African Panel on Modern Biotechnology (HLAP) constituted by the AU and NEPAD in 2006 (African Union, 2006a) discusses the concept of African Regional Innovation Communities (RICs) which it is believed should be defined as coterminous with RECs. The term 'innovation' implies both invention and the exploitation of the invention. This article refers to Regional Research Communities (RRCs) rather than RICs, since at the present time the capacity for exploitation of the research, particularly through commercial channels, is somewhat limited. Moreover, until research capacity is more firmly established on the continent, there will be very limited generation of intellectual property.

As stated in the report of the HLAP, the integration of science and technology considerations into regional agreements is recognition that the individual African economies are unable to marshal adequate scientific and technological resources for development. At the same time:

> weak regional science and technology institutions and the failure to adjust regional organisations have made it difficult to implement regional agreements. Many African countries continue to work with isolated R&D systems often with limited scientific and technical expertise and financial resources. The continent, as a whole, has spread its limited resources too thinly across science and technology fields … African countries should identify specific biotechnology priority areas that offer high potential for regional R&D and product development and integrate these priorities into African regionalisation processes and policies. (p.46)

On the regulatory front, the same report states:

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> Pre-emptive laws that focus on risks can hamper Africa's capacity to harness emerging technologies to meet its needs. Focusing on technological risks can overshadow the possible benefits of an emerging technology, which are often difficult to predict. Strict, risk-focused regulatory regimes may hinder the technology transfer, adoption, development, and potential benefits of emerging biotechnologies. Biosafety policies and laws need to be harmonised using national practices as a basis. The ideal locus for such harmonisation should be the Regional Economic Communities. On the whole, adopting laws that pre-empt technological opportunities should be pursued with caution. (p. 53)

A recent research report from the International Food Policy Research Institute emphasises (Omamo et al., 2007: 55) that 'in theory, regional integration and collective action in agricultural R&D among neighbouring countries can lead to economies of scale and spillover benefits that permit research systems to jointly achieve the critical mass and cost savings needed to address problems beyond the capacities of individual systems'. It goes on to itemise the potentially very large predicted economic gains for Eastern and Central Africa that could arise from regionally co-ordinated research in some of the important commodity crops. However, where such gains might be achieved in part through modern biotechnology interventions, it is clearly essential that regional co-ordination should include a common regional approach to biosafety measures.

A number of regionally co-ordinated research programmes are in fact emerging, some in response to initiatives of the African Union/NEPAD, but others have been put in place through different channels. A synthesis of relevant programmes is provided in Table 2, and the country membership of each of these programmes is listed in Table 1. It is apparent that there is only partial alignment between the RRCs and the RECs.

Table 2: Collaborative S&T programmes in Africa with an interest in the development of GMOs

Organisation	Background and rationale
L'Agence Africaine de Biotechnologie (AAB)	Aims to make available biotechnological tools, to ensure development and uptake of biotechnology. Mission is to reinforce national capacities of member states, with regard to biotechnology. In addition, it will co-ordinate and promote co-operative biotechnology research programmes, and encourage production, distribution and marketing of biotechnological products. Also contributes to the harmonisation of biosafety laws.
ASARECA (Association for Strengthening Agricultural Research in East and Central Africa)	A non-political organisation of national agricultural research institutes in 10 countries. Has launched a biotechnology and biosafety programme to promote the development and dissemination of relevant demand-driven biotechnologies for resource-poor farmers as well as appropriate policies and regulations in the area of biosafety, with the strategic goal of 'safe application of biotechnology for enhanced and sustainable productivity, competitiveness and value added agricultural systems' (see http://bch.biodiv.org/ database/record.shtml?id=7323).

