Adapting public agricultural extension services to climate change: Insights from Kenya

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Abstract

This paper analyses the adaptiveness of the Public Agricultural Extension Services (PAES) to climate change. Existing literature, interviews and group discussions among PAES actors in larger Makueni district, Kenya, provided the data for the analyses. The findings show that the PAES already have various elements of adaptiveness in its policies, approaches and methods of extension provision. However, the hierarchical structure of the PAES does not augur well for self-organisation at local levels of extension provision, especially under conditions of abrupt change which climate change might trigger. Most importantly, adpativeness presupposes adaptive capacity but the lack of resources in terms of funding for extension, limited mobility of extension officers, the low extension staff/farmer ratio, the aging of extension staff and significant dependence on donor funding limits the adaptiveness of the PAES. Accordingly criteria and indicators were identified in literature with which an initial assessement of the adaptiiveneess of PAES was conducted. However this assessment framework needs to be improved and future steps will integrate more specific inputs from actors in PAES in order to make the framework operational.

Keywords: Adaptiveness, adaptability, adaptation, extension services, climate change, resilience, Kenya

1. Introduction

International climate policy and discourse continue to advance with various tools and instruments designed to foster and guide adaptation to climate change. An example of such an instrument is the NAPA (National Adaptation Programmes of Action) and its various proposed projects. However the question of which actors within countries are

to use these instruments or implement the programmes have not yet been answered. If the implementing actors are government departments, how adaptable are their own structures and services to climate change?

The magnitude of the climate change problem, the temporal and spatial uncertainties surrounding its manifestations call for adaptiveness in the responses of the public administration to climate change. However, adaptiveness presupposes adaptive capacity and those actors affected by climate change expect the public administration at various levels of organisation, to facilitate processes and enabling conditions that promote adaptation to climate change. Yet in contrast to international discourse and negotiations, little is known in the climate change adaptation discourse on how prepared the African public administration is to respond to climate change.

Using the case of Public Agricultural Extension Services (PAES) in Kenya, this paper examines the adaptiveness of the PAES (crops and livestock extension services) to climate change using data collected on PAES in the Larger Makueni district. No studies have examined how the PAES in Africa can promote adaptation and what changes are necessary to enable them to promote farmer adaptation practices and the adaptation of agricultural systems to climate change. The assumption is that for the PAES to support farmers in adapting to climate change, PAES must first improve its own adaptiveness.

The Public Agricultural Extension Services (PAES) in Africa have played and continue to play key roles in agricultural development, in the diffusion of innovations, as medium for exchange of experiences with farmers and as a direct link between farmers and the government. According to the Government of Kenya (GOK 2001), Agricultural Extension Service (AES) is a two way communication/ training process involving adult learning techniques whose aim is to improve knowledge; change attitude/behaviour; lead to adoption of new technologies; and improve skills for both farmers and extension workers with a view of increasing and improving farmers' incomes and productivity on a sustained basis. The role of extension service is to provide information to extension clients in order to allow them better use of available resources by increasing technological options and organizational skills that in turn allow them to take greater advantage of production and market opportunities (GoK 2001). This definition refers to services provided by both public and private sector and encompasses activities relating to education, transfer of technology, change of

attitudes, human resources development, and the collection and dissemination of information GOK 2001, 2)

Thus, PAES are also expected to play a key role in adaptation to climate change in the field of agriculture. This focus becomes imperative considering the contribution of agriculture to sustainable land management, the overlap between adaptation and mitigation actions in the sector and by extension the potential contribution of agriculture to climate change mitigation.

2. The Larger Makueni District

Makueni district has been selected because it is one of the areas in Kenya that frequently experiences drought. It lies in the South–Eastern part of Kenya and comprises the newly created districts of Kilungu, Mukaa, Mbooni West, Mbooni East, Nzaui, Kibwezi, and Kathonzwen – these are referred to in this paper as the larger Makueni District,

The district is inhabited by Kamba ethnic group. The population was projected in 2002, to 839,155 (2004: 887,488) persons with a growth rate of 2.8%. The population is generally young as those aged below 15 years constitute 47% of the population while the dependency ratio is 100:109 (the Makueni District Development Plan, 2002-2008). The local economy is dominated by small-scale agro- pastoralism.

The context within which the PAES provide their services is characterised by widespread poverty, frequent droughts, high crops-, livestock pests and diseases occurrences, poor market prices and inadequate market information, exploitation of farmers by middle men, high cost of farm inputs, lack of water for irrigation, poor access roads, lack of technical knowledge, lack of adequate feeds (pasture), shortage of water, lack of credit facilities, livestock in-breeding, lack of value addition and socio- cultural issues (Kiteme 2009)

3. Methods

The study targeted households, groups and government departments / officers - frontline extension, district extension administration and national level policy makers. Data and information gathering were organized at two tiers: an extensive desk review of available literature, as well as past and existing policy documents and legislative instruments that have and continue to regulate agricultural extension services in

Kenya. Data was collected from 20 randomly sampled individual farm households from four villages in Muusini Location. There were also four focussed group discussions with common interest groups involved in various farming enterprises within the division. For the Institutions, interviews were held with four frontline extension officers of government and non-Governmental Organization (Business initiative for survival and eradication of poverty and Africa Medical Research Foundation (AMREF)), District Extension Administration (Agriculture, Livestock and Fisheries) and policy level senior government officials in agriculture/ crops, livestock and Fisheries Departments (Kiteme 2009).

