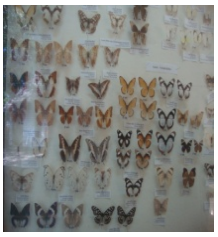
Joint Learning in Innovation Systems of African Agriculture (JOLISAA)

18 Inventory short cases

Kenya





Compiled by: Kamau, G., Ng'ang'a and Kirigua, V

Cover photo: Prosopis tree, Aloe nursery, Butterfly collection, Dairy goat and Solar ice maker

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1. Learning about management of *prosopis* in Baringo

1. Identification

Case number 1

Short title: *Prosopis* management in Baringo

Authors list:

2. The story line in a nutshell

This case is about a collaborative venture between a community, a national and an international organization to introduce *prosopis* tree which led to successful re-vegetation of a highly denuded area. The tree however became invasive and caused negative effects but concerted efforts by several organizations and capacity strengthening of the community yielded beneficial and favorable environmental effects.

3. Context and innovation description

The innovation case is from Baringo which is predominantly an arid to semi arid, area and characterized by prolonged droughts. This district borders West Pokot, Marakwet , Keiyo Koibatek and Samburu district and has an area of 8,655 square kilometres. It is divided into 14 divisions. The altitude varies between 752 metres in the lowlands to 2600 m in the Tugen Hills and thenthe surface drops steeply through a foothill zone of complex topography to the Tugen Plateau at 1100 to 1300 metres above sea level. This forms the Western boundary of the Lake Baringo trough which is bounded by the Njemps Flats and the Laikipia Plateau which rises close to 2000 metres above sea level. The area experiences one rain season from April to August and a prolonged dry season. The rainfall is very variable and is strongly influenced by local topography. The long -term average annual rainfall ranges from 600 mm in the lowlands (Njemps Flats) to 1000-1500 mm in the highlands. The annual mean minimum and maximum temperatures range from 16 to 180C and 25 to 300C respectively. The period between January and March is the hottest. Poverty is widespread in the district with the primary livelihood system being livestock rearing while 20,000 Ha of the land is used for cultivation of food and cash crop such as maize, beans, finger millet and sorghum for food while coffee and pyrethrum are the cash crops in the elevated areas. Baringo is a food deficit district and water supply from rivers and lakes is inadequate to meet domestic, livestock and irrigation needs. To meet water demands, wells, boreholes, dams and pans have been dug. Periodic droughts, flooding and overgrazing continue to negatively affect the quality of the pastures available in Baringo and this is made worse by inflow of livestock from neighboring districts during the dry season. All this puts pressure on the fragile eco-system and in common with other ASAL regions, the district lacks proper livestock marketing infrastructure due to the constraints imposed by poor physical and industrial infrastructure. The result is limited access to markets outside the district and even the country.

Land in the district is primarily trust and/or communal land and this is deemed inappropriate in the face of growing individual herds that use common pastures. The marsh areas around swamps and lakes provide important dry season grazing and are of great importance in local livestock husbandry. The quantity and quality of pastures are adversely affected by overgrazing, lack of a system for delineating and preserving reserve grazing

pastures and drought and floods. Further pastures are threatened by cutting down trees for charcoal burning, firewood, building materials and invasion especially by *Prosopis*, commonly known as *Mathenge*. In the event of a prolonged drought, livestock deaths take a toll on the communities' only means of livelihood thus compelling them to seek other livelihood options.

a) **Initial practice/situation, problem or opportunity being addressed and related triggers**

Following prolonged droughts, of the 1970s, the drylands of Baringo were severely degraded, leading to extensive vegetation loss and tree planting was given a high priority as an urgent rehabilitation strategy. The effort was however constrained by non availability of drought tolerant species and so screening trials were a prerequisite. Trees from *Prosopis* genus were enlisted because they had shown potential in rehabilitation of degraded lands in Bamburi cement quarry mines in Mombasa (Maghembe, Kariuki & Haller, 1983). These trees are more drought tolerant than the indigenous species (Olukoye, Wamicha & Kinyamario, 2003). Various Prosopis species were evaluated among which was *Prosopis juliflora* (Sw.) D.C, . Maghembe, Kariuki & Haller, 1983) which wsa found suitable for the purpose. The introduction of the tree into Baringo was done in 1982 by KEFRI, Ministry of Agriculture extension staff, NGOs and the local administration through government supported community nurseries. After successful introduction into the intended areas, livestock dispersed the seeds through their dung and twenty years later, the tree became invasive and occupied communal grazing areas posing a challenge to human, livestock and wildlife (Otsamo *et al.*, 1993). The search for a solution involved joint efforts between several international, national and local stakeholders and the local community.

b) Innovative practice(s) or arrangement(s) or innovation bundle

Technical innovation:	Use of pods for feeds
	Use of pods for food
	Prosopis charcoal and firewood
	New charcoal kilns
	Hammer mill
*Organizationa*l:	Community farmer field schools
	Prosopis charcoal burners' association/group
Institutional:	Prosopis charcoal licensing
	Marketing arrangements with Sigma feeds

4. Main Stakeholders involved and roles in the innovation process

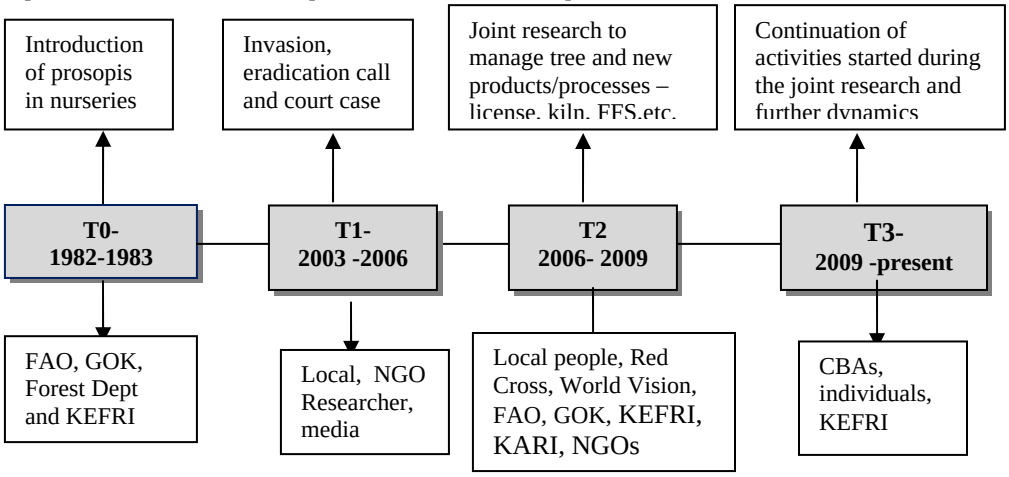
Table 1: Stakeholders, roles played, contributions made during the innovation

Stakeholder	Role	Contribution
FAO	Spearheaded the re-vegetation efforts	Provided financial support to implement project
DFID	Participated in prosopis utilization work esp. timber	Provided funds, equipment and skilled manpower for timber

	processing	processing
Government of Kenya	Supported the efforts through allowing the project to be implemented	Gave counterpart financial and physical resources support to the project
Local people	They complained to authorities and this led to joint action with other actors to manage tree.	- Burned charcoal, de-stumped prosopis and planted pasture grasses and also managed the trees through pruning -Came up with local innovations such as making impenetrable fences from young saplings, using leaf extract for healing prosopis induced injuries,
Kenya Forestry service (KFS)	In charge of forest and tree resources policy in Kenya	Introduction of charcoal burning license to manage p*rosopis*
Kenya Forestry Research Institute (KEFRI)	Organization in charge of forestry research	Managed the project and made major contribution in capacity building events
Provincial Administration	In charge of administrative concerns	Assisted the KFS in issue of license Ensured compliance with the requirements of license
Nairobi & Egerton Universities, KARI and ICRAF,	Research and Development institutions	Impact studies and use of prosopis pods for development of livestock feed rations
Sigma Feeds and others	Animal feed production	Utilization of *Prosopis* pods in production of livestock feeds.
ILRI	International research and development body	Linking feed industry to *Prosopis* feed resource and research on feed rations
NEMA	National body concerned with Environment management regulation	Conducted Environmental impact assessment for *prosopis*

5. History / dynamics of the innovation process

Figure 1: Main phases of the innovation process from t0 to the present



T0: Introduction of *prosopis juliflora* through nurseries (1982 -1983)

Baringo area was highly deprived of vegetation through overgrazing and prolonged droughts and a re-vegetation effort was made using Prosopis juliflora trees. This was through a collaborative project between FAO, the Government of Kenya, the then Department of Forestry, the Kenya Forestry Research Institute and KARI. Community nurseries were set up in various places and local farmers were supplied with the seedlings which they transplanted in their farms. At that time, the message was that this tree was going to be a useful livestock forage and this is what the community wsa looking forward to.

T1: Invasion calls for eradication and court case (2003- 2006)

The tree seedlings were distributed by KEFRI, the Forest department and NGOs to the farmers who were asked to take good care of them because they were useful sources of fodder for their animals and would also protect the soil from being blown away. The trees grew very well and started producing seeds and once these pods were eaten by the animals and passed through the dung, many seedlings sprouted thus the beginning of the trees' invasive character. Large areas of the region were covered by the tree and even in an extreme case a shopping centre had to be relocated owing to the colonization by the tree. River courses were clogged by the trees and this led to change of the river courses and evacuations were done by the Red cross and World Vision. The trees especially thrived in swamps which were useful dry season grazing fields and this threatened the local community's way of life. Cases of wounds caused by *prosopis* thorns were reported as well as plants growing through house walls, livestock being entangled in the *prosopis* bushes and being abandoned all drew attention from different quarters. The scientists also joined the fray and published reports that further sensitized the country to the dangers of '*mathenge*' weed also known as '*devils*' weed. The community aided by various other actors embarked on a vigorous campaign to compel the FAO and the Government to act with speed to eradicate the tree. These calls ended at the high court where a toothless goat was presented as evidence by nine members of the Ngambo community.

T2: Joint Research and new products – (charcoal burning, license, kiln, FFS, Feed evaluation, seed marketing, evacuation, pasture grass, fencing) - (2006 – 2009)

The increasing calls for eradication of the tree led to the beginning of a collaborative research project between various organizations through funds provided by the FAO and DFID. In this project, KEFRI trained the community members through the Farmer Field Schools on how to prune and thin *prosopis* trees and burn charcoal from the mature trees using the improved charcoal kiln. The community was also shown by KEFRI through DFID support how to use the mature trees for timber, building and fencing posts. KARI jointly with Nairobi and Egerton Universities conducted impact studies on the tree and facilitated a participatory process for the tree management, provided pasture grass seeds to reestablish lost pasture land and took part in capacity building events. The Kenya Forestry Service adjusted charcoal burning policy and authorized charcoal burning from *prosopis* and the provincial administration was charged with the responsibility of issuing them. Researchers and

collaborators introduced products such as wooden pallets for floors, carvings, fencing poles and use of pods for feeds. Networks such as the Charcoal burners association were formed out of the Farmer Field Schools that had been formed for purposes of research. The University of Nairobi jointly with ILRI conducted some tests on the use of pods for feed production and a consignment of the pods was sent ot South Africa for use as human food.

T3: Continuation of activities and further dynamics - (2008 to present)

The perception of the community towards prosopis changed after the exposure to the potential of *prosopis* and products and this has persisted to the present. Efforts by various NGOs are currently in place to up-scale the proper management and utilization of the tree. A good example is the proposed Kerio Valley development project where community members are given beehives. These are mounted on *prosopis* trees and plans are for honey from these hives to be branded as *Prosopis* honey to fetch a premium price. The community is using the young *prosopis* saplings to make an impenetrable fence that protects crops against small stock. Knowledge generated in the process is being shared with other communities living in other areas of the country with similar *prosopis* challenges such as Garissa and Bura and certain community members have been used as resource persons by NGOs such as the Desert Margins Initiative (DMI). Challenges still exist since the uptake of the introduced interventions remains partial with an example being the new charcoal kilns where the community members still use their old kilns. The hammer mill that was introduced by KEFRI as a sample is still in the store and pods are being used 'in situ' to feed livestock during droughts unlike the collection that was expected.

6. Results & effects of the innovation process so far (adoption)

- *Prosopis* has become a source of income for the people in this region through charcoal, poles, timber and sale of pods to people in areas with no *prosopis.* The prosopis pods are collected and sold as livestock feeds during the dry season
- A *prosopis* charcoal burner's association has been formed to deal with the welfare of charcoal burners . This association deals with issues of licensing of community members and also ensures that members do not cut trees outside the allowed species
- New businesses such as wooden floor pallets, charcoal and pod for feeds have emerged after the various capacity building events. These skills are also being shared with communities in areas outside Baringo such as Garissa and Hola through the Arid lands resource management project
- *Prosopis* pods are a useful dry season feed for the livestock when there is very little vegetation available. The goats and cows have no other feed resources available and hence congregate around the propospis bushes to feed on the dry pods.
- Dust storms have reduced unlike the pre-*prosopis* establishment period. These storms according to informants used to blow to as far as Nakuru and this is no longer happens.
- The droughts are less severe and temperatures in the area have reduced as witnessed by several community members who attested to the fact that they practice more weedings for their crops because of the extra moisture and also the nights are cold thus requiring one to cover themselves with blankets at night.

- A private company has expressed interest in establishing an electric power producing plant which will use *prosopis* tree as the source biomass.

7. Main lessons in light of the JOLISAA goals and questions

1) A technical solution without considering the socio-technical implications may create a challenge with far reaching implications
2) Any technical intervention that interferes with a community's livelihood system will require an extra effort to anchor it within an area despite the anticipate benefits.
3) Once an innovation provides an economic benefit option in an area where options are limited, it is easy for such an innovation to be scaled up sustainably even though in different forms
4) Capacity building, networking and action research are all key ingredients to the success of this innovation

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2. Domestication and processing of wild Aloe (secundiflora and Turkanensis) in Baringo District

1. Identification
Case number 2
Short title : Domestication of Aloe in Baringo
Authors list:

2.The story line in a nutshell

This case is about domestication, organized production, processing and marketing of indigenous Aloe Turkanensis and Secundiflora species in Baringo district where different individual farmers, private and public stakeholders were involved. This occurred following a presidential decree that declared Aloe a protected species and thus making trade in its products illegal.

3. Context and innovation description

Kenya has approximately 60 species of aloe of which 26 are endemic. Only five (*Aloe turkanensis, A. scabrifolia, A. secundiflora, A. calidophia* and *A. rivae*) are exploited commercially. Many of the commercial aloe species grow naturally in Baringo among other parts of Kenya. Baringo district in Rift Valley province is classified as an ASAL region and characterized by fragile ecosystems which are rocky and highly degraded, poor water distribution systems, conflict over control of natural resources with underdeveloped opportunity for markets of natural resources products. The soils are shallow and infertile but favorable for Aloe production. The communities living in this region are mostly pastoralists who keep cows and goats for their livelihoods. The region is endowed with a wide range of endemic plant and animal species and Aloe is one of them. Its use has a long history due to its medicinal values and income generation through the black market.

a) Initial practice/situation, problem or opportunity being addressed and related triggers

Unclear provisions for regulation of use of the species within the wildlife legislation framework saw the unchecked utilization of the aloe species in the 1980s resulting into over exploitation and wanton destruction in the wild. This prompted a Presidential Decree in 1986 prohibiting harvesting of the species from the wild for commercial purposes and instead encouraged establishment of aloe plantations for commercial use. Unchecked exploitation however continued because other East African countries had not restricted the exploitation. The Kenya government brought on board the Wildlife (Conservation and Management) (Aloe Species) Regulations, 2007 published in Legal Notice No 403, to protect and guide conservation and management of Aloe. Prior to this regulation, Kenya lacked adequate regulations and mechanisms to oversee or regulate the protection, conservation and management of aloes, outside protected areas.

b) Innovative practice(s) or arrangement(s) or innovation bundle, as it evolved over the duration of the innovation process (if relevant

Organizational: Aloe management units

Technical: Establishment of Aloe nursery
Processing of Aloe sap into bitters
Processing into soap, gels and other products
Purity test

Marketing: Registration of Baringo Aloe Bio enterprise
Contracting of Landmawe company

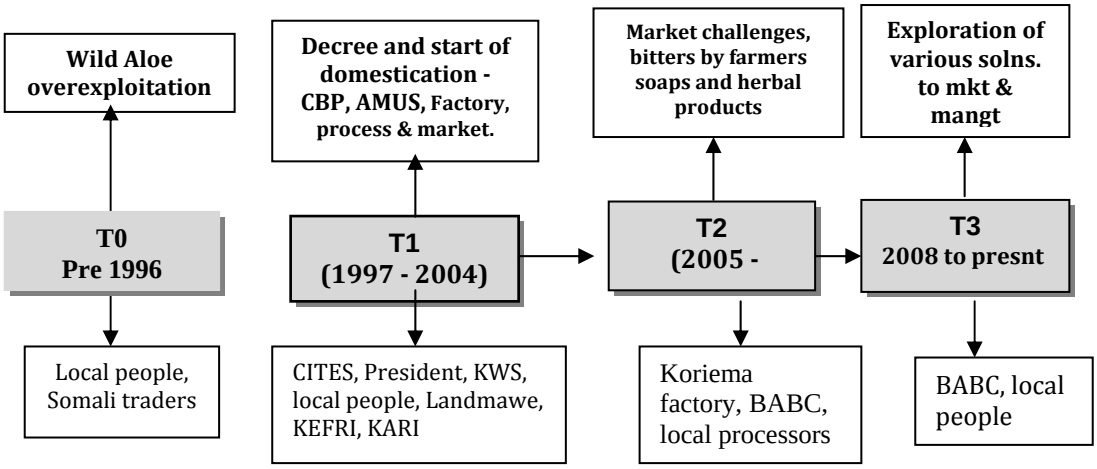
4. Main Stakeholders involved and roles in the innovation process

Table 2: Stakeholders, roles played, contributions made during the innovation process

Stakeholder	**Role**	**Contribution**
Members of the Aloe management units	Owned the land and were the beneficiaries of the project	Cultivated Aloe Formed BABC for management and marketing of Aloe products Gave advise to farmer groups and individuals from all over the country on how to start Aloe enterprise Developed the local test for purity Used Aloe roots for stabilizing hillsides Used Aloe sap and roots for medicinal uses
KEFRI, KARI Ministry of Agriculture and private consultants	Technical Service providers	Sensitized communities on domestication of Aloe Organized AMUs and trained on cultivation and processing of Aloe
KEFRI	Was the team leader in writing of proposal	Spearheaded the writing of proposal to EU Backstopped farmers
KWS	Overall custodian of wildlife and endemic flora	Provides export license to BABC Provides advice to BABC on Kenya Biodiversity Refer external groups to the Baringo group
KFS	Overall custodian of forests	Provided training on the Aloe husbandry practices
BABC (CBO), BABC (Company), AMU	Coordinate the production and marketing of produce	Brings together farmers from 8 constituency of Kenya. They grow, harvest, process and market Aloe products this are activities.
Landmawe	Private company contracted to manage the factory	Had a contract up to 2012 to manage the factory but suspended

5. History / dynamics of the innovation process

Figure 2: Main phases of the innovation process from t0 to the present



T0: Wild Aloe overexploitation

Various Aloe species were being commercially harvested freely without any conservation efforts. This exerted pressure on the species due to over exploitation and a decision was made to look for solutions to the problem. Efforts to do surveillance failed and this led to the declaration of a presidential decree which effectively declared the trade in Aloe products illegal. Any individual or organization interested in Aloe trade was henceforth required to seek authority from the KWS and contravention would lead to penalty and/or jail term.

TI: Decree and start of domestication – (Community Biodiversity Project (CBP) , Aloe Management Units (AMUs), Factory construction, processing and marketing (1997 - 2004)

To encourage sustainable utilization, KEFRI launched the Community Biodiversity Project with funds from EU through the Community Development Trust Funds. Jointly with Ministry of Agriculture, KARI and the KFS as well as the provincial administration they mobilized the community to form Aloe management units (AMUs). The members of the AMUs were trained by KEFRI, KARI and the KWS on how to cultivate Aloe, harvest and process the product. Skills on how to ensure quality of the processed Aloe were particularly emphasized. Through funds provided in the CBP project a factory was constructed at Koriema and Landmawe Company was charged with the responsibility of managing the factory. Owing to alleged misplaced claims by the Landmawe company, the contract was contested by the local community and a new company Baringo Aloe Bio-enterprise Company (BABC) was formed by the community. This company is the one running the factory to date.

