A mixed qualitative–quantitative–participatory methodology: a study of the agricultural knowledge and information system (AKIS) of small-scale farmers in Kirinyaga district, Kenya

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Abstract

Agriculture and rural development form the bedrock for effective development in Kenya, where about 80% of the farmers are smallholders. Small-scale farmers face many challenges in harnessing knowledge and information from appropriate sources. To help address the problems, and facilitate participation, sharing and exchange of knowledge and information, there is a need to understand the agricultural knowledge and information systems of small-scale farmers. This paper examines how key agricultural actors in Kirinyaga district, Kenya support sharing and exchange of agricultural knowledge and information. The paper is based on a study that adopts a triangulation of qualitative, quantitative and participatory methodologies and methods for sampling, data collection and data analysis. The methods combine Relaxed Appraisal of Agricultural Knowledge Systems and Participatory Rural Appraisal; questionnaires, interviews and focus group discussions; case studies; observation and analysis of secondary data. Preliminary results suggest that richer and deeper data is collected through mixed methodologies and methods. The study points to the need to strengthen and formalise linkages between farmers, researchers, extensionists, educators, farmers' groups, private sector, input stockists, microfinance institutions, media and civil society organisations.

Keywords: Agricultural knowledge and information system (AKIS); information behavior; qualitative-quantitative-participatory methodology; Kenya

1. Introduction and background

In Kenya, 80% of the population lives in rural areas and derive their livelihoods from agriculture. The agricultural sector plays a critical role in wealth creation and employment, and accounts for about 25% of the gross development product (Republic of Kenya 2008a). Agriculture provides raw materials to the manufacturing sector and stimulates indirect growth. The agricultural sector employs more than 80% of Kenya's workforce and contributes 57% of national income (Republic of Kenya 2006). Despite its importance, growth in the sector has declined over the years from 4.4% in 1996 to a record -2.4% in 2000 (Republic of Kenya 2006). Improvements were made from 2002 (1.8%) to 2005 (6.9%), but the growth rate dropped to 2.3% in 2007 (Republic of Kenya 2008b). Of the farmers in Kenya, 80% are smallholders, who produce for subsistence and for sale. These farmers face many barriers to attaining full agricultural production including poor access to agricultural information, low output and productivity, weak institutional capacity and coordination, inadequate markets and market information (Republic of Kenya 2006). In addition, Rees et al. (2000) observed that linkages between research, extension, civil society organisations and farmers were weak and that often the new improved technologies did not reach their intended beneficiaries.

The FAO and World Bank (2000) defined an agricultural knowledge and information systems (AKIS) as a system that "links rural people and institutions to promote mutual learning and generate, share and utilize agriculture-related technology, knowledge and information". The need to increase production, improve the poor linkages between agricultural actors, improve access to market information and agroprocessing, and address the limited supply of agricultural information and knowledge for farmers highlighted the need to understand the AKISs of small-scale farmers. Kirinyaga district, Central province provided a good entry site for the study of AKIS because of its high agricultural potential and population. Kirinyaga district is characterised by many small-scale farmers who keep livestock and grow cash crops and subsistence crops. The district faces immense challenges including the small landholdings (average farm sizes of 1.2 hectares), declining productivity in agriculture and livestock,

poverty, gender inequality, low incomes and a varied tropical climate. More significantly, the farmers do not have adequate access to agricultural information and knowledge on production, processing and marketing (Republic of Kenya 2002). This paper reports on a study of AKIS carried out in four divisions (Central, Gichugu, Mwea and Ndia) of Kirinyaga district. The study aimed to understand the role of small-scale farmers as key actors in supporting agricultural development, their information behaviour and their sources of knowledge and information and their system of inter-linkages for the sharing of agricultural knowledge and information. The study used a mixed qualitative-quantitative-participatory methodology, and focused on small-scale farmers' groups in exploring ways of strengthening linkages and improving the sharing and exchanging of agricultural knowledge and information between actors.

