Science and Public Policy, 34(4), May 2007, pages 251–260
DOI: 10.3152/030234207X214444; http://www.ingentaconnect.com/content/beech/spp

Technology, governance and place: situating biotechnology in Kenya

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Following the pioneering work of several Latin American anthropologists, reconnecting to the idea of place and examining networked strategies of marginalised actors are explored as useful approaches to analyse the governance of biotechnology in an African context. Such place-based approaches provide an opportunity to marry more traditional understandings of macro levels of governance with the politics of how local institutions assign needs, build relationships and manage change. The argument is illustrated via case studies of several tissue culture banana projects in Kenya. The cases show that a place-based approach to governance can be both empirically pragmatic and theoretically useful by providing a way to focus on the location of decision-making, and by putting politics and power differentials between actors more firmly within governance frameworks.

In Africa GM food could almost literally weed out poverty.

F Wambugu

THE CREATION AND ADOPTION of agricultural biotechnologies has become possibly the most publicised and contested rural development issue in the developing world.[1] Even fundamental analyses concerned with exploring the root causes of food security and famine have been subsumed by debates about whether biotechnology can or cannot make developing countries food secure.

The debate about the appropriateness of agricultural biotechnology has become increasingly divisive and divided. International non-governmental organisations (NGOs), national NGOs, research institutions and the media often end up emphasising extreme discourses. At one end of the spectrum, NGOs such as Action Aid argue that there are potentially no material benefits, only risks to be gained from agricultural biotechnologies in their current form (Action Aid, 2003). At the other end of the spectrum, scientists such as Dr Florence Wambugu, formerly of the International Service for the Acquisition of Agri-biotech Applications (ISAAA), make bold claims: "in Africa GM food could almost literally weed out poverty" (Wambugu, 2000).

Recently, these discussions have become as important as life itself. When genetically modified maize as part of World Food Programme food aid packages directed to the southern African famine of 2001/02 was first rejected, then accepted by Zambia, Zimbabwe and Malawi, it caused long delays in providing food aid in the most affected areas. The multiplicity of actors involved in these conflicts transcends sectoral divides. Not least, it is important to flag the role of the international development community in these debates, as European bilateral agencies and the United States Agency for International Development (USAID) provided advice on these issues that is embedded in their own contemporary domestic policies and future international trade regimes (Smith, 2003). Agricultural biotechnology in Africa appears to have taken root in highly contested terrain.

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This work was supported by the UK Economic and Social Research Council via the INNOGEN Centre for Social and Economic Research on Innovation in Genomics. The authors are grateful to colleagues, especially Joseph Murphy, who commented on earlier drafts of this paper when it was presented at two workshops sponsored by the Open University: the first meeting of the Governing Sustainable Technologies Network, 2004, Milton Keynes; and the Governing Technology for Development workshop, London, 2006.

 0302-3427/07/040251-10 US$08.00

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In this paper, we seek to explore some tools for surveying this terrain. In particular, we ask how some recent theoretical insights from anthropology and human geography might be able to help analyse and guide decisions about how biotechnologies get developed. Central to our analyses are ideas around 'place'. We ask how agency might be different for actors in different places, particularly actors occupying excluded or marginalised places. Further, we ask how this affects the way places are connected. We believe the usefulness in these concepts comes in terms of connecting scales or levels of decision-making or governance.

To be explicit, at the beginning of our argument we are purposely adopting this very broad definition of governance, effectively governance as decision-making, or, as Martello (2004) puts it, governance as "rules, institutions, practices and power through which collective life is organized, administered, and regulated". At this point, we only specify this definition further by stating that we are specifically interested in decisions about agricultural biotechnology and how it is produced and used in sub-Saharan Africa.

We acknowledge that governance is a contested term in theory and practice in developed and developing countries. We also acknowledge that debates about the role of the state and about power relationships among governance actors are particularly important to us (Harsh, 2005). A more detailed method to discuss and analyse governance is developed below through our theoretical exploration of place. We argue that one specific contribution of our place-based approach to governance is that it provides a way to put politics and power more firmly within governance frameworks.

Before we discuss place, we begin by introducing agricultural biotechnology in a country that we argue is the heart of donor-led, donor-funded biotechnological developments in sub-Saharan Africa — Kenya. We introduce the current status of agricultural biotechnology in Kenya and discuss the topography of governance of biotechnology there. Theoretical ideas around place are then introduced as tools to understand the topography in a more nuanced way. Finally, we illustrate these conceptual ideas via one of our ongoing case studies in Africa: the politics and dynamics of a series of tissue culture banana projects in Kenya.

