German Institute for Tropical and Subtropical Agriculture (DITSL)
at the Faculty of Organic Agricultural Sciences
of the University of Kassel

Identifying local innovations in pastoral areas in Marsabit County, Kenya

by Brigitte Kaufmann, William Nelson, Raphael Gudere, Vince Canger, David Golicha, Markus Frank, Hassan Roba, Okeyo Mwai and Christian Hülsebusch

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Phone: +49 5542 607 29 | Fax: +49 5542 607 39
email: info@ditsl.org | Internet: www.ditsl.org

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List of Acronyms

BMZ	Bundesministerium für wirtschaftliche Zusammenarbeit und Entwicklung / Federal Ministry for Economic Cooperation and Development
CBO	Community Based Organisation
DITSL	German Institute for Tropical and Subtropical Agriculture
EMC	Environmental Management Committee
ILRI	International Livestock Research Institute
KARI	Kenya Agricultural Research Institute
KBC	Kenya Broadcasting Corporation
WHH	Welthungerhilfe (NGO, German Agro Action)

Foreword

The research was conducted under the project "Mutual learning of livestock keepers and scientists for adaptation to climate change in pastoral areas" funded by GIZ on behalf of the Federal Ministry for Economic Cooperation and Development (BMZ), whose support is gratefully acknowledged. It was carried out by the German Institute for Tropical and Subtropical Agriculture (DITSL) in collaboration with the International Livestock Research Institute (ILRI), and the Kenya Agricultural Research Institute (KARI). Lead scientists were: Brigitte Kaufmann and Christian Hülsebusch (DITSL), Mwai Okeyo (ILRI) and Simon Kuria (KARI). Field work was conducted by William Nelson (DITSL), Raphael Gudere (consultant, Ngurunit), Vince Canger (DITSL), David Golicha (KARI) and Michael Ngutu (KARI).

The information provided in this manual could not have been compiled without the dedication and collaboration of the Rendille, Gabra and Borana people, who contributed to the study. Our special thanks go to the innovators, whose innovations are presented in the manual, for their willingness to share their knowledge, for their time, and for the effort they have taken to do so.

Comments made by Saverio Krätli on the draft are highly appreciated. All photographs are taken by William Nelson.

1 Introduction

This manual provides insight into the methods used and the experiences gained while identifying local innovations in pastoral areas in northern Kenya. It targets a wider audience, ranging from multipliers working with pastoral communities, development professionals, and decision makers to students and academic scholars focusing on the field of innovations and their generation and diffusion. It is intended as a source book for both, people interested in the topic of "local innovations in pastoral areas and their identification and documentation" and for those interested in the specific local innovations that were identified in Marsabit County as such.

We would like to promote the identification of local innovations as one possible bottom-up strategy to learn about and to spread innovations in pastoral areas. Many top-down approaches that aimed at introducing innovations from outside have failed, because they have underestimated the context-specificity of pastoral production. We start out from the point of view that any innovation needs to fit into the respective local production processes, which are constrained by a combination of particular and specific environmental, socio-cultural and economic conditions.

Local innovations – i.e. innovations developed by local farmers or pastoralists themselves of their own accord - respond to a problem situation experienced by the respective innovators. Spreading local innovations within the setting of pastoralist-to-pastoralist exchange meetings greatly facilitates learning about why and how innovations were developed, how they fit into the respective production system and what the specific characteristics of innovations are that render them either beneficial or not. These exchange meetings have over the recent decades proven a promising approach to facilitate the learning of farmers to improve their production and livelihood systems (Van Veldhuizen et al 1997).

This manual is based on fieldwork carried out among the Rendille, Gabra and Boran pastoral communities in Marsabit County in northern Kenya. As innovations are specific to the respective production system, the innovations presented here are specific to certain areas in Marsabit County, hence not even Kenya as a state. Therefore generalisations can only be made as far as the process of the identification and spread of local innovations is concerned but not for the specific innovations and their suitability as such.

This manual is structured as follows: In the chapter Background Information, we give an introduction to pastoral production in Marsabit County and we summarise the major challenges presented by the pastoralists as the innovation drivers. This section is kept rather short, only emphasising the aspects relevant for understanding the innovations described later. Some background information on the methodology of identification and documentation of local innovations is also given in this chapter. In the next chapter we describe in more detail the methods used in this project to identify innovations and we reflect on the methodology and the experiences made. In the second part of the manual we present the five local innovations that were shared in pastoralist-to-pastoralist exchange meetings. We consider it important that the innovations are presented from the innovator's point of view.

2 Background Information

2.1 Pastoral production in Marsabit County

Different definitions of pastoralism exist and so figures on the number of people engaged in pastoralism vary widely from 20 million pastoral households worldwide (Blench 2001) to 268 million pastoral people for Africa alone (African Union Policy Framework for Pastoralism in Africa 2010). This depends largely on how pastoralism is defined. Pastoral systems are grassland based production systems. The latter are defined as production systems, in which more than 90 % of the household income results from livestock production and more than 90 % of the fodder for the livestock comes from natural rangeland vegetation (Seré and Steinfeld, 1996). Swift et al. (1981) classified pastoralism as production system in which more than 50% of gross revenue (the value of subsistence plus marketed production) was directly derived from livestock or livestock-related activities. The same degree of dependence on livestock production is used by Rass (2006), who regards pastoralists as mobile livestock herders operating in drylands on communal land with a larger than 50 % share of agricultural income from livestock. Livestock not only contributes to income through the sale of live animals, carcasses, meat, hides, skins, and milk, but livestock products contribute directly to household nutrition, such as milk, meat and in the case of northern Kenya also blood that is regularly drained from the animals for human consumption.