2. Methodology and methods
Waring (2000 cited in Knox 2004) pointed out that it can be limiting to adopt only one methodological approach as "methodologies are best used in a complementary way" to ensure the bigger picture is not lost. Earlier, Pratt and Loizos (1992) observed that research touching on development issues required not only quantitative and qualitative aspects, but also participation of local stakeholders. This study used the qualitative and quantitative mixed style design (Creswell 2003), and participatory action methodology (Pretty and Vodouhe 1997; Bhana 2006) to explore ways of strengthening linkages and improving the sharing of agricultural knowledge and information. The Sense-Making Methodology (Dervin 1998; 1999; 2007; Romanello, Dervin and Fortner 2003) was used as an alternative approach to study information behaviour of small-scale farmers. The Sense-Making Methodology is based on the soft knowledge systems perspective. The soft systems methodology (SSM) (a participatory methodology) was used to link up the different activities by diverse agricultural actors into a purposeful whole (Checkland and Scholes 1990; Checkland 1999; 2000). More specifically, the SSM was used to help: i) identify actors and potential actors, ii) identify opportunities to improve a knowledge and information system, and iii) create awareness among relevant stakeholders.

A multi-method research design was adopted. We used qualitative techniques to study the AKIS of small-scale farmers and their information behaviour comprising a cross sectional survey, interviews, observation, action research, and focus group discussions. The survey method was used to assess people's feelings, thoughts, opinions and relationships (Shaughnessy, Zechmeister and Zechmeister 2003). Interviews were conducted in both the qualitative and quantitative approaches to provide the opportunity to clarify any outstanding issues, and obtain insights of the respondents (Babbie 2004). Dervin's Sense making interviewing technique was used for interviews and focus group discussions to gather in-depth data on agricultural actors, and to allow the farmers to deconstruct and describe their worlds in their own terms and meanings (Dervin 1999). A semi-structured questionnaire was used to investigate agricultural information providers. The Rapid Appraisal of Agricultural Knowledge Systems (RAAKS) (Engel and Salomon 1997; Salomon and Engel 1997a) – an SSM application, and the Participatory Rural Appraisal (PRA) methods were used to study the different agricultural actors and their social interactions in an AKIS of small-scale farmers. RAAKS provided for the inclusion of women and other frequently neglected groups such as the youth (Salomon and Engel 1997b). We used six RAAKS windows: Actor analysis (A2), Prime mover septagram (A5/B6), Knowledge network analysis - information source (B3a), Knowledge network analysis - communication sheet (B3b), Integration analysis (RAAKS B4/a), and Basic configurations. The PRA methods used were time lines, network diagrams, agriculture service maps and Venn diagrams. The PRA methods used yielded purely qualitative data, while RAAKS provided qualitative and quantitative data.

The study population was made up of small-scale farmers in Kirinyaga district (individuals and groups), and information providers. Cluster sampling was used to draw the sample as there was no comprehensive sampling frame and the population was large and scattered (Sapsford and Jupp 2006). The basis of the clusters was sub-locations. The selection of farmers' groups was guided by the criteria used by Rees et al. (2000) – have (i) a concentration and diversity of agricultural developments; (ii) diversity and concentration of actors; (iii) social organisation of farming groups and iv) agro-ecological

representation. In addition, we added the criteria (v) balanced representation of men, women and youth farmers (15-25 years). The sampling steps included (i) selection of three locations from each of the four divisions (12); (ii) selection of three sub-locations from each location (36); (iii) selection of three farmers' groups from each sub-location; (iv) one farmer was then selected from each farmers' group (focus group discussion), and each farmers' group was asked to identify a farmer not belonging to a group. In sum, a total of 90 focus group discussions were held with farmers' groups, 102 individual farmers belonging to a group and 71 individual farmers not belonging to a group were interviewed. Eight (8) questionnaires were sent out to information providers and the response rate was 50%. Detailed observations were made during field visits and throughout the data collection period in Kirinyaga district. One to one interviews were conducted with government ministries, research, training and education institutions (14), non-governmental organisations (NGOs), community based organisations (CBO), projects and religious organisations (8), input stockists (17), and key informant representatives (4). SPSS 15.0 and NUD.IST (NVIVO) 9 were used to analyse quantitative and qualitative data respectively.

