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Conflicting advocacy coalitions in an evolving modern biotechnology regulatory subsystem: policy learning and influencing Kenya's regulatory policy process

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In many countries in Africa, the twin processes of modern biotechnology transfer and development of a regulatory regime have co-evolved. This provides a rich context to evaluate the underlying social and institutional factors that confront an evolving regulatory subsystem. This paper uses Kenya's biosafety regulatory system for the management of biotechnology as a case study to analyse such co-evolution. Drawing some insights from the Advocacy Coalition Framework, this politically charged subsystem reveals empirically two advocacy coalitions which influenced the regulatory decision process trajectory. This has had significant implications for emerging regulatory instruments where different sources of knowledge informed the process. Thus, any innovation system with governance issues should reconceptualise how the tacit knowledge emanating from the complex relationships built around different advocacy coalitions is managed.

GOVERNANCE ISSUES RELATED TO management of risk associated with deployment of new biotechnologies[1] in agriculture have been widely debated. In Africa, however, it can be said that these technologies are slowly gaining importance, despite the challenges of creating institutional structures to manage the associated risk and other controversies. Kenya for instance has not been left behind and has implemented a number of technological developments since the early 1990s (see Table 1). Recent studies looking at biotechnology regulatory policy processes in Africa expose certain cultural and political dynamics associated with the practices of the actors, while suggesting that policy learning is important for young innovation systems that are still evolving (Mugwagwa, 2008; Kingiri, 2010; Harsh, 2005; Smith, 2009). Kingiri (2010) further demonstrates empirically that, driven by different motivations and opportunities, actors become entangled in controversial regulatory policy process in unprecedented ways. But perhaps more important is the way in which politics in biotechnology governance are played out in an institutionalised setting (Harsh, 2005), making it worthwhile to explore the dynamics of policy coalitions. This may be explained partly by the public policy controversies, usually driven by politics and values that go beyond technical considerations (Mazur, 1981 cited in Weible, 2007: 95).

In a practical sense, the process of policy-making is complex, messy, interactive and political in nature, exposing complex dynamics that relate to different actors, the generation of different knowledge, sharing of knowledge and resources, power dynamics and competences etc. (Considine, 2005; Sabatier, 2007). There is also intense learning which, from a

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policy process perspective, is important for young innovation systems that are still evolving like new biotechnologies. This is because the focus shifts from the analysis of incremental learning that leads to technological change, to the analysis of learning (sometimes short-lived) that targets policy change. The former is linked to innovation systems and policy networks (Lyall, 2007) while the latter is linked to policy coalitions (Sabatier, 2007; Hajer, 1995).

To obtain a good grasp of a political dispute in any public policy process, an analytical framework that focuses on a holistic view of a system would seem to be appealing. This is because it would take cognisance of the complex and interactive factors that underpin the functioning of such a system. The Advocacy Coalition Framework (ACF) has the potential to explain actors' behaviour and policy outcomes in intense political conflicts over periods of a decade or more (Sabatier, 1993; Sabatier and Weible, 2007). It offers an alternative approach to understanding the behaviour of policy actors in a manner that complements other theoretical approaches applied in the science-policy arena like governance theories and risk regulation. Using governance models, Tait *et al*. (2006) demonstrate how the governance of the life sciences is driven by the

Table 1. GE technological innovations in Kenya

GE activity	Initiative trigger	Stage of development
Sweet potato engineered for disease resistance (feathery mottle virus)	• Virus coat protein gene availability from Monsanto • Diseases attack causing low yields	CL and CFTs
Bt maize- Insect Resistant Maize for Africa (IRMA) project engineered for resistance to insects (African maize stem borer)	• *Bt* technology availability from Syngenta company • Infestation of pests in particular maize stalk borer	CL, greenhouse and CFTs
Cassava engineered for CMD resistance-African cassava mosaic virus and East African cassava mosaic virus	• Coat protein gene available from Monsanto • Disease infestation in particular CMD significantly reducing yields	CL, greenhouse and CFTs
Biofortified cassava with enhanced nutritional value (vitamin A)	• Opportunity to leverage the technology from DDPC • Low nutritional quality of cassava and malnutrition challenge in Africa	Contained greenhouse and CFTs
Bt cotton engineered for insect resistance-cotton bollworm	• *Bt* technology availability from Monsanto • Declining production performance: pest infestation, in particular African bollworm	Contained greenhouse, CFTs, multiple trials at different ecological zones
Transgenic sorghum for resistance to striga parasitic weed	• Availability of collaborative research grant • Persistence of parasitic striga weed in cereals growing areas in Kenya	CL and screen house
WEMA	• Persistent drought severely affecting maize • Drought tolerance transgenic events availability from Bayer (BASF) and Monsanto companies	Screen house, mock trials and CFTs
Biofortified sorghum for improvement of nutritional quality of sorghum (essential amino acids and vitamins mainly lysine, vitamin A, iron and zinc)	• Malnutrition challenge amongst susceptible women and children • Opportunity to leverage grain technology from DuPont, a company of Pioneer Hi-Bred	CL and greenhouse
Banana transformation for resistance to bacterial wilt and cassava transformation for post harvest deterioration	Planned for laboratory trials at BECA plant transformation laboratory at ILRI after review and approval by Kenyan regulatory body	

Source: Adapted from Kingiri and Ayele (2009) after updating in September 2010
Notes: CL contained laboratory
CFT confined field trial
IRMA insect-resistant maize for Africa
CMD cassava mosaic disease
DDPC Donald Danforth Plant Science Center, St Louis, MO, USA
WEMA water-efficient maize for Africa
BECA Biosciences Eastern and Central Africa
ILRI International Livestock Research Institute

The ACF offers an alternative approach to understanding the behaviour of policy actors in a manner that complements other theoretical approaches, like governance theories and risk regulation

political and value-laden nature of these technologies. Scholars in risk regulation have ostensibly appealed for scientific, political and democratic legitimacy of policy processes that take cognisance of different values and perceptions of risk (cf Levidow, 2007; Jasanoff, 2003). This paper augments these studies as it provides a theoretically substantiated basis for prospective policy studies which have governance issues. Using Kenya's regulatory policy subsystem that has been co-evolving alongside the technological processes for over one-and-a-half decades, the underlying factors are analysed through the lens of the ACF.