T2: Bitters, market challenges soaps and herbal products (2005 -2008)

Initially, the factory used to collect the aloe sap from the growers and would then boil it to produce Aloe bitters. Cost of firewood led to a change in approach where the growers were

asked to boil the aloe sap and produce the bitters at farm level . This is the product delivered to the factory and the company then looks for buyers. The current world market price is Ksh 350/ kg (2011) and offers have been made to the company to sell at Ksh 150/kg which they have rejected. Out of despair, however they have a recent offer of Ksh 165/kg and have sold 5 tons of bitters and more orders have been received. Due to the low prices offered, the company has decided to diversify and make final products such as soaps, gels and herbal products. The soap production option is challenged by the initial high investment and the cost of certain key ingredients. Currently, the production of soap and other products is outsourced and the company does the marketing.

T3 Exploration of marketing and management solutions (2008 to present)

The management has been exploring various marketing options but continues to get low offers. Diverse options have been explored including opening a warehouse in Mombasa where the company would then become the sub-contracting agent to collect Aloe bitters from various producers and export on their behalf. KWS continues referring various Individuals and organizations from different parts of the country to this company to be trained on Aloe management.

6. Results & effects of the innovation process so far (adoption)

- Aloe domestication represents an innovative way of conserving a plant species while utilizing it to create an alternative livelihood option thus enhancing biodiversity and environment sustainability
- A lot of Aloe bitters has been sold to traders in Nairobi and orders for supply of Aloe seedlings are received occasionally.
- Construction of Koriema factory is an achievement for the community
- Baringo Aloe Bio-enterprise (BABE), a community based organization (CBO) registered under the Ministry of Social Services and Baringo Aloe Bio-enterprise Company (BABC) created. The creation of BABC benefited the members who get a higher income than was the case earlier on.
- Requests for consultancies by individual farmers and groups on how to set up Aloe production ventures in the country and in the East African region received.
- Diversification into final products processing fetches more money than the raw materials even though the cost of ingredients is high.

7. Main lessons in light of the JOLISAA goals and questions

1. The importance of policy organs in driving an innovation process is apparent in this case and while this may seem a top down occurrence, it led to emergence of opportunities that if properly managed would lead to significant contribution to the economic development of this area.

2. Misunderstanding between stakeholders can lead to interruption of the innovation development process and this may come from a simple act by one party (*Landmawe company manager is said to have claimed sole proprietorship of the factory and members were their workers and this angered the members*). Thus, private partner involvement may not always be a guarantee of success in Multi-stakeholder processes

3. A clear marketing and management strategy is always critical for an innovation to succeed while lack of the same may drive a whole innovation process to its knees. The innovation case seems to be encountering challenges even though there is a huge untapped world wide market of Aloe products

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3. Participation of local communities in conservation of Arabuko Sokoke forest through butterfly farming

1. Identification

Case number 3
Short title: Forest conservation through butterfly farming
Authors list:

2. The story line in a nutshell

This case is about how a community living around a high biodiversity tropical forest in Coastal Kenya were mobilized by various international and national actors to participate in its conservation through introduction of butterfly farming as a livelihood option instead of the exploitation of trees and other vegetation for charcoal and firewood both for sale and direct use. The butterfly rearing activity provided the community with an alternative livelihood in which they reared butterflies from egg through to the chrysalis (cocoon stage). These butterflies are then sold in the international market in Europe and America. The case narrates how this process was initiated and how it progressed to its current state

3. Context and innovation description

The Arabuko-Sokoke Forest is located about 110 km north of Mombasa in Kilifi and Malindi Districts of Coast Province, Kenya. It lies close to the Indian Ocean and it is one of the last remnant indigenous forests that once dominated Kenya's coastal fringe. It contains three forest types which are mixed, *Brachystegia* and *Cynometra* forests. Each of these forests protects different communities of plants and animals. About 30% of Kenya's butterflies have been recorded in this small part (0.07%) of Kenya and at least 24 rare or endemic bird, mammal and butterfly species are restricted to this stretch of Coast. Subsistence agriculture is the main occupation of the surrounding population which includes production of maize, cassava, and beans, with income supplemented by cash crops such as cashew, mango, and coconut. Agricultural land is generally poor, and crop yields are low. The mean size of farm holdings is 6.9 ha (0.5 ha per capita) and most households own goats. For a long time the population around the forest has relied on the forest for various products that include fuelwood, poles, herbs and hunting of wildlife for meat. On several occasions, parts of the forest have been earmarked for '*degazettement*' to be allocated for agriculture or settlement but these efforts have been thwarted by the local communities and environmentalists.

a) Initial practice/situation, problem or opportunity being addressed and related triggers

Before the advent of the butterfly rearing project, communities living around the Arabuko Sokoke forest used to cut forest trees for charcoal burning, wood carvings, poles and other uses which led to problem of deforestation. Poaching for game meat and trophies for sale was also a common practice and in order to discourage these conservation unfriendly activities in 1993, East Africa Natural History, Society (EANHS, now Nature Kenya [NK]) in partnership with the National Museums of Kenya (NMK) started the Kipepeo project using funds from the Global Environment Facility (GEF) Small Grants Programme. Its objective was to change local attitudes by enabling the forest-adjacent community torear forest butterflies

for export to the live butterfly exhibit industry in Europe and America. Ths project was in line with the principles of participatory forest management and was started in one of the villages bordering the forest and the idea later spread to the rest of the villages.

b) Innovative practice(s) or arrangement(s) or innovation bundle, as it evolved over the duration of the innovation process (if relevant)

Technical: Trapping of butterflies
Rearing of butterflies in homemade cages
Training of illiterate farmers about life stages of the butterfly
Propagation of tree and vegetation species
Cultivation of mushrooms and sting less bees as options

Organizational: *P*ublic relations, financial and marketing committees
Butterfly producers association
Ccommunity involvement in forest management

Marketing: Formation of marketing and exhibitions sub committee
Friday as a butterfly marketing day

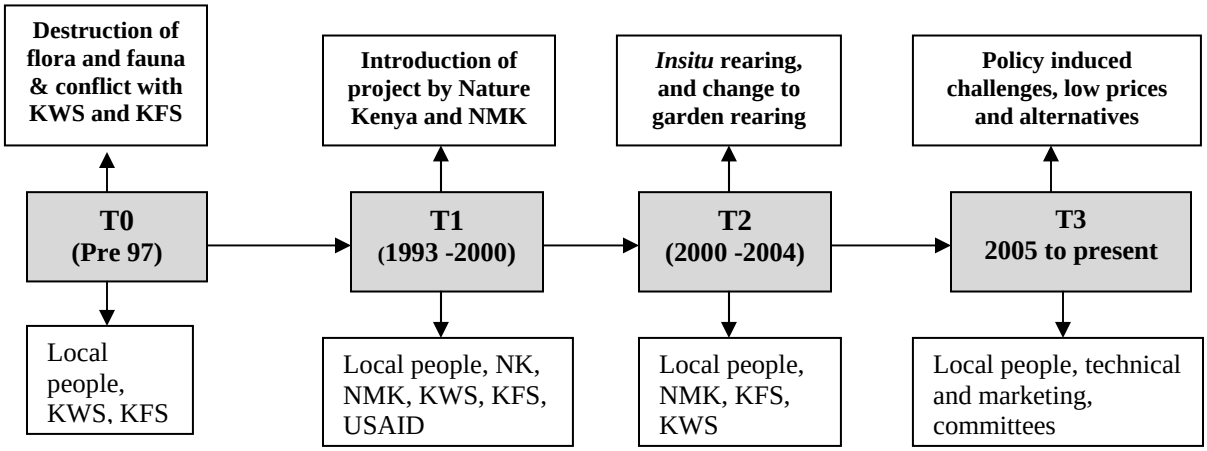
4. Main Stakeholders involved and roles in the innovation process

Table 3: Stakeholders, roles played, contributions made during the innovation process

Stakeholder	**Role**	**Contribution**
East Africa Natural History, Society (EANHS), now Nature Kenya (NK) and National Museums of Kenya	Initiated the project	Imparted capacity to the community on butterfly taxonomy, life cycle and handling techniques
Kenya Forestry Services	Custodian of Arabuko Sokoke forest	Involved in building capacity of community and also issuing of permits for access to forests
KWS	Custodial of fauna and flora in aprks and public places	Involved in building capacity of community and also issuing of permits for access to forests
KEFRI	Forestry R&D	Building capacity of community on forest trees and use
USAID	Provided financial support	Provided funds for the venture and supporting construction of a butterfly house at Fort Jesus in Mombasa
European/American butterfly keepers	Butterfly Market	Provide market for the pupae
Community members	Butterfly keepers	Changed from forest destroyer to conservers. Formulated several local innovations.

5. History / dynamics of the innovation process

Figure 3: Main phases of the innovation process from t0 to the present



T0: Destruction of forest fauna and flora

Before the advent of the initiative, the communities used to destroy the fauna and flora of the forest through logging and poaching activities. This often led to constant clash with the Kenya Wildlife Service (KWS) wardens and Kenya Forest SServices (KFS) forest guards. The local peoples' view was that the forest should be cleared to give way to subsistence farming activities and this view was supported by the local politicians

TI: Introduction of butterfly farming project (1993-1994)

Nature Kenya in collaboration with the National Museums of Kenya introduced the Kipepeo butterfly farming project in 1993 in which between June and December, the groundwork for the project was completed. Butterfly species targeted for export were selected on the basis of likely demand, seasonal availability, and ease of rearing. Local larval food plants were determined and seedlings grown in a nursery at the project headquarters at Gede Ruins. Breeding techniques were developed and field tested using 25 volunteers from the community. A contract was negotiated with a U.K. entomological dealer, and export procedures were developed in consultation with the Kenya Wildlife Service (KWS) and a courier company in Mombasa. Government involvement in the project was restricted to granting approval for its operations through the District Development Committee and the issuing of export and forest access permits by KWS and Forest Department. Exports started in 1994 and by the end of the year, more than 10,000 pupae were exported. Steady growth in exports and revenues was experienced with more than 23,000 pupae exported in 1997.

T2: In situ rearing, and change to garden rearing (2003 -2004)

Initially, the practice was to enclose a butterfly eggs laden branch with a netting material and on hatching, the caterpillars would develop inside the net. This approach was challenged by

ants and other predacious insects who would devour the caterpillars. The locals changed this system to one where they constructed cages in their gardens and collected forages for the caterpillars from the forests. Soon they learnt propagation techniques of several forest trees and shrubs which they established in their own gardens. The caterpillars would be reared until pupa stage when they would then be sold during a day set aside for marketing. A market place committee was formed comprising of farmer representative and technical representative from KFS, KWS and NMK. All decisions pertaining to marketing would be made in this committee and excess pupae are exhibited in a butterfly house in the project site and is used for exhibition to visiting students and tourists.

T3: Policy induced challenges and low prices and alternatives (2005- present)

The pupae used to be packed into boxes and would be sent to Europe and United states through ordinary cargo. However, due to a policy change on trade in live specimens, the dispatch mechanism was changed and the shipping costs became prohibitive. Competition from different parts of the world also posed a challenge and this made the business less profitable. Through an exchange of unique butterfly pupae arrangement between Arabuko farmers and those in Tanzania and Western Kenya, the competition effects have been reduced a bit due to targeted marketing (niche market). However, the project in consultation with the community had to diversify into other enterprises such as wild mushroom farming and bee keeping. These are alternatives which have a bearing on the forest since this is where the mushrooms and the bees originate from and hence the conservation objective is achieved. The alternatives have been accepted by the community and considerable income is being derived form them. Initially there was no demand in the hotels for the mushrooms and this was a challenge to the farmers. In order to stimulate to stimulate demand, the project invited chefs from Malindi to a gourmet seminar and an experienced chef demonstrated how to prepare various mushroom recipes. This seminar led to an increased demand which has outstripped supply. The new alternatives have introduced a new dynamic into the process and innovation continues. The above activities led to a sense of ownership of the forest by the community and they have become 'honorary guards' and wardens and issued with cards/passes to go into the forest. While there if they spot an unauthorized person destroying the forest they report them to the official wardens. An example of the effectiveness of this approach is the thwarting of efforts to *de-gazzete* and hive off a chunk of the forest for private development during the 2003 elections when surveyors were chased away and demonstrations held which attracted the media .

6. Results & effects of the innovation process so far (adoption)

- Butterfly earnings contributed some 73% of farmers' cash incomes in 1999 - the average earnings rose to KSh 5,854 (Euro 500) more than twice the 1993 earnings of Ksh 2728 (Euro 200) per capita
- A change in attitude by the local community that led to forest conservation due to increased awareness of its importance.
- Surplus pupae are exhibited in a butterfly house at the project site which earns some revenue and also sensitizes more people to importance of the forest.
- Successful resistance to '*degazettemen*t' of the forest by local communities, national and international organizations

- A butterfly exhibition to be opened at Fort Jesus in Mombasa for butterfly display

7. Main lessons in light of the JOLISAA goals and questions

1. Change in attitude may seem a daunting task but as long as an option is availed to replace an existing option, it is perhaps lack of capacity that would discourage the shift to the new option

2.) Illiteracy does not inhibit innovation capacity of communities and integrating conservation and development can be a practical and effective strategy for natural resource management.

3. Formal skills combined with non formal skills will result to successful initiatives and omplex concepts can be customized through practical exposure

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4. Production of contract seed maize production in the Perkerra irrigation scheme

1. Identification:

Case 4:
Short title: Contract seed maize in Perkerra Irrigation scheme
Authors list:

2. The story line in a nutshell

This innovation case involves the contract production of seed maize through an arrangement between National Irrigation Board (NIB), Perkerra Irrigation scheme farmers, Kenya Seed Company, Kenya Plant Health Services (KEPHIS), Baringo teachers Savings and Credit Cooperative Society, KARI and Scheme farmers in the NIB managed Perkerra irrigation scheme.

3. Context and innovation description

Perkerra irrigation scheme is located in Marigat division of Baringo district. The area is characterised by high temperatures due to its location in the valley bottom. It is irrigated using water diverted from the Perkerra river through a canal constructed in the 1950s using labour from detainees during the struggle for Kenya's independence and was formerly referred to as the Njemps irrigation scheme. It was developed in an effort to revive irrigation activities practiced by the local people (Njemps) since the early 1900s. A report prepared in 1936 by the government Public Works Department, hydraulics branch indicated the possibility of constructing the scheme at an estimated cost of BP 19080 (in Euros 3800) (1BP=Ksh 20). The project was shelved until 1952 when funds from the African land Development pilot scheme were used and by April 1956 a total of 1500 acres had been irrigated and fenced. This work was accomplished through 1500 Mau Mau detainees.

a) Initial practice/situation, problem or opportunity being addressed and related triggers

Following commissioning of the scheme in the late 1950s, local people were encouraged to occupy plots and grow food crops. Later on, horticultural crops were introduced and the scheme became a major source of bulb onions, chilies, watermelon, and papaya for wine making. Following liberalization of markets in the 1990s, the scheme could not compete favorably with other horticultural producers. Over a period of about five years, the scheme nearly collapsed because farmers were producing what they could not market. In 1996, a partnership between the National Irrigation Board (NIB), Kenya Seed Company, Kenya Agricultural Research Institute, Kenya Plant health Inspectorate services (KEPHIS) and farmers resulted in the production of hybrid seed maize. In this arrangement, the NIB was to organize the scheme farmers and ensure adherence to the contract obligations while KARI and Ministry of Agriculture extension staff were to provide technical support while KEPHIS was to inspect the seed maize.

b) Innovative practice(s) or arrangement(s) or innovation bundle, as it evolved over the duration of the innovation process (if relevant)

Technical: Seed maize production
Closer spacing of maize
Planting of follower crops to use residual fertilizers
Hiring of specific planters for maize planting

Organizational: Synchronized cultivation by the scheme farmers
Switch from horticultural crops to maize

Institutional: Arrangements with micro finance institutions eg. Baringo Sacco

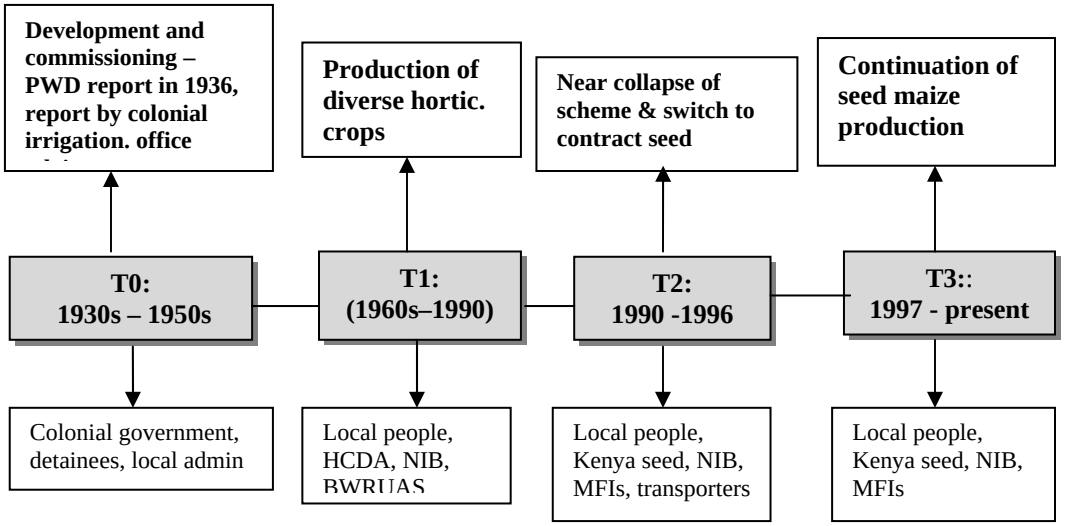
4. Main Stakeholders involved and roles in the innovation process

Table 4: Stakeholders, roles played, contributions made during the innovation process

Stakeholder	Role	Contribution
Public Works department and Agric. Department of colonial Kenya Government	In charge of scheme construction and coordination	Planning and financing construction of scheme and settling of farmers
Scheme farmers	Used to carry out traditional irrigation and continued in new scheme	Produced horticultural crops and then switched to seed under contract. Planted maize using closer spacing than recommended by the seed company
National Irrigation Board	In charge of all irrigation schemes in the country	Advices farmers on water use, manages the scheme and oversees seed production on behalf of Kenya Seed company
Kenya Plant health Inspectorate Services	In charge of seed inspection in the country	Conducts field inspection of maize crop at all stages and also after harvesting and packaging for quality and advices the producers and the client
Kenya Seed Company	Production and supply of diverse crop seeds in Kenya	Entered contract with NIB to grow seed maize and buys the produced seed
Baringo Teachers SACCO	A saving and credit organization in the region	Provides credit to seed farmers and recouped on delivery
Perkerra River Water Users Association	Coordinates water users and resolves any conflicts	Advises the irrigation scheme farmers on water use jointly with NIB

5. History / dynamics of the innovation process

Figure 4: Main phases of the innovation process from t0 to the present



T0: Development and commissioning of scheme (1930s – 1950s)
The irrigation scheme was constructed using 1500 detainees from 1952 to 1956 and on completion; the local people (Njemps) were encouraged to grow food crops. Later on, detainees who had graduated from the detention camp were allowed to practice crop production in the scheme. Production of horticultural crops was later encouraged by the ministry of agriculture and these used to be marketed through the Agricultural Development corporation.

T1 Production of Horticultural crops in scheme
Various horticultural crops like bulb onions, dried chillies, watermelon, cotton and papaya for wine making were grown for a period of 30 years but following liberalization of markets in the 1990s, the scheme could not compete favorably with other horticultural producers. The scheme nearly collapsed because farmers were producing what they could not market.

T1: Advent of contract seed maize production 1996
The Kenya seed company jointly with KARI Perkerra centre staff conducted trials on production of seed maize in the scheme and in 1996, contract arrangements were made with the National Irrigation Board for production of seed maize for low altitude areas such as Coast and Eastern Kenya. The assured market, better and prompt payments resulted in the seed maize crop becoming a turning point for crop production in the Scheme involving 672 farm households who own 3 to 4 acres of farmland.

T2 : Production of seed maize and current dynamics 1997 - present

Production of seed maize has continued and farmers have introduced their own innovations which include planting in closer spacings than the company has recommended. They also put their maize fields under horticultural crops soon as maize is harvested. The scheme farmers have been able to earn a livelihood from the scheme which could have not been the case if they insisted on horticultural crops production.

