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Working Paper No. 547

**Biotechnology Innovation in Kenya
Where are the Smallholder Farmers?**

By

Kennedy O. Ogoro

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Abstract

This study sets out to investigate the role of small holder farmers amidst the intervention of other actors in biotechnology innovation in the maize sub-sector, in Kenya. This exploratory research is a result of the challenges in understanding participation and the concept of public-private partnership in biotechnology innovation and its social construction. These challenges emerge as a result of a myriad of actors involved in biotechnology innovation. The study goes a step further to investigate the role of both human (social) and non-human (material) actors in the construction of biotechnology innovation in the maize sub-sector in Kenya. Here, focus is on the manoeuvres- negotiations and distantiations as played out by various actors in the creation of partnerships and the shaping of social interaction and participation for the Gene Revolution in Kenya. This way the study dissects the understanding that biotechnology innovation is about more than just development and use of agricultural technology.

The study will focus on two different programmes in Kenya. Not for comparison purposes but is intended to use biotechnology innovation combined with applying notions of actor participation on public-private partnership infrastructure to address the food needs of Kenyans. These programmes are; the Special Biotechnology Programme (1993) and the Insect Resistant Maize for Africa Project (1999). In view of this, the main objective is to contribute to understanding how actors conceptualize and actualize their roles, those of others, and the partnerships and interactions in biotechnology innovation programmes in Kenya that focus on small holder farmers. In so doing, the question of how socio-technical interactions between small holder farmers and other actors are constructed in biotechnology innovation process in Kenya would have been addressed.

In understanding the theoretical framework under which interactions take place, focus is on actor-oriented approach which will expand on contemporary social science debate which intends to rescue actors, heterogeneity, and social change (dynamics from a simplified structuralist analysis). Actor-network theory, issues of power and control, aims (public relations (PR), profits, or public interest), and the debate on participation shall be used.

This study will be to a large extent an exploratory study. Fieldwork will proceed by utilizing qualitative research methods of data collection for over a period of 21 months. The methods will generate data that clearly position small holder farmers in their rightful place in biotechnology innovation in Kenya amidst other actors involved in the construction of biotechnology.

Section 1

Background

Creation of Partnerships and Shaping of Social Interaction and Participation for the Gene Revolution in Kenya

Kenya has become a main playing field for socio-technical experiments on the introduction of agricultural biotechnologies. Several model programmes combine a triad of distinctive development narratives of the 1990s and 2000s: the potential of biotechnology, participation, and public-private partnerships.

Many observers, policy makers, and their development partners indicate that the 'Green Revolution' largely bypassed Africa and that this should not happen again with the Gene Revolution, since biotechnology has the potential to offer solutions to shortage of food, malnutrition, and fragile production systems in marginal areas (Conway & Toenissen; 2003, FAO, 2004; Pingali & Traxler, 2002). This view does not go uncontested. Golden Rice, a bio-engineered rice that should make up vitamin A deficiency, is an exemplary case. Critics argue that there are a series of reasons why the aim of solving 'hidden hunger' among the poor will never be realized through Golden Rice (Jasanoff, 2004; Sharma, 2003; Shiva, 2000). This is because the problem at hand is how the available food can reach the poor. Sharma (2003) argues that what is being realized by the global scientific and development community is that if they had aimed at eradicating hunger in the first place, there would be no "hidden hunger".

In order that the Gene Revolution takes place, biotechnology innovation should be strongly embedded in domestic

agricultural research, extension infrastructure and addressing local problems in farming. This idea has led to the consideration of tailor-made biotechnologies and calls for more participation in technology development than it was during the time of the Green Revolution. Such a more inclusive process would involve all actors and beneficiaries in the development, dissemination, and application in the networks at international, national and local levels. This will comply with the pace at which globalisation is claiming space in all fields of development. A participatory approach may also strengthen the position of pro-biotechnology voices in the wider public debate on biotechnology, in which one of the arguments against transgenic crops is that these are controlled by, and will further increase the possibilities of control by trans-national seed companies.

To make the Gene Revolution successful in Africa, it is furthermore argued (FAO, 2004) that the public sector should play a key role in technology development in coming up with technology packages for smallholder farmers. The goal of the private sector is that they will not invest in biotechnology use for technology innovation that addresses the needs of poor farmers and the public interest in general. It has therefore been argued that since biotechnology is almost entirely in the hands of private companies in the Developed countries (North), the only way to get this technology to the Developing countries (South) is to build "global partnerships" between the private sector of the North and the public sector of the South (Fresco, 2001; Pingali & Traxler, 2002; Rausser, Simon & Ameden, 2000; Wafula, 2001). This view inspired several efforts to initiate, and test the possibilities of public-private partnerships to get access to enabling technologies or transferring technologies developed by private actors for addressing poor farmers' needs (Kelemu et al, 2001; Pingali and Traxler, 2002).