The paper is presented as follows: the theoretical and analytical framework in which the empirical data are grounded, and the method applied for data collection are discussed. This is followed by a brief overview of Kenya's biotechnology sector, setting the scene for an exploration of the regulatory subsystem evolution process. Next is an analysis of conflicting advocacy policy coalitions and their role in influencing Kenya's regulatory policy subsystem. The paper concludes with a brief summary that highlights some key implications related to public policy processes.

ACF in the analysis of political subsystems

The ACF concept has been applied to explain the dynamics of policy change in subsystems that are political in nature. It emanates from Sabatier's conception of a policy subsystem which is an 'interaction of actors from different institutions who seek to influence governmental decisions in a policy area' (Sabatier 1993: 16; Sabatier and Weible, 2007: 192). Actors who constitute a policy subsystem aggregate into advocacy coalitions (ACs) which are amenable to analysis based on their 'belief systems'. A belief system is 'a set of basic values, causal assumptions, and problem perceptions' (Sabatier 1993: 25) while a coalition is made up of 'people from a variety of positions who share a particular belief system and who show a non-trivial degree of coordinated activity over time' (Sabatier, 1993). Stakeholders within a coalition are like-minded people who may include researchers, journalists, legal officers and government officials. They share basic values and search for means to accomplish them. They also tend to overemphasise the influence of their opponents (Sabatier and Weible, 2007; Sabatier and Jenkins-Smith, 1993). Moreover as these scholars argue, coalitions seek to manipulate institutional rules and actors in order to achieve certain policy goals. The dynamism of a coalition is dependent upon resources which include: money, expertise, technical information, the number of supporters and legal authority, with the latter being embedded in institutions (Sabatier and Jenkins-Smith, 1993: 29). The way these resources are used is important. For instance, technical information is used by actors as they 'seek to convince other actors of the soundness of their position concerning the problem and the consequences of one or more policy options' (Jenkins-Smith and Sabatier, 1993: 45). Shared beliefs rather than interests direct the behaviour of individuals within coalitions providing the 'principal glue of politics' (Sabatier, 1993: 27). Sabatier argues that beliefs are more inclusive and more verifiable than interests and that belief systems models are flexible and thus able to incorporate individual and institutional interests (Sabatier, 1993: 28). This argument tends to underplay the role of interests and values that play a significant role in policy processes linked to emerging innovations like the new life sciences (Laurie *et al*, 2009).

Unlike policy networks which focus on institutions such as the government or public for analysis of policy or institutional change (Lyall, 2007), a policy subsystem is the principal unit for understanding policy change. To assess the influence of actors on a particular policy system, a policy change must be evident. Based on an ACF approach, a policy change occurs as a result of various factors. First, non-cognitive factors external to a policy subsystem may change components of policy core beliefs. Secondly, 'policy-oriented learning' over long periods of time may result from incremental accumulation of information or increased experience of actors. Learning therefore affects the beliefs of actors within the policy subsystem which can lead to major policy change (Jenkins-Smith and Sabatier, 1993: 42). Thirdly, a hurting stalemate which is a situation in which all parties involved in a dispute view continuation of the status quo as unacceptable and run out of options and venues to achieve their objectives.

As an analytical framework, the ACF accounts for the mobility of specific individuals within institutions or a subsystem and variation in behaviour exhibited by individuals (Sabatier 1993:25). It creates an environment for players with similar beliefs (regarding a particular problem) to interact cooperatively while avoiding those with dissimilar beliefs (Weible, 2005). ACF's unique focus on a particular subsystem opens up additional ways of understanding the knowledge dynamics in a policy process like biotechnology regulation. It offers a way of understanding value-related factors linked to actors in a political system, thus

developing a good understanding of the underlying tensions. Thus, it is possible to grasp the political context of the problem being analysed (Weible, 2007: 96). Understanding the policy process requires knowledge of the goals and perceptions of actors 'over a period when these actors are actively seeking to propagate their specific spin on events' (Sabatier, 2007: 4). Policy outcomes would then be interpreted as the victory of a certain belief system.

These features make it possible to investigate a controversial regulatory subsystem in transition with an objective of exposing underpinning factors that direct such a process. These features distinguish the AC approach from other theoretical approaches that target policy change. One such theoretical approach is Hajer's (1995) discourse coalitions that stem from his study of 'the politics of environmental discourse' in which he explores the dynamics in environmental policy-making. Hajer's main argument is based on the fact that the social construction of environmental problems drives developments in environmental politics. The framing of issues consequently impacts the behaviour, organizations, institutional arrangements and the emerging policies. This approach exemplifies the way issues are talked about regarding a certain policy area, giving rise to relationships or discourse coalitions that reflect particular strategies or consensual paths. However, as others have noted (cf. Jasanoff, 2004), it gives a lot of attention to language which may limit its analytical potential. Moreover, as empirically shown by Boschert (2005), the concept takes beliefs, interests and values as given, elevating discourse above these factors that have been found to be key in controversial science-policy debates.

For the purpose of this paper, and based on the justification presented here, some features of the AC approach are taken up in the next sections to discuss Kenya's regulatory subsystem.