Based on the foregoing this paper is guided by the following research questions:

1. What challenges do the PAES face due to climate variability and climate change?
2. What characterises / constitutes the adaptiveness of PAES?
3. How can the adaptiveness of PAES be improved?

4. Adaptive capacity, Adaptability / Adaptiveness

To be able to answer the question of how adaptive the PAES is, we examine how adaptiveness is defined and characterized in literature. Adaptation aims to moderate the impacts of climate change and take the opportunities that it offers. However the capacity to adapt depends on the resources at the disposal of an actor. IPCC (2007, 869) defines adaptive capacity as the ability of a system to adjust to climate change (including climate variability and extremes), moderate potential damages, take advantage of opportunities, or cope with the consequences.

Adaptation thus encompasses the ability to cope, that is, to survive with livelihoods or functions more or less intact, and will depend on the type of climatic event, the options (endowments/entitlements) open to the population or organization and the ability to utilise those options. It also includes building adaptive capacity, thereby increasing the ability to adapt to changes (e.g. communicating climate change information, building awareness of potential impacts, investing in livelihood capital), and implementing adaptation decisions – transforming the capacity into action (Adger et al., 2005).

Adaptability (also understood as adaptiveness) has been defined by many authors. It refers to the capacity of actors in a SES to manage resilience in the face of uncertainty

and surprise “It implies remaining and developing within the current attractor of the SES” (Folke et al., 2005, 457).

Biermann (2007) refers to adaptiveness as a governance principle which reflects the ability to change governance elements, to respond to new situations, without harming both credibility and stability of the entire system. Adaptiveness can also be a question of ‘best fit’ to an objective situation (Grothmann and Patt 2005). Adaptiveness is thus the degree to which responses are near the desired outcomes. While adaptiveness depends primarily on adaptive capacity, having the capacity to adapt or having adaptive capacity does not automatically translate to adaptiveness. Adaptiveness hints at more than possessing adaptive capacity in that it stresses the action (less/more adaptive) arising from adaptive capacity. Adaptiveness can thus be understood as using the potentials to actually implement adaptation, and how successful the adaptations are, relative to desired outcomes. Thus analyzing for adaptiveness is a two step process, first to check for adaptive capacity and secondly to analyze how that adaptive capacity is being used (actual implementation) to reduce vulnerability to climate change, to take advantage of the opportunities it provides and to progress towards desirable outcomes. Various criteria and indicators are used in literature to characterise adaptiveness. These criteria and indicators will be used in the later part of this paper to examine how adaptive PAES are, in particular to climate change.

5 Climate change and its impacts on agriculture

The district extension administrators and the frontline extension officers are well aware of the climate change problem. They perceive climate change as change of weather patterns over a long period of time and the disruption of the annual weather pattern/ change of trend of annual weather patterns.

They found the district was affected by climate change in several ways: more frequent and prolonged droughts, change of rainy seasons - not following pattern as before, more variability of short rains as compared to the long rains, high temperature levels; increased aridity; increased rainfall failures; untimely rains - hence not able to advise farmers, drying up of water sources, reduced rainfall amounts, delayed onset of rains, decreased foliage - grasses have dried up and some species have disappeared.

The officers perceive the natural environment to be also changing. They found forests and bushes to have been depleted as farmers clear more bushes for farming. Forest

has also been cleared for settlement, farming, for charcoal production; building materials (timber) and the rate of depletion is not equal to rate of replacement. The officers report that natural water sources have decreased with water levels going down in rivers and many rivers have become seasonal. They have also noted that artificial water sources are in the increase especially earth dams, water pans, shallow wells. However, the periods the sources stay in use has decreased, they dry up faster and springs have diminished. Wild fruits used to exist but with deforestation and clearing of bushes, many have become rare. In addition, heavy winds have become frequent (before and after rains). Due to large open lands, roofs are ripped off usually in February, March, September and October.

These changes have affected agricultural productivity through crop failures thereby decreasing agricultural productivity, increasing food shortages and prolonging famines. Pasture is a problem, and water for livestock is scarce and people have to move long distances in search of water and pastures. The decrease in animal forage has led to a decrease in livestock production and livestock mortality has increased during droughts.

Thus farming has become a more costly undertaking than before due to crop failures, thereby discouraging new entries into the sector. As a result, many people, especially men migrate to mostly urban areas in search of jobs, leaving fewer people in production. Since the households do not earn incomes as before, there is a high rate of school drop outs, as children leave schools to towns to engage in casual labour.