This research project will look at *two* different programmes in Kenya that are intended to use biotechnology combined with applying notions of participation on public-private partnerships infrastructure to address the food needs of Kenyans. The Government of Kenya signed a bi-lateral agreement with DGIS (Directorate General for International Co-operation of the Government of Netherlands) for a Special Biotechnology Program in Kenya.¹ Kenya Agricultural Research Institute (KARI) in partnership with farmers and Kenya Agricultural Biotechnology Platform, a non-governmental organization now known as Biotechnology Trust Africa (BTA), started the implementation of this program in the districts of Machakos and Kakamega in 1993. The program focuses on participation of rural farmers in their agricultural projects (BTA, 2001) and can be seen as a response to food shortages experienced in Kenya in the 1980s. It emphasizes 'Interactive Bottom-Up (IBU) approach' and has focused on drought resistant maize among other areas². In this approach, priorities for research and development (R&D) activities are formulated with and for the benefit of smallholder farmers. Other actors in the project include public sector, private sector and civil society organizations. Apart from applying tissue culture to several crops, BTA also employs molecular marker technology for selection and maize breeding at the KARI's Regional Research Centre at Katumani, Machakos district, Kenya. This program was among others aimed at developing cultivars resistant to insect pests, maize streak virus and drought. The Interactive Bottom-Up approach not only entails technology development; its field of activity is broader and includes

¹ Other countries involved in similar venture with Dutch government in their respective countries are India, Colombia and Zimbabwe.

² The other areas include potato, cassava, citrus, macadamia, banana, bio-pesticides, animal health, and institutional support.

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information, public debate and institutionalization. The Special Biotechnology Program was intended to provide an opportunity for building the capacity of developing countries' to shape technology towards their unique circumstances.

A second programme has been founded on the infrastructure build in the Special Biotechnology Programme, but was more active in establishing a working relationship between a life science company, Novartis (now Syngenta), through the Syngenta Foundation for Sustainable Agriculture, KARI and an international agricultural research institute, International Maize and Wheat Improvement Centre (CIMMYT) as the core partners. This programme, called the Insect Resistant Maize for Africa project (IRMA), was launched in 1999 to advance biotechnology, is currently implementing three major activities: development of insect resistant maize germ-plasm using genetic engineering, development of effective dissemination strategies, and assessing the potential and actual impact of insect resistant germ-plasm in Kenya (CIMMYT, 2002). In Kenya's major mid- and high altitude maize growing areas, stem borers are farmers' primary concern outside of drought (Mugo, 2000, cited in Paalberg, 2001). The overall goal of this project is to increase maize production and food security through the development and deployment of insect resistant maize to reduce losses due to the stem borers.¹ The underlying concept of IRMA is however much broader than *developing science-user interactions* to successfully introduce a new technology. Rather, it aims to create an entirely new institutional framework in which technology innovation interacts with social and political objectives, which serves as 'a blueprint for successful partnerships in other developing countries'. IRMA seeks to encourage more open and balanced public policy debate about the role of

³The main strategy is insertion of genes from the bacterium *Bacillus thuringiensis* to produce a toxin against lepidopterous insects (caterpillars).

biotechnology in improving food production, to apply biosafety and bioethical standards and protocols, and to ensure that the technology fits within the country's institutional framework. It therefore collaborates with a broad coalition of partners, including NGOs, a series of state agencies, and processing industries (CIMMYT, 2000).

Section 2

Statement of the problem

Biotechnology does not only rely on science to give answers. It is a social construct as much whose development, dissemination and application relies on a diversity of actors. Up to now the academic reflection on these socio-technical experiments is quite limited, even though they intend to shape totally new forms of agricultural modernization. The programmes are also more or less explicitly considered as models for working on biotechnology innovation for the poor in the whole of Africa. A number of authors have written about food security and biotechnology from diverse perspectives. For instance, transformation of national agricultural research institutes by Odame (2003). Wafula (2001) has written on public-private partnerships while Kelemu et al. (2001) on harmonizing biotechnology debate for the benefit of African farmers. Other authors have written on bio-safety system for biotechnology in Kenya. For instance, Quemada et al. (2002) on assessment of biotechnology in Kenya, Thitai et al. (1999) on Kenya bio-safety framework, Wekunda and Kimoro (eds) (2001) on needs assessment for the Kenya biotechnology and bio-safety system, and Trayner and Macharia (2003) on bio-safety system for biotechnology framework in Kenya: Application of a conceptual framework.

This literature has increased our understanding of the official narratives on biotechnology. However, it is remarkable how little attention has been paid to farmers' interactions with other actors, e.g. with regard to farmers' influence on biotechnology innovations. The studies done so far appear not to address interactions between farmers and other actors, the different representation, how actors create room for manoeuvre, how they recreate relationships and how these

social processes influence biotechnology innovation. More knowledge on these issues is required, precisely because partnerships, participation, and institutionalization are presented as key features of these new modes of technology innovation. Only after developing this knowledge can we make a judgement about the value of these socio-technical experiments and the extent to which they can be used as models for future interventions in this field.