Methodology

This paper is based on research conducted in Kenya in the period 2006–2010. The rationale for selecting Kenya as a study area was based on several factors. First, there is a significant body of literature on the Kenyan regulatory policy process that reveals that the establishment of the Kenyan biosafety regulatory regime had become controversial (Sander, 2007; Harsh, 2005). Secondly, Kenya is perceived to have advanced in terms of both biotechnology research and development (R&D), and progress made towards establishment of a functional biosafety regulatory regime (Nang'ayo, 2007). The latter aspect presented an excellent innovation-policy model that makes it possible to analyse the science-policy controversies in an empirical setting. The process of instituting a regulatory regime for the management of biotechnology involved among other activities, the development of biosafety regulations. Thus, 'biosafety regulations implementation' was perceived to be an invaluable process through which rich data could be generated. This process involved a wide range of stakeholders making it possible to randomly select the 42 respondents who were interviewed in this study. These interviewees have been involved in biotechnology research and biosafety policy-making in their various capacities as biological scientists and non-scientists. They were affiliated to organizations that have (or claim to have) a stake in modern biotechnology and biosafety arena, ranging across researchers, policy makers, academics and nongovernmental organizations (NGOs) in both pro-biotechnology and civil society arenas. Most of the interviews were conducted at the height of controversies involving the legalisation of biotechnology activities in Kenya through the formulation of a biosafety law. The subjective views of the interviewees related to the implementation of regulations, why they hold these perspectives and their behaviour related to regulatory process were the topics for interpretation. Documentary material that include literature, policy documents and media reportage were also analysed in relation to the regulatory process and role of different actors. Direct observations were made during numerous biotechnology and biosafety fora held in the period 2007–2009 at the height of debate about the formulation of the biosafety bill. Analysis of the data obtained forms the narrative presented in the subsequent sections of this paper.

Kenya's biotechnology development: an overview

Kenya's new biotechnology revolution commenced in 1991 with transgenic sweet potato initiative and developed further into more crop initiatives engineered for different traits (see Table 1).

The activities outlined in Table 1 have over the years spurred the evolution of the regulatory regime as shown in Table 2. This has been accompanied by development and transformation of the institutions and organizations to support requisite technology transfer. The 1998 Republic of Kenya (RoK) regulations (RoK, 1998) for instance is an institutional milestone that was triggered by a technology push (Sander, 2007). These biotechnology initiatives have therefore provided a practical test environment for the implementation process of the biosafety regulatory system in Kenya for over one-and-a-half decades. It is, however, important to note that no product emanating from these activities has been released for commercial use.

Evolution of Kenya's regulatory subsystem between 1990 and 2010

Kenya signed and ratified the Cartagena Protocol in May 2000 and January 2002, respectively. This obligated the government to put regulatory structures

Table 2.Phases of Kenyan biotechnology regulatory process

Phases		Activity	Proactive actors
I (1990–1998)	1991–1997	• Research activities involving virus resistant sweet potato commence in USA by scientists from Kenya and USA • Regional conference on safety in biotechnology in 1993 exposed early scientists to biosafety regulation. Task force formed after this conference to draft regulations and guidelines for biosafety in biotechnology in period 1996–1998 • Commencement of early phases of sweet potato and rinderpest vaccine trials through ABSP • Sweet potato lines transformed in USA ready to be imported into Kenya • UNEP-GEF project phase 1 commences • KARI-Institutional Biosafety Committee (IBC) formed • KEPHIS is established through a government legal notice	• NCST • Two donor organizations (DGIS and USAID) • NACBAA committee, KABP/BTA • Scientists (at KARI, universities, regulatory agencies and government departments providing both technical and policy support)
	1998	• Regulations and guidelines for biosafety in biotechnology (RoK, 1998) adopted • Establishment of NBC • Approval of a virus resistant sweet potato as first GE crop in Kenya	
II (1999–2005)	1999	• Commencement of IRMA phase 1 project • Enactment of Environmental Management Coordination Act and creation of NEMA under provisions of this Act • Establishment of a National Biosafety framework through UNEP-GEF support	• Three main donors: (UNEP-GEF, USAID) through PBS, Swedish government funding BIOERN programme • Scientists (in practice and policy, as members of NBC or affiliated to donors and NGOs, in academic and research institutions) • Government through the NCST and regulatory agencies (e.g. DPH, KEPHIS, NEMA, KEBS, DVS) • Technology developers (e.g. Monsanto, CIMMYT, DDPC)
	2000	• Importation of GE sweet potato from USA by KARI for field trials • Kenya signs Cartagena Protocol	
	2001	• *Bt* maize trial using transgenic *Bt* leaves under IRMA obtains approval from NBC	
	2002	• Kenya ratifies Cartagena Protocol • Implementation of national biosafety framework under UNEP-GEF phase 2 commences setting pace for development of legal biosafety legislation	
	2002–2004	• On farm trials of recombinant rinderpest vaccine against rinderpest disease in African cattle was carried out at KARI, Kiboko Trial continued thereafter at a small scale under laboratory containment	
	2003	• Confined greenhouse approval to conduct *Bt* maize trial using *Bt* seed under IRMA project • Attempts to revise RoK (1998) to accommodate provisions of Cartagena Protocol • *Bt* cotton and transgenic cassava approved for screen house trials • Drafting of biotechnology policy and biosafety bill commences	
	2004	• Failure of transgenic sweet potato to confer resistance to sweet potato feathery mottle virus becomes publicly known • *Bt* maize under IRMA project approved for open field trials by NBC • Approval of *Bt* cotton resistant to African bollworms under open field trials by NBC	
	2005	• Planting of *Bt* maize and *Bt* cotton open field trials. *Bt* Maize open field trial publicly halted by a senior official from the Ministry of Agriculture citing non-compliance to biosafety requirements • Re-approval of *Bt* maize open field trial reviewed with stricter biosafety requirements • Open field trial cassava application resistant to viruses denied approval by NBC for lack of baseline biodiversity data	
III (2006–2009)	2006	• Adoption of biotechnology policy and approval of early version of biosafety bill	• One main donor actor (USAID through PBS) • Technology developers partnering with other players in GMOs sensitisation • Scientists (individuals and within groups) make a case for biotechnology and biosafety bill through awareness initiatives • NBC though NCST • Journalists targeted for biotechnology training and publicity • Many media agencies reporting on biotechnology and Biosafety Bill • AATF, ISAAA, regulatory agencies
	2007	• Approval of second *Bt* cotton open field trials which were extensively used by proponents of GMOs and scientists to lobby for political support. • First and second mentions of biosafety bill in parliament • Parliament prologues to pave way for general elections • Proliferation of NGOs (for and against GMOs, and enactment of biosafety bill) that led to intensified lobbying. Examples include KBioC and Kenya Biosafety Coalition • Parliament is dissolved to pave way for national general elections held in December 2007	
	2008	• First attempt to have draft biosafety bill 2008 published • University scientists publicly support modern biotechnology and Biosafety Bill • Civil society actively lobbies against bill citing potential risks and Kenya's unpreparedness to regulate and monitor GMOs (increased media reports on biosafety bill; public demonstrations led by anti-GMOs lobby group) • Fears that farmers were planting genetically modified seed exposed through media • National Biotechnology Awareness Strategy (BioAWARE) launched as a mechanism to educate public about GMOs • Sorghum engineered for striga parasitic weed resistance approved by NBC and trial commences at Kenyatta University	
	2006–2010	Confined field trials of cotton engineered for resistance to cotton boll worms (cotton bollgard II) continue under KARI	