A biotechnology hub for sub-Saharan Africa

In the light of the general contested nature of agricultural biotechnology in Africa, Kenya appears to be fertile ground. Agricultural biotechnology is heavily evidenced in the public-research sector, the non-governmental sector, the private sector and the media. The share of total agricultural gross domestic product that Kenya invests in agricultural research (known in the lexicon as the investment intensity ratio) was 2.6% in 2000, as high as some developed countries, and perhaps more illuminatingly, over three times the sub-Saharan African average.

Around 30 development agencies are engaged in agricultural research and development in Kenya. The Kenyan Agricultural Research Institute (KARI), which has been heavily funded by international donors for two decades, is spread over 25 campuses, and employs approximately 500 full-time equivalent researchers. There are two Consultative Group on International Agricultural Research centres based in the country, as well as the International Centre of Insect Physiology and Ecology. In 1999, total spending on agricultural research reached 3.3 billion Kenyan shillings (at current exchange rates around US$45 million) (Beintema *et al*, 2003).

More recently, there has been an increasing shift towards agricultural biotechnologies. Kenya was the first country in sub-Saharan Africa (barring South Africa) to conduct research and development of a genetically modified crop. This flagship project is the heavily publicised genetically modified (GM) sweet potato. Originally sponsored by Monsanto and USAID, the project dates back to 1991. Its goal was to produce sweet potato varieties resistant to certain viruses. In the first field trials, the potatoes failed to be resistant to local strains of viruses. This failure was reported in the national and international media (Gathura, 2004; *New Scientist*, 2004). The project is still ongoing and new varieties are being engineered.

Since the sweet potato project, there has been a flurry of other GM research and development in Kenya. Three other GM crops are now in various stages of development and testing: maize, cassava and cotton. Several GM animal vaccines have also been in development for over a decade. Table 1 lists current agricultural biotechnology projects in Kenya that involve genetic modification, the year research was approved,[2] and the project partners.

Table 1. Current agricultural biotechnology projects in Kenya that involve genetic modification

Product	Year of approval(s)	Main partners
Recombinant livestock vaccines (for diseases such as rinderpest and capripox)	1995 (*ad hoc*)[a]	KARI, Pirbright (UK), University of California, Davis
Virus-resistant sweet potato	1998	KARI, Monsanto, USAID, ISAAA, ARC-VOPI,[b] Danforth Center (USA)
Insect-resistant (Bt) maize	2001 leaves 2003 seeds	KARI, CIMMYT,[c] Syngenta Foundation, Rockefeller Foundation
Insect-resistant (Bt) cotton	2003	KARI, Monsanto
Virus-resistant cassava	2003	KARI, Danforth Center (USA) USAID (ABSP II)[d]

Notes: [a] There have been several recombinant animal vaccines that have been developed by Kenya and international partners. The first of which (a rinderpest vaccine) received ad hoc approval for importation by the Department of Veterinary Services in 1995: this approval came before the formation of the national biosafety guidelines (discussed more below) and the National Biosafety Committee in 1998
[b] Agriculture Research Council of South Africa, Vegetable and Ornamental Plant Institute
[c] International Maize and Wheat Improvement Center
[d] The Agricultural Biotechnology Support Program Part II is a five-year, US$34 million USAID program to "complement regional and country efforts to develop and commercialize genetically modified (GM) crops" (see ABSP II, 2005).

Source: Harsh (2005)

The level of development of GM technology is best seen by comparison. Neighbouring Tanzania, for example, has only recently begun development of GM cotton in February of 2005. In Uganda, the official Government stance has been that no GM development has occurred within Uganda.[3] It is important to clarify that no GM crops have been commercialised, or released to farmers in Kenya, or in any other sub-Saharan country except South Africa.

The preponderance of biotechnological research and development has contributed to Kenya becoming a hub for biotechnology internationally and regionally. This is underscored by several recent initiatives. In November 2004, the centre of Bioscientific Excellence for Eastern and Central Africa was launched by the New Partnership for African Development (NEPAD). This Nairobi-based initiative will focus primarily on biotechnological research and development.

More recently, in September of 2006, the African Agricultural Technology Foundation, an international NGO, launched the Nairobi Open Forum on Agricultural Biotechnology, a monthly gathering of policy-makers and scientists from across Africa to discuss agricultural biotechnology (Odhiambo, 2006). This is in addition to the work of another international NGO, the African Biotechnology Stakeholders Forum (founded in 2002), which has a remit surprisingly similar to that of the new Nairobi Open Forum initiative (ABSF, 2007). Most recently, at the African Union Summit in January of 2007, Kenya started its two-year term as president of the African Ministerial Council of Science and Technology. Commitments to development of biotechnology were a major output of the summit (Abwao, 2007).