3. Preliminary results

The preliminary data presented is based on the findings obtained from focus group discussions with farmers groups, RAAKS and PRAs. The content analysis of Sense Making is not covered in this paper. Of the 90 farmers' groups (N=90) (22, 26, 26, 16 in Central, Gichugu, Mwea and Ndia s respectively) that participated in the study, about two-thirds (67.8%) were mixed groups (male, female and youth), 21.1% female only, 6.7% male only and 4.4% youth only. The groups were diverse and while some were formal, others were informal. About 92.2% of the groups were registered and this status enabled them to exist as legal entities that can transact business, open bank accounts, negotiate agreements, apply for loans, access government support, sue and be sued. The majority (97.8%) were farmers' groups, while 2.2% were cooperatives.

Information behaviour

The study established that the main objectives of farmers' groups were to: generate income (22.3%), improve agricultural development and adopt modern technologies (20.9%), address social welfare activities (14.1%), reduce poverty (7.8%) and to access markets and good prices (7.3%) (Table 1).

Table 1: The main objectives of farmers' groups

Objective	Responses (N)	Percentage (%)
Income generation	46	22.3
To improve agricultural development / access modern technologies	43	20.9
Social welfare activities	29	14.1
To reduce poverty	16	7.8
To access markets and good prices	15	7.3
To conserve the environment, soil fertility	13	6.3
To create employment / self employment	12	5.8
Food security	11	5.3
To access services	11	5.3
To learn and access knowledge and information	7	3.4
To improve health	3	1.5
TOTAL	206	100

The groups cited about 44 enterprises (N=214 responses) as their main agricultural enterprises. Those more frequently mentioned were tissue culture bananas (TCB) (22 groups, 10.3% of responses), maize (19 groups 8.9%), coffee (16 groups, 7.5%), French beans and tree / fruit nursery seedlings (15 groups, 7.0% each), dairy goat (14 groups, 6.5%), and dairy cow (13 groups, 6.1%). Other enterprises of farmers' groups included tea, tomatoes, poultry, bee keeping, cotton, pigs, and avocado soap making.
The information needs of the groups were based on the enterprise(s) they ranked as priority. The enterprise(s) ranked as priority number 1 (N=88) appeared to be for income generation and food:

French beans (13.6%), maize (12.5%), coffee (10.2%), tea (8.0%) dairy cow and dairy goat (6.8% each), tree/fruit seedlings (5.7%), TCB (4.6%), as well as cotton, bee farming and horticulture (3.4% each). Enterprises ranked as priority number 2 (N=76) seemed to be primarily for household consumption and for selling: maize (12 groups, 15.8%), beans (7 groups, 9.2%), TCB (6 groups, 7.9%), dairy goat (5 groups, 6.6%), and tomatoes (4 groups, 5.3%). For each of these priority enterprises, the groups needed information on diverse areas cutting across the production to consumption continuum as presented in Table 2. The groups in Mwea and Ndia mainly sought information on TCB, while groups in Central and Gichugu required information on tea, animal feeds, animal health and breeds. Groups in Gichugu and Ndia looked for information on coffee, while groups in Mwea sought after information on cotton. There were no major differences between information needs related to specific enterprises that the groups ranked as priority number 1 and 2 except that there were more needs for value addition information for enterprises ranked as priority one (16.2% as opposed to 2.7%) (see Table 2).