(*continued*)

Table 2 (*continued*)

Phases		Activity	Proactive actors
	2009	• Biosafety bill enacted as an Act of Parliament in February • An interim National Biosafety Authority (NBA) is operationalised through appointment of an acting chief executive officer • A team of experts drafting the biosafety regulations to implement Biosafety Act • Application to undertake trials on biofortified sorghum (vitamin A) under greenhouse containment approved by NBC • Sweet potato engineered for resistance to sweet potato weevils approved for greenhouse trials. • Biofortified cassava (vitamin A) approved by NBC for greenhouse trials and later field trials • Cassava engineered for virus resistance approved by NBC for greenhouse trials and later field trials • Mock field trials for WEMA initiative commence at KARI, Kiboko • BECA biosafety levels II and III for animal and vaccine research at ILRI involving recombinant technology approved by DVS	
IV (Post approval of the Biosafety Act)	2010	• Actual implementation of Biosafety Act • Drafting of biosafety regulations by a committee of experts continues, supported by PBS • NBA board gazetted on 23rd April paving way for implementing regulations to be gazetted • Application to introduce WEMA trial under confined field trials discussed by KARI IBC and later approved by NBA • Application to undertake trials on biofortified sorghum under confined field trials discussed by KARI IBC • BECA plant transformation laboratory at ILRI approved by KEPHIS, DVS and NBA. Eventually launched by president on 5 November 2010 • Sensitization of biotechnology science continues through different actors including 'seeing is believing' tours organized by the industry and ISAAA to biotechnology growing regions in Africa	• One main donor actor (USAID through PBS) still active in this phase • Private sector, researchers • Consumers, farmers, regulators and government through NBA

Source: Various secondary material and interview data
Notes: NCST National Council for Science and Technology
UNEP United Nations Environmental Programme
GEF Global Environment Facility
KARI Kenya Agricultural Research Institute
KEPHIS Kenya Plant Health Inspectorate Service
IRMA Insect-resistant Maize for Africa
USAID United States Agency for International Development
DGIS Directorate General International Cooperation (the Netherlands)
NACBAA National Advisory Committee on Biotechnology Advances and their Applications
BTA Biotechnology Trust Africa, Kenya
KABP Kenya Agricultural Biotechnology Platform
NEMA National Environmental Management Authority
NBC National Biosafety Committee
PBS Programme for Biosafety Systems
BIOEARN Research Network for Biotechnology, Biosafety and Biotechnology Policy Development
DPH Department of Public Health
KEBS Kenya Bureau of Standards
DVS Department of Vetinary Science
CIMMYT International Maize and Wheat Improvement Centre
DDPC Donald Danforth Plant Science Center, USA
WEMA water-efficient maize for Africe
BECA Biosciences Eastern and Central Africa
ISAAA International Service for Acquisition of Agric-Biotech Applications
AATF Africa Agricultural Technology Forum

in place to operationalise the protocol. However, as mentioned elsewhere, the regulatory system has been co-evolving through four regulatory phases alongside the biotechnological development for over one-and-a-half decades (see Table 2). It has involved many players who may be perceived to hold diverse belief systems which are amenable to analysis. This scenario has been confounded by the complex interrelationship between technological, institutional, individual actors, and linkages between them that interplay significantly as components to influence the multifaceted dynamics in the overall innovation process, including the regulatory process (see Figure 1).