This discussion begs the obvious question: Why Kenya? We argue that the answers to this question all involve governance in one form or another. NEPAD, following trends set by the World Bank, sutures development aid and trade with 'good governance', generally referring to transparency, accountability and lack of corruption within the state.

At odds with this strategy of NEPAD, our interviews with donors such as the Rockefeller Foundation and the World Bank suggest that Kenya has become *the* destination for biotechnological research precisely because initially there was weak and limited governance in a legislative sense.[4] While the institutions or apparatuses necessary to govern technological development generally co-evolve alongside the development of technology itself (see, for example, Nelson, 1994; Fagerberg *et al*, 2005), Kenya is interesting in that, as we described above, it boasts a very well developed physical infrastructure and capacity but does not have a concomitant governance and legislative infrastructure.

Despite the enormous amounts of funding being pumped into Kenya, biotechnological development is still largely taking place in a "legislative vacuum" (Wakhungu and Wafula, 2004: 43), which leads to a particular lack of transparency and accountability in decisions about biotechnology — a lack of good governance. Some historical analysis is necessary to contextualise this point.

Perhaps the only positive outcome of the heavily publicised failure of the GM sweet potato project was that the Kenyan Government was forced to begin to think about and adopt a suite of biosafety regulations.[5] These began with the formulation of a

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National Biosafety Committee and Draft Guidelines for Biosafety in 1998.

To date, these regulations have not been sufficiently grounded in legal instruments, as the current proposed Biosafety Bill has not been passed into law (Traynor and Macharia, 2003; Jaffe, 2004). This is in spite of over a decade of development of GM biotechnologies performed under the auspices of these same biosafety guidelines. Again regional comparison is enlightening. Uganda has taken the position that no GM research or trials shall occur until a policy and regulatory legislation are prepared and approved (Wafula and Clark, 2005).

Concurrent technological and regulatory development also raises serious debate about the roles of foreign donors and the influence of foreign capital in the establishment of Kenya's biosafety regulations (Odame *et al*, 2003). Like many African countries, creation of the Kenyan biosafety system has been heavily funded by international initiatives, such as the United Nations Environment Program Global Environmental Facility (UNEP-GEF, 2003). Bilateral aid, too, has played a particularly large role in shaping biosafety in Kenya. Several past and current USAID initiatives, such as the Agricultural Biotechnology Support Program (parts I and II) and the Program for Biosafety Systems (PBS, 2005; ABSP II, 2005), have funded the development of the Kenyan regulatory system.

Good governance enters the picture in another sense here. Critics of good governance initiatives argue that the good governance agenda, while ostensibly about quelling corruption and promoting transparency, also includes encouraging states to adopt neo-liberal economic policies (Lipschutz, 1997). The current high level of biotechnological development, technology transfer and creation of a regulatory system that allows this, fits within a developmentalist perspective advocating the primacy of markets and free flows of capital and technologies within markets.

Overall, although the current biotechnology regulatory system in Kenya, the 'formal governance' of biotechnology in Kenya, has the ability to approve technology transfer and development, it largely does not include mechanisms to enforce regulations or include mechanisms for strategic decision-making to guide technology development (Harsh, 2005). If regulations cannot legally be enforced, accountability for decisions about biotechnology does not exist. The private sector, international donors or international research institutes cannot be held legally accountable to publics and farmers for their actions, should those actions violate biosafety guidelines (Harsh, 2005).

This reactive and supply-side approach to biotechnology means that decision-making about biotechnological projects has been devolved and fragmented down to specific projects and the donor programmes that fund them; governance of biotechnology in Kenya is more "informal" (Harsh, 2005). Governance is stretched across a series of projects, such as the tissue culture banana project discussed below, which may or may not be networked with each other, with other types of institutions such as parastatals, or with the smallholder farmers whose interests they claim to represent. The notions of inclusion, participation and accountability embedded within projects of this type — the politics of governance at a different level — need to be critically examined (compare with Crewe and Harrison, 1998). This practical reality links the fieldwork of this study with the conceptual ideas discussed below.

Governance as place, networks, localisation

In many ways, the notion of a biotechnological revolution taking place in Africa is the epitome of the modernist project of development, welding together science, nature and capital in ever more seamless ways and taking Africa further down the road of "progress" (Jasanoff, 2002). Seen in this light, the appeal of biotechnology in Africa is obvious. It represents a technical quick fix to food insecurity, reducing a difficult multi-dimensional and value-laden problem to a rational and technical linear inevitability — the political subsumed by the biological.