Therefore, the focus of this study is to make an analysis of what kinds of interactions exist between farmers and other actors in this socio-technical field and what kind of representations emerge. The study will specifically focus on actors' interaction processes, production, reproduction, and transformation of relationships, and their influence on biotechnology innovation and up scaling in Kenya. Note, where possible the history of the two cases above with a third case which is characterised by a high presence of a private actor in a public-private partnership on biotechnology innovation to address issues of poverty has even been greater-the transgenic sweet potato programme. This case is already examined (Odame et al, 2002). Critics have pointed out that viral infections on sweet potatoes is complex, thus the major challenge of the technology and biophysical conditions of farmers' fields remain the major constrain of generating and retaining satisfactory innovation for farmers (FAO, 2000, Gatonye, D/N Horizon, 2004). Some researchers in Kenya have argued that genetically modified (GM) technology imported from USA has failed to withstand virus challenge in the field (feathery mottle virus).

Therefore, the researcher will conduct interviews with key decision makers in the public, private and civil society sectors to study the interactions from a network perspective. The interactions take place amongst smallholder farmers,

smallholder farmers and other human actors, smallholder farmers and institutions and smallholder farmers and technologies.

Main objective

The main objective is to contribute to the understanding of the process on how actors conceptualize and actualize their roles, those of others, and the partnerships & interactions in biotechnology innovation programmes in Kenya that focus on smallholder farmers.

In scientific terms, this will increase our understanding of participatory approaches and the processes of modelling and implementing new technologies and related institutional context.

In societal terms, this project will provide reflexive contributions to the debate on biotechnology innovation and the possibilities for up scaling or up streaming participation.

Specific objectives

- (i) To analyze the participatory approaches in biotechnology innovation in Kenya.
- (ii) To analyze the role of smallholder farmers and their interaction with other actors in biotechnology innovation in Kenya.
- (iii) To explore partnership formation and mechanisms in place in biotechnology innovation between actors, and
- (iv) To explore consideration for up-scaling biotechnology packages already in use in Kenya.

Main research question

How are socio-technical interactions between smallholder farmers and other actors constructed in biotechnology innovation process in Kenya?

Sub-research questions

(a) What composes the actor-network around biotechnology innovation in Kenya?

- What types of biotechnologies are used in Kenya?
- Who is involved and who is not? Why? (i.e. who are the actors and what are their objectives, goals and strategies?)
- At what level/s of the innovation process are they involved and how are farmers engaged in the process?
- What are the controversies regarding biotechnology and how have actors in Kenya responded?

(b) How have different working models for biotechnology innovation for smallholder agriculture been constructed?

- Which participatory strategies are used in biotechnology innovation in Kenya?
- How have these methodologies been conceptualized, defined and actualized
- How have smallholder farmers responded to these approaches and the technologies?
- Why do farmers interact with other actors in the biotechnology innovation process the way they do?

(c) What partnerships exist and how do they operate?

- What partnerships have been formed at the international, national and local levels to advance the innovations and how are smallholder farmers positioned?
- How are these partnerships formed?
- How has the formation of partnership changed the roles of actors?

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- What are the negotiations, compromises and contradictions involved? How and why?
 - What is the impact of partnership formation on smallholder farmers?
 - What factors enhance the benefits of partnerships to smallholder farmers?
- (d) What are the considerations for up scaling models and up streaming participation?
- Who makes the choices on agricultural biotechnology innovation in Kenya and on whose behalf?
 - What different scripts and categories on participatory biotechnology innovation do exist in Kenya and how and why have these been constructed?
 - How are the farmers' views being understood and represented?

Section 3

Theoretical Framework

In the context of the methodology, the process is evaluated from sociology of science where actor oriented approach, actor network theory; public-private partnership and the debate on participation are used for understanding the roles of actors in biotechnology innovation. Innovation is a new pattern of coordination between people (human actors), technical devices and natural phenomena (non-human actors).

Studying actors and agency for understanding interactions: making use of the actor oriented approach

For the study of the interaction between the different actors involved in this process of biotechnology innovation, participation, and building of partnerships, expansion on contemporary social science debates which intend to rescue actors, heterogeneity, and social change/dynamics from a simplified structuralist analysis will be used. Basically, this means that we cannot assume from the start what roles or positions different actors will take in the processes under study.

This study deals with individual farmers, researchers, and policy makers, farmers in farmer organizations or women groups and their interaction with other actors, research organizations, development organizations, state agencies, and the connection between these different actors in public-private partnership. In our actor-oriented approach, social reality is not given but is seen as a process in which an ever-changing social world is continuously being recreated and transformed through the interaction of many different kinds of actors and actor groups (Long 1992b). Actor-oriented approaches emphasize the analysis of actors' everyday living experiences as well as exchanges between actors and social groups. The

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essence of an actor-oriented approach is that its concepts are grounded in the everyday life experiences and understandings of men and women, be they poor peasants, entrepreneurs, government bureaucrats or researchers" (Long 1992a; Long and Van der Ploeg 1994; Long and Villarreal 1994; Omosa, 1998).

The study of actors and agency is not necessarily contradictory to structural analysis since it is important to consider the structural conditions that constrain (or enable) actor's choice and strategies. In fact, structures can only be understood by looking at how they are produced, reproduced, and transformed by actor practices (Jansen, 1998; Long 1992b). Crucial is the recognition of multiple realities and the diverse social practices, interpretations and strategies of various actors and actor groups (Espling, 1999; Long, 1997a; Villarreal 1992). Biotechnology innovation should be viewed as a 'multiple reality' made up of differing cultural perceptions and social interests, and constituted by the ongoing social and political struggles that take place between the various social actors involved (cf. Long, 2001). To this end, there will be need to find out how the actors involved compromise and distance themselves from the process of biotechnology innovation and from one another, how they organize their resources to influence the innovation, and how they strategize in their dealings with other actors.