Pastoralists use rangeland resources including vegetation, water, and minerals, whose availability is highly variable both in space and time. Through the following, a short overview is given on the rangeland conditions of Marsabit County. A detailed account on climate, vegetation and resource availability for Marsabit County is provided by the Range Management Handbook for Marsabit District (Schwartz et al., 1991) and the Technical Reports produced by the Integrated Project on Arid Lands IPAL during the 1980ies. The rangelands in Marsabit County fall within the arid and semi-arid climate zone. The average annual rainfall is 200 – 300 mm in the lowlands and up to 700 mm on the mountain slopes. Rainfall is seasonal and is bimodally distributed with (theoretically) two rainy seasons per year. However, frequent failures occur particularly in the lowlands where the reliability of rainfall (both in terms of amount and length of rainy season) is low and the risk of prolonged droughts is high. It is part of the climatic variability that characterizes the system. In northern Kenya, droughts used to occur on average every five years. Schwartz et al. (1991) have published detailed maps on rainfall reliability for the long and the short rainy season in Marsabit.

Most of the land is not suitable for cropping mainly due to the low rainfall, but also because of edaphic reasons. Soils in the lowlands and the upland plateaus are predominantly deep and sandy with gravel areas with moderate infiltration capacity and low to very low organic matter in the topsoil. On slopes and mountains soils are rockier and have a moderately higher clay content. The landscape is covered by forest and woodland on the mountain-tops, perennial grassland and deciduous bush and shrub-land in the higher elevations and bushed grassland and dwarf shrub- land with sparse perennial shrubs and mostly annuals grasses and herbs in the lowlands. Considerable parts of the lowlands are barren. The rangeland is not uniform but consists of different rangeland patches. Due to high average temperatures, the evapotranspiration can reach 3000 mm per year, thereby causing an overall moisture deficit for the better part of the year. Schwartz et al. (1991) calculated very short (< 34 days) and episodic (less than 50 % of all rainy seasons permit growth) growing periods for the lowlands, and growing periods of up to 114 days only in the higher elevations. Still, longer growing periods occur only on the very tops of the mountains. Based on this climatic information together with a vegetation assessment, they have classified 23 different range units according to biomass production of different vegetation layers in response to the long and the short rainy season.

Maritz (2004) and Golicha (2011) found that pastoralists themselves differentiate rangeland patches according to a number of criteria that concern types of soil and vegetation but also their suitability for gra-

zing of a certain livestock species at a given point in time. The location of the different units is common knowledge within the community so the units can be delineate on a geographical map for outsiders to learn about their location. Herders follow a certain grazing itinerary depending on the characteristics of the units and the current rainfall situation. Thus they make use of the high temporal and spatial heterogeneity in quantity and quality of the vegetation growing on the different units throughout the course of the year. To exploit this heterogeneity in fodder resource availability and quality, livestock herds are mobile, i.e. they are taken by the herders to the different rangeland patches in order "to follow the forage" on a year round basis, while the core households are nowadays mostly sedentary.

Mobile pastoral production systems are characterized by several strategies that allow the systems to maintain its function (i.e. provide livelihood to the pastoral household through income and animal products), despite the uneven forage distribution and uncertainty of rainfall. The principal strategy is to match forage requirements of the different household herd livestock species with the forage on offer in the different grazing units. This is done during the course of a year through an extended grazing itinerary. Heterogeneity and mobility are thus the two paramount characteristics of pastoral systems with the latter being employed to explore the former (see also Krätli et al. 2013 for a more detailed description of the system's mechanisms). There are however increasing limitations to herd mobility, and therefore the ability to produce under high climate variability.

The animals belonging to one household are usually kept in two different herds, the so called satellite herd, which comprises the majority of animals, and the so called home-based herd, that consists of lactating animals and their calves to provide milk to the household either for consumption or sale. The satellite herd spends most of the year in far-away grazing areas in order to make use of the heterogeneous pasture vegetation. The household does usually not have access to this herd other than during ceremonies when the satellite herds come home. At this time, animals can be swapped between the satellite and the home-based herd, for instance, when lactation ceases or the condition of the animals deteriorates. The milk produced in the satellite herd is hence usually not available to the main household but provides for the herders moving with the herds and for raising the young stock.

2.2 Current challenges to pastoralist households

Pastoral communities living within the study area are Rendille, Gabra and Borana. Previously livestock keepers were highly mobile moving with their livestock and the entire household in the endeavour to drive their livestock to pastures. Households of the different communities have now become sedentary to varying degrees over the past decades (since the 1960s). Settlements have sprung up around water points and infrastructure (schools, mission stations, churches, dispensaries, hospitals/medical stations, shops), which was developed mostly by outsiders. The pastoral households, still earning their livelihoods from a livestock-based economy, have settled. However, their main livestock resources, i.e. those animals kept in the satellite herd, are still mobile.

The main households live in traditional "*manyatta* settlements" dispersed within approx. 1-15 km radius around the settlements (small towns). A *manyatta* consists of several households usually belonging to the same clan. The size of the manayattas varies depending on the pastoral community from a few households only (as can be the case with Gabra) up to 100 households (as can be the case with Rendille). Today, most *manyattas* are situated around the settlements.