Post- and anti-development theories assert that the decades-old idea of modern solutions to modern problems in the third world have, to coin an appropriately economics-based phrase, lost currency. Environmental degradation and loss of biodiversity are cases in point (Smith, 2005). The roots of this failure are development's fundamentally essentialist impulses for technification of rationality and marketisation of social life (Santos, 2002).

These processes create a conformity of economies, environments and peoples. Regimes of inclusion and exclusion, bedded in controlling access to resources, perpetuate rather than negate what was termed the third world. It is also important to note that the third world is becoming less and less about a strict geographic delineation and more and more about who can gain meaningful access to what. Despite, or in some senses because of, these hegemonic processes the notion of the local, and by extension place, as a counterpoint to the global remains a powerful idea.

The concept of place, then, has been undergoing something of an analytical and empirical renaissance in anthropology and geography (Escobar, 2001). Following Dirlik (2000), we believe this renaissance, at least in part, has been a result of renewed interest in the vagaries of globalisation and how it affects the fate of place. Here we first refer to place as a "category of thought" (Escobar, 2001: 140). The 'global' has become more associated as the category or space of capital and agency. The notion of place has been successively marginalised, as a category associated with local tradition and labour (Dirlik,

2000). In part, the marginalisation of place as an analytical category is a consequence of empirical processes. For example, proliferation of global organisations and treaties like the World Trade Organisation (WTO) and the General Agreement on Tariffs and Trade (GATT), re-scale global space driven by the evolution of capital.

In part, place has also lost theoretical influence because of a concurrent analytical reflection on globalisation phenomena in anthropology and geography. A focus on globalism has produced fruitful theoretical tools used in these disciplines, such as diaspora theories, forming a critique of the local, or of place, albeit a productive critique (Escobar, 2001).

However, particularly for geography, the notion of place is now increasingly resurging as a new way to analyse and understand culture *and* economy together, or place-based agency. This resurgence is not aimed at contradicting globalisation or diaspora theories, rather it is treated as a way of looking at the global from a different, complementary perspective. The geographer Doreen Massey's work on the idea of a "global sense of space" is particularly useful here (Massey, 1997). Massey argues for acknowledging local specificity and global connectedness at the same time.

Similarly, anthropologists use the concept of localisation as a way to achieve symmetry between the forces of the external and of the local (Harcourt, 1999; Ribiero, 1998). This is not a reification of 'the local' but an analytical move that brings out the inherent theoretical converse of globalisation theories, grounded in development contexts.

If the resurgence of place is not aimed at countering mobilisation theories, it is specifically aimed at countering what Escobar refers to as two decades of "European social theory" that has marginalised place (Escobar, 2001: 141). Despite what might seem a quite sweeping critique, there are concrete examples that are useful for defining the types of theory that place-based analysis is trying to refute.

Particularly relevant for our argument about technology is the ascendancy of science as articulated by Castells, whose network society is a future where "places" are replaced by "flows", where the network "subsumes the logic and meaning of place" (Castells, 1996). For Castells, ultimately nature will become culture just as the structural becomes the ether of the network. Place-based analysis does not take Castells' network formation and its destruction of the meaning of place for granted. Instead, it suggests interrogating existing networks from underneath, examining how places and flows conflict and reconfigure each other, and how new local networks might form from this conflict.

Such interrogations connect the use of place as an analytical category with the use of place as empirical experiences and realities. Focusing on this latter empirical sense further contributes to the resurgence of place (Escobar, 2001). For Peet and Watts (1996), the "development experience" marginalises local environments and culture and has thus led to increasing ruptures between local life and place. Yet, place continues to be important in peoples' lives: "to live is to live locally, and to know is first of all to know the places one is in" (Casey, 1996: 18). In Kenya, as in many parts of what is termed the third world, livelihoods, and the interactions those livelihoods generate, clearly depend on a particular set of place-based realities and place-based knowledge.

In many ways, the development of agricultural biotechnology, of technology-led agricultural development more generally, can be conceptualised as a process of the global subsuming the local, of culture consuming nature. A narrative of a 'one-size-fits-all GM seed package replacing the place-based crop biodiversity developed over many generations' that is often presented by activists and NGOs is far too simplistic. It is illustrative, though, of the perception of the processes of globalisation, centralisation and homogenisation that follow technologically-led development in agriculture, and indeed in other sectors.