6. Results & effects of the innovation process so far (adoption)

1) Farmers have been earning reasonable amounts (Sh100 million ($1.5 million) annually) through the sale of seed maize (eg Up to Sh89,000 ($1326) per acre).
2) Increased farmer participation in day to day running has made Perkerra scheme to sustain itself.
3) The initial collaboration between the scheme farmers, NIB and Kenya seed company attracted other collaborators such as the savings and credit society
4) Farmers have learn that growing of horticultural crops in the maize off season period benefits form the residual fertilizers applied to the maize crop

7. Main lessons in light of the JOLISAA goals and questions

1) An important lesson in this scheme is that innovations have to be responsive to changed economic situations brought about by policy changes at global level.
2) While the irrigation scheme was designed as a public service with little room for private actors, the PP partnership as a working arrangement has led to the success registered in this scheme

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5. Solving conflicts by managing water use through water resources users association on River Waseges Basin in Baringo

1. Identification:

Case 5:
Short title: Management of water through water resources users association
Authors list:

2. The story line in a nutshell

This case is about how community conflicts arising out of unequal water use were solved through organization of water users within a river catchment into water user units to ensure controlled and sustainable water utilization. This was through a collaborative effort between Ministry of water, Lake Bogoria Game Reserve, Ministry of fisheries, Kenya Marine Fisheries research Institute, provincial administration and the local farmers.

3. Context and innovation description:

Context

The case is located in the Rift Valley Catchment Area which has an estimated population of four million people and faces enormous challenges in management of its limited water resources. The natural flows of water in the water courses are highly variable in space and time and the situation has been worsened by the degradation of the water catchments due to deforestation and population pressure which affect surface water availability and ground water recharge. The water quality and quantity have been adversely affected due to over-abstraction of surface water, inappropriate land use practices, soil erosion and encroachment of riparian lands. The river Waseges valley provides an example of a basin where excess abstraction has been a source of conflict between two different ethnic communities.

a) Initial practice/situation, problem or opportunity being addressed and related triggers

The Waseges River flows down a semi-arid area which receives no more than 700 mm per annum of rain. People living along the basin rely predominantly on irrigated agriculture for food and cash crops for subsistence. An Irrigation Scheme (Lari Wendani) was initiated by the irrigation department in 1984 as a way of enhancing food security and production. Currently it supports 94 families covering 25 ha. Over the years deforestation and over-abstraction within and upstream of the scheme resulted in less water available for the scheme, and downstream there was sometimes no flow for over 5 months. This led to frequent conflicts between communities living in the catchments areas of this river and the situation was worsened by the cultural differences. The Water Resource Users Association (WRUA) was therefore aimed at seeking a remedy to these conflicts that were threatening to tear the communities apart.
The water resource users' association is a forum for all beneficiaries to discuss and agree on the best way of utilizing the water resource in a sustainable way and requires the

participation of all the beneficiaries and support groups in a process that is within the legal framework and ensures sustained interest by the stakeholders. It is a representative group consisting of members of various common interest groups whose main interest is to discuss issues related to water and it is a forum that is effective for participatory management of water resource use conflicts.
The WRUA members living up and down stream were brought together by WWF so as to initiate dialogue to resolve conflict. Communities were influenced to dig pan dams for water storage and use during the dry period so as to let the river flow. The irrigation department in partnership with WWF and the fisheries department provided training and sensitization for the communities water pan dams on their individual farms then stocking them with Tilapia and cat fish. As an incentive to the farmers the fisheries department integrated fish farming into the activity providing additional income to the farmers. During the rainy season between April and September the farmers can harvest storm flow and stock fish. At the end of the period farmers harvest fish and use the stored nutrient rich water for irrigation during the dry season (October to March) without interfering with the river.

b) Innovative practice(s) or arrangement(s) or innovation bundle, as it evolved over the duration of the innovation process (if relevant)

Organizational :

Village, Locational Environmental Planning Committees (l/VECs)
Sub-Basin Management committee (SBMC),
Water resource Users Association (RW-WRUA).

Technical : Water harvesting and storage structures
Fish farming using fast growing fish
Irrigating crops from pods.

4. Main Stakeholders involved and roles in the innovation process

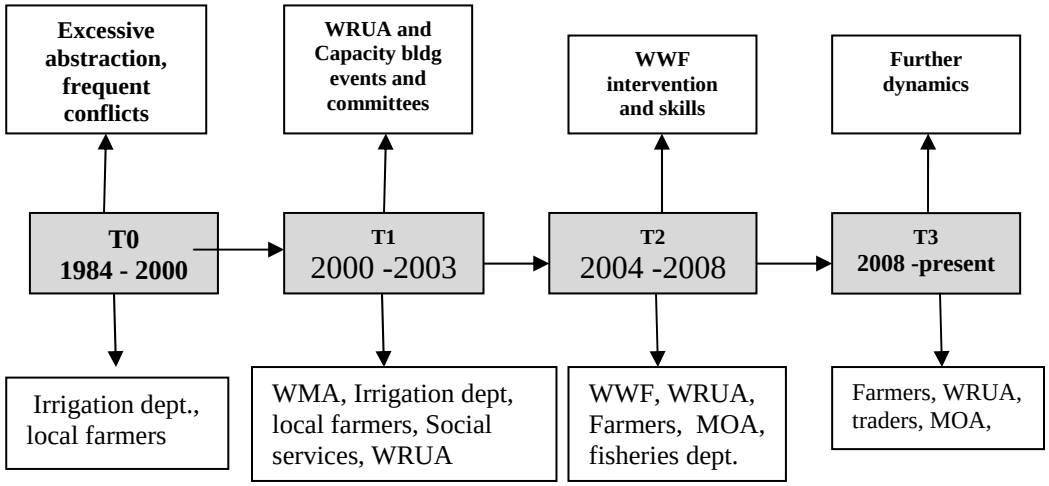
Table : Stakeholders, roles played, contributions made during the innovation process

Stakeholder	Role	Contribution
Ministry of Water	Water management and regulation docket	Interpreted policy and training on water harvesting
Lake Bogoria Game Reserve	Manages game reserve through which river flows	Participated in the capacity building and mobilization in their corporate Social responsibility
World Wildlife Fund (WWF),	Global wildlife advocacy	Provided funds for mobilization and capacity building
Farmers	Users of water in the basin	Participated in capacity building events, formed and actively participated in the VEC, LECs and WRUAs
Ministry of Fisheries, Kenya Marine Fisheries Research Institute	Provision of technical backstopping	Trained farmers on fish farming

Provincial Administration	In charge of administration and security	Coordinated adherence to the rules

5. History / dynamics of the innovation process

Figure 5: Main phases of the innovation process from t0 to the present



T0: Excessive abstraction and frequent conflicts (1984-2000)
The Lari Wendani Irrigation scheme was established by the Department of Irrigation and the local communities engaged in excessive water abstraction . This led to constant conflicts between the up and down stream communities and this was made worse by differences in the ethnic backgrounds.

T1 Formation of WWRUA, capacity building events and committees (200 -2003)
Efforts to resolve the conflict started with mobilization of the communities to discuss issues that were commonly affecting them. The sessions culminated in the formation of village and locational environment committees that later formed the Water Resource users association. The function of the committees was to coordinate operations while the individual farmers implemented the guidance of the committees with support from the various agencies.

T2 World Wildlife Fund intervention and skill deployment(2004 -2008)
The World Wildlife Fund initiated a process that culminated in the clearing of the outstanding misunderstanding between the communities. It initiated dialogue between members of the WWRUA and thereby helped them to realize that they had a common challenge. The communities were shown how to prepare earth dams, in preparation for

water harvesting and fish rearing, growing of vegetables, water and soil conservation. Owing to this approach, the water retention period of the river and everyone had enough for their use.

T3 Further dynamics (2008 - present)

Farmers in the river Waseges basin continue to harvest water but along the way they have innovated around the issues that they confront and those that pose challenges to them

6. Results & effects of the innovation process so far (adoption)

1) Farmers in the upper regions excavated water pans to capture excess water during the rainy season and use it during the dry season to remove the strain on the water river for the lower region farmers to benefit. This pan water was used for stocking fast growing fish that mature before the water is used up in irrigation and the cycle is repeated in the next year.

2) As a result of the reduced strain, Waseges River flowed continuously in August 2007 reaching the Lake Bogoria and as a result of this innovation, a drastic reduction in water use conflicts was observed.

3) The period in which river Waseges carries water was extended from four to nine months. The farmers were able to do water harvesting and storage to recharge the river and to utilize the water ponds for fish farming. As a result of this innovation, a drastic reduction in water use conflicts was observed and the period in which river Waseges carries water was extended from four to nine months.

7. Main lessons in light of the JOLISAA goals and questions

1) Innovations of a technical nature require organizational structures for sustainability. These structures require capacity strengthening for their sustainability
2) Knowledge bestowed on the beneficiaries is bound to sustain initiatives and especially when the inititative deals with critical resources.

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6. Private-Public Partnership in the management of soil acidity in Western Kenya using lime

1. Identification

Case 6:
Short title: Management of soil acidity in Western Kenya
Authors list:

2. The story line in a nutshell

This case is about how various public and private partners organized themselves to provide lime for amelioration of soil acidity in Western Kenya which led to marked improvement in crop yields and triggered social, technical and economic changes in the region.

3. Context and innovation description

Context

The Western region of Kenya, borders Uganda and it is one of Kenya's seven administrative provinces outside Nairobi located West of the Eastern Rift Valley and inhabited mainly by the Luhya people. The Kakamega Forest rainforest is part of the area and the headquarters is Kakamega town. The total population as per 1999 census was 3,358,776 inhabitants within an area of 8,361 km^2. The region has diverse physical features from the hills of Northern Bungoma to the plains bordering Lake Victoria in Busia District. The highest point in Western Province is the peak of Mount Elgon, while the lowest point is the town of Busia on the water at Lake Victoria. The entire province experiences very heavy rainfall all year round, with the long rains in the earlier months of the year. Rainfall ranges between 100 to 1400 mm and Farming is the main economic activity in this moist mid altitude zone where maize is grown for subsistence, alongside pearl millet and sorghum. Dairy farming is widely practiced, as well as the raising of poultry. The land size ranges from 3 to five acres but in some divisions, lower land size are common. The predominant crop in the region is maize, beans, cassava and sugarcane.

On-farm maize yield is too low to keep up with the rate of population growth, leading to serious food insecurity and poverty. The total maize production in the zone is about 232,000 tons, whilst consumption is approximately 387,000 tons, indicating a deficit of 155,000 tons per year. A recent survey revealed that maize yield in the area stands at 0.5 - 0.7 tons/ha., while on-farm trials indicate that 1.4 - 1.6 tons/ha can be achieved when improved maize varieties and fertilizers are applied. The low maize yield is associated with low adoption of productivity improving technologies such as improved seed, which many farmers believe is inappropriate and low or non application of fertilizers. Continuous cultivation of maize, sugar cane and fodder grasses has led to depletion of nutrients and the high precipitation levels have worsened the situation through leaching. This has rendered the soils to be acidic and in turn led to low crop yields.

a) Initial practice/situation, problem or opportunity being addressed and related triggers

Yields of maize were on a steep decline for a long time in Western Kenya and these low yields were assumed to be due to factors such as inadequate fertilizers, late planting, and some farmers even suspected that it was due to witchcraft. A study conducted by the KARI Kakamega centre scientists jointly with Moi Univeristy revealed high soil acidity (low pH) as the main cause of the low yields. Lime added to the fields drastically increased maize yields and wide scale testing was conducted to validate the findings. Lime raised the soil pH from 4.7 to 5.3 within three years and other studies showed positive response to phosphorous and lime and raised maize yields from 1 MT/ha to 4-6 MT/ha

b) Innovative practice(s) or arrangement(s) or innovation bundle, as it evolved over the duration of the innovation process (if relevant

Institutional: Private Public Partnership (several partners)
Equity Bank through '*kilimo biashara*'product

Technical : Use of lime for agricultural purpose instead of disposing
Use of lime for fish pods, tree nurseries and sugarcane
Reduced striga infestations after lime use

Organizational: CBOs to guarantee the farmers credit

Marketing: Credit to farmers *by* Agro input dealers

4. Main Stakeholders involved and roles in the innovation process

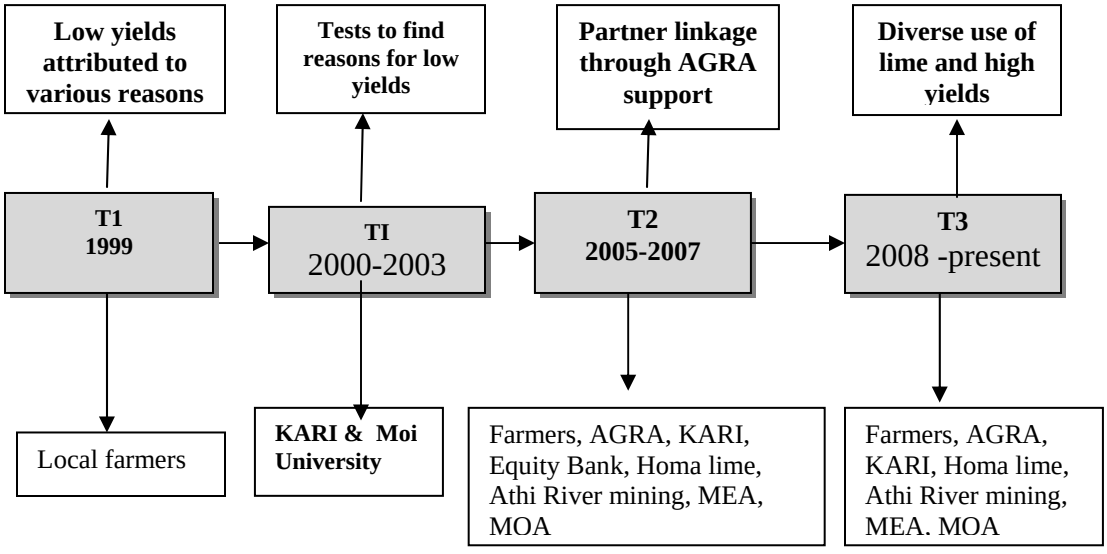
Table 6: Stakeholders, roles played, contributions made during the innovation process

Stakeholder	Role	Contribution
Equity Bank	Financial institution	Provided credit and loans to agro dealers and CBOs through support form AGRA
KARI	Research in the region	Generated and availed information about the technology
Homa lime	Lime processing plant	Supplied lime instead of disposing
Moi University	Educational institute located in the region	Developed provided information about the technology
Farmer groups and individual farmers	Owners of the land and users of the lime	Used lime to grow maize and other crops with remarkable success. They constructed bigger stores for the excess yields. Conflicts have been experienced due to past sales occasioned by low yields
CBOs,	Organized farmers into groups and served as collateral to the bank	Guaranteed credit for members

MOA	The ministry in charge of agriculture in the region	Hesitant at first and demanded a commitment by KARI scientist that compensation will be paid if results were negative. Later was convinced and supported the innovation and provided information to farmers
Provincial admin	Responsible for security and order on the region	Mobilized farmers and groups
Agro input dealers	Stock diverse inputs	Stocked lime and DAP and '*mavuno*' and advanced inputs to CBOs through the bank arrangements
Athi river mining	Fertilizer producing company	Supplied '*mavuno*' fertilizer

5. History / dynamics of the innovation process

Figure 6: Main phases of the innovation process from t0 to the present



T0: Very low yields attributed to various reasons 1999
Priori to the initiative maize yields realized by farmers were very low and this was attributed to various reasons including bewitching and other reasons. Some farmer even sold their land and moved on to other parts of the region.

TI Tests by KARI and university 200 -2003
Tests done by KARI and the university revealed that low pH was to blame for the dismal performance. A study was therefore set up to validate initial findings. This study was targeted to reach 50000 framers but at the inception of this study a controversy ensued where the Ministry of Agriculture representatives sought to discredit the findings from

research. They successfully convinced the district agricultural committee that the study was a trial and error exercise that would lead to farmers incurring high losses. This was with reference to the aspect of lending lime and fertilizers to the farmers that would be repaid back with some interest. The scientists were required to commit themselves in writing that if the farmers crop yields did not improve; they would be compensated with an equivalent amount of grain like what was expected from the experimental plots. The project scientist signed this commitment on behalf of the other partners (*ref. signed commitment and minutes of the DAC*). Arrangements to avail lime were made through coming together of various partners.

T2: Linkage arrangements and AGRA support 2005 -2007
Partners as listed in table above came together through an arrangement supported by AGRA and each played a role commensurate with their areas of specialization. The bank provided credit and loans to the various partners in order to make the lime available. Consequently what used to be a waste product in the lime factory became a useful yield enhancing product.

T3: Successful and diverse lime use and high yields 2008 -present
Farmers applied lime in their maize fields but also tried it out on other crops and enterprises with marked success. As a result of their own experiments other actors like the sugar companies were stimulated into engaging in lime testing activities among sugar cane growers. Agro input stores have been established throughout the region to sell the product and contribute towards yield improvement.

6. Results & effects of the innovation process so far (adoption)

1. Equity Bank financed various Agro dealers to the tune of Ksh 15M (83000 Euros) to stock lime while CBOS and the Provincial Administration mobilized the farmers. Due to the success of the project some stakeholders have donated free inputs for setting up demonstration plots in the new districts. Homa lime Company donated 200 bags of lime for widespread demonstration while Athi river mining company gave 50 bags of Mavuno fertilizer outside the formal project.

2. Despite the fact that there is no formal MOU signed between these partners, such contributions are a sure sign of commitment to the success of the project. Agro input stockists have been motivated to open businesses in many market centers which since the farmers have realized the significance of these inputs and hence provide a ready market.

3. Lime sales have increased dramatically and yields have equally improved. The acidity of the soils has been reduced and farmers who had sold land due to low yields are reclaiming it. Farmers are now able to engage in other activities that have to do with their improved welfare.

7. Main lessons in light of the JOLISAA goals and questions

- A technical innovation can significantly affect a social and economic system and its sustainability will rely on the importance of the innovation in the social system of an area.

- Partnerships should not always be formed between partners who share mandates. A non conventional partner like the bank and the lime producing factory has led to the success of the initiative. What started off between KARI , the Univerity and the farmer has led to a multiplicity of partners and each playing a crucial role towards the successof this innovation

- An important innovation can be killed by sceptism from an actor within the Innovation system and this may have been the case with this innovation if it were not for the insistence of one actor - the researcher

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4. Woomer,P.L, Okalebo, JR, Maritim, H.K, Obura, P. Mwaura, F.Nekesa, P., Mukhwana,E:2003 PREP-PAC: a nutrient replenishment product designed for smallholders in western Kenya

7. Public-Private -Partnership for commercial production of Gaddam sorghum in Makueni county, Eastern Kenya

1. Identification

Case number 7

Short Title: Commercialization of Gaddam sorghum variety in Makueni

Authors' list:

2. The story line in a nutshell

This case involves the partnership between several public and private partners to commercially produce Gaddam sorghum for beer malting by the East African Malting company a subsidiary of the Kenya Breweries Company. It involved the mobilization of farmers into sorghum production cells to aggregate sorghum inot quantitites that could economically be collected. This arrangement also made the advisory work of the extension easier.

3. Context innovation description

Mwingi District in Eastern province where this innovation is based is characterized by prolonged and frequent droughts with reduced rainfall. The communities living in these regions are agro-pastoralists growing both crops and keeping livestock. Sorghum production using traditional varieties has a history in the region as one of the drought tolerant crops that farmers grow but utilization for a long time had been limited to a few recipes. Its production had however reduced due to low prices and changing feeding habits in favor of maize and rice products.