5.1 *Implications of climate change for PAES*

Climate change is thus worsening the work conditions for extension services through several ways. Through frequent crop failures, the farmers become more impoverished. The frequent droughts also discourage the farmers to invest more into farming. It therefore becomes more difficult for extension officers to convince farmers to undertake investments that are exposed to climate risks.

In addition, the increased variability in rainfall conditions means the planned work cannot be implemented (annual plans). The extension officers must then change their planned work to fit the conditions. For instance, at the time of data collection an officer was bound to be dealing with forage conservation (hay bailing), unfortunately, little grass grew in the last season. Climate change thus makes timely and relevant

training more difficult – for example "you cannot train a farmer on harvesting during planting time whereby the harvest may not be realized". Often farmers attribute the failure or non-implementation of farm management or new farm technologies to lack of or inadequate rainfall. In this way they highlight the additional challenges that increasing climate variability poses to agricultural activities.

Due to the adverse impacts of climate change like crop failures and livestock deaths, male household heads often migrate to the urban centres in search of employment. Through this increased rural-urban migration women and the old are left to practice farming, thereby reducing agricultural labour and increasing the work burden of women.

The variable weather conditions also question the expertise, relevance and validity of extension officers and extension advice respectively. This arises also because when farmers implement extension advice and the weather conditions under which they do so no longer corresponds to that needed for implementation, thereby jeopardising the outcomes, the farmers often blame extension officers for giving them wrong advise. The question then is how to adjust extension services to a more uncertain weather?

5.2 *How PAES address adaptation to climate change*

Although farmers perceive changing climate variability as a challenge to their crop and livestock production they are more conscious of other production challenges like lack of ready markets for their produces, crops and livestock pests and diseases, inadequate tools and implements, and lack of or inadequate water for crops and livestock production. As such extension messages on adaptation to climate change are embedded into extension advice on maintaining crop and livestock production and reducing risks.

PAES uses various measures to advice farmers on adapting to climate change by packaging climate change adaptation information into advice on other production challenges that are of immediate importance to the farmers.

They thus advice farmers on enterprise choice; help initiate activities that counteract climate change impacts such as afforestration; set up conservation efforts; promote drought resistant crops, passing new farming techniques to the farmers and making the farmer willing to adopt

Primarily the PAES creates awareness on climate change and informs farmers on ways of overcoming the problems. As the advice of PAES to farmers related to climate change adaptation are numerous, some of them are summarised in Box 1.

Box 1: Extension advice to farmers on adaptation to climate change

- *Enterprise choice* - diversification of farming, incorporate other crops like cassava which are less water-demanding
- *Market intelligence* - farmers can grow trees for selling
- *Post harvest management* – To keep harvests free from disease and pests, keep harvests to last longer for use later during dry spells
- *New crop varieties* - farmers plant early maturing crops
- Drought resistant cultivars - farmers plant early maturing crops and drought resistant
- *Early warning systems* - planning with the coming rains or drought; Monitoring weather trends to keep farmers informed of what to expect for easy planning and take necessary measures
- *Conservation agriculture* - ensure moisture retention, Takes care of the little resources, especially water for the crop
- *Afforestration* - help in enhancing rainfall- increase in rainfall amounts and temperature regulation and attract rainfall
- *Forage conservation* - storing for use during drought periods; Hey is harvested and preserved for dry periods
- *Use of crop residues* - utilize residue after crop failure, for example as fodder for livestock
- *Urban farming* - keeping of local poultry which feed on termites- which are a menace to vegetation
- *Range improvement* - re seeding/ bush clearing - new pastures adapted to the area have developed; increased forage and pasture
- *Zero grazing* - proper utilization of available fodder; contributes to soil conservation
- *Livestock breeds* - avoid exotic breeds
- *Breeding* - drought tolerant animals, reduce to few and highly productive breeds, faster growing, easy marketing.
- *Improve sanitation* - farmers are more involved in production.
- *Water harvest management* - more water pans have been developed and earth dams excavated; preservation of water from the already dug shallow wells.
- *Food preservation* - farmers have been storing food for use when harvest are poor
- *Dry land cultivation* - water harvesting, increased water percolation, appropriate seed usage and substantial manuring.
- *Soil and water management (terracing)* - increased amount of water available to crop; reduced erosion.
- *Tumbukiza (water harvesting holes)* - increased and conserving water for the crop

Sources: Fieldwork (see Kiteme 2009)

6. Adaptiveness of the public agricultural extension services under a changing climate

6.1 *Extension policies and adaptiveness*

An examination of the current extension policies, the National Agricultural Extension Policy (GoK NAEP 2001,) and the new National Agricultural Sector Extension Policy (GoK NASEP 2005) shows that the Kenya agricultural extension policies contain various elements of adaptiveness. Changing the policies from the NAEP to the NASEP reflects adaptiveness as having realised that there are shortcomings in the NAEP the Kenya government improved the NAEP into the NASEP.