Indeed, further centralisation of proprietary rights to GM planting material *will* generate networks that will subsume some aspects of place. This is not to blindly assume that local micro-economies and cultures in Africa exist outside, and apart from, the scope of capital and modernity, but rather that agricultural biotechnology will create new forms of network, new knowledge and associational formations between the global and the local. In this context, governance moves beyond the state formation of policies that Kenya grappled with in the face of the prospect of GM sweet potatoes. Governance also telescopes down to the local level via the strategies that farmer groups use to negotiate the portfolio of networks within which they are embedded.

Theoretically, this is quite a different perspective from the more macro-level theories of governance emerging from political science (Jessop, 1998; Hajer and Wagenaar, 2003; Rhodes, 1997; Pierre and Peters, 2000). In some ways, the political science literature on governance can be seen as emerging from a similar theoretical 'up-scaling', and as originating from a similar European tradition as Castells' work or as other theories of globalism, against which theories of place are resurging.

For instance, one root of governance sprang literally out of Europeanisation. In the European Union (EU), governance is a term used for 'hollowing out' of state power as it is devolved up to the supranational EU and down to regional authorities (Jessop, 1998; Hajer and Wagenaar, 2003; Rhodes, 1997). Gone are states operating under a command and control style of decision-making; enter collectivity and negotiation between broad coalitions of actors (Pierre and Peters, 2000). Of course, these theories have been critiqued. Mainly this has been from a perspective of power relationships among actors in the process of collective problem-framing (Pestre, forthcoming). We argue that these critiques

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are especially valid when applied in non-European contexts.

A place-based analysis of technologies thus not only more closely fits empirical interactions between communities and development networks, but also produces a framing for power and politics-based critiques of governance. Critiques about collectivity and power relationships are perhaps better phrased with place-based (and in our case also technological) vocabulary: how does collective problem-framing, through development of particular technologies, mask specific place-based problems? What local struggles occur when national or international governance and technology networks interact with specific local communities or specific places? How do collisions between technical and local knowledge influence power relationships between farmers and extension workers?

Understanding processes of localisation, of holding on to culturally embedded notions of place and nature, are important in any systematic study of biotechnology and governance in Africa. Arturo Escobar ambitiously calls for an analysis of place-based struggles as multi-scale, networked strategies of localisation as a first stage in moving beyond notions of the third world and beyond homogenised ideas of modernity to something more localised, contextualised and nuanced (Escobar, 2004).

How we arrive at these multiple constructions of modernity remains unclear unfortunately. We rather less ambitiously recognise that an approach of this sort can provide useful insights into the local struggles regarding biotechnology that take place when agricultural extension workers visit farmers and community *indabas*.[6] Governance is about situating these technologies within these processes of struggle, resistance and re-appropriation. Governance is embedded in the day-to-day grapple for resources, local decision-making and livelihood activities that smallholder farmers — the type for whom aid agencies promote biotechnology as important — employ to negotiate their own understandings of consumption, culture and nature, and create their own strategies for entry into networks.

In summary, there are two key elements to be drawn from our argument to this point: first, governance, in whatever form it may occur, is manifested at a range of scales, and is networked, whether explicitly or tacitly. Therefore, it is important to understand how networks are formed that connect the global and the local, how knowledge is generated and valued in those networks, and how that knowledge is articulated and shared.[7] Secondly, an analysis of the governance of biotechnology should be connected to the local; governance networks must be interrogated from the perspective of the local. The politics of place is an important ingredient in understanding the relationships between nature and culture, and framing local strategies of governance, defiance and survival.

We now turn our attention to illustrating some of these conceptual insights by narrating one of our ongoing case studies in Africa: the politics and dynamics of a series of tissue culture banana projects in Kenya.

Tissue culture bananas in Kenya

We have spent some time studying one particular biotechnological commodity, tissue culture (TC) bananas (*Musa spp.*), and a particular system of innovation that produces knowledge of the commodity, a project entitled The Benefits of Biotechnology for Small-Scale Banana Producers in Kenya, initiated by KARI and ISAAA and funded by the Rockefeller Foundation and the International Development Research Centre of the Canadian Government (Wambugu and Kiome, 2001).

Tissue culture propagation is not a GM technique since no modification of any genome is taking place. It is however, important in the broader context of biotechnology in Africa, as it is a biotechnological technique that has been developed in Africa and tissue culture banana plantlets are in production in several areas of east Africa and in South Africa. Further, it is the most widely dispersed such commodity amongst smallholder farmers and considerable resources and effort have been diverted to developing and disseminating the technology.