Initial practice / situation, problem or opportunity being addressed and related triggers

The East Africa Breweries Limited (EABL) initiated a strategy to diversify its malt beer production from the more expensive barley to sorghum. Barley's increased global demand and the high shipping costs led to increase in beer prices and hence affected sales and the drive to replace barley with sorghum started. The company requires 60000 tonnes of barley every year and the intention is to substitute three quarters of this amount. The company started by sourcing Sorghum from Uganda but quality and quantity were not satisfactory. Kenya Agricultural Research Institute (KARI) had a sorghum variety (Gaddam El hamam) with good malting qualities and the two organizations entered into a partnership to commercially grow the Gaddam sorghum. SMART Logistics Company joined in the partnership as well as the Ministry of Agriculture and Equity Bank and all trying to support the farmers to produce the sorghum

Innovative practice(s) or arrangement(s) or innovation bundle, as it evolved over the duration of the innovation process

- Technical innovation:
    - New beer brands using sorghum.
    - Diverting birds from sorghum using sunflower and millet

- New sorghum-wheat blend recipes thus reducing demand for wheat
- Ware house receipt upon collection of sorghum

- Institutional innovation:
  - Contract between EABL and SMART Logistics
  - Partnership arrangement between EABL, KARI and MOA
  - Contract between SMART logistics and small holder farmers for collection and delivery of sorghum.
  - Equity bank special account for payment of farmers

4. Main Stakeholders involved and their roles in the innovation process

Table 7: Stakeholders, roles played, contributions made during the innovation process

Stakeholders	**Roles,**	**contribution, and phases of involvement**
Farmers' production cells (eg Mwikiliye Self Help Group etc).	Responsible for collective production of sorghum	Produced gaddam sorghum grain, • Contributed their farming practices (land, labor and other resources), • Assisted in monitoring, • Guarantee members input credit • Aggregating produce • Value addition of sorghum
KARI-Katumani Seed Unit	Responsible for production of open pollinated seeds (Gadam sorghum being one of them)	• Provision of quality seed and Research on emerging issues • Provide technical support to ensure good quality sorghum delivery to EAML
East African Malting limited –(Subsidiary of East African Breweries Ltd)	Responsible for malting raw materials for beer production	• Made decision to use gaddam sorghum for malt beer • Provided a guaranteed market
Ministry of Agriculture & Provincial Administration	Responsible for extension within the sorghum area	• Sensitized and mobilized farmers Capacity building, • Identifying markets for surplus grain
SMART Logistics	Arranges sorghum collection and delivery to the	• Collect grain from farmers. • Links EAMLand the seller (farmers), • Arranges farmer payments

	clients	through warehouse receipt
Equity Bank	Financial institution	• Pays farmers for sorghum delivered • Avails low interest credit to farmers • Builds farmers business capacity
USAID	Aid agency	Provided funds for threshers, dryers

To grow the sorghum farmers were organized into production cells following a stakeholder sensitization attended by government, public sector and private sector institutions. The cells have a membership of up to 25-30 members and comprise of both new and existent groups spread within the Mwingi District. An example is Mwikiliye Self Help Group with a current membership of 36 people having started with 10 in 1994.

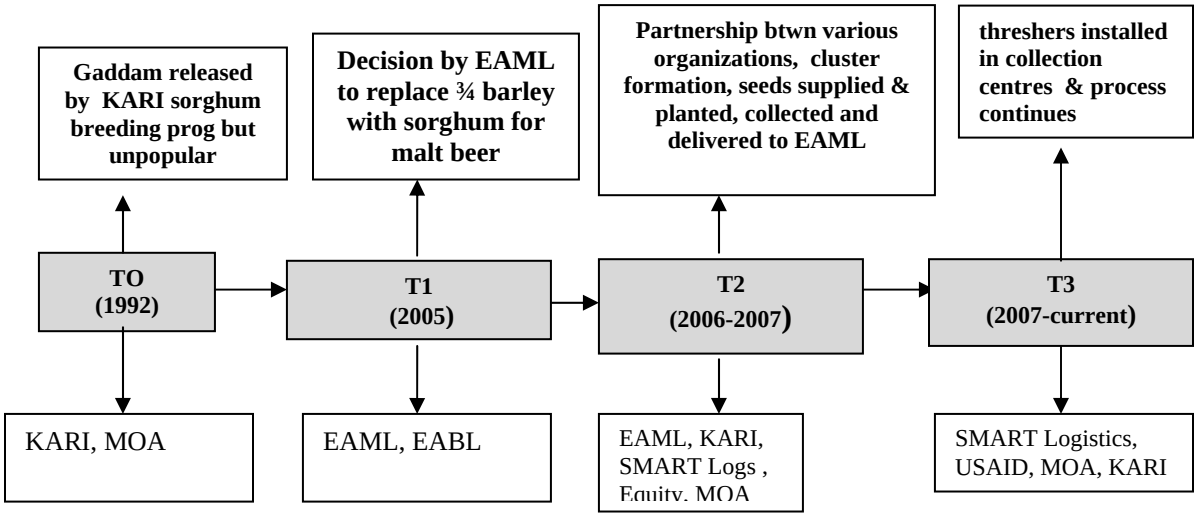
East Africa Breweries Ltd (EABL) is East Africa's leading branded alcohol beverage business with outstanding collection of beer and spirits brands for its wide diversity of consumers. This large network across the region demands diversity of products. East Africa Malting Ltd (EAML) is a wholly owned subsidiary of East Africa Breweries Ltd.

SMART Logistics was contracted by EAML to source the grains from the small holder farmers in Eastern province and supply to the beer company. The proprietor of this company is a former employee of EABL in the purchasing department

Equity bank offers low interest rate loans to farmers to purchase seeds and other farm inputs required for the production of gaddam sorghum and also pays the farmers promptly after the sorghum is delivered to SMAT Logistics..

5. History / dynamics of the innovation process

Figure 7: Main phases of the innovation process from t0 to the present



T0: Gaddam released by the Sorghum breeding programme (1992)
KARI officially released Gaddam el Hamam sorghum as a selection from its sorghum breeding programme. It is a white sorghum variety which is early maturing short in stature and suitable for cultivation in arid and semi-arid areas. The sorghum variety did not gain in popularity owing to its high bird damage susceptibility. In the year 2004, gaddam was reintroduced and it received mixed reactions from the farmers who complained that although the yields were good, lack of markets, low producer prices and bird damage constrained the production.

T1: Decision by EAML to replace ¾ barley with Sorghum for malt beer (2005-2006)
Owing to a barley price increase caused by increased global barley demand and high shipping costs, EABL through its subsidiary EAML decided to replace ¾ of the 60000 tons per year of barley used for malt beer. The company sourced the sorghum from Uganda and Tanzania but the quality and quantity were not satisfactory and then they entered into talks with KARI to explore the possibility of getting it from Kenya.

T2: EAML, KARI, SMART Logisitcs and Equity enter into partnership, sensitization of farmers and clusters formation (2007-2008)
The talks with KARI led to creation of a partnership in which KARI was to supply Gaddam seeds, EAML was to buy the grain and SMART Logisitcs was to organize for aggregation and quality assurance of the grain from the collection centres. Equity Bank was also included to do the payment to the farmers on presentation of warehouse receipts issued by SMART Logistics. Following the formation of partnership, the stakeholders led by KARI , Ministry of Agriculture and the provincial administration went on a sensitization campaign where farmers were organized into production clusters. The clusters comprised of between 15 – 20

members who were then trained on sorghum management practices. Each member was to plant an acre of Gaddam sorghum and follow all the management practices.

T3: Seeds supplied to production clusters and collected by SMART Logistics (2009/2010)

Following the sensitization, the cluster members were supplied with 4kg of good quality Gaddam sorghum seeds by KARI to be grown on an acre of land. This was followed by training on sorghum production practices from planting to harvesting by KARI and the Ministry of Agriculture staff. This training was followed by regular backstopping visits by the researchers and extension staff until harvesting time. At harvest, the farmers harvested the heads, threshed and separated the large grain from the small grains and delivered the former to the collection centres. These collection centres were in schools, churches, chiefs' centres and other such public paces. The SMART Logistics team then visited all the centers and assessed the grain for quality upon which was weighed and a warehouse receipt issued. This receipt is the one presented at the Equity bank counter for payment to the farmer. Production of Gaddam has now taken place for three years and more areas have requested inclusion in the activity. The SMART Logistics company has invested in some sorghum mobile sorghum threshers to be installed in strategic locations within the production areas. Equity bank has set up a mobile phone money transfer facility called M-kesho to be used for paying sorghum farmers. Additionally, Equity bank has set up agency banking services at various shopping centres and businesses which additionally makes the payment process easy.

6. Results & effects of the innovation process so far (adoption)

- The gaddam sorghum has been accepted by the community due to the market opportunity provided by EABL.
- Improved livelihoods and better eating habits:, Several families said they were used to one or two meals a day composed of maize and beans and now have three meals composed of a variety of dishes.
- The bank avails low interest loans which help the farmers out of their financial predicaments.
- SMART Logistics brought in their experience and knowledge of private enterprise
- Seven (7) stores have been constructed in Eastern region as collection points by SMART Logistics in collaboration with other partners like USAID, threshing and winnowing machines installed.
- The current infrastructure installed is wining the youth to agriculture as they are involved in post harvest which is more enticing than actual production.
- In 2009, only 3,000 farmers joined in to start the production and they delivered 100tones worth 1.7million Ksh after planting 15 tonnes of seeds. In 2010/11 short rains the amount of seeds planted was 200 tonnes increasing the demand for seeds.

7. Main lessons in light of the JOLISAA goals and questions

- A gender consideration in innovation projects is important for its success since where women are consulted by the development agency, husbands may not agree with the decisions or requirements of the innovation process.
- Partnership where roles are well shared is a good avenue for joint learning and capacity building.
- Innovation in agriculture needs to be aligned with the market and it is important to first understand what the gaps are in the market arena and then produce to fill the gap.

8. Key references

1. Daily Nation (2011) Brewers turn to sorghum as imports costs skyrocket - By Kitavi Mutua
2. Karanja, D.R., Kamau, C.K.. Ariithi, C.K., Kisilu, R., Kavoi, J. Kariuki, C. Wafula, J. Miano, D.and Ayemba, J.(2011) Improving food security and incomes for farmers in semi-arid areas through commercialization of sorghum Gaddam Production and marketing model with small-scale farmers. Poster
3. KARI Annual reports (2009)
4. The Standard Newspape (2011) Sorghum now green gold for residents of dry Eastern Kenya. By Wandera Ojanji, on 23rd September 2011.

8. The introduction and cultivation of oil palm tree for income generation in Western Kenya

1. Identification

Case number 8

Short Title: Oil palm introduction and cultivation in Western Kenya

Authors' list and affiliation:

2. The story line in a nutshell

The case is about the introduction of cold-tolerant, high yielding oil palm into Western Kenya by various international and national actors jointly with the local faremrs to help enhance the edible oil production of the region and to provide income and improve people's health through its Vitamin A and E richness.

3. Context and Innovation description

Context

Western Kenya is an area with a favorable climate which is conducive for production of annual and perennial crops. Rainfall is seasonal and reliable (1000-2400mm pa) and suitable for a range of both tropical and semi-tropical crops. Temperatures range between 12-30^{o} C. Agriculture is the main economic activity in the region where farmers produce mainly maize, groundnuts, vegetables, annual oil seed crops and livestock for subsistence use. Their main cash crops are coffee, tea and sugarcane. The farms have become fragmented (1-3 acres) as a result of increased populations. The climatic condition favorable for oil palm production in some parts of the region are said to be better than or comparable to Malaysia conditions due to the evenly distributed rainfall and more cumulative sunshine intensity.

Initial practice / situation, problem or opportunity being addressed and related triggers

Oil palm was introduced into the area following successful research and production of Cold-Tolerant Oil Palm by FAO researchers. The introduction of oil palm was viewed as an opportunity to reduce the country's dependence on imported edible oils. The tree was also viewed as an important cash crop to the local communities and was anticipated to improve health status as it contains precursors to Vitamin A & E. It does not compete against food crops or native vegetation and it stabilizes the soil thus reduces soil erosion. The trees start bearing after four years and thereafter continue bearing up to 35 years.

Innovative practice(s) or arrangement(s) or innovation bundle, as it evolved over the duration of the innovation process

- *Technical innovation:* Introduction of oil palm

  Adaptation of tree to Western Kenya

Harvesting of mature fruit bunches using a power saw
Manual extraction of oil using simple extractors
Use of palm leaf mid ribs for construction and joinery

- *Marketing innovation*: Local marketing and consumption at domestic level.
  Marketing through local networks

- *Institutional* : Seedling Distribution arrangement with Mumias sugar
  Setting up a nursery at Mabanga Agricultural Training Centre

4. Main Stakeholders involved and their roles in the innovation process

Table 8: Stakeholders, roles played, contributions made during the innovation process

Stakeholders	**Roles**	**Contribution**
FAO	Provision of technical and financial support	Introduced the crop in 2001 and funded the project
Mumia Sugar Company (MSC)	Sugar company	Hardening nursery for seedlings and also active in seedling dissemination
KARI-Kakamega	Research on diverse crops	Technical backstopping for innovation development and currently in a joint FAO/TCP project researching on Tissue Culture
Ministry of Agriculture	Provides extension services	Mobilized the farmers into learning groups and scaling out of oil palm growing regions
Agricultural Training Center (Mabanga Agricultural Training Centre)	Provide hands on training to farmers	Provided sites for hardening nurseries and dissemination
Farmers	Grow diverse crops	- Collected seedlings from nurseries and planted them -Process the kernels for edible oil Innovated around oil palm cultivation

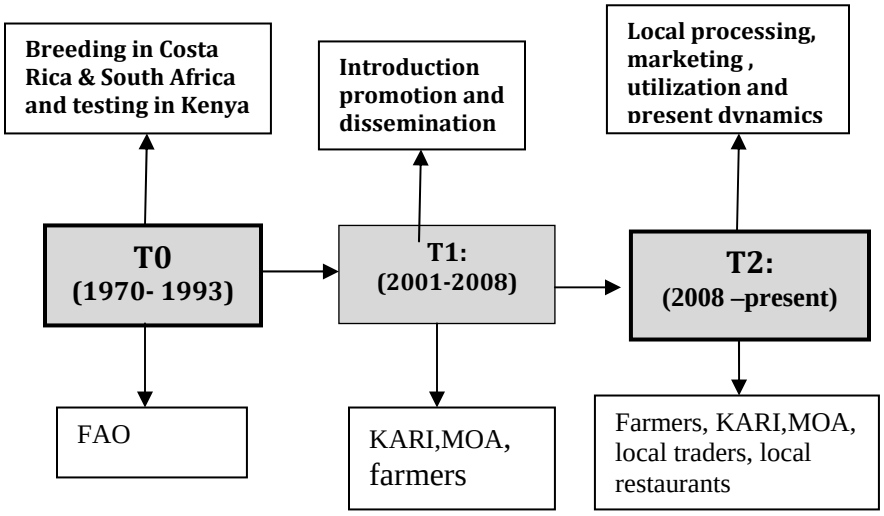
FAO in its programme on integrated production systems supported Cold Tolerant Oil Palm (CTOP) in its portfolio of agricultural oil crops.

Mumia Sugar Company (MSC) is the largest agro-industrial producer in the region and has huge investment in cane production and processing as a public company. At the start of the project, MSC farm estates in partnership with FAO and KARI spearheaded the planting of the oil palm. The company as said by farmers seems to have lost interest as they recently

uprooted their already established oil palm estates. The reason to this was not very clear but had to do with change of management and its national mandate.

5. History / dynamics of the innovation process

Figure 8: Main phases of the innovation process from t0 to the present



T0 Breeding of Cold Tolerant Palm in Costa Rica and South Africa and testing in Kenya and other countries (1970 -1993):

The FAO scientists first noted the potential of oil palm in Tanzania and Cameroon highlands in 1970s. This was the *dura* type, a low producing variety which produces fruits with a low volume of pulp. This was crossed with high yielding varieties from Costa Rica. FAO returned to Southern Africa (including Kenya) from Costa Rica with 17 lines of the resulting hybrid in 1993. Experimental plots were set up in Kenya and other parts of Africa. This produced the new hybrid variety of cold-tolerant, high-yielding oil palm (CTOP).

T1: Introduction, promotion and dissemination (2001 -2008)

The palms were later introduced commercially in 2001 by FAO into Western Kenya and promoted for production The seedlings were planted in large polythene bags at the Mumias Sugar Company and also at Mabanga ATC. . Farmers would collect the palms and technical information pertaining to planting and other cultural practices was provided by the technical staff in the nurseries. Since its introduction, 90,000 trees have been distributed to the farmers who are now producing an average of 3-10 liters of oil per week for local consumption as well as sale for income generation.

The farmers have been using knowledge from research as well as their local knowledge to manage the crop. An example is the use of power saw for harvesting. This knowledge although used by a few farmers has proved to drastically reduce harvesting labor where one hundred and twenty (120) trees can be harvested in one (1) hour using diesel that costs Ksh 350 (3 Euros). Conventional harvesting using the Malaysian knife takes close to 50% of the labor involved in oil palm production. Another area where farmers have used their local knowledge is in the manual processing, domestic utilization and local marketing.

T2: Processing, marketing, utilization and present dynamics in the IS (2008 –present)
The farmers extract oil by using simple oil extraction equipments for their domestic and local market demand. The oil is largely unknown in local restaurants but as production increases and cost of buying other conventional oils becomes prohibitive, there is increased demand for the oil palm. This is as witnessed by an ex-clergy man who is now a farmer who pointed out that there is a high demand form neighbours and even from as far as Kisumu and Nairobi. The planting materials are only available in Mumia Sugar Company (MSC) and the Mabanga ATC and according to the farmers such nurseries should be decentralized to make access easier. It would reduce the cost of one seeding which stands at 500ksh (5Euros) which is considered high for the smallholder farmers. The uprooting of the MSC palm oils is sending mixed signals to the farmers as well as the partners.

6.Results & effects of the innovation process so far (adoption)

- It is currently not clear of the significant results and effects of oil palm as it is a long term innovation. Its projected benefits will depend on demand and supply in food oils and the ability of Kenyan producers to meet the competitive pricing of foreign producers.

- A source of income as the produced oil is sold locally at ksh 150 (Euro 1.5)per litre

7.Main lessons in light of the JOLISAA goals and questions

- Institutional rigidity and attachment to defined goals can hinder the progress of an innovation as is being realized with Mumias Sugar Company. This is inspite of the advantages of diversifctaion that Oil palm provides to this area and the company could seize the opportunity to be a trail blazer.

- There is need for transparency and accountability at the initiation of any innovation that involves multi stakeholders to reduce the flow of inaccurate information.

8.Key references

1) Chinchilla, M. I. Carlos. 2003. Consultant report to FAO on Agronomic performance of introduced cold tolerant (stress tolerant) Oil palm germplasm in Western Kenya. Mission of June, 2003. ASD de Costa Rica, S.A. San Jose, Costa Rica, 28 p

2) Kenya Agricultural Research Institute – Kakamega 2008 Annual Report

3) Oil World. (1999). Oil World 1999 Annual Report. ISTA Mielke, GmbH, Hamburg, Germany.

4) Steel,P., Griffee, P., Western Kenya and the potential for Oil Palm. FAO Agricultural Department. http://www.fao.org/ag/ /oilpalm.pdf

9. Institutional framework engaged by goat breeders associations in Kitui and Mwingi District

1. Identification

Caser number 9

Short Title: Goat breeders association in Kitui and Mwingi District

Authors' list and affiliation:

2. The story line in a nutshell

The case is about how introduction of Togenberg goats by FARMAFRICA, Ministry of Livestock and Local administration for crossing with local goats in Mwingi and Kitui counties improved milk production and performance leading to improved livelihoods for the farmers in the community. Training of Community Animal Health Workers identified form among the community members enhanced the sustainability of the initiative

3. Context and innovation description

Context

Kitui and Mwingi Districts are located in the Eastern Province of Kenya and are classified as arid and semi arid areas of Kenya. Mwingi district has a population of 384,948, and a population growth rate of 2.4 per cent (2009 population census). Over 58% of the population lives below the poverty line (Mwingi District Development Plan 2008-2012). The district experienced poor rainfall and total crop failure for the main crop of maize, sorghum, millet, beans and peas in 2005/2006 short rains season. Most rivers are dry through most of the year, water levels in the shallow wells dug near streams either gets significantly low or dry up during the dry periods and the population has to walk long distances in search of water for both domestic use and livestock watering.Relief food (*mwolio)* is supplied to the community and this occurs almost every year. The communities living in the two districts practice agro-pastoralism where they keep livestock and practice crop farming during the rainy season. Their main rains occur in the months of October to December but occasionally, these rains may fail for periods of up to two or three years.

a)Initial practice / situation, problem or opportunity being addressed and related triggers

This innovation was initiated by an NGO called FARM Africa in the year 2004 with the aim of improving the lives of the farmers in the community. The selection of these people was done through the local administration where a total of 1050 very poor people were selected in several locations of Mwingi and Kitui Districts. These people were then taken through a training to expose them to goat management practices and following this training and construction of goat houses, the Togenberg goats were introduced. These goats were to be used for crossing with the local goats. In this process, a farmer was selected to be the Buck keeper which was to be used by the community members and another farm was used as the breeding station where pure Togenberg goats and bucks were maintained. To take care of the goats health community animal health workers (CAHWs) were trained on basic health

issues. The CAHWs worked very closely with the government and private veterinary officers. A crossing scheme was established where a pure goat and a local goat produced a 50% cross and this was back crossed to a pure to produce a 75% or ¾ cross. The crossing would then stop since this was the most stable level. During the dry season, the goats are fed on local acacia pods which improves their performance. To avoid in breeding, exchanging if bucks is practiced at regular intervals and the buck station custodian maintains good records of all the matings in their stations. These records are availed to the Dairy Goat Association of Kenya and are very crucial for marketing purposes. A local savings scheme has been introduced where farmers save some money to be borrowed in times of need.

b) Innovative practice(s) or arrangement(s) or innovation bundle, as it evolved over the duration of the innovation process

Technical: Community Animal Health Workers (CAHWs)
Crossing scheme
Buck station
Pods for supplementing goats in dry season
Upgrading of non members goats through members buck at a fee

Organizational: Local Savings and credit cooperative

Institutional innovation: Goat Keepers association run by a management committee.