Various elements of adaptiveness identified in the policies are summarised as follows (Sources GoK NAEP 2001, GoK NASEP 2005):

- *Transformation of approaches* like the training and visit approach, from the 'Whole Farm Approach' to "the Catchment Approach", which was later transformed into the "Focal Area Approach".
- *Liberalization* as a response to changing conditions (NAEP 2001); encourage *privatization* of extension services in areas/enterprises that attract private sector operations (GoK NASEP 2005).
- encourage the development of *pluralistic and demand driven* extension services and recognize the role of private sector;
- *participatory planning and implementation* of agricultural extension projects; involvement of relevant stakeholders and interested parties in PAES
- The demand for extension services to be *accountable* to her clients/ farmers
- The provision for extension services to be *flexible as they respond to demand diversity* (agro- ecology, types of commodities/ enterprises and socio- economic characteristics of clients) and *supply diversity* (existence of commercial firms, farmers' organizations and NGOs/ CBOs that also provide extension services.
- *Collaboration* in extension services at various levels (GoK NAEP 2001, NALEP 2003)
- *Vertical integration* in the Ministry of Agriculture and *horizontal integration* with other agriculture and rural development related Ministries such as Livestock and Fisheries Development and Cooperatives and Marketing.

- establish an *independent regulatory body* to oversee the regulation of extension service provision, including vetting, accreditation and monitoring of extension service providers;
- Encourage Extension Service Providers (ESPs) to *broaden their extension contents and knowledge* to cover the entire value chain, particularly on post-harvest management, value addition, utilization and marketing; and
- Formulate a *mechanism to strengthen partnerships, collaboration and networking*, and improve inter-sectoral planning and linkage with other stakeholders.
- promote *decentralized extension service provision* through clientele organisations and other grassroots institutions (GoK NASEP 2005)

However, the need for *external assistance* to finance the desired level of public agricultural extension services for some years to come (GoK NASEP 2005), detracts from this level of adaptiveness and dependence on donor funding for various extension services delivery can determine the speed with which certain extension services are provided.

Consideration of environment and clmate

On environmental issues, NAEP supports conservation of natural support systems in all agricultural programmes and projects by subjecting new projects to an environmental impact assessment and ensuring all extension officers are familiar with the Environmental Management and Coordination Act, (EMCA) 1999 (as it relates to agriculture). It advocates strengthening of training programs to raise both the awareness on a broad number of environmental matters and develop relevant messages for the farming community. Specifically, the extension service is expected to train farmers on soil and water conservation and on the safe use of pesticides and other agricultural chemicals. The policy directs the expansion of extension training on environmental matters to cover farmers, agro-processors and agro–input suppliers and service industries (GoK, NAEP 2001).

NASEP deals with sustainable environment and natural resources management issues by proposing that "all Extension Service Providers (ESPs) mainstream environment and natural resources- related issues in extension messages by imparting knowledge on

i. good practices on water catchments management, soil and water conservation, agro- forestry and wetland utilization,

ii. appropriate land use allocation and management of economically viable production units,
iii. existing initiatives by other stakeholders on community based natural resources management plans for land use, wild life, fisheries, forestry, livestock, etc; and
iv. importance of community disaster preparedness and link them with relevant institutions involved in early warning and disaster preparedness" (GoK , NASEP, 2005, p. 26).

Although climate change is not mentioned, issues related to climate variability and climate change are addressed. Thus the extension policies do address many issues of concern related to climate change and adaptiveness.

6.2 *Organisational structures and approaches of the PAES*

The main agents of agricultural extension in Kenya are government institutions comprising the Ministry of Agriculture and Ministry of Livestock and Fisheries Development. Some extension is also provided by Ministry of Co-operatives and Marketing. Most of the departments responsible for extension have nationwide representation, with the Ministry of Agriculture and Livestock extending their extension network to the locational level.

Extension service is also provided by Non Governmental Organisations (NGOs), some farmer organizations such as Kenya Federation of Agriculture Producers (KENFAP), Fresh Produce Exporters Association of Kenya (FPEAK), Kenya Flower council, Cereal Growers Association among others (GoK, NAEP 2001). Each of these has its own delivery systems and structures and their coverage vary from region to region depending on thematic focus and geographical area of operation.