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Organisation	Background and rationale
BecA (Biosciences eastern and Central Africa)	Established as a NEPAD initiative, with hub at ILRI in Kenya and a network of nodes in other countries of the region. BecA business plan for period 2005-9 identifies plant transformation as a core competency for development of improved crops of importance in Africa (Biosciences Eastern and Central Africa, 2005).
BIO-EARN	An East African research network with mission to build capacity in biotechnology in 4 East African countries and promote appropriate research and related policies. One of its objectives is to promote collaboration in biotechnology, biosafety and biotechnology policy development to address key challenges and opportunities in the region. Supported by the Swedish International Development Co-operation Agency (Sida).
CILSS (Permanent Interstate Committee for Drought Control in the Sahel)	Not specifically a RRC but a regional organisation to mobilise action in improving agriculture and food security in Sahel to combat effects of desertification. Acts in part as a RRC but also has a strong influence on policy matters. Goals include strengthening scientific and technical co-operation, and building capacity. Research arm is INSAH (Institut du Sahel). Has developed convention on common set of biosafety regulations, which has been signed by the agricultural ministers of each of the countries. Regional consultative committee on seeds and GMO regulation and control has been established to facilitate the movement of conventional and transgenic seeds and GMOs.
CORAF/WECARD (West and Central African Council for Agricultural Research and Development)	Mission to improve efficiency and effectiveness of agricultural research by contributing to construction and the consolidation of capacities of national agricultural research systems through co-operation between members, development partners, regional and international organisations, the private sector and NGOs. At operational planning meeting in March 2007 general agreement reached on need for Biotechnology and Biosafety programme (CORAF/WECARD, 2007).
FARA (Forum for Agricultural Research in Africa)	ASARECA, CORAF/WECARD and SADC/FANR are founding members of umbrella organisation FARA, which itself led an African Biotechnology and Biosafety Initiative in 2005, based on premise that benefits that application of modern biotechnology can bring to African agriculture need to be fully exploited. Initiative addressed need to build capacity in modern biotechnology, and harmonise biosafety frameworks at regional and sub-regional levels.
NABNet	Being established as NEPAD initiative with hub based at the National Research Centre in Egypt. The North African group has identified biotechnological improvement of cereals in North African arid and semi-arid lands as priority area, including use of genetic engineering techniques (NEPAD, 2005).
SANBio	NEPAD initiative with hub at the CSIR in South Africa. Aims to promote scientific excellence by bringing together a critical mass of scientists drawn from national, regional and international institutions in state-of-the-art facilities where they can undertake cutting-edge research to help solve some of most important development constraints

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Organisation	Background and rationale
	affecting health and well being of people in Southern Africa. Envisages involvement in range of activities in biosciences; proposed flagship projects include the development of recombinant tick vaccines and genetically modified sorghum and millet with improved nutritional value (NEPAD, 2005).
WABNet	Established as NEPAD initiative with hub based at Institut Sénégalais de Recherches Agricoles (ISRA). Parties involved have identified genetic engineering as priority area, and mention as constraint lack of explicit domestic biotechnology policies exacerbated by uninformed legal entities (NEPAD, 2005).

7 Biosafety approaches adopted by African countries

To date, despite the well-intentioned statements of the GEF strategy, the efforts of the UNEP team assisting countries in the development of their National Biosafety Frameworks (including the holding of regional and sub-regional workshops), and the science-based approach to risk assessment and management advocated in the Cartagena Protocol, it appears that individual countries in Africa are placing a variety of interpretations on the Protocol and taking a variety of paths towards dealing with the issue of GMOs.

Paarlberg (2000) details a spectrum of 'promotional, permissive, precautionary and preventative' approaches to biosafety legislation. As explained by Mackenzie et al. (2003), the Cartagena Protocol enshrines the precautionary approach, which is laid out in Article 15 of the Rio Declaration and states that uncertainty about the potential for serious environmental harm is not a valid ground for refraining from preventative measures. However, the Nuffield Report on the introduction of GM crops in developing countries (Nuffield Council on Bioethics, 2004) states that 'an excessively conservative interpretation of the precautionary approach, demanding evidence of the absence of all risk before allowing the pursuit of a new technology is fundamentally at odds with any practical strategy of investigating new technologies'. The same report also states:

> any highly restrictive interpretation of the precautionary approach is likely to ignore the possibility that, in some cases, the use of a GM crop variety may pose fewer risks than are implied by current practices or by plausible non-GM alternatives. In applying the precautionary approach, risks implied by the option of inaction (or by alternative actions) must also be considered. (Summary and recommendations, p. xvi)

Despite this warning, a number of countries in Africa appear to be taking an approach that is more preventative than precautionary. Zambia has recently promulgated a national Biosafety Bill, which according to Saviour Chishimba, chairperson of the Zambian Education, Science and Technology Committee, 'is aimed

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at ensuring that Zambia remains a GMO free country'.[3] As another example, Ethiopia has taken a very strict stance in its attitude towards GMOs, and has issued a draft biosafety proclamation with strong clauses regarding liability and redress.