The use of tissue culture techniques to produce banana plantlets operates on the premise that Kenyan farmers' practice of using disease-infected sucker material for propagation is the main constraint for improving crop yield performance. Tipping a hat to James Ferguson, we have been critical of the set of narratives generated by scientists and donors to justify this particular technology as a cure-all of sorts for stagnant rural livelihoods, food insecurity and rural poverty (Smith, 2004). The project is, in many ways, a classic example of framing a political, historical problem as a modern problem with a modern solution. Rural people are reliant wholly on agriculture, yields are dropping purely because of an environmental problem, a technical solution is sought, and development will inevitably follow.

Back to bananas, tissue culture is performed via laboratory-based micropropagation techniques that provide disease-free planting material. This results

in increased banana productivity. One of the advantages of tissue culture is that it is a relatively simple biotechnological technique. Table 2 highlights some of the advantages and disadvantages of tissue culture technologies and their application to bananas.

The tissue culture technique has been used since the 1980s in South Africa, for example. Jomo Kenyatta University of Agriculture and Technology in Kenya began the micropropagation of banana in Kenya in 1995, with the help of World Bank funding. The objective of the project is to scale up this production to provide large amounts of tissue culture plantlets to smallholder farmers. It aims to do this by building and upgrading national banana tissue culture capacity and establishing viable biotechnology distribution channels.

Several international donors, development agencies, Kenyan universities, NGOs and parastatals are involved in projects of this type in Kenya. For widespread technology adoption to occur, especially amongst smallholder producers, the project envisaged the creation of institutions and capacity building for technology dissemination. There are further plans to extend the technology to Uganda and Tanzania, where it is claimed similar problems with the banana sector exist.

Our fieldwork in Kenya has shown the critical roles that local networks, cultures and environments play out in the governance of TC banana projects. We find it useful to compare two case studies. In the first case, we examine two communities of farmers: one in the Murang'a district of the Central Province and the other in the Embu District of the Eastern Province. Both communities work directly with ISAAA to obtain TC plantlets. In the second case, the community, located in the Nakuru district of the Rift Valley Province, does not work directly with ISAAA to obtain the TC technology.

Table 2. Advantages and disadvantages of tissue culture bananas

Advantages	Disadvantages
TC plantlets are free of most of the pests and diseases that exist in Kenya, notably weevils, nematodes and fungi.	Tissue culture procedures remove most pathogens, but not viruses.
Yield performance of TC plantlets is superior to clean conventional sucker material. According to a South African study, yields are 20% higher in the first year, then slightly decreasing, but still measurable after the third year.	TC plants require more care and improved management. TC plants have no nutrient reserves when planted and external stress is particularly harmful. Fertilisation, weeding and sufficient water supply are crucial to TC plants.
In vitro plantlets are uniform and this may simplify orchard management compared to conventional material. However, uniformity decreases over time, meaning this is not a long-term advantage.	TC planting material has a higher price than conventional suckers. This implies a high cash outlay for the adoption of the technology.
Experience with TC techniques and the establishment of efficient germplasm distribution channels are also preconditions for progression to more advanced biotechnologies. For example, transgenic banana varieties.	There is an increased risk of mutant with TC bananas. Mutations such as dwarfing or other undesired morphological features decrease yields. Mutation rates can reach 50%.

Source: Adapted from Wambugu and Kiome (2001)

For the communities where ISAAA is the main project designer, ISAAA envisioned networks of smallholder farmers as the essential mechanism for technology distribution — disseminating banana plantlets. Community-based organisations, generally formed around local social networks like churches and farmers groups, were enlisted as distribution centres for plantlets. For example, in Embu (300 km north of Nairobi) the Catholic diocese regularly transports plantlets from Nairobi to Embu.

The power differential between farmers and ISAAA staff or extension workers, and the politics of this enlistment process needs to be explicitly examined. Our research shows that KARI and ISAAA generally approach farmers and suggest growing TC bananas as a commercial or cash crop. In Murang'a, the head of the group of farmers published an article in a local paper asking for help in choosing a crop to replace coffee crops, which he could no longer sell. ISAAA and KARI then approached him and suggested that he grow TC bananas as a cash crop and encourage others to do so as well.

We argue that, starting with this enlistment process, right through to the end of projects, collectivity of problem-framing is at best contested in interactions between farmers and NGO or extension workers. The enlistment process is technology-driven as opposed to livelihood-driven.