The major challenges expressed by pastoralists taking part in the current study in Marsabit County were:

a) the change in rainfall pattern and the increased frequency and severity of droughts in the past decade, and
b) the increased sedentarisation of the households that has led to the concentration of human and livestock populations around settlement areas. This has affected the availability of pasture resources, especially of those that are accessible for the home-based herds.

With the increasing concentration of human population around the settled areas the conditions for keeping home-based herds have further deteriorated. This has a negative impact on the households' ability to produce milk both for self-consumption and for sale. This however increases their household expenses for purchasing food-stuff from the shops and at the same time reduces their daily cash income from milk sales. Fodder supply and supplementation for the home-based herds during droughts is therefore crucial for many households. In some climatically favoured areas, such as Ngurunit town at the edge of the Ndoto Mountains, grass, tree leaves and wild tubers are collected in the mountains to sustain the home-based animals. However this is very labour intensive. In other settlements - particularly on the plains where rainfall is considerably lower, the majority of the households no longer keep home-based herds during the dry seasons.

Another consequence of the sedentarisation of the pastoral households and their concentration around a few settlements is the depletion of tree vegetation cover. Thorny branches from acacia trees are used for fencing the night enclosures (*kraals*, *bomas*) for the home-based herds. The fencing material degrades fast due to high temperatures and termite damage. As night enclosures are shifted from time to time for sanitary reasons, fences need to be rebuilt about every two months. The high demand for fencing material has led to the depletion of tree vegetation around settlements. Environmental management committees (EMC) have, in recent years, enforced by-laws aiming to protect trees around the settlements. Fencing material needs therefore to be transported from further away. This can be very labour intensive.

Decreasing fodder availability – particularly during dry seasons – and decreasing tree vegetation around the settlements are thus both consequences of the increasing degree of sedentarisation of the households in the livestock based pastoral economy in Marsabit. At the same time, they limit the number of animals that the sedentary part of the household can keep close-by. Poorer households that only have a few animals (e.g. less than 50 small-stock) cannot live from their livestock production alone and tend to keep their animals near the settlements, mostly due to labour availability. Hence their animals cannot profit from good pasture vegetation in the faraway grazing areas. This effects their production and reproduction and traps the already poor livestock keepers in. Such households are driven to create non-livestock related income or to seek employment elsewhere.

2.3 Identification and documentation of local innovations

According to Wettasinha et al. (2008) the term "local innovation refers to the process by which people in a given locality discover or develop new and better ways of doing things – using the locally available resources and on their own initiative, without pressure or direct support from formal research or development agents". Edquist (2001) distinguishes two different types of local innovation: process and product innovation. The term process innovation refers to technological innovation such as a new farming practice or an improvement in post-harvest storage, or to organizational innovations such as cooperation between neighbouring farmers or the organization of labour. Product innovations are related to new goods such as the integration of new market crops or animal products, and to new services such as changes in product marketing.

Learning about local innovations in marginal areas is often constrained by very limited availability of or access to information about their existence. Sometimes, even farmers within the same village do not know about the innovations their neighbours are making or experimenting with (Gupta, 2000). One reason for this is that farmers are not always aware that they are actually innovating, since experimentation is part of their daily on-farm activities and is often not recognized or seen as actions separate from routine farm work (Richards, 1989; den Biggelaar & Hart, 1996).

Given this situation, a couple of procedures to identify innovators and innovations are proposed. A methodology published by Haile et al. (2001) proposes four approaches. The first approach is observation in the field, and particularly pays attention to "everything that appears unusual". This also includes conver-

sations and discussions with the farmers, which can give indications of any innovation that is underway. The second approach is to contact key informants who may be local leaders or older inhabitants and ask them for the names of farmers in the community who are known as people who try out things, which have not been tried before, or who practice different techniques. The third approach is to "trace the history of a given innovation". That means to ask for older/existing innovations that had been established and to identify the person(s) or the groups of persons involved in developing them. The fourth approach is finally to "identify farmers who did not accept extension packages as given", but rather use the new knowledge and integrate it into their own ideas and farming practices.

Once local innovators and innovations have been identified, the next step is to document them. It is commonly argued that the main purpose for documenting local innovations is that this enables information sharing and experiences among a wide range of stakeholders (farmers, extension agents, researchers and policy makers).

Whereas the documentation was often previously done by outsiders, of late, participatory approaches for farmer-led documentation are becoming more popular (Rüter-Noordzij and Piepenstock, 2006). The new processes involve farmers taking the leading roles in documenting their innovations. Different documentation tools and arrangements are used, depending on the readership/audience of the documented material, the cultural context and on skills, funds and equipment available (Wettasinha et al., 2008).

Documenting local innovations by and for illiterate farmers can require the use of visual tools combined with oral explanations. The visual and oral information can be shared during exchange meetings. For local innovations in smallholder agricultural systems, farmer-to-farmer learning activities and on-farm demonstrations have proved to be successful diffusion methods. One cornerstone of farmer-to-farmer learning is the possibility of visual success. This is more obvious for crop farmers than for livestock keepers, because the visual appearance of plants or fields is more indicative of the production success than is the case with animals or herds in pastoral systems.