Table 2: Information needs for enterprises ranked priority number 1 and 2

Information need	Enterprise ranked Priority no. 1 (% of cases)	Enterprise ranked Priority no. 2 (% of cases)
Crop husbandry	61 groups (69.3%)	54 groups (73.1%)
Marketing and price information	28 groups (31.8%)	16 groups (21.6%)
Seed varieties and seedlings	23 groups (26.1%)	24 groups (32.4%)
Pests and disease control	20 groups (22.7%)	14 groups (18.9%)
Animal husbandry	17 groups (19.3%)	17 groups (23%)
Value addition	16 groups (18.2%	2 groups (2.7%)
Fertiliser use and application	11 groups (12.5%)	7 groups (9.5%)

Farmers' groups in Kirinyaga district expressed diverse information seeking behaviour. About half (44 groups, 51.8% for enterprise ranked priority number 1 (N=129 responses) and 36 groups, 50.7% for enterprise ranked priority number 2 (N=113 responses)) of the respondents indicated that they obtained information from extension service providers. The groups either invited the extensionists to their group meetings, or representatives of the groups visited extension officers in their offices. Others participated in farmer field schools, attended training at agricultural training centres, visited research institutions or worked with NGOs to access knowledge and information, or were trained at their locality by local and external experts such as horticultural exporting companies. The groups also consulted input stockists at their premises, veterinary officers, attended field days, shows, seminars and study tours. Some respondents only relied on their own knowledge.

The responsibility for collecting information for the groups (N=90) rested with the secretary (26.5%), or the executive committee (25%), or the chairperson (21.25%). Individual farmers also collected information. Information for the enterprise ranked priority number 1 (N=155 responses) was shared through meetings (75 groups, 88.2% of cases), training (21 groups, 24.7%), demonstrations (19 groups, 22.4%), one on one oral discussions (13 groups, 15.3%), barazas[1] (10 groups, 11.8%), cellular phone, print materials, field days and churches. A similar pattern was observed in the manner in which the groups shared information and knowledge for the enterprise ranked priority number 2. Most of the groups shared information through group meetings (58 groups, 84.1% of responses), training sessions (12 groups, 17.4%), oral discussion (9 groups13.0%), barazas (8 groups, 11.6%), and demonstrations (7 groups, 10.1%). About 81.8% of the focus groups indicated that they shared the information they accessed with other members of the community including other farmers, neighbours and friends, (89.9%), other groups, leaders and visitors that asked. Most information was shared orally (60%) at training sessions, meetings, social and prayer gatherings, followed by demonstrations and observation (14.3%). Local and / or indigenous knowledge[2] was considered important, with 51 groups (58.6%) indicating that they shared indigenous and / or local knowledge assets they possessed with other community members. This knowledge was tapped from knowledgeable elders, groups, parents, other farmers and the radio.

AKIS of Kirinyaga district

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There were more than 100 active information and knowledge providers in Kirinyaga district. These were categorised under the following sub systems: i) research (3 national institutions and 3 international institutions); ii) training and education institutions (7); iii) public sector (government departments and programmes (15), and parastatals (4)); iv) local producers (farmers' groups, model / innovative farmers, neighbours, relatives, friends); v) markets (local (Kagio, Kutus, Makutano, Sagana, Kibirigwi, Baricho, Kerugoya), external outside Kirinyaga (e.g. Nairobi, Mombasa) and export markets); vi) civil society organisations (17 NGOs and associations, 4 projects, 5 faith based organisations); vii) private sector organisations (36), (which included horticultural exporting companies, input stockists, agrochemical companies, seed suppliers, feeds and fertiliser manufacturers, credit and microfinance institutions (11)); viii) media (e.g. Inooro and Cooro radio stations, television and newspapers) and ix) development partners (donors) (6).