Heading the list of countries taking a more positive approach towards the introduction of GMOs is South Africa. Burkina Faso is moving forward rapidly with field trials on GM cotton, while Egypt, Kenya, Morocco, Tanzania, Zambia and Zimbabwe are also conducting, or have conducted, confined field trials.

8 Analysis of the National Biosafety Frameworks

Considering the emphasis of the GEF strategy on the benefits of regional co-operation, it might have been expected that, with the guidance of UNEP, the majority of National Biosafety Frameworks (NBFs) would at least address regional and sub-regional issues, even if there were no immediate plans for co-operation and harmonisation.

An analysis of the NBFs produced through development-phase projects that have been published on the UNEP website (see Table 3) shows that, of the 31 published NBFs from development-phase countries, only 16 advocate regional harmonisation. Moreover, in most cases regional harmonisation or collaboration is mentioned in very general terms, without making specific recommendations for action or even presenting reasons why harmonisation would be important. Trade issues are generally not highlighted in the NBFs (Mozambique, Rwanda and Djibouti are exceptions). As an extreme case, the Liberia NBF makes no reference at all to neighbouring countries or the region. The Lesotho NBF does not refer to the South African situation, despite the fact that Lesotho is bounded on all sides by South Africa. The implementation-phase countries appear to be generally aware of the need for co-operation, although Cameroon and Kenya appear to be ahead of Namibia and Uganda in this regard. Only 13 of the published development-phase NBFs mention their country's membership of specific RECs (see Table 3), and in most cases the specific policies of these RECs were not taken into account during the drafting of the NBF.

Judging from the NBFs, in effect few of the countries have seriously considered the effect on sub-regional trade if there is no adoption of a common approach to acceptance of GMOs and their products. A number of emerging initiatives such as the WAEMU Regional Biosafety Project seem to indicate a changing trend, but in reality, biosafety still remains a somewhat hypothetical issue for most of the countries. Indeed, South Africa, as the only country on the continent that has already commercialised GMOs, has recognised the potential impact on trade, and the South African Department of Trade and Industry is undertaking a study to determine the likely impact. Until this report has been finalised, South Africa has delayed the further approval of commodity clearance applications.

The development of a regional or sub-regional approach is particularly important in view of the high levels of informal and unregulated cross-boundary trade on the African continent. Few countries would claim to have very effective border controls, thus giving a high probability to unauthorised transboundary movement of GMOs.

3. Mr Chishimba's remarks were reported on the SciDevNet website http://www.scidev.net/News/index.cfm?fuseaction=readNews&itemid=3549&language=1

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Table 3: An analysis of the NBFs published on the UNEP website (with some additional country information)