At the interface is where actors meet and negotiate and renegotiate the process of biotechnology innovation. An important element of this approach, which is helpful for the research, is the potential to account for the contradictions that characterize the practices of diverse actors in biotechnology innovation and partnerships. It will lead to a better understanding of how actors process information, how they strategize, order and pattern their involvement. This will

include the possibility to say something meaningful about actor consciousness, everyday contests and compromises, commonplace power relations, where, as is most often the case, neither complete collective disobedience or rebellion against innovation is likely or possible (Scott, 1985). The research scientists have their own way in scientific innovation whereas farmers have their own way of crafting. Those with power and knowledge in innovation are not however in total control of the process. Other actors may find sufficient room for manoeuvre to suggest subtly their disdain for the process. Farmers continue with their innovation and in a way it is only here that the terrain is relatively favourable to the meagre arsenal of the disadvantaged (Scott, 1985). It is the conviction of this study to attempt to elucidate how farmers play it out and how they in the process create space for manoeuvre as they interact with other actors in biotechnology innovation.

The notions of scripts, inscription, and extended networks: making use of actor-network theory

Sociological approaches on actors for quite some time did not conceptualize technology, since technology was located outside the realm of human relationships. This shortcoming can be overcome by making use of other bodies of thought, for example actor-network theory (Bruun and Hukkinen, 2003; Callon and Latour, 1981; Latour, 1994; Law and Hassard, 1999; Rip and Kemp, 1998; Ylikoski, 2000). The theory posits that some events cannot be predicted or explained with reference to a particular pattern of social relationship and rejects *a priori* distinctions, such as nature-society, micro-macro, global-local, nature-culture. It argues that such distinctions are not pre-given, but can only be the outcome of interactions between actors involved in the construction of technology and knowledge. It recognizes the roles played both by humans and non-humans who operate on

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given 'scripts'. This means that a non-human setting can send a signal, which has the same meaning as that of human.

Biotechnology innovation in Kenya, in the two programmes (special biotechnology and insect resistant for maize) that will be studied, is shaped through 'extending actor-networks'. The programmes depart, although each in a different degree, from earlier schemes of technology innovation. The latter more clearly separates a development stage in the lab from the insertion of a technology in a social system. The current programmes, on the contrary, include from the start a broader range of actors as well as issues (farmer participation, bio safety regulations, property rights issues, extension, public debate, and so on) in their core activities. It is as if they put actor-network theory into practice. When problems arise, in this case, a public controversy around biotechnology, actors start to increase their power in order to get their project realized by extending the networks involved in the project. This concept of extending actor-networks informs this study as it raises the question on how different actors are put together, who and what is included, and who and what is excluded.

In actor-network theory the issue of 'script' is used to advance that artefacts, such as a new maize variety or the bio safety legal framework, shape actor actions as well as structure the form and content of their practices; the artefact is constructed and in-built with the designer's interest to dictate its direction (Suchman, 1994a). 'Script' for this study problem is defined as a set of packing and unpacking processes, which involve one's arrangements, rules, activities, goals, strategies and beliefs to be adhered to in technology innovation. It may only be well understood by the designer, but probably more often even the designer does not recognize everything which is being inscribed in the artefact during the design phase. One

could argue that not only artefacts are 'inscribed' but also the specific schemes for participation and the public-private partnerships. Hence, what rules, activities, goals, strategies and beliefs are packed into these schemes for participation and in these partnerships?

It has to be emphasized that these scripts are not an outcome of individual thought or action. The way the notion of script is to be used here overlaps with the notion of category as developed by Durkheim. Actors' involvement in these programmes of biotechnology innovation can be seen as a process in which actors engage through social groups. This engagement is like a ritual where practices take place followed by beliefs. The actors end up viewing biotechnology innovation, participation, and public-private partnerships as carrying a magico-religious connotation. They adhere to the rules governing biotechnology innovation programmes as a religious ritual (Durkheim, 1964[1893]), cited in Richards 2004, Long 2001). The actors go through scientific or participatory initiation and get fused into partnerships to ensure that the biotechnology innovation process intended by the designer is achieved. This initiation, as Durkheim would argue, does not necessarily displace actors' beliefs or opinions, but helps to create the categories shared by the involved people. It is these categories, i.e. the ways people represent the potentials of biotechnology, the possibility for farmer participation, and the need for public-private partnerships, which will be understood through this research project.

Public-private partnership: Issues of power and control, and aims (PR, profits, or public interest)

Making use of actor-network theory, public-private partnership and participation schemes can be seen as a series of interconnections of actors that constitute action. It means

that different actors in partnership form a network. This network constitutes agency (the capacity to act). The power of actors (Bruun and Hukkinen, 2003), or the issue of empowerment, is central and how it is determined, achieved and discharged is important in technology innovation. In partnership, different actors translate the world according to their intentions. It is a question of how the actors involved in the programmes agree on the criteria of functionality of the artefact to be developed. The agreement operates on trust and at the same time recognition is given to risk involved in the whole process of technology development and diffusion. In any biotechnology innovation, actors will be seen as entering new paths of action within a context of old commitments, which they find familiar (Wynne 2001).