Despite the focus on local networks for technology distribution, the projects led by ISAAA failed to conceptualise how local networks might also play a role in marketing bananas. Reflecting the overall technological deterministic attitude of the project, marketing and selling bananas — an obvious step for better livelihoods — was not problematised or strategised at the outset of the project: "No one thought ahead about surplus bananas".[8]

Forming the network, connecting research scientists and community groups to deliver clean planting materials was seen as the problem and the accomplishment. Whether clean planting material was a priority or a need for the farmers appears not to have been a primary consideration. Linking was prioritised over livelihoods, network subsuming place, with no apparent mechanism present for feedback or accountability.

Local environments and culture were marginalised in other ways in these TC banana projects. Directly linking nature with culture, the Kamau Growers Association in Murang'a expressed concerns about biodiversity. As native bananas are part of betrothal ceremonies, there is a fear that the spread of TC bananas directly threatens local

culture.[9] Global discourses such as the need for increased food security were mobilised here over cultural or environmental concerns.

Farmers in Murang'a assert that bananas are not even a subsistence crop in the local environment: "Basically we eat maize and beans".[10] Thus, TC bananas in this case closely match the argument of Peet and Watts (1996) about the importance of particular local constructs of nature and the environment. The constructs of local environments and livelihoods wielded when scientists and development workers frame problems are often quite different (compare with Smith, 2004).

Our research in the Murang'a and Embu has shown that farmers themselves see establishing strong local networks as a priority for their own development. They want the ability to make decisions collectively about what to grow and the power to market their crops collectively .[11] There is little sign in Kenya of the kind of localisation of networks that scholars have identified in Latin America (compare with Radcliffe, 1999).

Formalised networks supporting the dissemination of biotechnological products are beginning to proliferate — organisations like ISAAA, Africa Harvest Biotech International (headed by Florence Wambugu), and the African Agricultural Technology Foundation. These organisations operate locally, but are funded internationally through bilateral donors and foundations. They are perhaps not quite the kind of multi-scale, networked strategies that Escobar imagined.

A counterpoint to this is another multi-scale network; the solidly anti-biotechnology NGO Action Aid have recently moved their African office from Johannesburg to Nairobi, partly to counter the growing number of pro-biotechnology NGOs that are being established. Wholly local networks are beginning to emerge; the Catholic Diocese of Embu is currently employing experts to generate a pro-poor biotechnology policy. As yet, outside of the churches, other elements of localised civil society have not engaged with the role biotechnology may play in Kenya's future.

One exception to this might be our second case study from the Nakuru district. Our work here is a further illustration of the importance of place and local networks, yet testifies to the multiplicity of different strategies of localisation, even of the same tissue culture technology. In the Nakuru district, a local NGO called Farming Systems Kenya (FSK) has been working with local farmers in the Nakuru district for over 25 years.[12] FSK helped farmers build a scaled network explicitly for the purpose of taking advantage of economies of scale and collective marketing.

Farmers organise themselves in a federation or pyramid system, where small groups of farmers join into larger groups, and these groupings are then joined further and so on. FSK has 'federated' over 7000 farmers and enabled them to hire their own marketing consultant and eliminate the 'middle man' in distribution. The work of FSK has never been explicitly focused on biotechnology. However, as a result of the amount of recent attention and investment in tissue culture bananas, FSK considered the technology for their farmers.

Unlike the Central Province, Nakuru is not a traditional banana growing area in Kenya. Therefore FSK took several farmers to another province where they explored the TC technology at a KARI facility.[13] Like farmers in Embu and Murang'a, the Nakuru farmers were impressed by demonstrations by agricultural workers, showing large and numerous fruits. Several farmers returned to Nakuru and, with the help of FSK, were able to purchase TC plantlets via a local KARI office.

The power differentials between the NGO workers and the farmers deciding to join the TC network in this instance are perhaps less than in the case above. However, there was no 'magic bullet' or master blueprint of a participatory form that enabled this. Representation of farmers' needs, if greater, was so because of the long commitment of one NGO working within one community. Compare FSK's 25 years of working with just one district and ISAAA's approximately five years of experience working with farmers across many districts in Kenya.

Still, our research shows that, when these farmers began using the technology, they had mixed experiences. While noting some increased yields, many farmers commented on the higher degree of labour, fertiliser inputs and larger need for water of the TC technologies as significant constraints. As a result of these constraints, some plantlets died immediately.[14]

However, farmers in Nakuru generally planted far fewer trees than those in the banana growing areas of the central district. Nakuru farmers were not looking for a cash crop; they were not encouraged and did not want to grow and sell their bananas on a large scale. The farmers we spoke with had at most ten banana trees. At this smaller scale, ISAAA's focus on local network for distribution, on building a system of innovation, becomes a moot point.