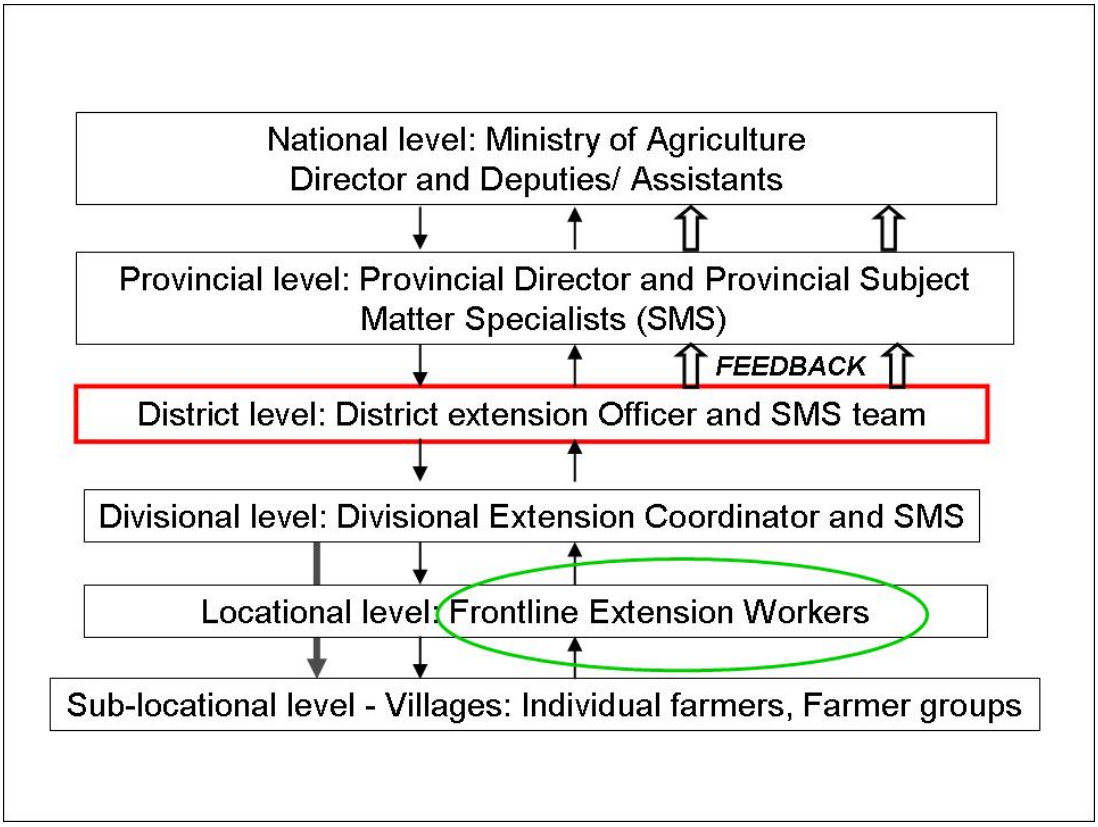
The focus here is on government AES. AES is carried out at three main levels: the national, the provincial and district level (Figure 1).

National level comprises of a director and deputies/ assistants concerned with the policy formulation, interpretation, review monitoring and evaluation as well as approval of programme work plans and advising/ backstopping.

At the provincial levels, the provincial director and provincial Subject Matter Specialists (SMS) compile work plans and annual/semi annual reports, organize training sessions and workshops, support and backstop district SMS and plan for monitoring and follow-up on the implementation progress.

The district level comprises the district extension coordinator/ officer and a team of SMS. Their role is to compile work plans, semi annual and annual reports, organize training sessions and workshops, support and backstop the divisional level and planning for monitoring and follow-ups. The district level extension administration also deals with administering policy and giving feedback to provincial management and national policy makers (GoK, NALEP 2003).

Figure 1: The organisational structure of PAES in Kenya



Source: Based on information from GoK NAEP 2001; Own design

At the Divisional level, the division extension team comprises the divisional Extension Coordinator and appointed SMS. Their role is to backstop the frontline extension workers (FEW), conduct PRAs together with the FEWs, develop farm interventions in form of farm business plans, and organize training for the FEWs and members of the common interest groups (CIGs) and farming community at large.

The location level (FEWs) does the actual implementation of agricultural extension services and are in frequent contact with extension clienteles. At each level, there is a separate organizational structure based on the subject matter specialists involved and

the nature of agricultural enterprises in the area (GoK, NALEP 2003). The FEWs are crucial for the dissemination of extension messages and need to have the necessary skills and knowledge considering the changing climate.

The organisational structure of the PAES is hierarchical, such that the FEWs do not have a direct channel to the policy makers on top. The due procedure is for them to report to the provincial and district levels who then forward the information to the higher levels of authority. Since the district level has the mandate to report to the top and to monitor extension services at the bottom it can serve as a filter and connector for information coming from the top and the bottom. However, under exceptional circumstances, the FEWs at field level do not have alternative medium to report to the policy makers at the top and this does not augur well for adaptiveness under abruptly changing conditions.

In larger Makuein district, AES is provided by multiple organisations. These include: government, NGOs, Donors, Farmer groups/ cooperatives, etc. These various Extension Services Providers (ESP) used to operate solely but are currently trying to harmonize their extension operations through collaborations and setting up structures such as district stakeholder forums. They are also becoming more supportive and participatory. Other organisations that provide AES include AMREF, BISEP, individual farmers who have been trained and render the service to fellow farmers; private companies like Bayer East Africa which deals with pesticides for the farmer; CBOs and associations. in the livestock sector- NGOs such as Land O' Lakes promotes milk production through livestock farmer field schools, INADES promotes local poultry and group marketing. The following focuses on government extension provision.