A major focus in our study of partnerships around technology development is how the commitments of different actors in the partnership are rearranged. The fact that the private sector in the North accepts to form a partnership with the public sector in the South as a conduit for biotechnology transfer is worth finding out issues that emerge. We hypothesize that private actors are primarily guided by the goal of making profit while public sector organizations have a mandate to serve the public interest. Both may have an interest in these programmes as a good public relations (PR) activity, which in the future may help to overcome the criticism on genetic engineering of food. To what extent this is the case will be examined. This will be done with a specific notion of power that not only refers to specific direct economic interest, but also to the discourse of the 'necessity of public-private partnerships' as it is currently embedded in current thinking about agricultural modernization. Foucault (1970) noted that discourses are not to be grounded in pure reason ("idealist") as the enlightenment "myth" would have us believe, but in social interest. For Foucault, that makes all such discourses

ultimately about power. When designing technology or signing public-private contracts we are designing social relations (Suchman 1994a (128), 1995 (129)) and we are designing specific forms of control. Following Richards (2004), we have to analyse to what level current forms of public-private-partnerships allow for democratic control and technology development in the public interest.

The issues of efficiency in innovation vs. effectiveness of democracy and up scaling vs. up streaming: making use of the debate on participation

The reform of the technology sector in Kenya has been dominated, since the 1980s, by the language of "participation". Participatory approaches to innovation and adaptation generally aim to recognise (i.e. make space for) local capacity, to empower local innovators, and to work towards the functional integration of craft and science-based technology systems. Richards (forthcoming) argues that this raises two major linked issues, with far-reaching organizational, methodological and political implications - convergence (of formal and informal technology systems) and scaling up (of participatory micro-projects to comprehensive programmes).

After independence, in its campaign to Africanise the economy, Kenya government policy sought to modernize agriculture. This modernization was interpreted as intervention in two key areas; influencing the nature of inputs that farmers applied and regulating the marketing of farm produce (Kenya Sessional Paper No. 1 of 1965, p. 48, Omosa, 1998). In the same year, the idea of participation was mooted in Sessional Paper No. 10 of 1965, *African Socialism and Its Application to Planning in Kenya*. This paper, which is Kenya's maiden document on national economic policy, placed heavy emphasis on government's commitment to

drawing on the best of African traditions. This paper stated in part that:

“Planning cannot be done effectively unless every important activity is accounted for and every important decision-maker involved” (Republic of Kenya, 1965:49).

The period 1961-70 was characterized by intensive maize research that resulted into 16 new maize seed varieties intended to respond to severe hunger experienced in 1965 due to shortage of food. In the 1970s, Kenya was an agricultural success story in the African region. During this time, smallholder farmers participated in the adoption of hybrid maize seed technology (Paalberg, 2001). Nevertheless, the success story was short-lived; food security could not be guaranteed due to deterioration of the nation's public institutions, harsh or sensitive political environment, soil degradation, inadequate water supply, and severe pests and disease infestation of crops in the 1980s (Kenya, 1989-93, Omosa, 1998). It was realized that feeding Kenya's growing population required increasing supplies of staple food, especially maize and it was argued that any per capita increase in maize was to come from intensified agriculture and not extensive cultivation (Kenya, 1989-93:106). Intensification then meant the advent of scientification to meet food requirements for the ever-increasing population. It is in this context of scientification and food security that biotechnology programmes target the smallholder farmers and develop a notion of participation.

In the debate on participation in rural development as it took place over the last decades (Richards, 1965; Warren, 1991; Chambers, 1989; Cornwall and Pratt, 2003), two approaches can be identified. One approach is to see the utility of farmer participation in technology innovation in terms of efficiency.

Farmers will have to participate because the technology to be developed has to address their needs and production conditions. If not, the technology will not be adopted. A second approach would emphasize a different element: that of democracy. It is the farmers right to become involved in setting the research agenda. The distinction here is a heuristic device that well serves as a starting point to look at the views on participation as they are living within research and development organizations, state agencies, farmer organizations, NGOs, and among farmers.

A second distinction is about how the involved actors define up scaling, in this case the up scaling of participatory programmes on technology innovation. One possible definition of up scaling refers to the expansion of programmes in time and space to cover more targets (actors) over a large geographical area fast, affordably, equitably and lastingly. A second possible definition of up scaling refers to an upstream involvement of smallholder farmers in defining policies in biotechnology innovation as a result of trust, communication, capacity and collective action. One can see that these two definitions of up scaling overlap with the two approaches of participation as 'increasing efficiency' versus 'increasing democracy'. It must be emphasized that these distinctions are hereby made conceptually to study where people and organizations stand in this respect: they may well overlap in the practice of biotechnology innovation programmes in Kenya.

Hypothesis

Smallholder farmers' participation as they interact with other actors at different levels of biotechnology innovation process in biotechnology programmes in Kenya is positively related to increased up-scaling.