3 Methods used in identifying local innovations in Marsabit County

3.1 Project location

The field-work upon which this manual is based was conducted in Marsabit County and to some extent also in Isiolo County in Northern Kenya. The areas included are inhabited by Rendille, Gabra and Borana pastoral groups (Figure 1).

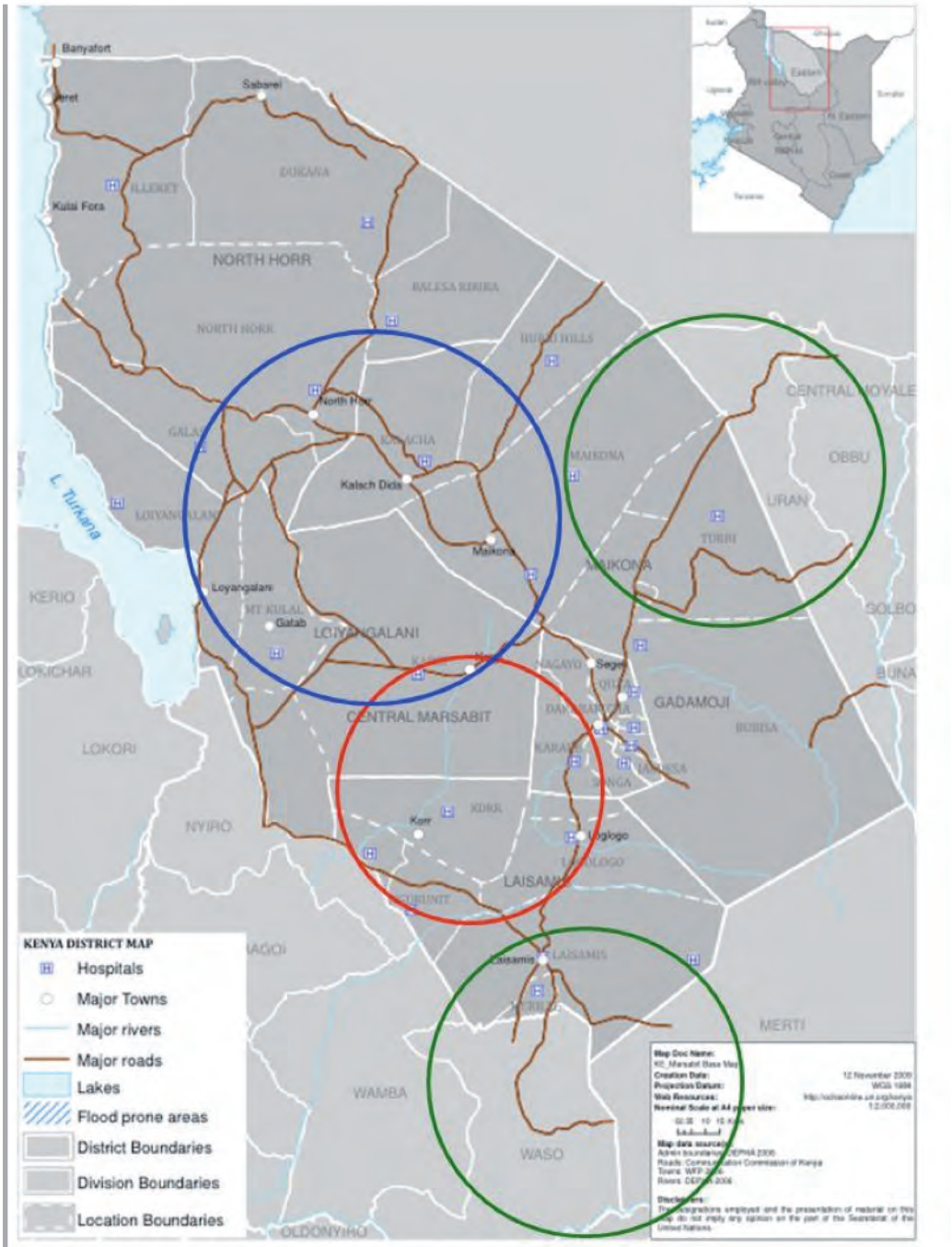

Figure 1: Marsabit County Map adopted from OCHA (2012). Marked areas inhabited by Rendille (red), Gabra (blue), and Boran (green) pastoral communities.

At the onset of the fieldwork, we visited several NGO offices based in Marsabit town in order to explore whether they have knowledge of livestock keepers who have developed innovations. The organisations visited included local organisations such as Community Initiative Facilitation and Assistance (CIFA), a Kenyan NGO, and field offices of larger, international organisations, such as World Vision and Veterinaires sans Frontieres. As they were not aware of local innovations the visits mostly led to learning about their own activities.

The areas included in this study are located in the lowlands surrounding Marsabit Mountain. Field-work was carried out in two periods – one in November and December 2011 and one in May and June 2012. The areas and villages visited are listed in box 1.

Box 1: Pastoral communities and settlements visited during two fieldwork periods

Pastoral Community	Time of visits	Duration of visit (days)	Settlements visited
Rendille	Nov/Dec 2011	8	Kargi, Korr, Namarei, Ngurunit
Rendille	May/Jun 2012	7	Kargi, Korr, Logologo, Merille, Namarei, Ngurunit, South Horr
Gabra	Nov/Dec 2011	6	Kalacha, Maikona
Gabra	May/Jun 2012	7	Hurri Hills, Kalacha, Maikona
Borana	Nov/Dec 2011	4	Moyale, Sololo, Turbi
Borana	May/Jun 2012	6	Moyale, Sololo, Turbi
Borana	May/Jun 2012	7	Garba Tula, Kinna, Kula Mawe (all Isiolo County)

3.2 Methods used to identify innovations

In order to identify people who have developed innovations themselves, or who are keen on experimenting, we used two different methods: "Innovation Identification Tour" and "Call for Innovations through Radio Broadcast".