The role of different players in the regulatory process creates controversies that may be interpreted in different ways. Prior to the current study, Paarlberg (2001) exposed the political environment of genetically modified (GM) crop regulation in Kenya, claiming that environmental groups had dominated the regulatory process. This claim has partly been confirmed by this study but has exposed empirically the proactive role of the private sector as key members of the pro-biotechnology coalition. These

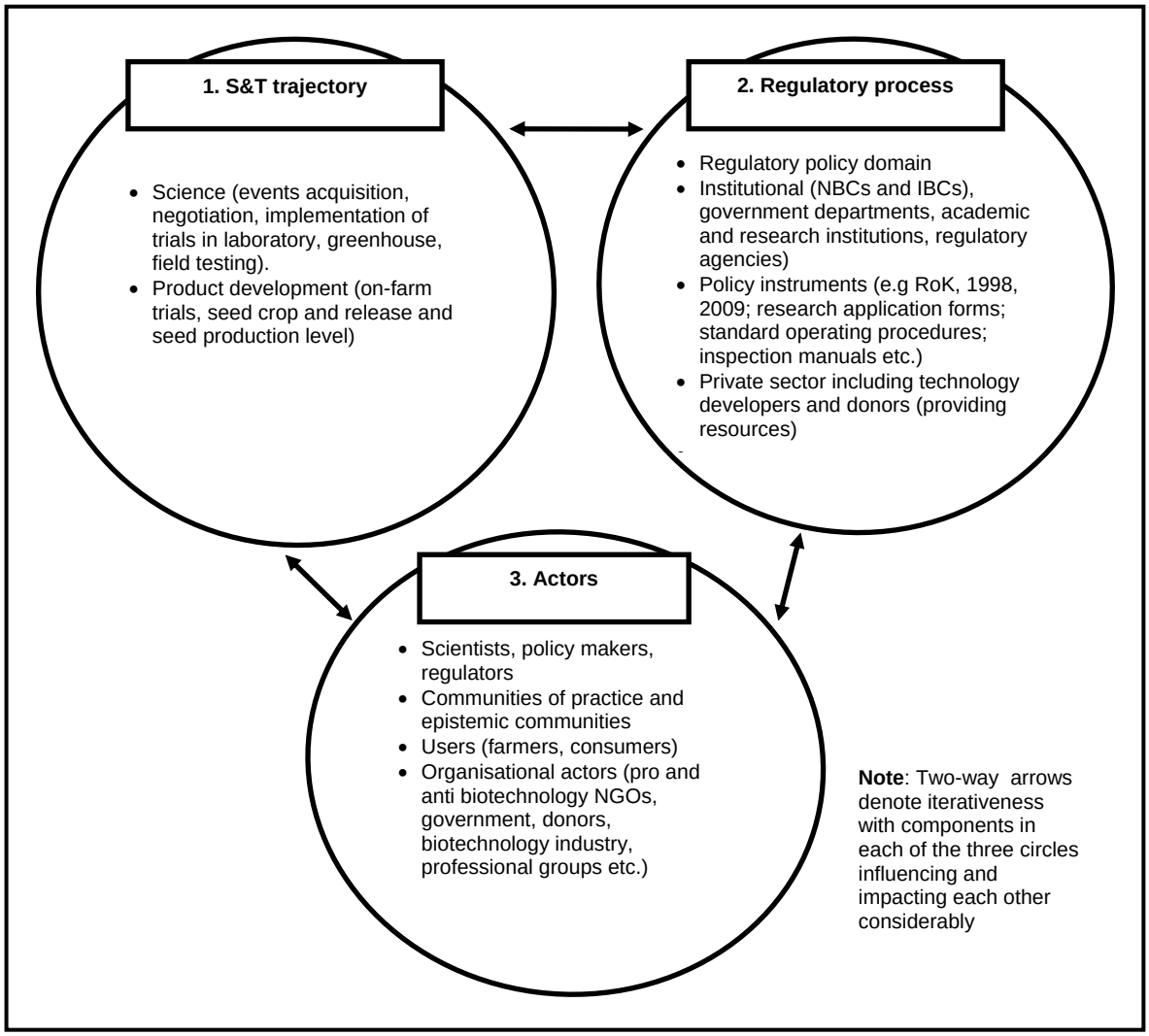

Figure 1: A non-linear, iterative illustration of a complex interrelationship between components in governance of biotechnology in Kenya (adapted from Kingiri, 2010)

findings are in agreement with Harsh (2005) who exposed the political role of the NGOs in biotechnology regulation in Kenya. A critical analysis of the different phases of the regulatory trajectory presented in Table 2 suggests the dynamism of the actors in relation to cumulative learning, knowledge production and use, and the impact of this knowledge on technological and regulatory innovations. Understanding this dynamism is important and provides a context for reviewing the role of policy actors in influencing the regulatory process. One key regulatory instrument that engaged actors considerably is the Biosafety Act (RoK, 2009). This Act seeks to operationalise the Cartagena Protocol. The controversial developments surrounding its formulation over the years also provide a context for this paper. Harsh (2005) reports similar controversies prior to 2005, however, these controversies escalated after 2005 (Kingiri and Ayele, 2009; Kingiri, 2010). Table 3 captures some of the main developments, revealing the dynamics that include the different actors who are involved, and the nature of engagement, and also details the different forms of engagement by the public and policy-makers in the period 2002–2010. Within this period, various versions of the biosafety bill were drafted and discussed before it became law.

Conflicting advocacy coalitions exposed in Kenyan regulatory policy subsystem

The biotechnology and biosafety arenas are important spaces where different communities converged to consolidate support for their visions and views about the regulatory policy process. Within these spheres, they seem to have shared norms and beliefs with regards to new biotechnologies and desired regulations to a certain extent, thereby behaving like an epistemic community. Members of an epistemic community belong to knowledge-based groups and share principled and causal beliefs (Haas, 1992: 35). As like-minded individuals, they are transmission belts through which new knowledge is developed and transmitted (Haas, 2004: 587). Efforts by different players, both scientific and non-scientific communities, to influence the regulatory policy subsystem, particularly through the biosafety bill occurred within informal ACs. This deduction is derived from the analysis of this sub-