Country NBF	Reference to regional harmonisation	Reference to science and technology development and collaboration
Algeria	NBF refers to need for regional harmonisation and suggests a role for the AMU or the AAB	Hhas a considerable number of universities but most biotechnology has been traditional rather than modern. Creation of the 'Centre National de Développement des Ressources Biologiques' (CNDRB) is likely to stimulate activities in modern biotechnology. AAB is based in Algeria.
Benin	NBF makes no reference to Benin's situation in sub-region, its regional affiliations or regional trade. Does mention that applications for GMO activities will be transmitted to states in the sub-region and AU member states for comment.	Has no biotechnology policy though there are fragmented biotechnology activities in universities and research institutes. NBF makes no reference to Benin's membership of CORAF/WECARD or WABNet.
Botswana	NBF recognises regional and international initiatives for the safe application of biotechnology including SADC Guidelines on Biotechnology and African Model Law on Biosafety, but makes no recommendations on harmonisation or regional trade.	NBF includes a national policy on biotechnology and biosafety that recognises need to build capacity and promote safe development and application of biotechnology. No status report on current application of modern biotechnology and no reference to Botswana's regional involvement in SANBio.
Burkina Faso	NBF recognises need to harmonise with laws of neighbouring countries, but does not make specific recommendations. Refers to sub-regional agreements such CILSS but does not mention regional trade agreements such as ECOWAS and CEN-SAD. UNEP sent draft NBF for external review; a recommendation was that relationships should be developed with neighbouring countries.	Has a number of national strategies which implicitly may involve application of biotechnology, but no actual biotechnology policy and not clear how much biotechnology research is taking place even though has embarked on field trials of GM cotton. NBF does not refer to Burkina Faso's role in regional research initiatives.
Burundi	NBF promotes development of regional and sub-regional co-operation, specifically through (currently inactive) CEPGL (Economic Community of Great Lakes Countries). However, trade aspects not specifically mentioned.	Has some activities in traditional biotechnology but little or no capacity in modern biotechnology. NBF proposes strengthening of co-operation with ASARECA, BIO-EARN, AAB and other organisations.
Cameroon	Has a Biosafety Act, passed in 2003, which may tend towards preventative side of precautionary approach. This law now being adopted. According to project documentation for implementation-phase project, has been elected as the regional Focal Point for Biosafety by countries of west/central African region. Progress towards a regional biosafety database.	Has some biotechnology research capacity, is actively involved in CORAF/WECARD and sees need for regional co-operation in biotechnology research (Njamnshi, 2005).

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Cape Verde	No mention of trade or regional issues. Proposes to deal with GMOs as an extension of phytosanitary legislation.	Has insufficient resources to undertake activities in modern biotechnology, but has positive attitude and intends to develop the technology.
Comoros	Has very little private industry and low level of trade despite membership of COMESA. Sees introduction of GMOs produced at competitive prices as threat to its less competitive agriculture. The NBF proposes to use COMESA and SADC as vehicles for exchange of information and simplification of Advance Informed Agreement (AIA) procedures (although Comoros is not a member of SADC).	Has no scientific institution able to carry out research in field of biotechnology. NBF suggests that COMESA and SADC could be used for creation of a centre of excellence, capacity-building, and academic exchange programmes.
Congo	NBF recognises porous nature of Congo's boundaries and mentions its role in ECCAS as well as CEMAC. Sub-regional co-operation in biotechnology and biosafety is advocated, but no analysis of biotechnology or biosafety systems in sub-region.	Has limited activity in traditional biotechnology but little or no modern biotechnology. No mention of regional research co-operation in NBF.
Côte d'Ivoire	NBF urges harmonisation of biosafety policies in sub-region, specifically in ECOWAS. However, no further mention of any activities towards this goal.	Has initiated development of biosafety/biotechnology policy, and has nascent research in modern biotechnology. NBF makes no reference to country's involvement in any regional research communities.
Djibouti	Port is major conduit for regional trade especially into Ethiopia, but even basic phytosanitary controls deficient. NBF promotes role for IGAD (Intergovernmental Authority on Development), in developing harmonised approach to biosafety in region.	No research on modern biotechnology, and does not appear to be involved in any regional research communities.
Egypt	Developed biosafety guidelines in 1995 and has conducted field trials, but no binding regulatory framework although there is draft legislation. Does not appear to have made efforts towards regional harmonisation.	Has active involvement in biotechnology through AGERI (Agricultural Genetic Engineering Research Institute), but does not appear to be significant sub-regional collaboration.
Eritrea	NBF states an objective to be regional harmonisation, but does not mention COMESA or CEN-SAD. NBF apparently took into account other NBFs in the sub-region.	Has only one tissue-culture laboratory, but sees potential for application of biotechnology for food security and poverty alleviation. No mention of involvement in RRCs or opportunities to share expertise.
Ethiopia	NBF stresses need for law to ensure national safety with respect to GMOs and also because it could be affected by laws of neighbouring countries. A draft biosafety law/proclamation relies as heavily on African Model Law as on Cartagena Protocol. Approach to biosafety not been integrated with other countries in sub-region and no mention of its membership of RECs.	Has interest in biotechnology through involvement in BIO-EARN programme and BecA. Apparently little or no alignment between country's biotechnology interests and approach to biosafety.