4.Main Stakeholders involved and their roles in the innovation process

Table 9: Stakeholders, roles played, contributions made during the innovation process

Stakeholder	Role	Contribution
Farm Africa	Initiated project	Introduced the goats and provided capacity building to the communities
Dairy Goats Association of Kenya	Regulation of dairy goat breeding	Registers dairy goat keeping groups Maintains records for the dairy goats kept here and for the country Keeps track of available goats for marketing purposes
Veterinary services	Health of the goats	Treat the goats and also advice the farmers Train Community Animal health workers
Community Animal Health workers	Jointly with veterinary services took care of goats health	Treat the goats and also advice the farmers Work closely with private and public veterinary officers

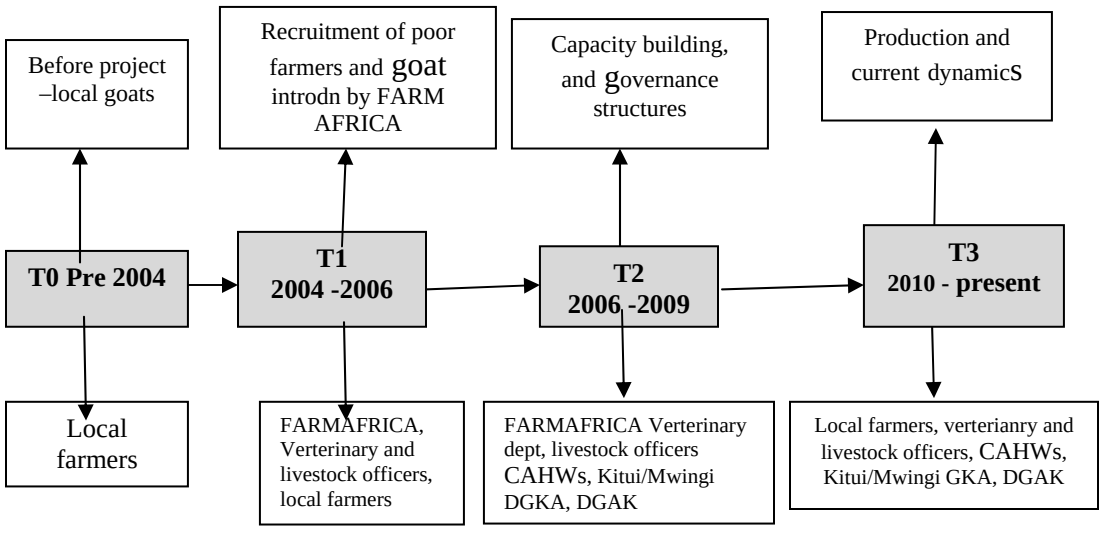
Dairy Goat keepers at different levels (ordinary, breeders, buck keepers, officials of locational, divisional and district goat keepers association)	Play different roles in the process	Tend the different goat classes – ordinary goats, breeding stock, bucks

Farm Africa is a registered charity in the UK founded in 1985. It works with the marginalized poor farmers in Africa to grow more food, keep their livestock healthy, make a basic living and manage their natural resources in a sustainable way.

Community Animal Health workers are members of the community who are taken through some basic training on maintenance of goat health and basic diagnosis of common goat diseases and abnormalities. They do goat hoof trimming, dehorning and de-worming. They are also trained on which conditions require veterinary doctors attention. The village, divisional and district level goat keepers structures are the governing organs of the system and decisions are made at these levels. They all link with the national dairy goat keepers association. They maintain traceable records and help these farmers track the goats in their area. Any goats sold must be traceable (from birth and before) and prices are fixed. Non members may sell through this structure but prices are lower.

5.History / dynamics of the innovation process

Figure 9: Main phases of the innovation process from t0 to the present



T0: Before project –local goats - pre 2004

This was characterized by abject poverty as the communities had few livelihood options and used to rely on food handouts. Their living conditions were generally very low.

T1: Recruitment of poor farmers and goat introduction by FARM AFRICA -2004-2006

FARM AFRICA came into the area in 1996 and recruited 1050 poor people. They selected the poorest of the poor based on a scale developed with the community and these were provided with the initial stock and capacity building was done where basic goat management skills were introduced.

T2: Capacity building, CAHW recruitment and governance structures-2006-2009

A capacity building activity followed where CAHWs were recruited and governancestructures were put in place and following on stabilization of the structures, the FARM AFRICA staff moved to other areas and the community was left to continue

T3: Production of goats and current dynamics -2010-present

The community has continued maintaining the production of dairy goats and produce milk which they sell to non goat keepers and they are currently trying to come up with ways of selling this milk out of their immediate neighborhood. They have been participating in agricultural shows and especially the Nairobi International trade fair where they have scooped many prizes as depicted by photos with ministers and other dignitaries. The goats have transformed the area and dignitaries like Kofi Anan and others have visited to witness the transformation. The breeding station has a thriving flock of pure Togenbergs with three month old goat kids selling at Ksh 25000 (250 Euros) each. They are fed on local tree pods and other feeds purchased from the shops. The community health workers is a model that works very well since there are very few veterinary officers in this area.

6. Results & effects of the innovation process so far (adoption) (< 1/2 p.)

1. The training of the poor communities members as CAHWs enabled them to earn a livelihood as they charge the other community members for services offered.
2. Goat milk provides community members with income as well as nutrition
3. Sale of goats to other areas or even within earns the members reasonable income
4. The community members are often sought by other communities to train them on goat keeping skills
5. DGAK still contacts these farmers whenever they get buyers of goats and also when society goats need to be taken for shows
6. A pure breeding station was established for purpose of establishing new groups.

7.Main lessons in light of the JOLISAA goals and questions (< 1/3 p.)

- For any innovation to be successful, community capacity building is important.
- Community ownership of current challenges and the desire to improve it leaves a lasting mark even after the departure of other stakeholders

8.Key references (5-6 max., < ¼ p.)

1. Ojango, J.M.K., Ahuya, C., Mwai, A.O. and Rege, J.E.O. 2010. The FARM-Africa dairy goat improvement project in Kenya: A case study. AGTR Case Study. Nairobi, Kenya: ILRI.

2. Peacock, C., Ahuya, C.,Ojang,J.,Okeyo,A. 2010 Practical crossbreeding for improved livelihoods in developing countries: The FARM Africa goat project.LivestockScience **V**ol. 136, Issue 1, March 2011, Pages 38–44

10. Improvement of farmer livelihoods through mango processing and marketing.

1.Identification

Case 10

Short title : Mango production, processing and marketing

Authors' list and affiliation:

2. The story line in a nutshell: what is this case all about in 4-5lines?

This case is about the improvement of livelihood of a community by several public and private sector stakeholders who introduced proceessing and marketing of mangoes in an area that had no other significant source of income.

3. Context and innovation d*escription*

Mbeere is an arid and semi arid area which experiences low rainfall amounts and food shortages are a frequent occurrence. The inhabitants of the area practice mixed farming where they mainly depend on food crops such as peas, sorghum, green grams and millets. They also keep bees and grow dry land crops like sorghums and millets. Their main source of income is from the on farmer activities and this is often a challenge due to the low rainfall amounts.

a) Initial practice / situation, problem or opportunity being addressed and related triggers

Prior to 1999, farmers in Mbeere area operated at subsistence level with no surpluses to generate income. They mainly depended on food crops such as peas, sorghum, green grams and millets. The area was found suitable for mango production as exhibited by the good performance of the local mangoes and hence improving mango production was identified as an alternative livelihood option.

b) Innovative practice(s) or arrangement(s) or innovation bundle, as it evolved over the duration of the innovation process

Technical : Mango dryer
Drying of mangoes
Mango grafting
Use of trap to monitor mango pests
Use of wild melon for moisture preservation
Use of cement bags and large plastic for raising root stocks

Top working (Grafting of mature trees) to change the variety

Organizational : Mango production and marketing groups
Mango producers Association

Institutional : Farmers' processors' links

4.Main Stakeholders involved and their roles in the innovation process (1/2 p.)

b. Table 10: stakeholders, roles played, contributions made (resources, knowledge, etc), phase(s) of involvement (by making reference to phases drawn in Figure 1)

Stakeholder	**Role**	**Contribution**
Kamurugu Integrated Agricultural Development Initiative (KADI)	NGO involved in development issues of the Kamurugu area	Spearheaded the PRAs that identified mango Set up a mango drying facility Linked farmers with processors
Ministry of Agriculture	Involved in extension matters in the area	Provided capacity building to farmers Conducted Safe use of pesticides training
Kenya Agricultural Research Institute (KARI)	Involved in research and development work in the region	Provided technical backstopping Supplied grafted mangoes
Various processors – Azuri etc	Processing of mango	Buy dried mangoes and products
Kenya Federation of Agricultural producers (KENFAP)	Involved with organizing farmers/producers into associations	Organized for farmers to join mango producers Association
Mango growers	Actual production and drying of the mangoes	Grow, process and market mangoes to schools and other local outlets
Agro dealers eg Twiga chemicals, Bayer EA.	Sell agro chemicals for crop protection	Provide agro chemicals and capacity building to farmers
GTZ	NGO involved with development in the region	Links farmers to markets and capacity building in value chains

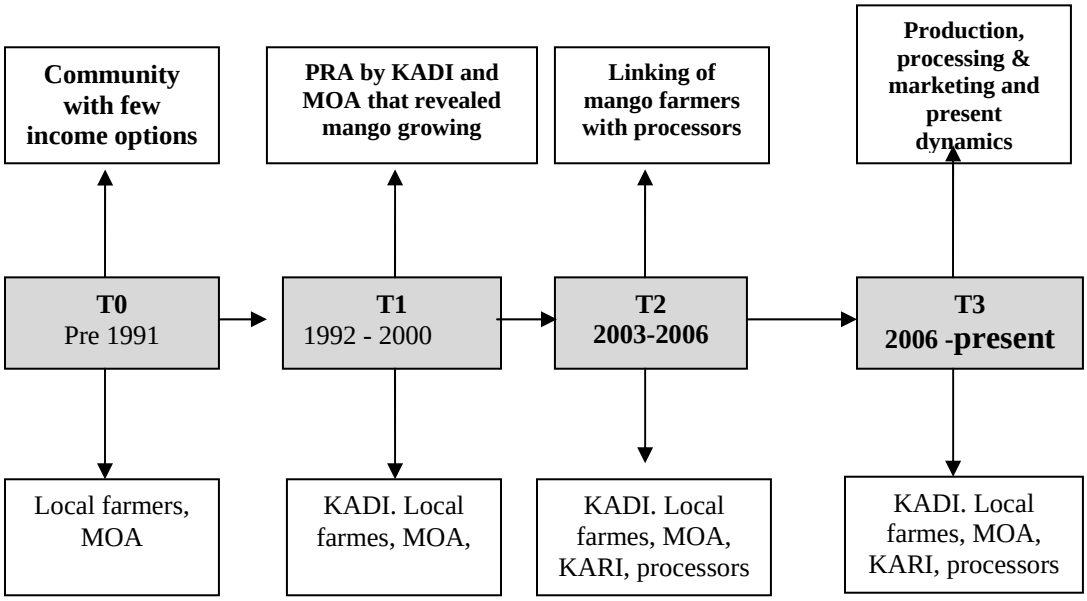
Agro processors have been buying the dried mangoes to be used for blending with other products. The prices have however not been favorable for the farmers when the cost of production is taken into consideration

The Kenya Ministry of Agriculture jointly with KARI have embarked on a project aimed at establishing fruit fly free zones in order to enable export of Kenyan mangoes which are currently not allowed for export in the international market

Agro dealers such as Bayer chemicals have been involved in capacity building besides supply of pesticides eg the scouting of pests etc

5.History / dynamics of the innovation process (1 p.)

Figure : synthesized graphical representation of the main phases of the innovation process



T0: Community with few income options -Pre 1991

Prior to 1991, farmers in this region used to rely on subsistence farming for their own food and very little income. Their standard of living was low and frequent hunger was a common occurrence

T1: PRA by KADI and MOA that revealed mango growing (1992 -2000)

KADI in collaboration with the ministry of agriculture conducted a PRA which revealed that improvement of mango production was a viable income generating activity. The NGO and the ministry of agriculture trained the farmers on good mango management practices and they consulted KARI for grafted mango seedlings. KARI supplied the mangoes and also trained the farmers on how to manage the seedlings. Farmers managed the mangoes and production improved. To manage pests an diseases, agro suppliers like Bayer chemicals and others were invited to train the farmers and also supply appropriate chemicals. The Kenya Bureau of standards was also included for certification purposes.

T2: Linking of mango farmers with processors (2003 -2006)
To market this perishable crop, value addition was necessary and KADI purchased mango dryers and availed them for use by farmers who dried their mangoes and packed them. KADI contacted processors in Nairobi who liked the products and henceforth started buying these dried products. Such processors were like Azuri products, fine crafts and others. Other mangoes were sold to the local market and schools.

T3: Present dynamics (2008 – present)

Production, processing and marketing still continues and other players like GTZ have come in to train further on value chain operations. The farmers are also involved in paw paw production as well as bee keeping. The farmers have also brought in their local knowledge to bear in the process where for example they use the fruit of a wild melon plant to maintain moisture especially to raise the young seedlings. They also use cement bags and other large water proof bags to raise local root stock seedlings which they graft when at an advanced age unlike the normal grafting where seedlings are grafted when of pencil thickness. This approach enhances percentage graft take (number of grafted plants that survive). Challenges encountered include low prices offered by the processors and also the fact that some of the members often sell their mangoes at farm gate to middle men who offer meager prices.

7.Main lessons in light of the JOLISAA goals and questions (< 1/3 p.)

1. Building on an existent innovations provides a rich ground for more innovation

8.Key references:

1. Njeru, G 2003. Livelihood diversification and entrepreneurship: an analysis of production and marketing innovations in smallholder farming in a rural Kenyan district, 2. Mbeere Griesbach, J Mango growing in Kenya

11. Small input packs for promotion of yield enhancing inputs

Identification:

Caser number 11

Short Title: Testing small inputs packs for enhanced uptake

Authors' list and affiliation: Kamau G, Teresiah, N and Kirigua V.

2 .The story line in a nutshell: what is this case all about in 4-5lines?

This case involves empowerment of smallholder farmers to conduct own experimentation with small input packs whose aim was to facilitate a "learn-by-doing" by farmers on their own farms and thereafter look for the farm input stockist to purchase larger quantities of the inputs. The case involved a Non Governmental Organization, KARI, Input manufacturers, agro dealers, extension officers, Community/village Extension workers and the farmers.

3.Context and innovation description

Western Kenya is characterized by high rainfall amounts which are suitable for growing of various food and cash crops. The yields obtained are however low due to a number of factors with a major one being low user knowledge on the yield enhancing innovations. This is due to the fact that farmers are often informed about the new innovations without being given a chance to test them.

a) Initial practice/situation, problem or opportunity being addressed and related triggers

Demonstrations, shows, field days and road shows have always been the conventional approach to introduction of new inputs. The farmers are then expected to make decisions on which inputs to use based on these visual experiences. No opportunity is provided in this approach for the farmers to get some experiences with the new inputs

b) Innovative practice(s) or arrangement(s) or innovation bundle, as it evolved over the duration of the innovation process (if relevant

Technical: **S**mall input packs for awareness and testing –Ksh 10 or 20 worth of seed
Accompanying inputs in pack (eg seed, fertilizer, insecticide etc)

Institutional: FIPS collaboration with agro-dealers, Extension and KARI
Production of smaller affordable quantities of inputs eg 10kg of fertilizer etc

Organizational: Village approach with a village extension worker
Use of market places to advertise the inputs

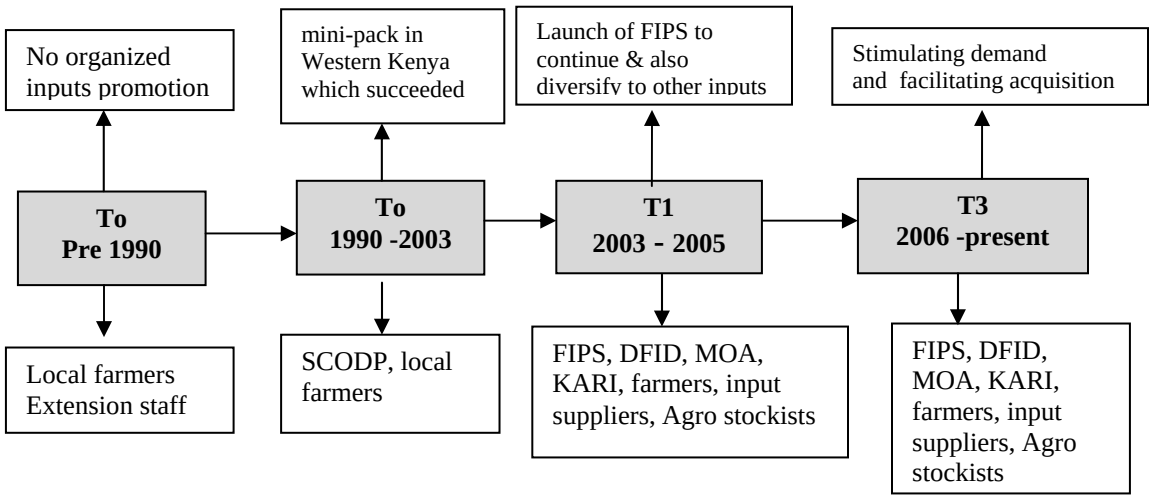
4.Main Stakeholders involved and roles in the innovation process (1/2 p.)

Table 11: stakeholders, roles played, contributions made (resources, knowledge, etc), phase(s) of involvement (by making reference to phases drawn in Figure 1)

Stakeholder	Role	Contribution
Farm Input Promotion services	Promoted input use	- Stimulated farmer demand for small pack fertilizer, seeds, insecticides and herbicides- -Promoted village-based agricultural advisors, village input suppliers and facilitate increased farmers' access to agricultural inputs -Promoted sector partnerships with research centres, fertilizer and seed companies and stimulated inputs markets through increased demand and supply by local agro-input suppliers
Athi River Mining, Monsanto, Lachlan and Western Seed company	Provided fertilizers, pesticides and seeds for testing	Supply FIPS with 'mavuno ' fertilizer, Round up max herbicide, Sprintor dust and Ws 501 for testing by the farmers and stocking by the agro dealers
National Agricultural Extension Program (MOA)	Offers agricultural extension service to farmers	- Facilitated stakeholder forums to link many actors at regional (district) levels to set agendas and collaborate in selected initiatives - Provided technical (extension) support in production - Facilitated implementation of policy and program coordination (lead agency)
Kenya Maize Development Program	Service providers to maize farmers	Provided information of maize trends and new varieties in the market
Kenya Agricultural Research Instittue	Provided information on various inputs	Worked closely with FIPS on new information of inputs
Agro input dealers	Stock inputs	Collaborated with FIPS in bulk supply of inputs
Farmers	Use inputs	Participated in testing, acquisition and use of inputs

5.History / dynamics of the innovation process (1 p.)

a) **<u>Figure 11</u>**: Synthesized graphical representation of the main phases of the innovation process from t0 to the present (max. **4-5 phases**, less if possible)



T0: No organized inputs promotion (Pre 1990)

Prior to the 1990s, there was no organized promotion of inputs in Western Kenya or for that matter any part of the country. Extension services were in place but of a general nature

T1: Sustainable Community Development Programme (1990 -2003):

This NGO started a programme in Siaya (Western Kenya) to popularize maize fertilizers. The aim of the NGO was to make appropriate fertilizers available to farmers who could not afford this important yield enhancing input. They therefore embarked on process where they identified the nutrients limiting production in various areas; they raised awareness about this particular nutrient and thereafter stocked the particular nutrient. They also encouraged farmers to test these nutrients through small packs stocked in their shops weighing 100g to 200g. Links with Ministry of agriculture combined with leaflets and colored posters at stockists shops helped farmers to understand the inputs. Awareness Raising campaigns were also hosted in schools, churches and other public places.