3.2.1 Identification of innovators through "Innovation Identification Tours"

The process of identifying innovators through the "Innovation Identification Tour" consisted of the following steps:

1. On arrival in a settlement, the local chief (i.e. the administrator of the respective administrative location) was visited
   - The research team introduced themselves and the project's objectives
   - Once the aims of the project were understood, the chief was asked whether s/he was aware of anyone who might be of interest to the project
   - The chief then guided the research team to the *manyatta* where an innovator could potentially be found
2. In the *manyatta* the research team met with a group of elders
   - The research team introduced themselves and the project's objectives
   - The elders were asked whether they were aware of anyone who might be of interest to the project
   - Elders would then guide the research team to a potentially innovative pastoralist

3. The potential innovator was visited
    - The research team introduced themselves and the project's objectives
    - Upon a brief discussion with the innovator about the innovation in question and upon the innovators consent to participate in the study, a more detailed interview was scheduled
    - In order to learn about the innovation a semi-structured informal interview was conducted and recorded (see 3.2.3)
    - Contact details of the innovator were taken
    - The innovator was then asked whether s/he was aware of anyone else who might be of interest to the project

If potential innovations were identified through interviewees, these were followed up; if not, other leads from the area chief were followed up. Sampling thus followed the Snowball Method in all areas visited. Interviewed persons were asked to recommend others who might be of interest to the team. Those recommended were then contacted and the process continued. On average 2-3 potential innovators were contacted a day. If in a visited settlement location there were no further leads available to follow, the research team moved on to the next location, and the process started again.

The research team was fortunate to have Mr Raphael Gudere as a team member, who for more than 10 years has worked in livestock related research projects, while at same time remaining a livestock keeper in the Rendille area. Mr Gudere has contacts to other livestock keepers in Rendille settlement areas and could link up with individuals that know the area well or are known to be keen on experimenting. This greatly facilitated the access of the research team to pastoral communities. To have a livestock keeper from the area in the team proved also essential, because, being familiar with livestock management practises, Mr Gudere could advise on whether an "innovative process" was indeed new and of interest.

3.2.2 Call for innovations through radio broadcasts

In order to reach more people than those contacted through the Snowball Method, the team also used radio broadcasts to spread the information about the project activities. The radio broadcasts were used to inform the local communities about the search for innovators and on how to get in contact with the project team in case they knew of an innovator. The messages were broadcasted during the vernacular radio programmes (in the respective language) transmitted by the Kenya Broadcast Corporation (KBC), Nairobi. An example of one of the broadcast message is given below:

"Residents of Korr, Laisamis District, KARI wants to learn about any interesting ideas that you use to cope with drought and to improve livestock production. If you think you have an innovative idea, join the KARI team tomorrow at Acacia Shade Lodge, Thursday the 1st of December, or inform your local chief of who and where you are and what you do".

These messages were usually transmitted two times over a 2 - 4 day period before the project team reached the location targeted for a visit. The organisation of broadcasting the messages took the following steps:

1. A meeting was arranged at KBC Headquarters Nairobi, with the person responsible for the management of the vernacular broadcasts in Marsabit County. The project was explained in detail and the costs and payment methods for the service clarified.
2. 3-5 days prior to planned radio broadcast, the message was emailed to the contact person in KBC followed by a phone call to confirm the message had been received: Each message was formulated to fit the specific location, giving location name, meeting date, place, and time. In the following locations messages were broadcasted to: Korr, Kargi, Namarei and Ilaut in the Rendille area, and Maikona and Kalacha in the Gabra area.

3. The broadcasting fee was transferred to the contact person in KBC via the mobile phone money transferring system MPESA. A message of the size given above broadcasted once costs 2,000 KShs (US$ 23.30). For every repetition the same amount was charged.
4. On returning to Nairobi, the KBC Headquarters were re-visited to offer feedback on the response to the messages.

3.2.3 Documenting information about local innovations

After innovators and their respective innovations were identified the innovator was interviewed using a set of questions to learn more systematically about the innovation. At the beginning of the interview, the location was noted as well as the name and the contact details of the innovator. Thereafter, a semi-structured interview was held following the guiding questions compiled in box 2.

All interviews were recorded using a voice recorder and photographs were taken of the innovation presented. To highlight and focus on the perspective of the innovator, i.e. what s/he emphasised as important aspects of her/his innovation, the innovator was briefly trained on how to operate a digital camera. Innovators were then asked to photograph their innovation as they wish in order to highlight from their own perspective what the most important aspects of their innovation are, with no influence from the project team in terms of what to capture.