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Country NBF	Reference to regional harmonisation	Reference to science and technology development and collaboration
Gabon	Sees a need for harmonisation, and NBF refers to African model law as means to achieve this. NBF promotes ECCAS as vehicle that could simplify transboundary movement of GMOs in sub-region.	Biotechnology research still at embryonic stage, and does not appear that development of GM technology is likely in near future. No reference to Gabon's involvement in RRCs.
Gambia	NBF makes no reference to involvement in any REC, and no mention of regional harmonisation. Trade issues not a focus of NBF, although one proposed role for National Biosafety Technical Committee is to analyse potential trade risks associated with GMOs and their products.	According to NBF, has little or no biotechnology activity, even at level of plant tissue culture. No mention of involvement in CORAF/WECARD or WABNet.
Ghana	NBF refers to membership of ECOWAS but does not consider implications in handling of biosafety matters. Mention made of survey report on regional mechanisms for harmonisation of biosafety activities, but no recommendations incorporated into NBF.	Modern biotechnology identified as key tool both in research and development agenda and in modernisation of agricultural practices, but no reference made to involvement in regional biotechnology research communities.
Guinea	NBF advocates sub-regional agreement for legal harmonisation and transboundary control. However, does not mention which countries should be involved and no reference to membership of ECOWAS.	Variety of institutions undertaking biotechnology activities, although most not involved with genetic modification. NBF does not refer to any regional research initiatives.
Kenya	Biosafety Bill has been developed and biosafety regulations in place. Some confined field trials have taken place. Has been involved in meetings with COMESA partners through RABESA programme to discuss regional approach to biotechnology and biosafety.	Has an active biotechnology research community. Its Biotechnology Policy, approved in 2006, aims to further develop biotechnology.
Lesotho	NBF makes passing reference to SADC interim guidelines on biotechnology and biosafety, but does not discuss role in SADC, or importance of trade within sub-region, particularly with South Africa. No mention of harmonisation with other countries in sub-region.	Has limited activities in tissue culture but little or no modern biotechnology and S and T policy does not address biotechnology or biosafety. NBF does not refer to exchange of biosafety data with South Africa (which surrounds it on all sides) or to its involvement in regional research activities.
Liberia	NBF does not refer to involvement in any regional or sub-regional organisations, and no mention of any regional trade issues or collaboration with neighbouring countries.	Little information provided on state of S and T in general, and biotechnology in particular. No mention of involvement in regional biotechnology initiatives.
Madagascar	NBF focuses largely on dangers if country accepts LMOs. No mention of membership of any sub-regional organisations.	According to NBF, has little or no expertise in biotechnology. NBF silent on involvement in ASARECA and BecA.