Government departments of agriculture and livestock offer extension services in the area. The basic duties performed by respective district extension heads included coordination of crops and livestock production programmes in the district- this includes extension and training, and administrative issues. The districts AES receive reports from the divisions AES via reports, phone briefs, meetings and consolidate before forwarding to the provincial levels.

The type of backstopping support received from superiors at division or district subject matter specialists in agriculture include monitoring, facilitation of transport, and allowances to some extent and provision of materials for demonstrations. In the

livestock sector these include information on any new technology, facilitation on request, and provision of transport during mobilization.

Various extension approaches have been used over time resulting in a plethora of approaches from which the AES can choose from or combine to achieve desired results. The most popular agricultural extension approaches that have been used in Kenya include the farmer (pastoralists) training centres, Individual farm visit Approach, Group Approach, Whole Farm Approach, Integrated Project Management Approach, Farming System Approach to Research, Extension and Training, Training and Visit (T&V), Commodity Extension Approach, Farmer Field School (FFS), Focal Area Approach (FAA) (cf. Kiteme et al., forthcoming 2009).

Table 1: Farmer reports of extension approaches used in Larger Makueni district

Extension Approaches	Training/attendance in the past five (%) years	Perceived to be effective (%)
Farmer training	45	40
Farmer exchange visits	60	40
Barazas	85	70
Mass media	65% had listened to a radio AES programme, while 5% had read a newspaper on AES Programmes.	40
Source: Kiteme 2009		

Each approach has its merits and demerits and has proved effective in certain circumstances to reach farmers. Generally, approaches that focus on individual farmers (individual farm visit, whole farm approach) require substantial resources to implement, such as high staff-farmer ratio for wide coverage. Some farmers found that through farmer training, direct application of what is learnt is possible and that it is the best since it addresses topics of concern at length.

Exchange visits ‘enable observation and comparisons which enhances adoption and implementation. Farmers feel in the same level hence can ask any relevant question/ share information freely’

The training and visit approach was found to be very effective but it demanded a lot of time for both the farmer and the extension worker. This left no time to collaborate

with other extension providers. The approach is also hindered by the shortage of agricultural extension officers'

Integrated approaches (Integrated Project Management Approach, Farming System Approach to Research, Extension and Training) also require high amount of resources. They address farmer's problems by providing wide range of services on the provision of credit and other inputs, marketing services by strengthening cooperative services, construction of rural access roads and others. While the group approaches reduce the amount of resources required and have proved effective as one extension worker is able to reach many farmers in a short period, they do not address the specific challenges of individual farmers.

All these approaches have used different methods and tools to facilitate interventions, the most prominent of them being demonstrations, field days, shows, tours, on farm research trials.

6.3 *Availability of resources for provision of AES in Larger Makueni district*

Planning AES activities - The AES in Larger Makueni district uses annual/ seasonal calendar for planning the implementation of extension activities, but community and official circumstances often interrupt adherence to the calendar. However, the department of livestock did not have a calendar as such but work plans and budgets based on activities as per programmes. *Transport availability, commitment of the target group and staffing levels influence the successful implementation of the calendar.*

Inadequate transport facilities - The transport arrangements are not sufficient for agriculture and livestock extension (with one livestock extension officer the area is so large for one person to cover). As a result agriculture extension uses group extension approaches like Chief's Barazas (public meetings) and farmer field days. The recently acquired vehicles are expected to alleviate the transportation constraints of the extension services. Earlier the extension officers had to either go by foot or borrowed motor bikes and bicycles from the divisional level.

Inadequate office space and equipments - Both office space and equipment were inadequate over the years for both livestock ad agriculture extension at the district and division levels although districts were slightly better than divisions in infrastructure.

Inadequate and aging extension staff - The level of staffing was inadequate to meet the AES requirements and demands. There has been no hiring of frontline extension

staff and those present do not have adequate transport. At the time of data collection, there were no frontline extension officers in three divisions for agriculture. GoK NASEP (2005, p. 5) reports that "during the last 15 years, the staffing and facilitation of public sector extension has declined mainly as a result of public employment freeze and reduced funding for operations and maintenance. In the public sector, for example, the ratio of frontline extension worker (FEW) to farmers is about 1:1000 compared to the desired level of 1:400. In the absence of effective private sector operations to fill the vacuum, the situation has led to reduced spatial coverage, targeting and effectiveness of service delivery reflected by clientele complaints". The district has a thin and aging extension staff for both crop and livestock extension services with an average of 21 years in service (see Kiteme 2009 for details).

Low level of funding – Funding levels have been generally low although in the past but have increased progressively, but are still inadequate. Although funding for livestock in the district has been low compared to agriculture extension, agriculture extension staff receive more requests than they can address. Major sources of funding are government and donors in addition to NGOs and local communities. The government funds the general extension; give grants to groups, construction of water pans, relief seeds, farmer education, demonstrations, field days, mobility of staff. Donors' funds have been used as grants to support production, marketing and capacity building, and for farmer training, construction of feeder roads, small irrigation practices, shallow wells/ water pans, and farmer information desks, etc. NGOs have supported community initiatives towards food security. Communities fund extension through cost sharing in programme activities, e.g. unskilled labour for works and informal support to programme activities.