Box 2: Guiding questions for documenting the local innovation

1. What are the challenges that you wanted to overcome with the innovation?
2. Can you tell us about the innovation that you are practicing to combat/mitigate these challenges?
3. Please tell us more about this innovation? (Probe)
4. Can you tell us more about how this innovation was discovered? Since when have you used it? Were others involved in its discovery?
5. Can this innovation be seen anywhere else?
6. Can you tell us more about how this innovation works (step-by-step explanation)?
7. Where do the required materials come from? Is this replicable for other people?
8. Can you tell us about the positive results this innovation brings?
9. Can you tell us about whether it improves your livelihood?
10. Can you tell us about any negative results/challenges that come with this innovation?
11. Are you willing to share this innovation with others as part of the planned knowledge exchange workshops?
12. Can you tell us about any other innovators and or innovations people practice?
13. Can you tell us how one might best communicate new innovations to pastoralist communities?
14. Out of the innovations we have gathered, which do you feel would benefit your production?
15. With regard to the innovations you find interesting, what information do you need to know in order to implement this?

4 Reflections on the methods used to identify innovations

In total, 23 innovations were identified in approximately 12 weeks of fieldwork. All the documented innovations were identified using the "Innovation Identification Tours". The "Call for Innovations through Radio Broadcasts" did not yield the expected outcome, as no innovation could be identified through this method. Furthermore it incurred relatively high costs. It was therefore only practised during the first field trip from November to December 2011. However, in Maikona, the only area where the mobile phone network was functional at the time, six livestock keepers were responsive to the radio announcement and showed their interest in the project. They first called the phone number given to learn more about the project and then came to the advertised meeting point. With the currently increasing mobile phone coverage in the area, radio broadcasting is still seen as beneficial for contacting otherwise isolated communities and we consider a follow-up worthwhile with modified messages and a higher transmission frequency. For instance, larger events could be promoted through radio broadcasts if messages were transmitted earlier and over more days. This could raise the profile of such meetings and attract more people and potential sources of innovations.

A difficulty encountered during this study resulted from different interpretations of the term "innovation" and the misunderstanding that can arise from it. Initially, the term innovation tended to be understood as a drastic change in the production system, beyond the scope of an ordinary livestock producer. It was rather used for external interventions carried into the system by external actors. So it turned out that pastoralists would not classify the changes they introduced in their production practices as innovations. In the course of the project, however, the meaning of the term innovation was explained by the examples of innovations that were already locally identified.

Consequentially, when broadcasting messages the problem with the term innovation becomes more obvious, since its meaning cannot be clarified as well as it can be through personal interaction, given the limited time allocated for radio broadcasts. However, with the results from this study examples of local innovations identified so far could be presented in radio programmes and used to stimulate other livestock keepers to share their own innovations, experiences or thoughts.

Identifying innovations requires a very good understanding of the processes in the pastoral production systems (i.e. to have in-depth knowledge on past and current production practices) in order to initially assess suitability or potential prospects of the innovation identified ("is it really new?" and "is it potentially useful?"). Since scientists and extension workers usually lack such insights two options are proposed: a) to include livestock keepers in the research team, who would play a key role of guiding and linking the team to his peers; b) a team member to undergo practical training, through a form of internship, in which s/he gains experience in the production practices. The latter also helps to gain an in-depth understanding of pastoral production systems and prepares the researcher for closer interactions with pastoralists directly on the topic of interest.

Innovations in mobile livestock production systems are more difficult to identify than in sedentary crop production. In the latter, the innovation can lie in new tools used and the effect can be seen when comparing different fields for instance. The effect of the innovation on a mobile herd might not be easily observed by outsiders as it can only be seen when monitoring the herds or individual animals over a longer time period. Further, in low external input systems, these innovations are often process innovations, i.e. a change in the way the practices are conducted. Hence the innovation as such will not be visible, it is not tangible for instance when it consists of a new form of organisation.

5 Knowledge Exchange Sessions

Of the 23 innovations identified, five were selected to be shared in pastoralist-to-pastoralist learning workshops – which we termed Knowledge exchange sessions (KnowlEX-Sessions). The selection was based on:

- Is the practice in question significantly different from the normal practice, so it is something unusual, that others do not do?
- Is the innovation related to livestock production and management and hence of interest to other livestock keepers? Could they potentially benefit from it?
- Is the innovation replicable by other livestock keepers?
- How big is the observed or expected impact of the innovation compared to the other innovations?

Innovations identified that were not considered for the exchange sessions because they are already practised by many were for example "Use of maize porridge as supplement during drought", "Use of acacia pods as supplement during drought". Others were not relevant for livestock keepers, such as the "Well based vegetable production" in Kalacha. Some were only applicable in certain areas such as "Hurri Hills water catchment system". And others required sophisticated logistics, which is not yet widely available as in the case of "Sale of camels at the Moyale camel market".

The following innovations were selected:

- Chain-link Boma Fence
- Namarai Partitioned Cordia Boma
- Ngurunit Grass Garden
- Farakoren Ramati Livestock Marketing CBO
- DHEDA Resource Management CBO

KnowlEX-sessions were either done through "Innovator Tours", where the innovator visits other interested peers to present her/his innovation, or as "Innovation Field Days", where a group of interested pastoralists would visit an innovator to learn about the innovation. Both types of KnowlEX-sessions are described below.