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Malawi	Has Biosafety Act passed in 2002 in response to food aid crisis, but needs to be updated. Does not yet appear to be significant focus on harmonisation with other countries in region.	Has little activity in modern biotechnology, but its S and T policy highlights need to build capacity in this area, and to establish programmes of international co-operation. More focused biotechnology policy under development. No specific reference to membership of SADC or COMESA.
Mali	Attention to sub-regional aspects highlighted as component to be included in draft legislation. Sub-regional workshops and other initiatives to harmonise the national legislation with that of neighbouring countries advocated, especially in context of sub-regional integration (including AU, ECOWAS and others)	NBF specifies need for promotion of sub-regional and international scientific and technical co-operation in biotechnology and biosafety development.
Mozambique	Mention made of SADC Protocol on Trade and need to harmonise phytosanitary regulations. Plans to develop templates for regional agreements also mentioned, and potential for trade in GMOs recognised.	Biotechnology still in infancy, but potential contribution to meet critical needs for food, agriculture and human health care recognised. General policy on S and T, and NBF advocates development of biotechnology policy but not currently in place. No mention of regional biotechnology developments.
Namibia	NBF published in 1999 (Republic of Namibia, 1999) and Biosafety Act passed in December 2006. Established Biosafety Council, one function of which is international liaison. NBF advocates international co-operation, particularly with neighbours, though no mention of SADC. Has drawn on experience and expertise of South Africa in developing own systems.	Has some expertise in biotechnology, centred at University of Namibia. However, agricultural biotechnology apparently not seen as priority for food security and unlikely there will be high demand for cutting-edge biotechnology applications.
Niger	NBF mentions ECOWAS but not CEN-SAD. Stated that risk management will take into account regional and international dimensions. However, no mention of mechanisms for co-operation or harmonisation with other countries in sub-region.	Does not have any recombinant DNA activities. Research focused on improvement of local crop varieties. No mention of regional research activities.
Nigeria	NBF states as fundamental principle that Nigeria shall endeavour to co-operate with other states in sub-region and Africa. However, no mention of specific RECs or harmonisation, and trade issues not considered.	Has national biotechnology policy and capacity to undertake modern biotechnology exists, but actual progress slow. NBF silent on research priorities and regional research initiatives.
Rwanda	Although NBF acknowledges importance of trade into and through country, no mention made of membership of COMESA and ECCAS, and NBF silent on need for harmonisation with neighbouring countries.	National development strategy promotes S and T in general, but biotechnology still in infancy. NBF does not provide any information on involvement in regional biotechnology research.

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Country NBF	Reference to regional harmonisation	Reference to science and technology development and collaboration
Senegal	NBF addresses need for sub-regional harmonisation, and mentions CILSS, ECOWAS and WAEMU but does not refer to membership of CEN-SAD.	Has chosen to adopt modern biotechnology as means of increasing food production. Over more than 15 years has created centres and research laboratories in fields of plant, animal and microbial biotechnologies and recently developed strategy and action plan to promote biotechnology. Mention made of efforts of CORAF/WECARD towards sub-regional harmonisation in biosafety matters.
Seychelles	Much food imported from South Africa, but NBF silent on co-operation with that country. Plant quarantine controls insufficiently enforced. NBF does not refer to membership of COMESA, or potential for harmonisation. Regional co-operation with Small Island Development States (SIDS) apparently regarded as of greater importance.	Little or no activity in modern biotechnology, and insufficient expertise to deal with biosafety issues. Seeks support of international experts but no specific mention of sourcing expertise from South Africa as major trading partner. Involvement in biotechnology development as member of SANBio also not discussed.
Sierra Leone	Harmonisation of sub-regional laws on biosafety mentioned as priority, but without specific reference to membership of ECOWAS or CEN-SAD. Inter-African Phyto-Sanitary Council cited as one vehicle for harmonisation.	Keen to take advantage of benefits of modern biotechnology but lacks capacity in both biotechnology and biosafety. Mention of need for capacity-building in risk assessment within scientific communities of sub-region.
South Africa	Has taken lead in Africa, having passed its GMO Act in 1997 and is only country with commercial plantings of GM crops. GMO legislation did not take account of situation in neighbouring countries, but draft biosafety policy (South African National Department of Agriculture, 2005) has as objective, co-operation with other SADC countries and Southern African Customs Union (SACU) in harmonisation of biosafety regulatory oversight. Africa accounts for 24% of value of agricultural exports (Daya et al., 2006).	Has national biotechnology strategy and active programme of biotechnology research. Strategy does not specifically refer to regional collaboration, but South Africa provides hub for SANBio and actively promotes regional integration.
Sudan	NBF states that the safety policy should be in harmony with regional and international agreements to which Sudan is party. However, no mention of membership of any REC, and no indication of how harmonisation might be achieved.	Has ongoing activities in tissue culture, molecular markers and diagnostics, and research activities involving genetic modification envisaged. NBF does not refer to any regional or sub-regional linkages in S and T.