Section 4

Methodology

Introduction

This is an exploratory research which is aimed at figuring out which questions to ask and which answers to seek. Dane (1990) says that exploratory research involves an attempt to determine whether or not a phenomenon exists. Kontari (1985) adds that the major emphasis in such study is on the discovery of ideas and insights. It is with this in mind that a research design, where non-probability sampling as a basic technique for data collection is adopted. In this study purposive and referral sampling techniques (snowballing) will be particularly utilized. Purposive sampling is where a researcher decides to pick on respondents who can have answers to the research questions. In snowballing, one subject gives the researcher the name of another subject who in turn gives the name of another (Vogt 1999). This is because of logistical considerations such as time, personnel and capital, and this means that there will not be statistical significance accorded in the selection of the sample.

Geographical coverage

Main study sites where farmers will be interviewed are divisions of Machakos district, Kenya where maize research development programmes have been conducted. In addition visits will be made to the offices of the various involved organizations in Nairobi and other places, and the various sites where Insect Resistant Maize for Africa (IRMA) project is active. Machakos district is one of the areas where the Special Biotechnology Program has been implemented and where the IRMA project is conducting on-station Bt. Maize experiments. The district has one of the most modern laboratories, which has been used for these programmes to

develop technologies. It is interesting to study how farmers interact with scientists as they carry out their work in this laboratory, which gives leverage to explain how farmers interact with research scientist and other actors at the level of technology development.

Some of the maize technologies developed by these programs have reached the farmers for experiment and this will provide a good platform to analyse farmers' interactions at different levels of biotechnology innovation. Of importance is the fact that a civil society organization and a private organization are involved in technology development in these programmes in Machakos district. Maize, currently the target for genetic modification, is a good subject for debate given that its shortage is associated with hunger regardless of the availability of other food crops. More than 70% of maize area in Kenya is cultivated on farms of less than 20 acre (8ha) (Karanja, 1990).

Sample selection procedures

The project will start off by seeking an overall picture of biotechnology innovation in Kenya. This includes a study of the discussions on how the legal framework defines biotechnology innovation, compliance to Article 23 of the Cartagena Protocol on Biosafety and Actors' participation in Kenya. The research then will identify the actor-networks involved in the Special Biotechnology Programme and the IRMA programme, and analyse deeply the interactions between smallholder farmers with the public sector, private sector, civil society organizations, government, and the international community, and their partnership formation. The Kenya National Council for Science and Technology which facilitates biotechnology innovation process in Kenya will be earmarked as the point of departure. It is from here that

contact will be established and referral made to reach and interview other actors involved in the innovation process.

With regard to the farmer population, a purposive sample of about 15 farmers who have participated in programmes of our focus will be drawn. The researcher will make use of Government Agricultural Officers at the Ministry and district level to trace the farmers in question. Farmers with different views on biotechnology and with different relationships with actors working in this field will be selected. Based on this, work decisions will be made in a second stage, if necessary, whether the sample will be enlarged with more farmers to extend this in-depth study, or whether further findings will be needed on which a quantitative study will be launched, to answer specific question through a survey (Sayer, 1992).

While in the field, year round observation of agricultural biotechnology use and farmers' interaction with other actors in the area will be undertaken. These observations will focus on what actors do, how they do it, when, to whom and who undertakes what activities. Information will be collected on how farmers as actors interpret and strategize for purposes of producing food, how they resolve problematic situations, how they recreate relationships with other actors, how they process their experiences, how they assign new meaning to these experiences and what shapes the choice that they make. At the same time purposive sampling and interviews will be carried out on institutional actors involved in the innovation process.

Methods of data collection

Qualitative methods of data collection are to be used for this study. These qualitative methods include: available data, key informants, informal interviews between interviewer and respondents, ordinary conversations, observations and

brainstorming. These methods are such that they are inter-related in checking or complementing one another. Methods of data collection will be used to elicit information from the available sources. There are two sources of data collection; secondary sources (what has been written about the phenomenon being investigated) and Primary sources which will utilize emic approach (informal interviews, informant interviews, ordinary conversations and brainstorming) and etic approach (observations and inferences made thereto by researcher).

Secondary sources of data collection

Secondary data in this study refers to relevant information-qualitative and quantitative that is already available when this study on biotechnology innovation in Kenya starts. These data will be retrieved from documented materials. Materials such as government policy documents, government reports, civil society reports, seminar/workshop papers, project reports, journal publications and other relevant documentation will be reviewed to provide the necessary background information for the field data collection and at the stage of analysis. Newspaper clippings, other magazines and brochures will be points of reference in order to capture independent sources of information on issues relevant to this research. Secondary sources will focus on biotechnology changes in Kenya; legal framework, interactive bottom-up participatory method, roles of diverse actors and partnerships already established and documented.

To this end, secondary data will be made use of, mainly government policy documents and other existing records on biotechnology innovation from diverse sources and will prove a vital source in as far as it will save time in avoiding repetitions by use of primary sources to get the same information. These sources will provide the necessary

background information in terms of who is involved and what has taken place over time. Using these sources, the country's agro-technical changes and related policy issues will be considered. These changes will be positioned in relation to farmers' role in the changing agro-technical regimes and how they interact with other actors in the process. It will be at this point where methodologies that have been used in the programmes will be sought, how they have been defined and operationalized. Of interest also are partnerships that exist, process of their formation and their operations.