Innovator Tours

For the Innovator Tours an innovator was brought to 3 different localities over the course of approximately one week. At each locality, up to 10 participants were selected to attend the KnowlEX-session the following morning/afternoon. Sessions lasted on average approximately 75 - 120 minutes with the core session being utilized for the explanation of the innovation followed by participants' questions. We organised a total of 9 Innovator Tour KnowlEX-sessions in the areas of Merille, Kargi, Ngurunit, Korr, and Maikona. Most sessions were held in Kargi and Korr, as these lie en-route to other destinations. Innovations on which Innovator Tours KnowlEX-sessions were held were: Chain-link Boma Fence, Farakoren Ramati Marketing Group CBO, and Ngurunit Grass Garden. The Innovator Tour approach is – obviously – more theoretical as the innovation has to be explained verbally and can only be made more tangible through pictures or graphic representations. On the other hand, the Innovator Tour approach is less demanding in terms of cost, organisational efforts and time. However, during the Innovator Tours the participants often expressed the desire to witness/observe the innovation first hand and on-site, rather than through pictures.

Innovation Field Day

The Innovation Field Day KnowlEX-sessions entailed selecting one participant per locality from a range of different localities in Marsabit County and taking them to see the innovation on-site in the style of a field day, allowing the respective innovators to speak of their work in the setting in which they created the innovation. This approach reaches less people. This means the demanded on time, organizational effort

and money per person is higher. However, it met the participants wish to see the innovation and possibly its effects in reality rather than through pictures. Participants were brought from areas such as Merille, Kargi, Ilaut, Ngurunit, Namarei, Korr, Maikona, and Kula Mawe (Isiolo County). Two Innovation Field Day KnowlEX-sessions were held: one on the DHEDA Resource Management CBO and one on the Namarai Partitioned Cordia Boma.

The selection of participants for the KnowlEX-sessions mostly followed a snowball approach similar to the procedure used in identifying innovators. In addition, participants were often individuals who the research team were referred to or had met during the search for innovations, but who were not necessarily practicing innovative techniques or adaptations. During the selection process, attention was paid to the distribution of age, gender, wealth and community "role" among the participants in order to bring together a dynamic group. Most importantly, it was sought after that the innovations were applicable to the pastoralists selected and these factors combined were utilized to increase their participation and possible adoption of the innovations presented.

Before the KnowlEX-sessions, innovators received a small training on presenting their innovations to a group. In order to do this without inflicting a great deal of "outsider" bias, a semi-structured interview was made with the innovator prior to presenting. This consisted essentially of a set of questions concerning the core components and the effects of the innovation. These questions were put to the innovator in order to sensitize her/him to the possible expectation that an audience might have towards their presentation. The set of questions could then be used as a possible structure for the presentation. The respective questions are compiled in box 3 below:

Box 3: Guiding questions for presenters of local innovations

Core Components of Innovation	**Effects and Impact of Innovation**
What was the problem you wanted to overcome?	What are the benefits/positive aspects of this innovation?
What did the system look like before the innovation?	What are the constraints/negative aspects of this innovation?
How does the innovation work? "Break-Down" of materials used and techniques employed	What differences/impacts does it make on your livelihood?
Step-wise description of innovation (i.e. "recipe")	Who was initially involved in trying out the idea?
When and why did you make this change?	What do others (i.e. community) think about the innovation?
What was the origin of the idea, how did you develop the idea for this change?	Did anyone else start using or adapting this idea?

Following the semi-structured interview, the innovators were told that the information they had just provided to the research team would be the necessary information to discuss again during the KnowlEX-sessions. This appeared to be an effective technique and, in general, innovators presented well in a group of their peers.

The KnowlEX-sessions were under the full control of the pastoralists. Only the introduction, laptop assistance for showing pictures, and some concluding statements were made by the outside research team. When translation was necessary, Mr Raphael Gudere (Rendille) and Mr David Duba Golicha (Gabra/Boran) utilized their language skills to translate the information.

Innovators and participants alike reacted positively to the ease of discussions as well as their relation and knowledge to the topics being discussed. They posed many questions and also critically assessed the feasibility of the innovation under their own circumstances. The participants' feedback led us to conclude that using local innovations is a promising starting point for development initiatives.

6 Local innovations used for KnowlEX-Sessions

In this chapter, the five local innovations selected for pastoralist-to-pastoralist exchange sessions are presented. They relate to specific problems that are present in Marsabit County. This means that they do not constitute innovations for pastoral production per se but for those that live in similar conditions and face similar problems. The first two innovations relate to problems that are common to pastoral producers throughout Marsabit County, one is the lack of market access the other is the weakened communal management of pasture and water resources.

The other three innovations presented relate to the problem of high human concentration around settlement areas, which is an issue mainly among the Rendille pastoralists. In some Rendille areas the concentration of humans has also led to a concentration of livestock. This is the case at the edges of mountains, such as the Ndoto Mountains, where due to higher rainfall animals can be kept in the vicinity of the homestead for longer periods of time. Hence their mobility is largely reduced. This means that the three innovations relate to problems created by the overall constraints to make use of strategic mobility. They are solutions to cope with induced sedentarisation. Hence these ‚innovations' are rather damage containment solutions and are not a path to modern pastoralism, as the notion of innovation somehow suggests. However, these solutions also show which aspects of the problem are under the managerial control of individuals, and point to the fact that innovations that would allow pastoralists to enhance livestock mobility would require communal, governmental and infrastructural efforts, such as e.g. for providing mobile services. The last three 'innovations' presented here can hence also be regarded as short term solutions that help to sustain a condition that is ultimately unsustainable.

In the following sections the innovations are presented using the following structure: Problem to be tackled by the innovation, Description of the innovation, Achievements, Challenges and Future plans, if appropriate. The text is based on the explanations given by the innovators, during the semi-structured interviews and exchange sessions.