T1: Launch of FIPS to continue with SCODP work and diversify (2003-2005)

FIPS not for Profit Company was created as an offshoot of the SCODP project to facilitate up scaling of the SCODP program to the high potential areas of Kenya. Being a commercial entity, the company was able to deal more effectively with input suppliers. The company used partnership with farmers and with relevant stakeholders including research centres, ministry, NGOs and input suppliers to establish the yield limiting factors in any one area. Once established, sources of these inputs were identified and discussions with relevant organizations would see the production of mini packs. These minipacks would range

anything between 1 kg of fertilizer costing Ksh 30 and a free 150g of new seed variety. The FIPS operators would tour the market places and with a megaphone talk about the characteristics of the new seed. The farmers would use these minipacks as a low risk means of testing these new innovations. The company also would establish FFS and embark on a campaign to introduce other management practices. Another approach would be to give 30 bean seeds and ask for 300 seeds I n return and this would contribute towards seed bulking while still leaving the farmer with enough seeds for next seasons planting.

T2: Further involvement and current dynamics (2005 –present)

FIPS has entered into various partnerships with public bodies including the Kenya Maize Development programme under USAID support. This project has been concentrating on the high potential areas but has also expanded into the low marginal areas with substantial success. FPS has also entered into partnerships with Athi River Mining who produce Mavuno fertilizers. The company decided to blend the DAP fertilizer to include other nutrients and for every kilogramme of fertilizer bought farmers would get 150g of seed. Monsanto company that is involved in herbicide sale introduced Round Up max for conservation tillage through a mini combi that was enough for 5x10m. The mini combi included 1kg of '*mavuno'*, 150g of DK 8071 seed, 10gm of Round Up max and a 1 liter hand sprayer all at a cost of Ksh 8 0 (1$). Lachlan company an agent of Dow chemicals also sold Sprintor Dust for control of larger grain borer in 150gm tins but previously only available in 1kg tins. Western Seed also entered into a partnership with FIPS and sold their new lysine rich maize seeds WS 501 using small packs and a packet of fertilizer.

6.Results & effects of the innovation process so far (adoption) (< 1/2 p.)

- In 2003, Athi River Mining sold 0.5 tonnes of 'mavuno' fertilizer but one year later sold 86 tonnes and by 2004, they were selling 800 tonnes of fertilizer.
- Western seed sold 5 tonnes initially in 2003 but this rose to 30 tonnes in 2004.
- Over 80% of the users reported excellent, very good or good results from the use of these fertilizers while 94% reported that they would buy more quantities of the fertilizers in the following season.
- Over 90% of the respondents reported an increase in the consumption of the daily staples –maize and sorghum

7.Main lessons in light of the JOLISAA goals and questions (< 1/3 p.)

- A proper and participatory assessment and understanding of the market will more often than not result to success
- A small start up company can stimulate establishment of new institutional models for scaling up

8. Key references (5-6 max., < ¼ p.)

1. Blackie M and Albright, K (2005) : Lessons learning study of the farm inputs promotion services project in Kenya with a special focus on PPP for input provision and implications for regional up scaling. DFID publication

12. Dairy milk production processing and marketing in Meru

Identification:

Case number 12

Short Title: Authors' list and affiliation:

2.The story line in a nutshell: what is this case all about in 4-5lines?

The focus of this case is how farmers in collaboration with a NGO, Ministry of livestock, KARI, ministry of cooperatives were able to organize the production, collection, processing and marketing of goat milk. This was triggered by decreasing land holdings, and financial resource limitations in Meru which limited farmers' ability to keep dairy cattle for milk production.

3. Context and innovation d*escription*

Meru is situated about 3 kilometres North of the equator, at approximately 1700 metres altitude, in an area of mixed forest and clearings on the North east slopes of Mount Kenya. It is a high potential area which is densely populated. The area serves as an important producer of coffee grown at high-altitudes in the volcanic soils of the district.

a) Initial practice/situation, problem or opportunity being addressed and related triggers

The inhabitants of Meru are mixed farmers who do crop farming and also keep livestock. Before the advent o the dairy goats, local goats with low milk production and low weight gain rates were kept. This was in addition to cattle whose large land requirement led to non viability of the enterprise. High dairy yielding goats were therefore a suitable alternative.

b) Innovative practice(s) or arrangement(s) or innovation bundle, as it evolved over the duration of the innovation process (if relevant

Technical:	processing of milk into yoghurt Community Animal health workers Improved fodder trees and shrubs Goat records
Organizational:	Meru dairy goat breeders association Collection and delivery of milk using bicycles and motor bikes
Institutional :	Farm Africa links with Ministry of Livestock, KARI, GTL and Dairy Goat Association of Kenya (DGAK)

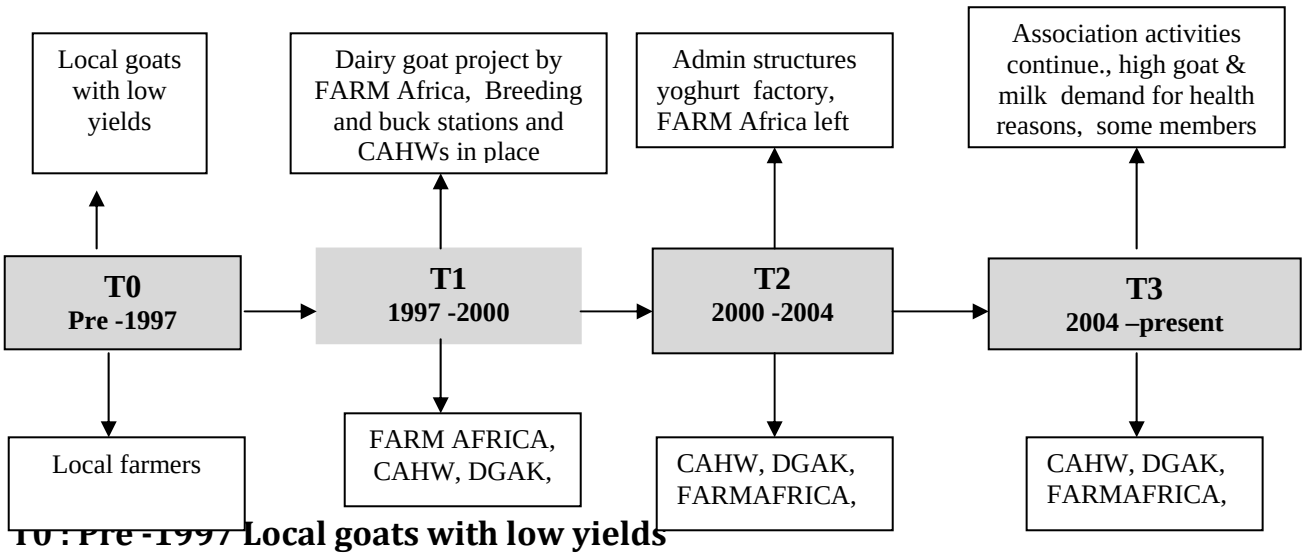
4.Main Stakeholders involved and roles in the innovation process (1/2 p.)

a) **Table 12**: stakeholders, roles played, contributions made (resources, knowledge, etc), phase(s) of involvement (by making reference to phases drawn in Figure 1)

Stakeholder	Role	Contribution
Farm Africa	NGO that serves poor farmers	Introduced exotic goats Build capacity of local community Helped establish breeders records
Community Animal health workers	Provide basic health services	Managed the health of the animals
Ministry of Livestock development	Provision of extension services	Provided technical support and linked goat keepers to markets
Kenya Agricultural Research Institute	Provide research and devept services	Provided fodder trees and also built capacity of goat keepers
Goat Keepers	keeping goats	Maintained the goats Used own knowledge to supplement what was provided – eg local shrubs with veterinary value
Processors	Responsible for processing	Processed the raw milk and added value through products like yoghurt and fresh milk Advised the goat keepers on milk quality issues
Meru Goat Breeders association (MGBA) Dairy Goat Association of Kenya (DGAK) , Kenya Dairy development Network (KEGODEN)	Various roles	Umbrella organizations that helped manage the project Helped maintain the records Coordinated marketing of pedigree goat sand crosses

5.History / dynamics of the innovation process (1 p.)

Figure 12: synthesized graphical representation of the main phases of the innovation process from t0 to the present (max. **4-5 phases**, less if possible)



T0 : Pre -1997 Local goats with low yields

Local goats kept by the community with low milk yields and also low weight gains. Cattle kept but many farmers cannot afford due to reduced land size owing to to population pressure.

T1 : Dairy goat project by FARM Africa, Breeding and buck stations and CAHWs put in place -1997-2000

FARM Africa, a UK based NGO starts the goat project targeting to the poor in the community. The NGO started with capacity building of the community on goat management practices. Goat houses were constructed and thereafter some of the farmers were selected to provide the breeding and buck stations. Community Animal health workers trained and commissioned to advice goat keepers on health concerns. Local goats are upgraded through a crossing scheme where a 25% cross is upgraded to 50% and ultimately to 75%. This last level is said to be the best since it perseveres adverse conditions better than the pure and also produces more milk than the local.

T2 : Administrative structures established and FARM Africa handed over the project 2000 -2004

Administrative structures starting from the village level to the district were established. They included village, locational, divisional goat keepers association and an umbrella body Meru Goat breeders association were established with each playing a role at its level. A Kenya Goat development network (KEGODEN) and a Dairy Goat Association of Kenya (DGAK) were formed to coordinate goat keeping issues in Kenya and also in the region.

T3 : Association activities continue - 2004 –present

Association activities continued and a yoghurt factory. There was a very high goat demand and some of the community members became resource persons to new clients who would buy goats form the MGBA. The yoghurt processing plant acquired a cooling plant which they use to cool the milk after pasteurization and then it is packed and distributed to supermarkets. Some processors form Nairobi have approached the factory management to explore possibilities of sending the milk to Nairobi due to the high demand.

NB: Make sure to describe the current (last) stage of development of the innovation.

5. Results & effects of the innovation process so far (adoption)

- Farmer groups grew from an initial ten of 25 each (250 farmers) to more than 160 (4000 farmers) within the project area, while another 56 were formed thirteen divisions from original five.
- Toggenburg goats population grew from the initial 130 to more than 1,000 in a period of 10 years
- New groups were also formed in other areas of the country including Mwingi, Kitui and Western Kenya
- Milk production increased from about a quarter of a litre by indigenous goats up to 2 litres by 75% exotic goats.

- Prices of breeding goats within the community ranged from $25 for an indigenous goat to US $154 for a crossbred and US $415 for a pure-bred Toggenburg

6. Main lessons in light of the JOLISAA goals and questions (< 1/3 p.)

- Blending of local and improved innovations can lead to successful initiatives if supported by proper institutional structures

7. Key references (5-6 max., < ¼ p.)

1. FARM-Africa, (2003). Delivering affordable and quality animal health services to Kenya's rural poor. FARM-Africa's experiences. FARM-Africa Pb, ed.

2. Ahuya CO, Okeyo AM, Kitalyi A, Mutia P, Murithi FM, (2003). Farm-Africa dairy goat and animal healthcare project: a successful case of agricultural research and sustainable development partnership. Global Forum on Agricultural Research (GFAR), May 22-24, 2003. Dakar Senegal.

3. Ahuya C, Ojango JMK, Mosi RO, Peacock C, Okeyo AM, in press. Performance of Toggenburg dairy goats in smallholder production systems of the eastern highlands of Kenya. Small Ruminant Research.

4. Peacock C, (2008). Dairy goat development in East Africa: A replicable model for smallholders? Small Ruminant Research 77: 225-238

13. Tissue culture bananas for small scale producers in Kenya

Identification:

Caser number 13

Short Title:

Authors' list and affiliation:

2. The story line in a nutshell: what is this case all about in 4-5lines?

This case involves the introduction of Tissue Culture banana propagation through a collaborative effort of the government, non government organization, private sector and the farmers . The technique was widely adopted by smallholder farmers in response to declining banana caused pest and disease nfestation – and in particular, the Panama disease, S*igatoka,* weevils and nematode complexes. The acceptance of the innovation exceeded the *ex ante* scepticism of its viability.

3*. Context and innovation description*

Central Kenya is characterized by high rainfall amounts which are suitable for growing of various food and cash crops including bananas. The yields obtained are however low with a major reason being use of poor agronomic practices..

a) Initial practice/situation, problem or opportunity being addressed and related triggers

Banana production in many parts of Kenya was and still remains a common practice. Different banana varieties are grown for different uses and the source of planting material has always been through suckers obtained from old orchards. This practice has phytosanitary implications since the suckers are transferred to the new site together with soil and plant materials that end up transferring harmful pathogens as well as pests if present. The innovation was therefore triggered by reduction in productivity of conventional banana orchards due to a complex of pest and diseases resulting to a steep rise in the price of bananas making them unaffordable to the common Kenyan citizenry. This complex was attributed to lack of clean planting material and a banana yields decline of up to 90% thus leading to the beginnings of tissue culture banana propagation.

b) Innovative practice(s) or arrangement(s) or innovation bundle, as it evolved over the duration of the innovation process (if relevant

Technical: TC banana seedlings
De-suckering iron

Organizational: Community-based approach - Banana production groups
Banana growers 'association

Institutional: Links between ISAAA and others

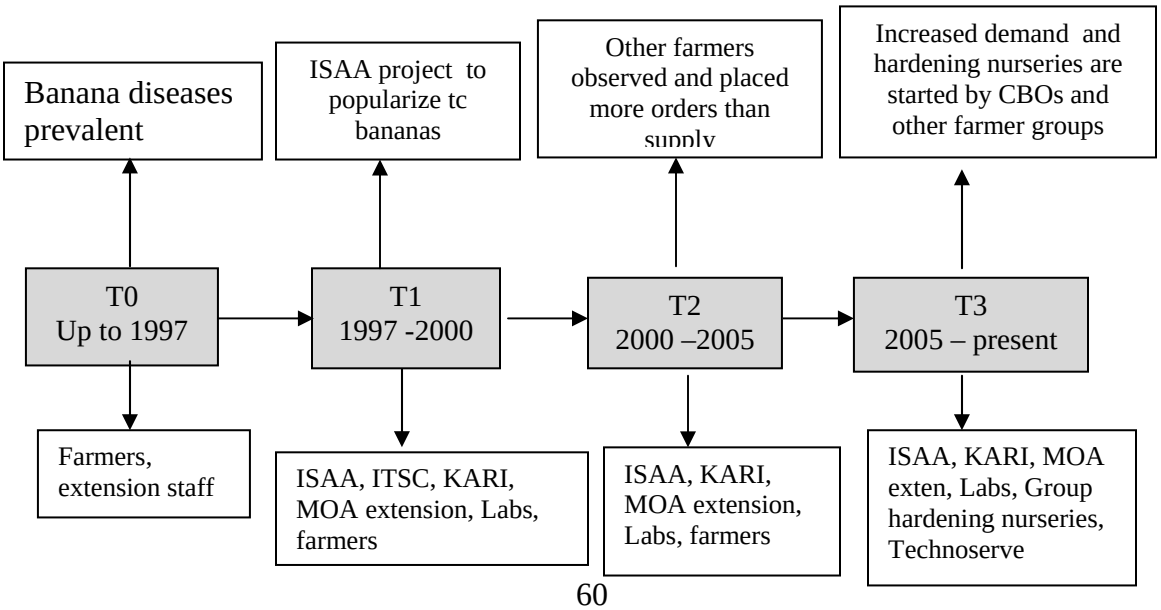
4. Main Stakeholders involved and roles in the innovation process (1/2 p.)

b) **Table 13**: stakeholders, roles played, contributions made (resources, knowledge, etc), phase(s) of involvement (by making reference to phases drawn in Figure 1)

Stakeholder	Role	Contribution
International Service for Acquisiton of Agro-Biotechnologies(ISAA) and Institute of Tropical and Sub tropical crops((ITSC)	Financed TC banana project	Sourced the tc and built capacity of farmers Launched a micro credit scheme Technical backstopping
Gentics Technologies Laboratories (GTL)	Multiplied TC bananas and sold to farmers	Produced and supplied tc bananas
KARI	Research on bananas	Capacity building and later set up laboratories
Ministry of Agriculture	Extension to banana farmers	Provided banana management skills thro' extension programmes Mobilized farmers into groups
Banana growers, CBOS and farmer groups	Grew and hardened seedlings	Participated in capacity building events and also Used local knowledge in growing managing orchards Managed the hardening nurseries
Technoserve	Helped to market bananas (market linkages)	Helped to link farmers to markets

5.History / dynamics of the innovation process (1 p.)

b) **Figure 13**: synthesized graphical representation of the main phases of the innovation process from t0 to the present (max. **4-5 phases**, less if possible)



T0: Use of suckers from old orchards and launch of Tc technique 1990 -97

Prior to the 1990s a banana farmers used suckers form old orchards which would be uprooted and planted into new areas without taking any precautionary measures in terms of sanitation. A serious problem occurred and wiped out a lot of banana orchards in the banana growing areas of Central Kenya. This necessitated introduction of a system of propagation that would ensure clean planting material and Banana tissue culture propagation technique was introduced. The introduction was done by The tissue culture project was launched in 1997 through the International Service of acquisition of agrobiotechnologies (ISAAA) in collaboration with KARI and genetic technologies laboratories (GTL).

T1: Biotechnology to benefit small scale banana producers – 1997 -2000

Upon the launch of the project and with a view to availing the tc bananas to farmers a project entitled "Biotechnology to Benefit Small-Scale Banana Producers in Kenya" Project, was initiated in 1997. Funding was from the Rockefeller Foundation of the United States of America and the International Development Research Centre (IDRC) of Canada. It was implemented by ISAAA, with KARI as the host institute, working closely with other strategic partners, such as the Genetic Technology Laboratory (GTL) in Kenya for the production of tc-banana plantlets, the Institute of Tropical and Sub-tropical Crops (ITSC) of South Africa in the provision of technical backstopping services, amongst others. The project was a holistic pilot project to assess the service impact of introducing TC bananas to 150 small holders in the Kenya's four major banana growing areas. The farmers were advanced 80 banana plantlets each which is the economical banana orchard unit which they were to pay at harvest time. This micro-credit scheme worked very well and at the end of the first season farmers were willing to expand their banana orchards after paying off their credit.

T2: Up-scaling of the tissue culture bananas to more farmers in other areas 2000- 2005.

When other farmers observed the performance of the tissue culture bananas and as the Ministry of agriculture, KARI and ISAA built the capacity of farmers more farmers got interested and placed many orders for the tc bananas. Laboratories were initiated in various institutions and yet the demand continued outstripping the supply.

T3: Demand increases and hardening nurseries operated by CBOs are started - 2005 – present

As demand outstripped the supply, CBOs were encouraged to establish hardening nurseries where they would receive very young tc plantlets and harden in the nursery in readiness for planting in their orchards. This helped to ease the demand and pressure on the labs allowing them to increase their output since they required very little time to produce the very young plantlets. This is currently the model being used by most laboratories and as the CBOs sell out the plants to farmers they scoop the cost of maintaining the seedlings. Other partners also joined in to help in marketing of the bananas with an example being Technoserve

limited. Issues have been raised about the tc since their field life is not as long as that of the traditional bananas. The management practices are also higher and this has also raised concerns.

6. Results & effects of the innovation process so far (adoption) (< 1/2 p.)

i. Increase in the quality and yields of bananas (30kg weight cf 10-15kg).
ii. 500,000 Small Scale banana producers benefit from tissue culture.
iii. Annual benefits of US$1.574 million on an investment of US$ 0.669 million.
iv. Uniformity in maturity thus facilitating bulk marketing

7. Main lessons in light of the JOLISAA goals and questions (< 1/3 p.)

- A seemingly complex innovation can be customized for purpose by involving the users at an early stage

8.Key references (5-6 max., < ¼ p.)