Extension emerged as the most important source of information. Extension services from the Ministry of Agriculture and information from model farmers were perceived to be closer and more accessible to farmers than other sources. Other key sources included the private sector, especially horticultural exporting companies, input stockists and NGOs. Because of the varied climate and diverse agroecological conditions in the district, the different divisions, locations and sub-locations had their own major sources. For example, Figure 1 presents a Venn diagram showing the main sources of agricultural information in Miuu sub location, Murinduko location in Mwea that shows institutions, organisations, groups and important individuals found in Miuu sub location. The size of the circle represents the perceived views of the groups regarding the importance and contact with the information provider. The distance from the centre denotes how close (in terms of physical distance) the service provider is to the group.

The farmers' groups in Miuu sub location perceived the Ministry of Agriculture to be the most important and accessible source of agricultural information and knowledge. The Ministry of Fisheries Development and the Christian Community Service, Ministry of Livestock Development, Veterinary Department and Forest Department were considered important but not easily accessible. The Kenya Agricultural Research Institute (KARI) and the cotton ginnery were viewed to be of medium importance but were perceived to be closer to the community. Other key sources were Mwea Irrigation Agricultural Development Centre (MIAD), the Horticultural Crops Development Authority (HCDA), Africa Harvest and churches. Model and innovative farmers, though few and scattered played a vital role in providing agricultural information and knowledge to the surrounding community. NGOs and faith-based organisations were more active in Mwea, Ndia and Central, where there was a strong presence of private sector organisations and microfinance and credit institutions. However, extension services, horticultural exporting companies, agrochemical and seed companies, and stockists provided information and knowledge in all the four divisions. Access to credit was crucial in facilitating acquisition of agricultural inputs, which have become very expensive. Some focus group discussion members often remarked: "we have been trained but we do not have money to buy the inputs". Microfinance and credit institutions were thus a key actor in the AKIS of Kirinyaga district.

There were various services linking the different actors in Kirinyaga district to farmers' groups. Extension services were provided by: the public sector, coffee cooperatives and societies, NGOs and faith based organisations. The groups acquired agricultural inputs from stockists and in some cases from Kamweti Agricultural Training Centre (sweet potato vines), KARI - Mwea (cotton seed), MIAD (rice seed), Coffee Research Foundation (improved coffee seedlings), or Jomo Kenyatta University of Agriculture and Technology (JKUAT) (TCB plantlets). Private animal health service providers offered health care and artificial insemination services to farmers who could afford to pay. Horticultural exporting companies, coffee factories, associations, and private companies provided services for the control and management of plant pests and diseases at cost. Ox plough services were the most preferred ploughing method because of the hilly terrain in Kirinyaga district, while a few farmers used tractors and the hoe or fork "*jembe*". Horticultural exporters, traders and hawkers collected farm produce at designated collection sheds or the farm gate. Farmers transported their goods on donkey

carts (especially in Mwea), pickup trucks, canters or lorries and sold it at the main local markets at Kagio, Sagana, Makutano and Kutus (Figure 2). The groups mainly accessed credit from their merry-go-rounds³, savings and credit cooperatives, KREP, Agricultural Finance Cooperation and Equity bank (Figure 2).

This study established that linkages between the various actors and farmers were weak. Although some services were easily accessible, others were distant and inaccessible or not affordable to farmers. For example, the network diagram for Kombu-ini sub location, Kangai location in Mwea demonstrated that farmers had stronger links with neighbours and other farmers, stockists, agrochemical companies and horticultural exporters, while linkages with extension, markets, credit institutions, the National Irrigation Board (NIB) and markets were weak (Figure 2). A network diagram for Kithumbu sub location, Mwerua location in Ndia brought out farmers' groups as being an important and accessible actor.
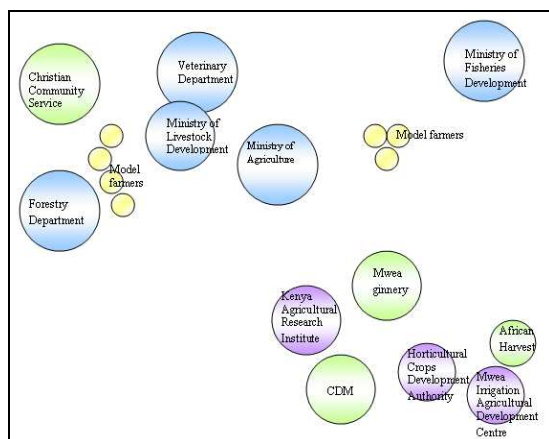