Table 3. Major developments surrounding formulation of the Biosafety Act

Period	Activity
The signing and ratification of Cartagena Protocol in 2000 and 2002 set various activities in motion	
July 2002	Scientists and lawyers developed zero draft copies of the biotechnology policy and the biosafety bill after a two-week meeting
March 2003	First discussion of zero drafts of biotechnology policy and biosafety bill by scientists and lawyers in a two-day meeting
April 2003	First stakeholders' one-week meeting to discuss draft copies
August 2003	Two-day meeting with members of parliament to discuss draft copies
November 2003	One-week meeting of stakeholders (policy-makers, the majority being members of parliament) to sensitise them to issues in biosafety bill
May 2004	Two-day study tour for members of parliamentary committees to biotechnology facilities in Kenya to assess the biotechnology and biosafety capacity as they debated the bill in parliament
March 2005	One-week meeting of 17 experts (scientists and lawyers) to review both the policy and the bill
April 2006	Interested stakeholders discussed revised draft policy documents to identify any omissions for further input
July 2006	Final reviewed documents presented to the Attorney General by the Minister for S&T for perusal before being presented to the cabinet
September 2006	Policy and bill approved by cabinet
22 June 2007	Bill is published in the Kenya Gazette to solicit public comments
22 June–11 July 2007	Period during which it remained in the public domain, significant number of public comments received
July 2007	A half-day stakeholders' meeting to discuss the bill and be sensitization on its importance
August 2007	One-week meeting by a committee of experts (three lawyers and five scientists) to review comments from the public. Committee proposed a number of technically sound amendments to bill
October 2007	Biosafety bill, 2007 tabled in the nineth parliament by the Minister for S&T. It went through the first and second readings
	Parliament was dissolved before the third reading, hence further discussion ceased
Feb 2008	NCST incorporated the proposed amendments to the biosafety bill, 2007 and consequently requested the Attorney General to re-publish the then biosafety bill, 2008
27 June–16 July 2008	Bill published in Kenya Gazette and placed in public domain for comments. No public comments were raised
July 2008	Biosafety bill, 2008 tabled in the tenth parliament by newly elected Minister for S&T
Nov 27 2008	Bill passed the second reading and moved to committee stage of whole parliamentary house
9 Dec 2008	Bill passed after it was approved by parliament
12 Feb 2009	Presidential assent and finally bill became law. It was officially published in a special issue of the Kenyan Gazette in February 2009 as Biosafety Act 2009
24 April 2010	Members of the new NBA established under the provisions of the Act are officially appointed through publication in the Kenya Gazette

Source: Primary and secondary sources (Macharia, 2008; selected media articles; correspondences within government departments; PBS resource materials (Available at <www.pbs.org>) and interviews)
Notes: S&T Science and technology
NBA National Biosafety Authority
PBS-Programme for Biosafety Systems

system and its actors as it evolved for one-and-a-half decades, with increased tension and conflict in the period 2001–2009. This tension is anticipated to continue as the Biosafety Act, 2009 enters its implementation phase. There is, however, a striking difference in the way beliefs and values were shared in a regulatory context as described below.

The scope of the Kenyan regulatory policy subsystem and actors

The scope is defined by innovation in modern biotechnology and actors in public and private sectors implementing the various regulatory instruments. The actors comprise: government players, academics, researchers, journalists, legal officers, farmers, consumers, media, NGOs in the biotechnology arena and civil society among others. The heterogeneous group of the scientific community involved in modern biotechnology research and policy initiatives form part of this scope. Similarly, the scientific and non-scientific communities within the civil society groups are also important actors in this subsystem.

Coalition members

Data identified two rival coalitions. The dominant one comprised of a large group of scientists from the

policy, practice and pro-biotechnology NGOs, their respective institutions comprising the private and public sector, and some members of parliament. The minor coalition comprised members from the civil society, some being the environmentalist groups, media and some members of parliament.

Policy core beliefs

The interviewees were polarised in their preferences for a biosafety bill. Some supported the bill due to its potential to enhance modern biotechnology deployment while others felt that it would regulate and hence promote responsible biotechnology research. Some members of civil society supported the bill for its potential to enhance public protection through legal controls while others were totally opposed to it. These differences in policy beliefs seemed to explain the ambivalences in the nature of biosafety regulations different actors seemed to detest or prefer (enabling, constraining, permissive, restrictive or cautious).

The AC concept predicts that membership of a coalition and policy core beliefs remain stable (Sabatier and Weible, 2007) and can be useful in identifying impediments to policy resolution in the formulation of the biosafety bill. Critical analysis of the regulatory policy subsystem during the evolving regulatory phases (see Table 2) exposes different groups with different political interests who could negotiate core values and beliefs based on the concern or conflict at hand (Sabatier, 1993). The biosafety bill conflict therefore separates different coalitions based on the different core policy beliefs. In this particular case, the legalisation of regulations through enactment of the bill for the management of modern biotechnology was the concern at hand.

Scientists in both the practice and policy arenas stood to gain from a regulatory policy that would enhance their scientific and policy ethos. This is supported by the blurred boundary between pro-biotechnology scientists in practice and NGOs on the one hand and scientists in the policy arena on the other, which qualified them to be proponents especially in pursuing the temporary shared belief (biosafety bill for management of biotechnology). Consequently they viewed the 'non-scientific public' as non-supportive of new biotechnology (resisting and fighting the biosafety bill was perceived to be a rejection of this technology). This consensual view of the bill portrayed by the scientific community (although for different reasons) denotes a shared belief (for details of their proactive engagement in the biosafety bill process, see Karembu *et al.*, 2010). Thus, as mentioned previously, analysis of the data identified two competing coalitions (opponents and proponents of the biosafety bill). The opponents (civil society) presented a competing counter coalition. The two coalitions influenced the regulatory policy subsystem in various ways, which we now explore.