1. Africasciencenews (2007) Africa: TC Banana not for small scale farmers Publication date: 12/12/2007

2. Wambugu, F (2004) Food, Nutrition and Economic Empowerment: The Case for Scaling up the Tissue Culture Banana Project to the Rest of Africa. Paper presented at the NEPAD/IGAD regional conference "Agricultural Successes in the Greater Horn of Africa" Nairobi, November 22-25, 2004

3. Wambugu F. and Kiome, R. (2001). The benefits of Biotechnology for small holder banana farmers in Kenya, ISAAA briefs No. 22. ISAAA: Itahca, NY.

4. Mbogoh, G. S., Wambugu, F, Wakhusama, S. (2003) Socio-economic Impact of Biotechnology Applications: Some Lessons from the Pilot Tissue- Culture (tc) Banana Production Promotion Project in Kenya, 1997-2002 A Contributed Paper Submission for the XXV IAAE Conference August 2003, Durban, South Africa

14. Finger millet seed saving and out-scaling in Machakos district

1. Identification:
Caser number 14

Short Title: Finger millet nurseries
Authors' list and affiliation:

2. The story line in a nutshell: what is this case all about in 4-5lines?

This case involves efforts to re- introduce finger millet in semi arid areas of Kenya through a collaborative effort between the department of adult education, ministyr of agriculture, provincial administration and the local community. The effort involved raising of millet seedlings in a nursery a month before the onset of rains. These seedlings are transplanted to the field at the onset of rains and this gives them a head start as compared to sees planted directly in the field. The nurseries are out-scaled using adult literacy classes education where the nursery concept is used as a practical lesson in the classses.

3. Context and innovation description

Machakos district and Eastern province in general experiences semi –arid climatic conditions characterized by prolonged and frequent droughts with reduced rainfall. The crops grown here include drought tolerant ones such as sorghums, millets and pulses. The average farm sizes vary from area to area with some districts having up to 15 hectares to others with 3hectares. Population pressure i slow apart from in the hill masses where they tend to be high. Income generating activities are limited in the area. The framers often sell their produce immediately after harvest thus getting very little since the prices are often very low.

a) Initial practice/situation, problem or opportunity being addressed and related triggers

Conventional production of finger millet in Eastern Kenya entails land preparation, seed broadcasting and thereafter covering the same using a tree branch. This results to excessive use of seed, loss of seed to birds before coverage and this in turn gives poor stand establishment and intensive labour usage during weeding. This has led to a decline in finger millet production even though it is a drought tolerant crop. The cost of the grain has therefore gone very high making it unaffordable to many small holder farmers.

b) Innovative practice(s) or arrangement(s) or innovation bundle, as it evolved over the duration of the innovation process (if relevant

Technical: Finger millet nursery
Transplanting of millet seedlings

Organizational **:** Use of adult literacy classes for out-scaling

Institutional: Links between Adult literacy, Ministry of Agriculture and KARI

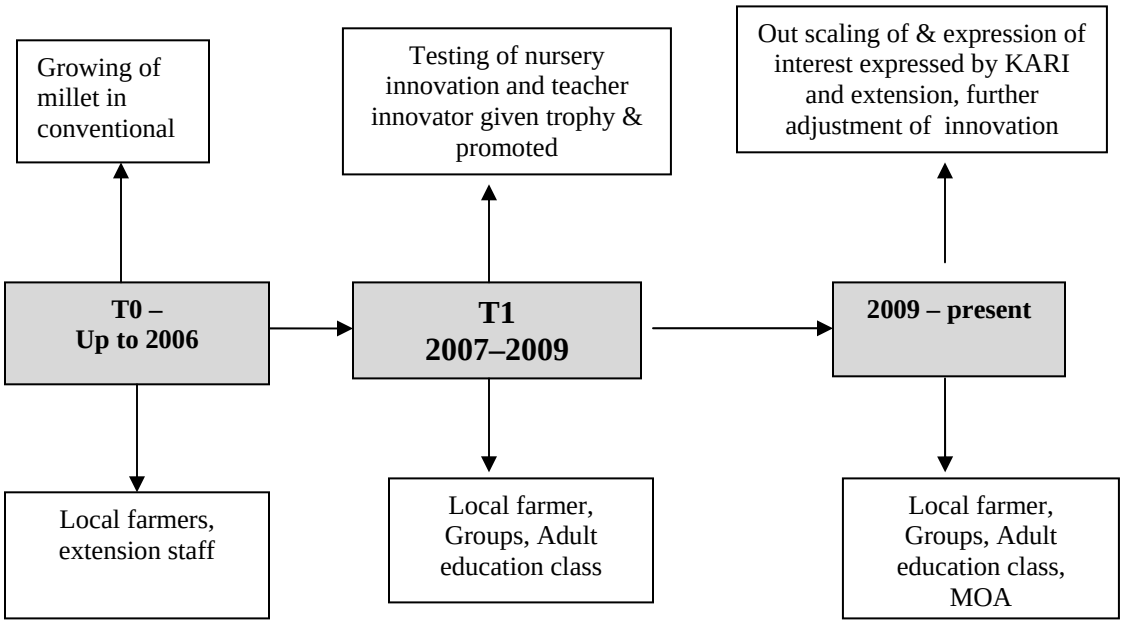
4. Main Stakeholders involved and roles in the innovation process (1/2 p.)

c) **Table 14**: stakeholders, roles played, contributions made (resources, knowledge, etc), phase(s) of involvement (by making reference to phases drawn in Figure 1)

Stakeholder	Roles	Contribution
Department of Adult Education	Responsible for adult education	Allowed their classes to be used to test the innovation Awarded innovator a trophy
Ministry of Agriculture	Extension service provision	Provided extension support to farmers
Local administration	In charge of administration	Allowed their public meeting to be used to publicize the innovation
Famers, farmer groups	Growing of food crops	Participated in the testing of innovation and its deployment
Adult education learners	Adult learners in the adult literacy classes	Tested the innovation Used local knowledge such as washing roots
KARI	Source of some of the millet materials	Provided guidelines on how to deploy innovation and also involved in further testing

5.History / dynamics of the innovation process (1 p.)

c) **Figure 14**: synthesized graphical representation of the main phases of the innovation process from t0 to the present (max. **4-5 phases**, less if possible)



T0 - Up to 2006 Growing of millet in conventional way

Farmers grew the millet in the conventional way and thereby used a lot of seed, lost many to birds thus giving poor stand establishment and intensive labour usage during weeding. Very poor yields were harvested and many farmers got discouraged

T1: Testing of nursery innovation and teacher innovator given trophy & promoted2007–2009

Adult education teacher in Machakos, Kalama division tried out finger millet establishment through a nursery. The innovation gives the transplanted seedling a head start over seedlings established through direct planting. The innovation targets utilization of available moisture; avoids seed loss through birds and utilizes minimum seed quantities. Due to the interest by the learners, the teacher registered most students in his class and his employer recognized his efforts and awarded him a trophy and promoted him for his efforts.

T3: Out scaling of & expression of interest expressed by KARI and extension, further adjustment of innovation 2009 – present

The teacher and uses his adult education class as a mechanism through which to out-scale the innovation by introducing the nursery as a practical lesson in his class besides the numeric and literacy classes. The case comes to the notice of KARI through PROLINNOVA and scientists got interested and wrote a proposal on further testing of difffere3nt millet varieties. Farmers also continue innovating and started growing the millet in polythene bags and tins to save on water use and also ensure a uniform crop.

6.Results & effects of the innovation process so far (adoption) (< 1/2 p.)

- Re-introduction of finger millet in the area
- Use of less seeds
- Higher yields – (up to three (3) 90 kg bags from half an acre)
- Many farmers in the division have taken up the practice

7.Main lessons in light of the JOLISAA goals and questions (< 1/3 p.)

- Farmers if encouraged by existent institutions can also produce useful innovations

8.Key references (5-6 max., < ¼ p.)

1. Kavoi et al (2010) Finger millet as a seed saving innovation . Presented during the JOLISAA workshop

15. Processing and cooling of milk through solar energy in the Kenyan South Coast

1. Identification:

Caser number 15

Short title : Solar milk processing and cooling

Authors list :

2. The story line in a nutshell: what is this case all about in 4-5lines?

This case involves the processing and solar cooling of milk and distribution by a rural based cooperative society jointly with other partners to solve a marketing challenge thus creating employment and increasing small holder incomes. In the process, high quality milk value added products were made available to rural based consumers.

3.Context and innovation description

The Kenya Coast is an area that si characterized by high temperatures, high humidity and rainfall levels. The area inland from the coast is a rural farming area with limited electrical distribution. Most of the farming is small-scale subsistence farming and the main crop is maize which is grown for own consumption and excess is sold for income. Other crops grown are cashews, a variety of vegetables, bananas, mangoes, goats, chickens, etc. Much of the produce is sent to market by individual farmers on the public buses that serve the area.

Heifer Project International worked with the Kinago and Dzombo farmers on dairying to take advantage of the strong milk market in the coastal urban areas. The work led to increased milk production beyond what they could consume within their own families or sell to their neighbors. Selling this milk would bring important additional income to them but marketing milk to a distant market proved difficult due to spoilage within a few hours.

Heifer project International sought funds form the World bank development Marketplace for a pilot project to install three solar icemakers from Solar Ice Company to chill milk and sell it to the urban areas for a profit. The project name was “Rural Milk Collection”, for the year 2006, in Kenya. The project was recognized as an innovative development project which is replicable to other areas and hence became a development market place winner. The solar icemaker is also usable for artisanal fishing, for cold drinks and for vaccine preservation. It enables many small-sale, environmentally sustainable rural businesses.

a) Initial practice/situation, problem or opportunity being addressed and related triggers

Farmers in Kinango area used to produce low milk levels until 2007 when a project to increase milk production was initiated by Hefer Project International. Through improved

management practices, the milk production levels were raised and the problem of marketing arose because of the short shelf life of raw milk.

b) Innovative practice(s) or arrangement(s) or innovation bundle, as it evolved over the duration of the innovation process (if relevant

Technical: Solar collectors
Rural based yoghurt and sour milk production
Ice blocks production and use

Organizational: Formation of rural dairy farmer cooperative
Bicycle distribution teams for different localities

Institutional: Kidzo dairy and the links with other partners

4. Main Stakeholders involved and roles in the innovation process (1/2 p.)

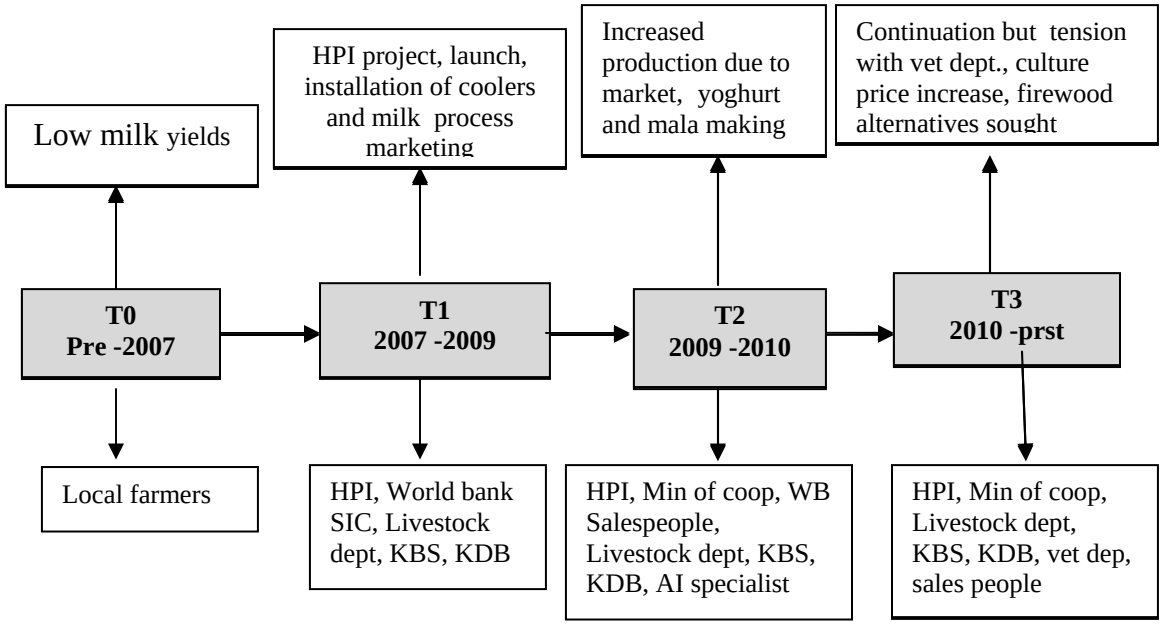
d) **Table 15**: stakeholders, roles played, contributions made (resources, knowledge, etc), phase(s) of involvement (by making reference to phases drawn in Figure 1)

Stakeholder	Role	Contribution
Heifer project international	Development work in dairy –worked with Kidzo group	Started project Built capacity of local dairy cattle owners
World Bank Development marketplace	Financed the project	Funds for the project
Solar Ice Company	Manufactured solar maker	Supplied the equipment
Ministry of livestock development - Veterinary department,	Services to the dairy farmers of Kidzo	Worked closely with HPI in capacity building Provided veterinary care to the dairy cattle
Kenya Dairy Board	Service provider in dairy sector	Provided capacity to local dairy cattle owners on milk handling Licensed the milk distributors and vendors
Kidzo Cooperative society	Dairy farmer group who agreed to process and market milk together	Organized the farmers Managed the collection, processing and marketing of the milk
Dairy cattle owners	Keeping of dairy cattle in Kwale	Managed the cattle Delivered milk to the coop Used local knowledge to supplement partner sourced capacity

Milk product distributors	Distribute milk in Kwale area	Distributed milk to the consumers Collected consumer feedback to the coop
Shop keepers and hotel operators	Stocked milk delivered by cooperative members	Purchased milk and products Conveyed consumer feedback to the distributors

5.History of the innovation process

Figure 15: synthesized graphical representation of the main phases of the innovation process from t0 to the present (max. **4-5 phases**, less if possible)



T0: low milk yields due to low levels of management Pre 2006

There were low milk yields from the dairy cows kept in Kinango area due to low management levels and lack of know how. Most of the animals kept were the low indigenous breeds whose milk yields are low. They were fed on local forages and had to travel long distances in search of pasture and water.

T1: HPI project, registration of coop, installation coolers and milk processing and marketing -2006 -2009

In 2007, Heifer project International worked with the farmers together with the ministry of livestock and Kenya dairy board. Young men were trained to become paravets for the member's cow herds and would provide veterinary care in close collaboration with the government and private veterinary doctors. A cooperative society was formed and

registered under the Ministry of Co-operative development. The aim was to mobilize the smallholder farmers in Dzombo of Kinango area to collectively process and market their milk. Lack of electricity was a challenge since milk shelf life was low owing to the high temperatures. A solar ice maker that uses ammonia gas to cool and freeze water was procured from Solar Ice Company with assistance of World bank Development Market place funds. The icemakers were shipped to Kenya and installed by SIC with the assistance of the technicians from the co-operatives and other men from the village. Operators were trained how to operate the icemakers by demonstrating operation a few times and then having them operate the machine themselves. For additional information, the physical processes occurring were described. To chill the milk, 50 liter milk cans are immersed into a plastic water barrel ice bath. The ice blocks are also placed inside the containers carrying packets of packed milk and once covered, the shelf life of the milk is prolonged.

T2 : Continuation of coop activities, tension with veterinary department and price hikes of milk cultures and firewood -2009 -2011

The milk production and processing continued with customers getting used to the milk products and in 2010, the of yoghurt cultures was made easier by the acquisition of mobile phones and introduction of 'm-pesa' services. Cultures would be ordered by the coop and money transferred to the suppliers account. The supplier then would send the culture by courier to Mombasa form where the coop would collect. As a result of an increase in price of cultures, sugar and firewood, there was a corresponding increase in the price of the milk products. The distributors also raised concerns since their payments were not correspondingly increased and the management had to make a decision to adjust their pay. A challenge arose with the veterinary department when they confiscated the AI canister used to carry semen for insemination of member herds. The vet department claim was that the para-vet was not qualified to inseminate but reports the coop members feel hat this was a case of a 'conflict of interest' since this would lead to loss of the vets. customers.

6.Results & effects of the innovation process so far (adoption) (< 1/2 p.)

- Increased milk production – currently collect 100 litres daily
- Improved shelf life of milk
- Value added milk products –yoghurt and sour milk
- Improved incomes to farmers –Ksh 30 (30Euro cents)/litre
- Employment creation – 8 distributors and three workers at the shop

7. Main lessons in light of the JOLISAA goals and questions (< 1/3 p.)

- Local institutions are better placed to provide solutions to local challenges
- Conflict of interest can hinder the spirit of innovation

8. Key references (5-6 max., < ¼ p.)

1. Erickson C. A (2010) Rural Milk Preservation with the ISAAC Solar Icemaker
2.Erickson, C. A. 1998. "Performance of the ISAAC Solar Icemaker" Solar Engineering 1998 edited by J.M. Morehouse and R.E. Hogan, pp171 – 175.

3. Voices of Africa Foundation : (2009)Solar ice relieves dairy sector
(http://voicesofafrica.africanews.com/site/East_Africa_Solar_ice_relieves_dairy_sector/list_messages/19286)

16. 'Jua Kali' rice production and marketing outside the Mwea Irrigation Scheme

1. Identification:
Caser number 16

2. The story line in a nutshell: what is this case all about in 4-5lines?
This innovation case involved growing of rice in wetlands by smallholder farmers and how they were able to overcome various production challenges that they faced without any extension support. This involved the farmers, middlemen, traders, stockists and casual laborers form the adjacent Mwea rice irrigation scheme.

3. Context and innovation d*escription*

Ndia division of Kirinyaga area is a high potential area on the Southern slopes of Mount Kenya and is characterized by rich volcanic soils. The area is suitable for growing of a diverse array of crops and owing to the streams and rivers traversing the area as well as the level topography, the area is suitable for irrigation.

a) Initial practice/situation, problem or opportunity being addressed and related triggers
Prior to 1998, rice in Kenya could only be grown in the designated irrigation schemes like the Mwea Irrigation Scheme in Central Kenya as per National Irrigation Board statutes. The management of the irrigation schemes was highly oppressive to the tenants and in 1998/9, the farmers in the scheme rose in arms against the oppression and refused to deliver rice to the irrigation board stores. Efforts to quell the disturbances by the irrigation board authorities were in vain and no more rice was delivered to the stores by the farmers and this paralyzed the board's operations. Farmers outside the scheme then started growing various rice varieties in their fields especially in the swampy valleys of the streams and rivers found in the region.

b) Innovative practice(s) or arrangement(s) or innovation bundle, as it evolved over the duration of the innovation process (if relevant

Technical:	Selection of rice varieties for different soils
	Fertilization rates using field portions units
	Germination of rice seeds using fire and rice straw
	Selling of rice seedlings
	Use of Azolla weed as nutrient for rice and other crops
Organizational:	Rice growers information exchange clusters
	Rice marketing clusters
Institutional:	Broker – rice producer credit facility

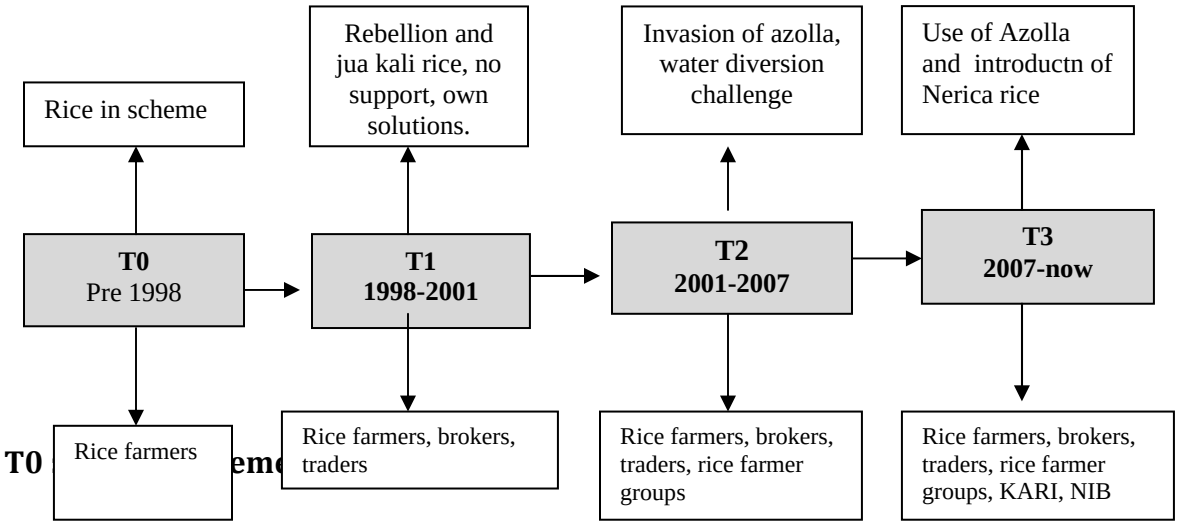
4.Main Stakeholders involved and roles in the innovation process (1/2 p.)

e) **Table 16**: stakeholders, roles played, contributions made (resources, knowledge, etc), phase(s) of involvement (by making reference to phases drawn in Figure 1)

Stakeholder	Roles	Contribution
Rice farmers	Growers of rice outside the scheme	Started rice production using knowledge from the irrigation scheme Generated local knowledge to surmount the specific rice growing challenges in the swamps Entered into association with brokers for credit, information and rice market
Rice Brokers (middle men)	Buy rice from growers, transmit information from farmer to farmer	Provided information to producers Provided credit in advance to producers for anticipated rice harvest
Rice stockists	Buy rice either through brokers or direct from growers	Purchased rice from the producers Provided producers with feedback from consumers
Casual workers	Employed in the rice fields	Used their skills to do the work and in the process the field owners learnt key rice management skills
Agro input suppliers	Stock essential inputs	Supplied agro inputs to produces Provided rice producers with information from other producers

5.History of the innovation process

Figure 16: synthesized graphical representation of the main phases of the innovation process from t0 to the present (max. **4-5 phases**, less if possible)



Growing of rice outside the rice irrigation scheme was illegal and the management of the scheme was highly oppressive to the tenants.