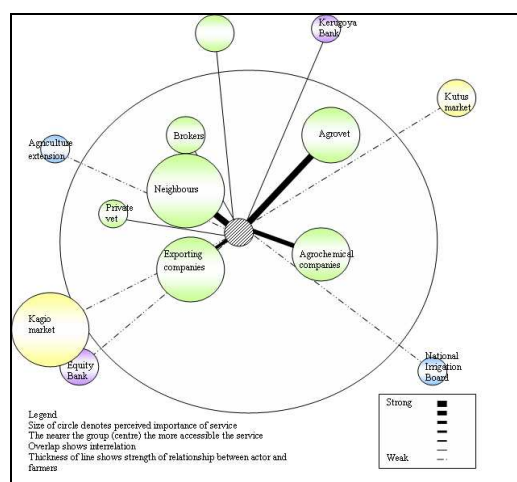Figure 1: Venn diagram of Miuu sub location, Murinduko location, Mwea division

Figure 21: Network diagram for Kombui-ini sub location, Kangai location, Mwea division

Prime mover septagrams helped to determine the most influential actor(s) in the operational activities of farmers' groups in terms of the quality and strength of the relationship between the groups with the world around them. The shape of the septagrams depended on the conditions in the location, the actors
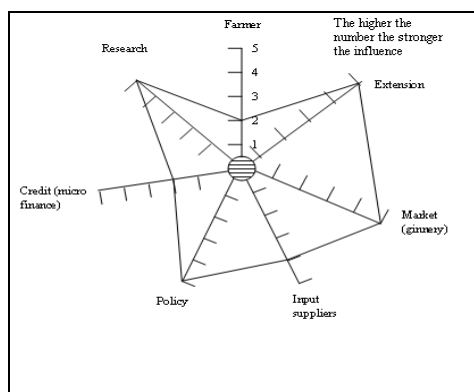

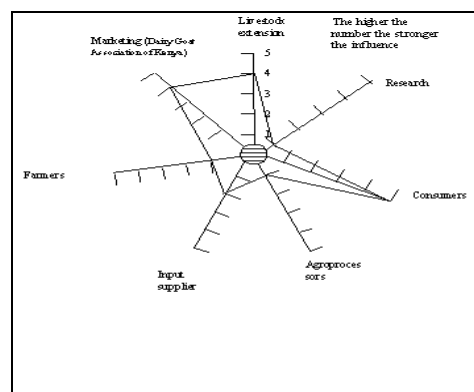Figure 3: Prime mover septagram of Wendani Cotton Self Help Group

Figure 4: Prime mover septagram of Ngakandu Dairy Goat Keeping Self Help Group

and services on the ground as well as the enterprise(s) produced. The septagram for Wendani Cotton Self Help Group in Riagicheru sub location, Murinduko location in Mwea showed that research, extension, market and the new cotton policy influenced cotton production (Figure 3). It was apparent that markets were increasingly becoming the drivers of agricultural production, and farmers were willing to adopt any enterprise as long as there was a market and good economic returns. Farmers in Riagicheru sub location adopted cotton because the ginnery provided a ready market. In contrast, the septagram for Ngakandu Dairy Goat Keeping Self Help Group in Karia sub-location, Koroma location in Central (Figure 4) showed that consumers of dairy goat milk were the prime movers. Research and agro processors exerted the least influence for the dairy goat enterprise.