As a result of shortage of funding and reforms, extension services are no longer free as extension officers demand lunch and fuel from the farmers. While some farmers pay for these services with the understanding that the services are at least available, other farmers contend that extension services should be free of charge.

Due to groups being enlightened on many issues, they are able to go as groups to seek for these services, and when you get to the officers in the office, they actually help. The extension officers keep training farmers in field days/ open forums and do forums to follow up those they trained.

However, farmers generally perceive the reforms in extension services provision as positive. More farming groups have come together to produce and market together,

liberalization of market and standardization has come up. In the past there were complaints of not seeing the extension officers, however, with demand orientation, the farmer utilizes the officer fully- when farmers are capacitated they can approach the officers at any time. The policy framework addresses all areas and the only challenge is implementation/ funding. In livestock, private extension services need to be legalized and some existing Acts reviewed such as Coffee and environmental conservation Acts.

6.4 *Policy and structural gaps*

Gaps in Policy - Policies limit poorer farmers' access to extension services - The idea of charges on AES has affected farmers' access to and adoption of AES technologies in a number of ways. Any farmer who is able gets the service while those unable end up missing hence non/low adoption. On the other hand, agriculture reported positive outcomes as services not charged are not valued by farmers since it is free. Farmers' willingness to pay for extension services is confined to commercial enterprises (farmers) such as fruit growers in agriculture. There is a higher willingness in livestock provided there is confidence in the service provider.

Gaps in legislation - Legislative instruments in agriculture do no encourage farmers to grow traditional crops like cassava, sorghum as they do for scheduled crops like maize (Kiteme, 2009). This locks out farmers' diversification initiatives to cope with climate change as most crop enterprises involved are not classified as essential crops by law. In this respect, the guaranteed minimum returns that would act as motivator to adaptation is not feasible to the small holder farmers. There is also an emphasis on large scale farms with no consideration for small holder farmers who are the majority and who would also require guaranteed minimum returns and advances.

Gaps in resources and structures - The capacity of institutions/structures to follow up on knowledge-skill- action- behaviour change/ adaptation is limited. There is no ability to respond to all farmers needs adequately due to the following limitations: poor transport facilities/ lack of cars, poor road infrastructure, large areas to cover, few/inadequate staff, lack of enough facilitation, congested schedule, there is low staff-farmer ratio- the staff are over worked. Experiences of district extension administration respondents in managing AES over the years showed that *the most difficult challenge is mobility and access to information.*

The suggestions of the respondents on how agricultural extension should be organized for it to promote strategies for adaptation to climate change include the following: identify key areas; making the sites learning centres, promote group learning; address attitudes; build common visions; find ways agreeable on up-scaling what has been learned. The officers should be fully trained. Target groups must be well informed about the changes to develop suitable calendars which should be followed properly. Design packages of extension with respect to the agro- ecological zone in mind. The findings show adaptation messages have to be accompanied with advice on water use, farm inputs, and credit, because the recipients are poor.

7. Measuring the adaptiveness of PAES to climate change

Based on the foregoing, various criteria and indicators (see Table 1) have been derived from literature on adaptiveness and related concepts of vulnerability, resilience, adaptation, social learning and adaptive capacity. The first column identifies the general dimensions of adaptiveness, the second column the criteria and the third column the indicators that reflect the desired outcomes. Based on data collected and our analyses, the adaptiveness of PAEs based on these criteria and indicators have been assessed qualitatively in the last column. This is still exploratory and it is planned to take this template back to actors in PAES so they can do the assessments themselves and improve on the criteria. As it is, Table 1 can be further improved to be used by the PAES to assess its progress in adaptiveness. The letters VL, L, M, H, VH, depict, very low, low, medium, high and very high respectively.

Table 2: A proposed framework for measuring adaptiveness of PAES to climate change

Dimensions of adaptiveness	**Criteria**	**Indicators**	**Qualitative weighting**
		Question: How adaptive are the public extension services (PAES)?	
Resources	Human capital	PAES has adequate human capital (skills and knowledge)	M
	Adequate staff	PAES has adequate staff (numbers)	L
	Internal incentives	PAES offers competitive salaries relative to private Extension Service Providers	L
	Information	PAES can access all research results	L
	Transportation and access	PAES has the facilities to easily access the farmers	L-M
	Appropriate financing system	Sufficient (public and private) financial resources are available	L
	Cost recovery	Costs are recovered from the 'users' by public and private financial instruments (charges, prices, insurance etc.)	M
	Financial flexibility	Decision-making and financing in one hand	L
*Legal / policy framework	Appropriate policy/legal framework	A legal framework for ES exists	VH
		Policies have been reviewed and changed periodically	H
	Adaptable legislation	Laws and regulation can easily be changed	M
	Climate protection	PAES promotes climate protection	VH
	Site-specific knowledge	PAES use site-specific knowledge	VH
	External incentives	Promote (at least not hinder) the adaptation option (incentives)	H
	Diversity	PAES providers are diverse	M
		PAES uses diverse approaches, tools and methods	H
	Stewardship	Encourage stewardship (in contrast to exploitation/mining resources) rather than just management	VH