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Swaziland	First-hand reports indicate that farms straddling border with South Africa may already be unofficially growing GM crops. However, NBF makes no reference to regional co-ordination with neighbouring countries (South Africa and Mozambique), nor to membership of SADC.	Recognised need to build capacity for biotechnology research and risk assessment to enable meaningful participation in regional networking activities
Tanzania	NBF states that role for National Biosafety Focal Point is to establish contacts and linkages with national, regional and international agencies/institutions, and mentions regional/sub-regional and global co-operation as component of enabling environment. However, no specific reference to SADC or any other regional organisation.	Has fairly active programme of biotechnology research, although not detailed in NBF. Commission for Science and Technology (COSTECH) collaborates in biotechnology research with other East African countries through BIO-EARN programme and as member of ASARECA but these are not mentioned in NBF.
Togo	NBF mentions promotion of regional and sub-regional co-operation as a goal. Absence of regional vision at level of ECOWAS or WAEMU is mentioned as a problem, but these organisations are cited as presenting opportunities for sub-regional harmonisation.	Has no activities in modern biotechnology and only a limited number of scientists in relevant biological sciences. No mention of involvement in any regional or sub-regional research activities.
Uganda	Implementation-phase project undertaken without any regional focus. National biotechnology and biosafety policy drafted that makes only passing reference to encouraging regional collaboration.	Has some activities in modern biotechnology including some transgenic crop development. Project document submitted to UNEP mentions involvement in BIO-EARN or ASARECA, but these are not mentioned in the biotechnology policy and no implications drawn.
Zimbabwe	Although NBF has not been published, new National Biotechnology Authority Act passed in 2006, but does not appear to be fully aligned with Cartagena Protocol. Survey of regional collaborative arrangements in biotechnology and biosafety apparently undertaken through NBF development project.	Has some expertise in modern biotechnology. New National Biotechnology Authority Act attempts to actively promote biotechnology research, but may not be helpful in stimulating regional collaborative activities, since seeks to regulate proteomics, bioinformatics and other techniques outside Cartagena Protocol (Zimbabwe National Biotechnology Authority Act, 2006).

Notes: Table includes information from all NBFs that have been published on UNEP website. From other information available, 3 countries (Malawi, South Africa, Zimbabwe), whose NBFs have not been published, are included. In addition, available information from implementation-phase countries (Cameroon, Kenya, Namibia, Uganda) is included (implementation-phase countries shown with grey background). A number of countries (Cameroon, Egypt, Kenya, Malawi, Mauritania, Mauritius, Tunisia, Zambia) were involved in pilot-phase projects but only a few of these proceeded to the implementation phase.

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Transboundary movement through such informal trade cannot necessarily be regarded as 'unintentional' as provided for in Article 17 of the Cartagena Protocol, but would also not be covered by the Advance Informed Agreement (AIA) procedures. Although Article 17 only requires parties to act if an unintentional transboundary movement is 'likely to have significant adverse effects on the conservation and sustainable use of biological diversity', in fact few of the NBFs deal with this matter at all, let alone considering the potential for regional co-operation measures to mitigate any problems.

Even fewer of the NBFs mention their country's involvement in RRCs. Burundi, Cameroon and Senegal are exceptions, with specific mention of RRCs and their importance in harmonising biosafety. There is an apparent lack of linkage between the country approaches to biosafety and initiatives to develop biotechnology. This may be in part because of a policy vacuum in many countries, but is also a reflection of weak national biotechnology research initiatives. However, a justification for the lack of linkage to RRCs, particularly at the level of NEPAD and the AU, could be that the NBFs were in some cases published before regional S&T strategies were available.

Despite the significant lack of capacity in biotechnology and biosafety in many of the countries, the majority of NBFs propose the setting up of biosafety regulatory systems that would draw on (sometimes non-existent) in-country expertise in risk assessment. Many countries advocate the building of capacity in their countries, without seriously considering whether neighbouring countries might have capacity in both biotechnology and biosafety that could be harnessed in a regional context. The lack of real expertise in carrying out risk assessments and developing appropriate risk-management strategies is likely to lead to significant problems once the countries attempt to implement their NBFs. It is perhaps reflective of the unrealistic expectations of many African countries that the roster of experts in the Biosafety Clearing House lists more experts in Africa than in any other continent (Secretariat of the Convention on Biodiversity, 2007b).