This information will be found at the District Information and Documentation Centre, Ministries of Agriculture; Science and Technology; Constitutional Affairs and Environment, National libraries, Research Institutions, legal regulators offices, national achieves and public universities.

Primary sources of data collection

The data that will be collected by use of primary techniques will be relied more and form the backbone of the thesis. The basic methods that will be used to collect primary data will include: interviewing (key informant interviews, informal interviews, ordinary conversation, brainstorming and personal observation).

Interviewing

Interviewing will involve asking people to respond to issues from their own perspective in regard to biotechnology innovation in Kenya. Respondents will have a chance to say what they know about the problem of study. Prewitt, (1975) observes that:

“An interview is a social exchange between the interviewer and the respondent insight intuition and personal rapport play a part in the outcome of this exchange, just as they do

in any other social situation. A good interviewer realizes that the interviewee is guessing at the motives of the interviewer and is perhaps tailoring the answers accordingly. Thus it is very important that the interviewer realizes how his own behaviour and dress and manner might affect the interview situation”

This study will use interview schedules- on key respondents from institutions small holder farmers, and other individual actors. Informal interviews will also be applied on different actors as need arises.

Key informant interviews

These are interviews directed to an informant in order to elicit the specific knowledge of the individual. Key informant interviews are considered on individuals who are particularly knowledgeable about a particular issue and are accessible and willing to talk. It is useful for eliciting specific individual held information, opinions and unique views.

The method will be used to gather information on how biotechnology packages are developed and principles of transfer, dissemination and use, policy formulation and its implication to the agricultural sector and how it affects the farmers and the public at large. The information to collect will be on the politics of biotechnology in Kenya in view of the legal process and involvement of farmers in the legal framework in compliance with Article 23 of the Cartagena Protocol on Bio-safety. The other information to seek here is when, why and how biotechnology was developed in Kenya, trend and main characteristics, controversy associated with biotechnology and why. Questions related to up scaling and participatory methodology will also be addressed at this level.

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The respondents here will be institutional representatives such as Government Ministries, public legal regulators, research organizations, CBOs and NGOs, universities, donors and other interested parties who have participated in the formulation of the legal framework in Kenya. A list of attendants from Kenya National Council for Science and Technology (facilitator) will be used to track down these key informants to their different organization. Interviews will also be conducted on key actors from Kenya National Council for Science and Technology. It will be at this level when referral sampling will be used as the key respondents will refer the researcher to other actors who have made contribution to the innovation process.

These actors will be interviewed to establish their role and influence on participation in as far as biotechnology information is concerned. This will be necessary as balanced information will be collected as to how actors interact with small holder farmers as they carry out their roles as stipulated in law or otherwise.

Informal interviews

Informal interviews will particularly be a preserve of the researcher. This technique will develop rapport and elicit information by using unstructured questions such that there will be no set of questions to be followed. These interviews will be conducted throughout the data collection period and will especially be used to elicit information that was difficult to capture during key informant interviews. This technique will give the researcher and respondent an opportunity for direct interaction as information is elicited aimed at achieving the research objectives. As Bober (2004) notes, it is conducted up-front, it helps orient the evaluator to the study and to the situation; it is conducted post hoc, to help the evaluator better

understand information gleaned from other sources or other methods.

Prewitt (1975) and Ogoro (1998) add that in the interview approach the researcher or interviewer interacts directly with the respondents, questions are asked and the answers recorded on a person to person level. The interview provides the researcher with some measure of control over the research setting. One of the advantages of this method is that the questions can be modified or rephrased if misunderstood by the respondent; probes can be made to elicit detailed information.

Through this method reliability will be ensured because it will act as a cross-check to the other methods, and also improve the researcher's working relationship with the respondents. This will meet the principle of exploratory research as Kothari (1990) states that such studies must be flexible enough to provide flexibility for considering different aspects of a problem under study.

It is worthwhile to mention that this method will be intensively utilized to 'dig deeper' into understanding people's perception of biotechnology innovation process expected to provide an avenue for all actors involved to participate in ensuring food security.

This method will be applied on small holder farmers, farmers' representatives and some of the key respondents from both public and private sectors and the CBO and NGO sectors.

Ordinary discussions (conversations) and brainstorming
During the period of data collection, ordinary conversations will be utilized especially during times the researcher will make impromptu visits to public places, government offices

and small hold farms. This will reveal desirable information as the respondents will not experience a situation where notes are straight away taken from their responses. This will especially assist to define as to who sets the agenda on whose behalf in biotechnology innovation. Ordinary discussions with individual government officers and other actors will commence, focusing on research questions and respondents will have the leeway to take the discussion in directions that interest them. Previous interviews in subsequent visits will be points of departure and in some way will situate government officers and other actors at certain levels of participation in biotechnology innovation. This technique will go a step further to complement the other interview techniques. Brainstorming will also be handy when dealing with respondents. It will enable the researcher to get more information on the Participatory Rural appraisal used. This technique will be enriching in complementing and strengthening information gathered by use of other techniques of data collection.