Use of resources

The pro-bill coalition utilised resources in the following ways:

- The policy players happen to have legal authority to coordinate and direct the policies placing them at an advantage over their opponents. The NCST, for instance, directed the policy initiatives under the legal mandate of the Science and Technology Act, (RoK, 1980) and the interim biosafety regulations (RoK, 1998).
- In knowledge-intensive subjects like biosafety and biotechnology, scientists in practice and those linked to pro-biotechnology NGOs or the private sector, who happen to control scientific resources, played a key role in provision of technical and scientific information. They also came together as an *ad hoc* network, the Kenya Biosafety Coalition (KBC) to articulate this role. The Handbook for Policy Makers (2007) is evidence of a combined endeavour between policy players, research scientists and actors from the private sector.
- Scientists affiliated to pro-biotechnology NGOs were also connected to funding agencies/donors thus commanding substantial amounts of finance directed towards policy, technological and biosafety research. They were extensively linked to most policy and biotechnology fora, and activities organised during the period under analysis.

The anti-bill coalition on the other hand utilised resources in the following ways:

- It commanded considerable amounts of finance. This was disclosed by two respondents from the civil society who claimed that at the early regulatory phases, funds were limiting their activities but later they were able to consolidate enough finances to counter pro-bill groups. The increased media reportage discrediting the bill (and sometimes GMOs) may suggest increased finances and mobilisation of a wide range of civil society actors, thus strengthening the coalition. Initially the coalition under the Kenya GMOs Concern (KEGCO) had seven members (Harsh, 2008) but the number grew to 12 (Action Aid, 2004). The membership of this coalition has increased significantly under the Kenya Biodiversity Coalition (KBioC) which is made up of more than 70 farmer organizations, animal welfare networks, consumer networks, faith-based organizations, and community-based groups (Kamau, 2010). Members have an interest in the areas of environment, agriculture and biodiversity.
- This coalition seemed to have public support through the orchestrated activities of the established and popular members (e.g. Action Aid financing their activities, Kenya Organic Farmers Association Network (KOAN) representing organic farmers, Consumer Information Network

(CIN) representing consumers and Kenya Federation of Agricultural Producers (KENFAP) representing farmers). They therefore used the public as a resource.
- Different members of this coalition had access to environmental groups. For instance, one respondent stated that the KBioC coalition members had received training in advocacy from Europe's Greenpeace. The members were also privileged to access 'reliable' scientific information. Members from this coalition who were interviewed referred to one of their members who is a trained molecular biologist and offered valuable scientific advice to the coalition. She was also purportedly linked to some scientific aspects of certain media reports originating from the civil society through this coalition as disclosed by journalist interviewees.

Available venues are institutional arenas within which stakeholders have the opportunity to influence policy-making (Weible, 2007: 96). The pro-biosafety bill coalition was active in various venues facilitated by the pro-biotechnology fraternity and the government (conferences, workshops and government institutions like NCST, KEPHIS, NBC and media). Parliament was another venue in which both coalitions actively engaged the parliamentarians. This is evidenced by two counter parallel bills tabled in parliament by each of the coalitions (biosafety bill 2008 from the dominant pro-bill coalition and the biotechnology and biosafety bill 2008 from members of the minor biodiversity coalition). The court was another venue used by the anti-bill coalition (a confidential document provided by some respondents is proof of this litigation act). The public is another institutional venue, operationalised by the anti-bill coalition through demonstrations to amass public and political support which was reported extensively by local media. The media therefore was another space used extensively by both groups (cf *Sunday Nation*, 2008; *Daily Nation*, 2008a,b; *Science Africa Magazine on Science*, 2008).

Policy learning and influence

How was policy change achieved in Kenya's regulatory policy subsystem? Based on Sabatier's ACF, three factors can cause learning and belief change: external shock, policy-oriented learning and a hurting stalemate (Sabatier and Weible, 2007), and are explored below in relation to policy change associated with Kenya's regulatory policy subsystem.

An 'external shock' is likely to change components of policy core beliefs. In the Kenyan scenario, the over-emphasised potential of biotechnology applications to address food insecurity impacted actors' reconceptualisation of their stances towards, for instance stringent regulations. This approach to regulation made pro-regulatory policy advocacy coalition to argue for pro-innovation regulatory policy (permissive or facilitative) in order to enhance economic competitiveness, presumably for the benefit of the poor. The initiation of the biotechnology programme in the early 1990s through the sweet potato and rinderpest vaccine projects gave a new thrust to the hyped biotechnology innovation and emerging regulatory policy subsystem that commenced with the drafting of first regulations and guidelines (RoK, 1998).

The general elections towards the end of 2007 may be seen as another external political shock. Many of the actors how were interviewed linked this shock to the premature halt to efforts by the pro-bill coalition group to push for the enactment of the bill just before the parliament was dissolved to pave way for the election campaigns. Similarly, the dissolution of parliament was seen as a 'divine intervention from God' by some members of the anti-bill coalition, which in their view prevented approval of a purportedly flawed bill.

Policy-oriented learning may be analysed relative to the one-and-a-half decades that the subsystem has been co-evolving alongside the biotechnology subsector. During this period, there has been an incremental accumulation of scientific and policy information. Policy learning has presumably been gradual and incremental as the scientific community engaged in biotechnology and biosafety activities and as they dealt with challenges and conflicts during implementation of the 1998 interim regulations. Learning was also enhanced through the heterogeneous knowledge-based nodes like the *ad hoc* KBC network fronted by the scientists and the private sector, and KEGCO and KBioC fronted by the civil society. The influence of policy may be linked to the legalisation of the biotechnology activities and the biosafety regulatory regime through the approval of the biotechnology policy (RoK, 2006) and subsequent enactment of the Biosafety Act. The Act emerged and replaced the previously official 'no commercial GMOs' policy that many interviewees interpreted as ineffective, paving the way for a balanced policy approach to safety and development (RoK, 2009).

The policy learning impacted the shifting perspectives and beliefs of actors over time. However, productive learning could have been constrained by instances where actors may have despised or rejected conflicting or threatening information coming from opposing groups. This would enhance a socially desirable balanced view making it a legitimate process.