Farmers can acquire small qualities of plantlets directly from KARI's Njoro office. This took ideas about the importance of local networks for production and distribution of plantlets out of the equation.

Formalised networks supporting the dissemination of biotechnological products are beginning to proliferate: these organisations operate locally, but are funded internationally through bilateral donors and foundations

More importantly still, there was no need to establish networks to market and sell bananas. The bananas were generally eaten or used as fodder within households, or traded between households.

Nakuru farmers re-appropriated the tissue culture technology, through situating it within their own local sense of place and needs, via their own local strategy. Although negotiations with the technology in this context still produced and re-produced power struggles and struggles for resources (such as for water and fertiliser), the technology yielded more satisfaction compared to Embu and Murang'a. However, the strategy and struggles of localising and situating the technology were quite different from those originally envisioned by international, global networks, such as those headed by ISAAA.

Farming Systems Kenya might be unique in Kenya, as many civil society organisations were not able to have a history under the previous regime; Kenya's civil society is only beginning to recover from the repression of Daniel Arap Moi's presidency. Experience elsewhere in Africa, particularly in countries such as Botswana, Moçambique and South Africa, suggests that more local networks will follow (Habib, 2005; Maundeni, 2004; Bellucci, 2002; Pfeiffer, 2004) . In doing so, it is hoped they might create networks of meaning of their own, which correlate to their imaginings of nature and culture. In this emergent time, place-based analysis will be a key tool to understand these phenomena.

Conclusion

Ideas about place drawn from the work of a number of Latin American development anthropologists perhaps allow an examination of the governance of biotechnology in Kenya through a new set of lenses. Particularly in the case of tissue culture bananas in Kenya, interrogating networks of decision-making through a place-based perspective reveals the variety of struggles and compromises between conceptions of nature and culture, and the divergent strategies local actors use in entering multi-scaled networks. The argument in the paper is thus effectively a pragmatic approach to analysing governance of biotechnologies because it is one that focuses on the location of decision-making.

The argument is also made as a call for a new research agenda to develop these tools further. To advance this, we need to further unstitch the dynamics of place, power and networks that frame the biotechnology debate, not just in Kenya, but also in Africa as a whole. Place is central to this analysis (Escobar, 2001:169):

> [P]laces are surely connected and constructed yet those constructions entail boundaries, grounds, selective connection, interaction and positioning, and in some cases a renewal of history-making skills. Connectivity, interactivity and positionality are the correlative characteristics of the attachment to place, and they derive greatly from the modes of operation of the networks that are becoming central to the strategies of localization advanced by social movements (and of course by capital in different ways).

Place-based analysis will hopefully go some way towards understanding these networks and how they shape our perception of nature/culture relationships. By extension, it could help us to discern how and why particular forms of governance dominate, shape and situate African environments and futures, and the role biotechnology may or may not play in these futures.

Notes

1. There is much confusion about the definition of agricultural biotechnology. Frequently the term is used to refer to technologies that involve modifying the genomes of plant species. However, it is also often used for technologies that do not involve genetic modification (GM). Some of these non-GM technologies include old technologies, like traditional plant breeding and fermentation. Technologies such as bio-pesticides and tissue culture (see below) are newer biotechnologies that still do not involve GM. We use the term agricultural biotechnology inclusively to cover both GM technologies and technological precursors to GM such as tissue culture.
2. Approval here refers to the year that the products were approved for importation by the Kenyan regulatory system discussed below.
3. Uganda has been partnering research centres in other countries for development of GM banana since 2002 (Wafula and Clark, 2005). An application was recently made to import a genetically modified banana into Uganda for confined trials (Nakkazi, 2007).
4. Interviews conducted with Africa programme managers, New York, December 2003.
5. Interview with Margaret Karembu, Nairobi, April 2004.
6. *Indaba* is Swahili for local-level meetings.
7. Especially when discussing knowledge, we acknowledge the influential role that the field of science and technology studies can play in contributing to place-based analysis of technologies. Some of these connections are explored in other contributions in this special issue.
8. Interview with Embu farmers, conducted April 2004.
9. Interview at Kamau Growers Association Meeting, conducted April 2004.
10. Interview at Kamau Growers Association Meeting, conducted April 2004.
11. Interview with Embu farmers, conducted April 2004.
12. Interview with Farmers Systems Kenya, Nakuru, conducted April 2004.
13. Interview with Farmers Systems Kenya, Nakuru, conducted February 2005.
14. Interviews with farmers in Naishi area between Njoro and Nakuru, conducted February 2005.

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