4. Discussion and conclusion
The combined qualitative-quantitative-participatory methodology made the research "fun", and as observed by Duffy (1987), mixed methodologies encouraged creativity and enriched the understanding of problems being investigated (Hoskisson et al. 1999). Data from the participatory approaches complemented the survey and focus group discussions data and the mix provided results that were more reliable and rounded (Cohen, Manion and Morrison 2007), with pictorial representations that enhanced understanding. The SSM facilitated the understanding of complex "organisational" problems, innovation, learning and choice making (Röling 1988). The methodology helped to highlight the roles and relationships between different agricultural actors, what they actually did, how they learnt, and how they shared ideas and experiences (Engel and Salomon 1997). RAAKS provided tools for studying AKIS and the participatory approach helped to visualise things, tap the farmers' knowledge, facilite learning (Rölling and Pretty 1997), and provide a balance between science and practice (Cronholm and Goldkuhl 2004), and to enable the rural people to arrive at solutions to their problems. Triangulation of methodologies provided the freedom to choose appropriate research methods that were practical and that best addressed the research question(s) (Hoskisson et al. 1999). Further, the blend increased the robustness of the results of the study (Esteves and Pastor 2004).

However, some critics of mixed methodologies have argued that it is difficult to discern the link between two methodologies because the paradigms for each might be different (de Vos 1998:360). Knox (2004) argued that mixing of methodologies could complicate the research process. The experience of this study showed that triangulation of methodologies led to synergy, enrichment and complementarity of data. The process was however very expensive in terms of time, money and energy. The triangulation resulted in a massive store of data requiring much time on analysis. Although some of the methods duplicated the data obtained, the investment was justified by the completeness and detail of results obtained. The interviews and focus group discussions were long (about 3½ hours), and there were challenges in getting some group members to participate in the discussions. Some participants had very high expectations and viewed the study as the mouthpiece they were waiting for to air their problems and bring solutions.

The study of AKIS of Kirinyaga district corroborated the results of previous studies (Rees et al. 2000; Garforth 2001) in other locations. Linkages between actors were weak and each actor was driven by their own motives and interest, some of which were conflicting. The study also confirmed that the AKIS of small-scale farmers was location specific and varied with the enterprise(s) produced. Despite the non-availability of extension officers due to low staff numbers, the demand-driven public extension services were the most important source of information and knowledge for farmers' groups in Kirinyaga. It showed that farmers' groups were a key actor in the district and they worked collectively to learn, address problems and make discovery. Some of the groups had amalgamated to form umbrella groups such as the Rungeto Leaders Group. The groups were effective in promoting and scaling up new technologies, displaying innovation and improving farming methods. Although the study revealed that linkages between the actors themselves were weak, the TCB enterprise provided a good example of synergy between actors, where Africa Harvest (an NGO promoting TCB) collaborated with TechnoServe (an NGO linking farmers to markets) and the Ministry of Agriculture (for general husbandry). Most groups that had adopted TCB expressed satisfaction with the outcome. Another

example is the National Agriculture and Livestock Extension Programme (NALEP) that demonstrated a pluralistic approach and partnership between the public sector, private sector, civil society and farmers' groups through the establishment of a multi-stakeholder forum. The forum has facilitated interaction among actors and enhanced the sharing and dissemination of agricultural information and knowledge, but it had challenges of non-attendance by some stakeholders. This suggests the need for policy and regulatory frameworks that strengthen and formalise linkages between key actors.

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Footnotes

[1]**Baraza** is a Kiswahili word meaning a public space or gathering of people for the purpose of a meeting. The meetings may be simple informal gatherings of people or formal public or communal.

[2]**Local knowledge** is a blend of knowledge generated locally through practice and experience, and incorporating knowledge from several cultures within individual societies that may not be indigenous to the community in an ecosystem.

Indigenous knowledge is the unique knowledge existing within people's memories and developed around specific conditions of women and men indigenous to a particular geographic area.

[3]**Merry go rounds** are an innovative arrangement between farmers' group members who come together for strength. The members contribute money regularly to build a reservoir of funds for investment (a revolving bank) and the money is loaned to members on a rotating basis. The merry go rounds have provided easy access to credit.