9 Conclusion

It is clear that regional and sub-regional approaches to biotechnology and biosafety are not yet well developed, and lack alignment with regional trade and economic policies. NBFs have in most cases been developed by countries based on their own perceived needs, rather than with a focus on achieving alignment with overarching agreements at the level of RECs. The consideration of sub-regional trade in GMOs and their products is not a major feature of any of the NBFs.

Regarding biotechnology strategies at the level of the AU and the RRCs, it is also clear that there is insufficient integration between regional biotechnology research developments and the biosafety approaches of the countries. For most countries with little or no capacity in biotechnology and biosafety, there is insufficient consideration of possibilities to pool expertise within the sub-region, or to consider mutual acceptance of data or regional risk assessment and decision-making.

It is unfortunate that, despite the existence of over-arching policy statements at the level of the AU and NEPAD, a number of countries in Africa are taking their own paths in the development of biotechnology and biosafety. If effective higher-level regional policies are to be implemented in the future, a binding Directive (in the manner of the

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European Community Directives) might be necessary to ensure that countries implement their national frameworks according to a common agreement. Nevertheless, if such a regional mechanism should be put in place, it is essential that the AU should adopt an approach that facilitates trade and technology development, while considering the member countries' obligations in terms of international law. In this context, the adoption by the AU of the African Model Law (unless significantly revised and aligned with the Cartagena Protocol) is unwise because of significant problems with its content.

If African countries are to move beyond consideration of the introduction of GM crops that have been developed by the major multinational companies, to development of crops and traits that are of particular relevance to the continent, then consideration must be given to mechanisms that will lower the barriers to entry. The RRCs show promise in generating a critical mass of scientific expertise, reducing cost through the sharing of facilities and equipment and shortening the time for technology development. However, the cost and complexity of taking GM crops through the regulatory processes will be prohibitive to public-sector progress if approval has to be obtained separately for each country in Africa. Indeed, if the value of an improved crop to farmers and/or consumers is not sufficiently beneficial, despite being targeted to local needs, then it may not be worth the effort and expense of surmounting the regulatory hurdles. This will be the case, in particular, for small countries without a sufficiently large population, or crop-growing area, to justify take-up of the technology. It will also be the case for GMOs that offer benefits targeted to small sectors of the community with specific needs.

Besides the cost of the development and introduction of the technology, countries should also consider the cost of setting up and maintaining their regulatory systems. An indication of costs was provided by Morris and Koch (2002). It appears that many countries in Africa are dependent on financial support through the GEF for the implementation of their biosafety frameworks. However, in the long run it cannot be expected that international funding will be available for ongoing maintenance of the regulatory systems, and there is a real danger of these systems collapsing when funding is eventually withdrawn. If countries approaching implementation were now to consider a regional approach, including sharing of data, pooling of resources for risk assessment, and mutual acceptance of approvals as appropriate, the costs of implementation could be dramatically reduced and the likelihood of sustainability greatly enhanced. Moreover, the safety issues facing most African countries are not dissimilar. For example, the continent as a whole needs to consider how to handle GM derivatives of its indigenous crops such as sorghum and millet, while recognising that a crop such as maize, without wild relatives, poses much less of a problem from an environmental perspective. In addition, borders between countries in Africa are extremely porous, and seed can easily pass between farmers in neighbouring countries regardless of regulatory processes.

Whether or not individual countries decide to develop and/or grow GM crops themselves, the reality of trade in agricultural products remains an issue. The imposition of restrictions on cross-border trade in GMOs and their products, even within RECs that have agreed to dismantle trade barriers, is likely to have a significant negative effect on intra-regional trade and hamper economic development through the introduction of costly administrative hurdles and additional paperwork. Few NBFs mention RECs in

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their evaluation of national and regional strengths. This suggests that both NBFs and RECs need to understand and publicise the RECs' regional role in facilitating trade in approved GMOs and their products between member countries.

The Cartagena Protocol has been widely welcomed and supported by the majority of African countries, who have seen it as a means to overcome some of their own lack of capacity to handle GMOs. Yet, until the countries concerned adopt a harmonised, cost-effective and realistic approach to the implementation of the Protocol, the question remains: will the Cartagena Protocol be a boon or a bane for Africa?

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