Personal observation

Bamberger et al (1986) states that observational indicators are useful for evaluation of physical conditions of the community. The researcher will employ this method side by side during interviews and discussions in order to capture non-verbal behaviour, explore interactions that are flexible and collect unusual data. This will be used in this study to be able to understand how different actors involved in biotechnology innovation interact with one another in their roles, and their reactions in areas where disagreements and contradictions emerge. Observation will also assist to find out if there are any coping initiatives employed by farmers and the rest of the actors in the whole process of biotechnology innovation. It will be interesting to observe how these partners interact

during their stakeholders' meetings, and at a time when they are subjected to interviews.

In essence, personal observation will be used to give credence to some of the information collected through other fore-mentioned techniques and it is believed that it will be holistic.

Tools or instruments of data collection

These are tools such as questionnaires, interview schedules, pens, note books etc used in data collection.

Unstructured interviewing schedules

This instrument will be in-depth focusing on issues that the researcher would like to cover in this study. Unstructured interviewing schedules will focus on specific issues with actors such as how their involvement in partnership has contributed to biotechnology innovation, their activities, goals and strategies and how they harmonize individual 'scripts' and the partnership arrangement. These actors will also be asked to explain how they engage farmers in their activities in biotechnology innovation and what the farmers' roles are and why. We will further seek information on the degree and stage of participation by actors in the interactive bottom-up approach. The strategy to be employed here will make note of contradictions, disagreements and agreements on technology development and dissemination and partnership formation. The issue of controversy associated with biotechnology and response to the same will be inquired.

The other tools to be used are pencils, pens, note books and camera. Note books will be used during informal interviews and key respondent interviews to take summary notes of responses. Camera will be used to capture interactions as they take place and maize experiments. These tools will also be

and small hold farms. This will reveal desirable information as the respondents will not experience a situation where notes are straight away taken from their responses. This will especially assist to define as to who sets the agenda on whose behalf in biotechnology innovation. Ordinary discussions with individual government officers and other actors will commence, focusing on research questions and respondents will have the leeway to take the discussion in directions that interest them. Previous interviews in subsequent visits will be points of departure and in some way will situate government officers and other actors at certain levels of participation in biotechnology innovation. This technique will go a step further to complement the other interview techniques. Brainstorming will also be handy when dealing with respondents. It will enable the researcher to get more information on the Participatory Rural appraisal used. This technique will be enriching in complementing and strengthening information gathered by use of other techniques of data collection.

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used to capture whatever will be of interest to the research objectives for visual advantage when looking at the results.

During the research period all the debates on biotechnology innovation will be followed and where possible the researcher will participate in public events. The researcher will furthermore participate in meetings or events where farmers meet other actors in order to observe the shaping, reproduction, and transformation of scripts and categories. With the assistance of a research assistant, notes will be taken as interviews ensue to further examine the shaping, reproduction, and transformation of scripts and categories, as well the interaction between the different actors during such events.

Respondents

The respondents for this study are actors who have been involved in one way or the other in biotechnology innovation. These include:

Public sector

This will cover the ministries of agriculture, education, environment and the attorney general's office. Also to be covered are parastatals such as the universities, Kenya Agricultural Research Institute, Kenya Plant Health Inspectorate, and Kenya Institute for Property Rights etc. CIMMYT, an international agricultural Research Institute and others will also be covered. The questions here will be the participatory approaches used, how models have been constructed, bio-safety regulations partnership formation and up scaling.

Private sector

Here, focus will be on the private organizations such as seed companies, ISAAA and media houses. The questions here will

be; how the seeds reach the farmers, role of ISAAA in public private partnership and the role of the media in the development, dissemination of information and publicity in the use of technology by farmers and need for up scaling.

Civil Society

The focus here will be both on international, regional, national and community based organizations. This will cover Biotechnology Trust Africa, African Biotechnology Stakeholders Forum, Harvest Africa, Africa Agricultural Technology Foundation, Science and Development Network, women groups and farmers' organizations. The question of how they develop technology, how they involve farmers, approaches used, how they disseminate it and their involvement in relationships in biotechnology will be addressed. The issue of upscaling models that have been successful will also be addressed.

Individuals

This will cover small holder farmers, scientists, extension officers and other key respondents who have stake in biotechnology innovation in Kenya. The questions here will be how farmers are brought on board and their participation in the whole process of biotechnology innovation. This will also apply to scientists, extension officers and others.

In first instance, this project will basically use a qualitative approach. QSR Nud*ist Version N6, a software package for the management and analysis of qualitative data, will be used. This programme is based on grounded theory and the underlying ideas about the role of concepts in social science will be used (Sayer 1992; Silverman 2001). The case study approach of selected farmers and other actors is an application of the extended case method in the sense that it intends to reconstruct existing theories by focusing on the processes and

mechanisms in case studies of instructive situations, selected in such a way that they allow the generation of insights about the macro level of intervention programmes and official scripts (or discourses) (Burawoy 1991; Mitchell 1983; Silverman 2001).

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