	Environmental protection	PAES messages benefit the environment	H
Self-organisation	Local resources use	PAES uses locally available resources	H
	Own resources	PAES relies on own resources for its work	L-M
Networks	Cooperation and networks	Promotes cooperation and networks among farmers	H
	Cross-sectoral co-operation	Sectoral governments are actively involved in PAES	H
		Co-operation structures include government bodies from different sectors	M
	Co-operation between administrative levels	Lower level extension officers are involved in decision-making by directors at the national level	L
	Co-operation across administrative boundaries	PAES cooperate with non-NR-based government sectors	L
	Stakeholder participation	Any farmer can participate in the Barazas (group meetings)	H
		Co-operation with private extension providers	H
		Co-operation with other government departments active at locational level	H
		Non-governmental stakeholders actually contribute to agenda setting, analysing problems, developing solutions and taking decisions (“co-production”)	L
		Non-governmental stakeholders provide ES themselves (e.g. common interest groups)	M
		Researchers participate in ESP	M
Learning capacity	Knowledge combination	PAES uses research results from different disciplines	H
*Policy development and implementation	*Long time horizon	Solutions for short term problems do not cause more problems in the (far) future (20 years or more)	M
		Already now preparations are taken for the (far) future (20 years or more)	L
	*Flexible measures, keeping options open	Measures taken now or proposed for the near future do not limit the range of possible measures that can be taken in the far future and are preferably reversible	M
	Farm resources use	PAES promotes services that rely on farm resources use	H

	Flexibility	PAES at national level can adjust management structures and laws to new conditions	H
	Flexibility	PAES practice can adjust management procedures to new conditions	M
	Feedback among peers	PAES promotes interactions between PAES practitioners	H
	Feedback farmer-extension	PAES approaches promote feedback between farmers and extension officers	VH
	Feedback farmer-policy-makers	PAES approaches promote feedback between farmers and policy makers	L
	Feedback extension-policy-makers	PAES approaches promote feedback between extension practice and policy makers	L
	Feedback farmers-researchers	PAES approaches promote feedback between farmers and researchers	H
	Local ecological knowledge	PAES builds on or transmit local ecological knowledge	M
	*Experimentation	Small-scale policy experiments take place/ are financially supported.	L
	*Full consideration of possible measures	PAES considers several alternatives and scenarios	L-M
		Alternatives include small and large-scale and structural and non-structural measures	L
	*Actual implementation of policies	Plans and policies are actually implemented	M
		Policies are not dogmatically stuck to when there are good reasons not to implement policies, such as new and unforeseen circumstances and new insights	M
*Information management	*Joint/ participative information production	Different government bodies are involved in setting the terms of reference and supervising the search, or at least consulted (interviews, surveys etc.)	L-M
		Idem for non-governmental stakeholders	L-M
	*Elicitation of mental models/ critical self-reflection about assumptions	PAES allow their messages to be challenged by stakeholders and present their own assumption in as far as they are aware of them	M
		PAES are not presented in an authoritative way, but in a facilitative way, to stimulate reflection	M

		by the stakeholders about what is possible and what it is they want	
	*Explicit consideration of uncertainty	Uncertainties are not glossed over but communicated (in final reports, orally)	H
	*Broad communication	PAES exchanges information and data with other government departments	M
		PAES actively disseminate information and data to the public: on mobile phones, the internet, but also by producing leaflets, though the media, etc.	M
	*Utilization of information	New information is used in public debates (and is not distorted)	L

Source: Based on literature (* from Randgever et al., 2006, op. cit.) / own design

Legend: VL: Very Low; L: Low; M: Moderate; H: High; VH: Very High

8. Conclusions and Outlook

The foregoing shows that the PAES has achieved various levels of adaptiveness in its policies and in the knowledge and approaches that it uses. The highly hierarchical organisation does not augur well for feedback between the various levels of organisation.

The policy encompasses various adaptive principles but resources limit implementation. In order to address resource limitations, there is need to incorporate other means of extension services provision such as using radio. There has been an emergence of technologies and these should be patented. It is claimed that most of the technology still lies in the shelves of research stations. Therefore, the research-extension-farmer linkage and also upscale adaptive research to come up with farmer friendly least cost technologies. For extension staff, continuous training needs assessment should be conducted. A good scheme of service and a good remuneration package are also pre-requisites for good performance.

Issues of scale and multi-level dimensions still need to be addressed as these influence adaptiveness of the extension system as a whole. There is need for further research to improve the measurement framework. Further group discussions with actors in PAES and farmers to assign (appropriate) weighting to the indicators is one aspect that could be undertaken. As it is not the sole role of research to define what PAES is desirable and the PAES vision under a changing climate, further research with active participation of the PAES actors and policy makers can provide further insights.

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