Hurting stalemate, as mentioned previously, is a situation in which all parties involved in a dispute view continuation of the status quo as unacceptable and run out of options and venues to achieve their objectives (Sabatier and Weible, 2007). Two interpretations may be drawn from the Kenyan case. First, the

anti-bill coalition may have succeeded in curtailing the efforts of the pro-bill group in pushing for the enactment of the bill but this was only temporary. It may also have weakened the position of the pro-bill coalition and perhaps strengthening opportunities for an 'all-inclusive coalition' that could emerge in the post-Biosafety Act era. When a stalemate was experienced during the third regulatory phase, various attempts to engage the opponents may be construed to be consensus-based efforts towards dealing with the stalemate. The opening remarks by one respondent from a public university who was moderating a stakeholders' workshop between pro-bill and anti-bill groups appealed for both groups to work together towards a common agenda, the deployment of biotechnology for economic usefulness (NCST, 2007). At the same time, the National Biotechnology Awareness Strategy (BioAWARE), a public awareness tool was launched to integrate the voice of the public in the deployment of GMOs (RoK, 2008). Secondly, the bill was eventually promulgated into law in February 2009 (RoK, 2009). This may be construed to be a victory for the pro-bill coalition. The Biosafety Act is a product of a prolonged conflict between the pro-bill process group and the anti-process group.

It is relatively early to be able to tell whether or not the coalitions will experience a hurting stalemate during the implementation of the Act. However, analysis of the policy subsystem makes it possible to offer policy recommendations that may facilitate effective implementation of the Act and related technology transfer.

Conclusion

Using the principles of policy coalitions, this paper has empirically demonstrated dynamism in ACs formed around biosafety regulations implementation**,** and how resources and belief systems interplay to influence policy learning and subsequent policy change. These findings resonate with Weible's (2005, 2007) who demonstrated how policy core beliefs and resources interplay in influencing formulation of a conflict laden subsystem in the USA (in Weible's case, the Marine Life Protection Act).

Members within ACs are able to adapt to challenges and opportunities through learning in order to realise their goals. The intense coordination and relationship building of like-minded players with respect to both coalitions (opponents and proponents) supports the policy core belief concept that drives the sustainability of advocacy coalitions as asserted by Sabatier and Weible. How the game was played out defies the coalition principles related to policy learning, beliefs and consequent policy change. This is because policy scientists behaved more like an interest group by interacting with actors of similar beliefs (with respect to the biosafety bill) rather than practicing a non-partisan role which would represent the interests of all players. Although this behaviour supports AC principles where government agencies can be members of coalitions, shared beliefs fail to explain explicitly the dynamism of the policy learning experienced particularly during the third regulatory phase.

The strategies used in the Kenyan subsystem exposed high-level relationship building and persuasion in an attempt to enlist members who could support their respective coalitions' policy beliefs. This persuasion is tantamount to influence, which is not given adequate space by the AC approach (this paper is not testing this theory). However, this has both positive and negative implications. First, from a positive view, this may have triggered faster approval of the Biosafety Law which was perceived to have taken less time than other agricultural policies like the seed policy referred to by some respondents. Approval of the Act has indeed opened up a new era for technology transfer through deployment of products of new biotechnology, which may be good for the country economically considering that Kenya's agriculture has been negatively impacted by numerous abiotic and biotic production challenges (RoK, 2005). Secondly, from a negative view, the approved regulatory policy may be perceived to be lacking non-scientific or public input. For instance information (or policy-relevant knowledge) within the pro-biosafety bill advocacy coalition was predominantly sought from allies within the same coalition (policy-makers relied upon researchers and the private sector) who were members of the same coalition. This may impact the implementation of the Biosafety Act, as it did not receive wider public scrutiny or input. The dominant coalition made up of the scientific community and their active participation in the regulatory process may have resulted in more technical and scientific knowledge informing the policy deliberations. This may have ignored some other relevant knowledge which may enhance future implementation of regulatory and innovation policies linked to contentious technologies like biotechnologies. On the other hand, the tacit knowledge emanating from both coalitions may confuse knowledge users considering that each coalition may be driven by interests that may not be representative of the public interests (Harsh, 2005).

This paper has empirically re-affirmed that learning and consequent relationships building in politicised policy processes are largely driven by belief systems that may exclude players who hold contradictory beliefs (Sabatier and Weible, 2007). Policy coalitions have exposed the politics inherent in regulatory policy-making as well as the underlying factors that confound learning and relationship building. The context under which learning occurs in a regulatory context may need to be reconsidered when researchers are analysing contentious innovation systems like the new life sciences and environmental sciences. In this context, risk perceptions play a major role in influencing the regulatory

behaviour of actors and consequently the nature of knowledge that is used in policy processes (Levidow, 2007). To address the implications that may result from narrow and socially undesirable usage of knowledge, the government has a major role to play by adopting a governance approach to regulation through weighing and analysing the types of knowledge that inform the process (Lyall and Tait, 2005). Governance 'attempts to set parameters of the system within which people and institutions behave so that self regulation achieves the desired outcomes.' (Lyall and Tait, 2005: 3). The objective would be to ensure a legitimate and democratic process. For instance, inclusion of a wide range of expertise that encompasses non-technical professionals is a positive way to democratise the process (Nowotny, 2003). Despite accommodating more participative decision-making processes (as the governance approach seems to suggest), it is also paramount that all the actors change their attitude as a way of encouraging a reflexive and responsive regulatory policy-making.

Notes

1. Developed through manipulation of living organisms or genetic engineering (GE) to produce goods and services useful to humans, also known as genetically modified organisms (GMOs). GE is distinguished from traditional (or conventional) methods in that it is a modern or transgenic approach that develops products (such as seed varieties) through the insertion of genetic material from different species into a host plant.

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