T1 Rebellion and 'jua kali' rice, no support, own solutions - 1998-2001
The farmers in the scheme organized an uprising and refused to deliver rice to the board stores. Efforts to quell the disturbances were in vain and led to a loss of human life and property. No more rice was delivered to the stores henceforth and this paralyzed the board's operations. Following these riots, farmers outside the irrigation scheme who had never planted rice before started growing it and this marked the beginning of cultivation of '*jua kali*' rice. No extension support was provided to the farmers. Inexperience of the new farmers in rice cultivation, had to rely on trial and error and observations from those who had successfully tried new practices. Middlemen (brokers) would also move from farm to farm in search of produce and hence gather useful information and share it with other farmers. Some of the new rice farmers hired casual workers who had worked in the adjacent irrigation scheme to take advantage of their experience. Consequently, a number of new rice cultivation innovations developed ranging from variety selection, pre-germination techniques, nursery establishment, weeding, soil management, seed selection and harvesting techniques.

T2 Invasion of azolla, water diversion challenge -2001-2007
A water weed Azolla invaded the rice fields leading to loss of crop and wastage of labor. Lots of hours were spent every week to remove the floating weed. The collected weds would be heaped next to the rice plots and plants growing adjacent to such heaps were observed to exhibit lush growth. The NIB board also sent out water scouts to monitor the use of water within the upper reaches of the scheme and the farmers had to strategize. They started holding meetings in the mornings and soon the meetings developed into rice production information sharing sessions.

T3 Use of Azolla and introduction of Nerica rice - 2007-now
Over time, farmers noticed that low water levels maintained the weed at a level that could not choke the growing seedlings. In times of absolute water shortage, the plots covered by *azolla* were found to perform better than those without since the dense ground cover protected loss of moisture and hence benefited the growing rice crop. All these observations led to a different perception of the weed which henceforth became an ally in the cultivation of j*ua kali* rice and other crops where composted *azolla* became a common source of nutrients for the other crops. A new rice variety Nerica with low water requirements was introduced and this has changed the rice production status of the jua kali sector. Problems of quality of rice and environmental management challenges due to utilization of wetlands.

NB: Make sure to describe the current (last) stage of development of the innovation.

6.Results & effects of the innovation process so far (adoption) (< 1/2 p.)

- Increase in rice production by expanding area outside the scheme
- New insights into rice production
- Use of azolla as crop nutrient source

- Improved income for the Jua kali rice producers

7.Main lessons in light of the JOLISAA goals and questions (< 1/3 p.)

- **A blend of local and exotic solutions give rise to lasting solutions to local challenges**
- A holistic approach ranging from technical to social and institutional should be encouraged to deal with local challenges

8.Key references (5-6 max., < ¼ p.)

1. Kamau GM and Almekinders, CJ (2006) From strangler to a nourisher: How novice rice farmers changed a floating challenge to an opportunity – in *Susan Kaaria et al* (eds) Innovations Africa 2006.
2.
3. Gakiha, W., (1998). Mwea farmers or serfs? Sunday Nation, January 1998.
4. Chambers, R., (1973a). The history of the scheme. In: Chambers, R., Morris, J. (Eds.), Mwea: an irrigated rice settlement in Kenya. Weltforum Verlag, Munchen, pp. 64-78.
5. Kamaru L. Kinyua (2003) Comparative Economic Analysis of NIB farmer-Tenant and Jua Kali Irrigated Rice Production Systems: A Case of Mwea Area Kirinyaga District, Kenya
6. Kuria J. N. , Ommeh H., KabuageL., Mbogo, S. and Mutero, C. (2003) TechnicalEfficiency of rice producers in Mwea Irrigation Scheme, African Crop Science Conference Proceedings, Vol. 6. 668-673

17. Ecological management of stem borer using push-pull technique in smallholder farms

1. Identification:
Caser number 17
Short title: Push pull for stalk borer management
Authors:

2. The story line in a nutshell: what is this case all about in 4-5lines?
This innovation case involves the management of maize stem borer in Western and Central Kenya through manipulation of mixed olfactory signals transmitted by three different crops. This was through a collaborative effort between ICIPE, KARI, Ministry of agriculture, local farmers and local NGOs. The case was triggered by the immense losses incurred from stem borers but the innovation also provided solutions to s*triga* weeds, low soil fertility and availability of livestock feeds in the small holder farms of these regions.

3.Context and innovation *description*
Context
The crop lands of Western and Central Kenya are mostly high in potential and diverse crops are grown by the small holder farmers. Rainfall is adequate and the soils are moderate in nutrients. The mixed farming nature of the smallholders facilitates for integration of crops and livestock.

a) Initial practice/situation, problem or opportunity being addressed and related triggers
Prior to the advent of this innovation, maize stem borers caused losses amounting to more than 30% besides reduced grain quality and environmental degradation through use if health affecting pesticides. In the striga infested areas, losses of up to 100% have been observed in heavily infested areas while low fertility combined with inferior management practices such as poor crop variety choice and other cultural practices would cause immense yield and quality losses leading to food insecurity. The innovation in this case was aimed at addressing these issues.

b) Innovative practice(s) or arrangement(s) or innovation bundle, as it evolved over the duration of the innovation process (if relevant

Technical:	New cropping system New crop –desmodium New source of feeds
Organizational:	Push pull farmers groups
Institutional:	KARI/Biovision partnership

4.Main Stakeholders involved and roles in the innovation process (1/2 p.)

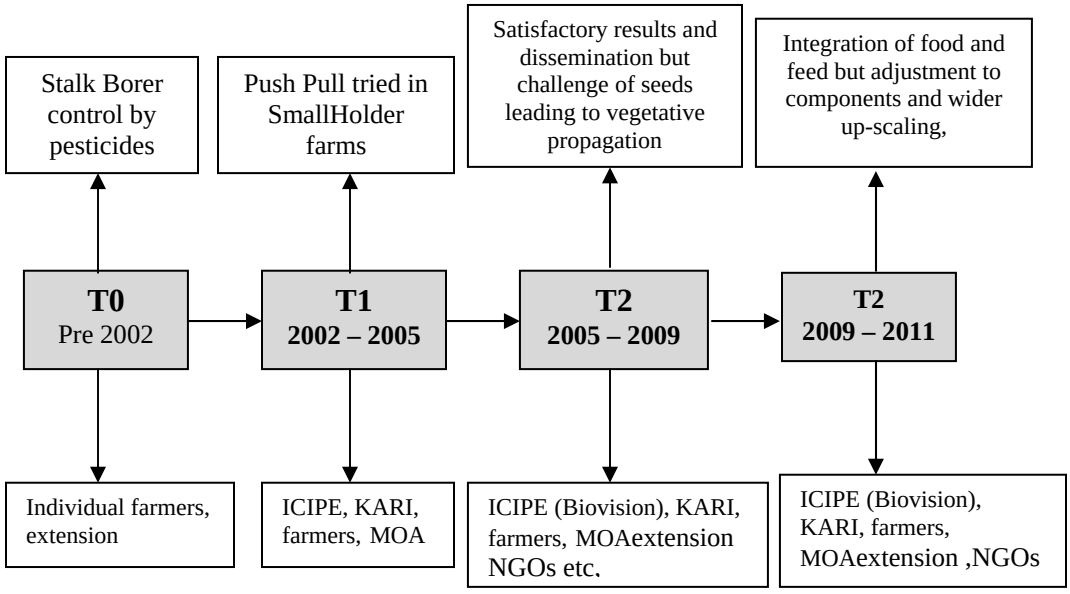
a. **Table 17**: stakeholders, roles played, contributions made (resources, knowledge, etc), phase(s) of involvement (by making reference to phases drawn in Figure 1)

Stakeholders	Roles	Contribution
ICIPE	Research on insect ecology	Tested and introduced innovation
KARI (Kenya),	Research on technologies	Collaborated in tests Built capacity of farmers
Ministry of Agriculture - extension networks	Extension work	Mobilized farmers and coordinated dissemination efforts Built farmers capacity
NGOs	Development work	Participated in dissemination events Mobilized farmers
Farmers	Practice technology	Participated in the test Adopted the innovation Adjusted innovation Applied local knowledge eg propagation of desmodium

5.History of the innovation process

Figure 17: synthesized graphical representation of the main phases of the innovation process from t0 to the present (max. **4-5 phases**, less if possible)

a) Characterize briefly (1 parag. /phase) each one of the main phases, e



T0 : Stalk Borer control by pesticides Pre 2002
Immense losses incurred by smallholder cereal producers in Western and Central Kenya from stem borers, striga and nutrient deficiency and control of stemborers using pesticides thus polluting the environment.

T1 Push Pull tried in SH farms - 2002 – 2005
Research on an integrated approach to striga, stem borer and soil fertility management started in 1994 by International Centre of Insect Physiology and Ecology (ICIPE) but introduced in 2002. This approach involved planting of maize, Napier grass and Desmodium as companion crops in a system where insect behavior-modifying stimuli (chemical) are released and Nitrogen is fixed by desmodium.

T2 Satisfactory results and dissemination, -2005 – 2009
The introduction of the systems in smallholder farms was at first received with skepticism since the technical explanations were not well understood. The cost of desmodium sees was also prohibitive at Ksh 1200 per kig (Euro 12). The end results of the push pull system were however quite evident to those who tried it and this led to a positive perception. Farmers successfully experimented with vegetative propagation of the desmodium vines. Many farmers who saw the performance were willing to try it out in their farms and this led to wide scale dissemination

T2 Integration of food/feed, adjustment to components 2009 – 2011
The integration of a food and feed production system rendered it acceptable and many farmers adopted it. However owing to the nature of the environments, farmers disaggregated the components so that in areas without striga, farmers planted maize and Napier while in striga prone areas all the three were planted. Farmers in areas where stem borer is not a problem planted desmodium after every 3 to 5 rows of maize instead of after every row of maize. The maximization of land and labour became an attractive option for the system since whle weeding maize, a farmer would be in effect weeding of Napier and desmodium. . various challenges are however still outstanding such as the high cost of desmodium, the management of perennial weeds especially due to teh perennial nature of desmodium while Napier and desmodium are not necessary for farmers without livestock.

NB: Make sure to describe the current (last) stage of development of the innovation.

6. Results & effects of the innovation process so far (adoption) (< 1/2 p.)

- An increase of from 1 to 3.5 t/ha in maize
- over 30,000 small-holders in Western Kenya and is spreading to the rest of the Eastern Africa region.
- Provision of year-round quality fodder resulting in significant increases in yields of milk thus improving nutrition in children in the smallholder households.
- Sale of surplus grain, milk and Desmodium seed and Napier forage.

- benefit of 'push–pull' estimated at US$ 2–3 million annually

7.Main lessons in light of the JOLISAA goals and questions (< 1/3 p.)

- A solution to one challenge may be applied to solve diverse challenges

8.Key references (5-6 max., < ¼ p.)

1. Annual Review of Entomology (2007) The Use of Push-Pull Strategies in Integrated Pest Management Vol. 52: 375-400

2. Khan, Z.R., Hassanali, A., Khamis, T.M., Overholt, W.A., Hooper, A.M., Pickett, J.A., Wahams, L.J.,,Woodcock, C.M., (2002). Control of the witchweed, Striga hermonthica, by intercropping with Desmodium spp., and the mechanism defined as allelopathic. Journal of Chemical Ecology 28: 1871-1885.

3. Khan, Z.R., Midega, C.A.O., Hassanali, A., Pickett, J.A., Wadhams, L.J., (2007). Assessment of different Legumes for the Control of Striga hermonthica in Maize and Sorghum.Crop Science 47:730-73

18. Commercialization of grafting, pruning and spraying of Avocadoes and Mangoes

1. Identification:
Caser number 18
Short title : Mango and avocado commercialization
Author list :

2. The story line in a nutshell:
This case involves the conversion of old low yielding mango and avocado fruit trees to produce high fruit yield and quality acceptable to the local and international market. The effort involved a local consultancy firm, USAID Business Development Services project, Nursery operators, Equity Bank and the farmers.

3. Context and innovation d*escription*
Central Kenya is characterized by high rainfall amounts which are suitable for growing of various food and cash crops including mangoes and avocadoes. The yields obtained are however low because of use of traditional trees and poor agronomic practices. Many farmers believe that tree crops grow naturally and should not be interfered with hence low yields and poor quality continue being a challenge

a) Initial practice/situation, problem or opportunity being addressed and related triggers
Farmers used to produce low quality fruits from their traditional mango and avocado trees thus denying them the local and international markets. The trees were also poorly managed with pests and diseases largely not managed. The old trees were tall and occupied a lot of space thus shading out other low growing crops.

b) Innovative practice(s) or arrangement(s) or innovation bundle, as it evolved over the duration of the innovation process (if relevant

Technical:	Top working and grafting of old trees Spraying and pruning Service provider training –book keeping and tree husbandry
Organizational:	Service provider network
Institutional:	Special credit for equipment purchase

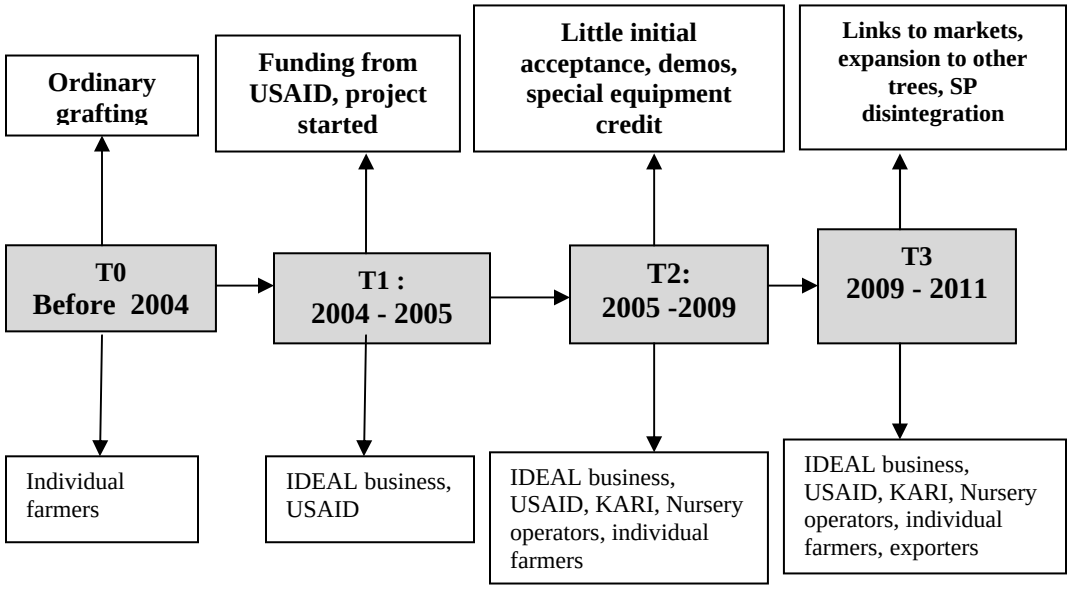
4. Main Stakeholders involved and roles in the innovation process (1/2 p.)

f) **Table 1**: stakeholders, roles played, contributions made (resources, knowledge, etc), phase(s) of involvement (by making reference to phases drawn in Figure 1)

Stakeholders	Roles	Contribution
Ideal Business Links	Development consultant work	Wrote a project and funded by USAID Coordinated links between farmers and various agencies
Ideal Matunda limited	Subsidiary of IBL dealing with fruit exports	Linked farmers with market Processed avocado
Ministry of agriculture	Extension work to fruit growers	Built capacity of farmers Mobilized farmers into production and marketing groups
KARI -Thika	Research on fruits	Built capacity of farmers and nursery operators Provided demonstration plots
Farmers	Growing of fruits	Accepted top working of their trees Used local knowledge to manage trees Sought local markets
Tree Nursery Operators	Production of fruit trees	Participated in training events Provided services to producers Used loans to procure equipment Continued after project ended

5.History and dynamics of innovation process

Figure 1: synthesized graphical representation of the main phases of the innovation process from t0 to the present (max. **4-5 phases**, less if possible)



T0 : Before 2004
Mango production was from low yielding and poorly managed trees. Farmers were not aware of tree requirements and the assumption was that trees don not require any external inputs and/or care

T1 : Funding obtained and project started (2004 - 2005)
Private company Ideal business links through funds sourced form the USAID business development support project (BDS) initiated a fruit tree top working project in several regions of the country in 2004. The project was aimed at converting the local, old and low yielding trees into high yielding trees of the desired quality fruits. It involved the cutting down of old fruit trees and grafting after the new sprouts emerged. This was to be done by nursery operators who were to be trained and organized to offer these services at a fee to the individual orchard operators.

T2: Little initial acceptance, demonstration, special credit (2005 -2009)
The idea was not accepted by farmers who were not ready to cut down old trees that had characterized the landscape for many years. The company arranged for a demonstration on a few trees with the assistance of the agricultural extension staff and the KARI Horticultural centre, Thika. The demonstrations were on good tree grafting practices, top working, pruning and spraying. Nursery operators were trained on book keeping skills and to facilitate purchase of proper equipment a loan was sourced from the Equity bank. The equipment included power saws for felling trees, knives for grafting, shears for pruning, and pumps for spraying. The nursery operators were then encouraged to form service provision groups where they would be hired by tree owners to carry out any required operation as per their skills at an agreed upon fee.

T3 : Links to markets, expansion to other trees, SP disintegration (2009 - 2011)
Farmers were then linked to markets by of Ideal Matunda a subsidiary company of Ideal business links. The top working and grafting services gradually extended to crops outside the project such as coffee where old conventional coffee varieties were top worked into new disease tolerant varieties like Ruiru 11 and Batian. The services offered were accompanied by a warranty where replacement of any unsuccessful grafting process is repeated at no cost to the farmer. This work is on going even though some of the service provider networks have encountered operational difficulties leading to disintegration. The results of the top working are already evident in many areas where improved mango production has been observed and links to markets established. Challenges of over production however have now become an issue and this has led to local cottage industries such a s drying and juice production.

NB: Make sure to describe the current (last) stage of development of the innovation.

6.Results & effects of the innovation process so far (adoption) (< 1/2 p.)

- Increased mango and avocado yields -100 fruits to 300 fruits/tree
- Improved quality of mangoes – market desired fruits
- Improved tree management

- Reduced tree competition
- Establishment of cottage industries

7.Main lessons in light of the JOLISAA goals and questions (< 1/3 p.)

- For innovation processes to be successful, a holistic perspective is necessary

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8. Key references (5-6 max., < ¼ p.)

1. Mwangi B (2008) Commercialization of mango and avocado grafting services presented during the GTZ, PSDA meeting

2. Njuguna, K. and Mwangi, B (2011) Providing extension services to farmers through private service providers in Maragua and Makueni districts iN Kenya. Innovations in Extension Conference in Nairobi Kenya 2011

Map showing location of the cases