6.1 DHEDA Resource Management CBO

Innovators: Boran pastoralists of Kinna Location, Garba Tula District.
Innovation presented by Mr. Mohamed Diqa Sama and Mr. Madera Bonaya

Problem tackled

Kinna is situated about 75 km northeast of Isiolo and inhabited by Boran pastoral people. They came up with the innovation because of three main reasons. The first is that Boran livestock keepers from the area realised that the advice they get from extension officers on how to deal with the problems of the pastoral community was not applicable and practical in solving their problems. They attributed this to the circumstances that the extension staff does not have a good understanding of their production and livelihood system, they do not understand their language and do not know the area well. The way "they are seeing [the challenge] and the way we are seeing them do not go together". This resulted in some conflict with the extension services and finally motivated the elders of Kinna to develop their own ideas on how to improve the situation.

The second reason was that during the past decades pasture resources degraded due to a lack of regulation. Traditionally, Boran regulated access of their livestock to pasture and permanent water sources through a system called Dheda. However, after Kenya's independence the authority to regulate was taken over by the government. The land traditionally managed and used by Boran could now be used by neighbouring communities such as the Somalis and Meru. As Somalis entered the area with high animal numbers and used the watering wells at their own wish, tribal conflicts developed. The Boran could not implement their regulation mechanism anymore and the system was abandoned.

The third reason is that due to the recent increase in frequency and severity of drought and the fact that people do not move but tend to settle, pasture around settlement areas is under increasing pressure. This leads to a lack of fodder during the dry season for the milk herds that are kept near the settlements.

Due to these reasons, elders from the Kinna region found it important to revive the traditional management system in a way that is also recognised by the government. As there were already a number of groups dealing with resource management, such as the Environmental Management committee (EMC) and the Natural Resource Management CBO – although these have not been very effective – they incorporated them under an umbrella organisation called DHEDA CBO. It is registered with the Ministry of Social Services and its by-laws are therefore officially recognised.

Description of the innovation

The DHEDA CBO was registered in 2005 and only local people are members, both men and women. It involves all the residents of Kinna, regardless of whether they come from outside villages or from within the town, all elders belong to the DEDHA. Every village sends representatives to be part of the DHEDA committee. The DHEDA CBO controls grazing during wet and dry seasons. During the wet season, livestock does not require water from the well because they can drink rain-water. Animals are sent to the areas where there is no permanent water source but where they can drink from dams. When these have dried up they are sent to those areas where they can drink from shallow wells. In this way, the areas with deep wells are reserved for the dry season. In the dry season the access to wells is regulated, as described below. Furthermore, the CBO have installed a zone of 15 km radius around the Kinna area where no satellite herd is allowed to enter. This reserves the pasture for the milk herds kept at home, thus providing milk for home consumption and sale.

During the dry season the group manage the access to the permanent wells in the entire grazing area that belongs to Kinna. When the non-permanent water sources are dry, the DHEDA committee calls a meeting. They count the herds in the area and distribute the herds evenly over the wells in the areas, so that no well is overcrowded. This means each herd is allocated to a particular well and their watering days are fixed. Usually cows are watered every 2nd day. The wells are individually supervised by their owners and they have to apply a set of rules on how the watering is done.

The person, who dug the well, is recognised as the well owner. However, it is still a community well, so the owner is the one who needs to care for the well. One responsibility is to make sure there is a fence around the well so that animals cannot enter the construction. The owner must protect the well against wild animals such as monkeys that tend to enter and either damage the structure or pollute the water. He also needs to provide a large trough so that up to 20 cattle can be watered at a time (Plate 1 and Plate 2). These troughs are made from long palm tree logs that are split, hollowed and supported by mud on the outside. The troughs need to be placed at a slight distance from the well. If troughs are too close to the well animals may push each other into it. DHEDA regularly checks the wells. If the above requirements are not met the owner must act on the CBOs recommendations.

According to the rules of DHEDA the owner has to water his herd last. This is to ensure they are present at their well and make sure there is no conflict among the other herders who are watering their animals at that day. If the well supervisor is not present at all times during watering and a conflict arises he can be fined by the CBO.

If an individual attempts to water his/ her herd before their allocated time, they will be reported to the CBO committee, which could potentially fine or ban that individual from receiving water from any of the wells. This would force that person to move to an area in which s/he is not recognised and works to ensure that people follow the order of watering decided by the committee.

The DHEDA organisation also improves communication and information about the state of resources in

their area. Everyone in the CBO knows where committee members live and are therefore able to report matters of interest if necessary. Through this, water resources are well monitored and managed.

The assessment of the region's natural resources is made through well supervisors and village representatives constantly interacting with herders to get information about what is happening in the grazing areas. Sometimes, the committee sends people to visit different grazing areas to assess resources and enforce regulations.

DHEDA also controls the access of animals to pasture from outside communities. Outsiders of Kinna wishing to utilise Kinna's pasture or water base must first report to DHEDA committee members before doing so. Usually outsiders first meet the chief who links them to DHEDA. Committee members will then go and see how many animals the person wants to bring and check whether they have diseases. They will also assess the pasture to see whether it is enough to support other herds. Then they can grant access to the pasture, or if the situation is bad they can also explain that they cannot grant access. In this way the CBO has a record of resource usage and is able to plan accordingly. This also helps to reduce the spread of animal diseases by monitoring and restricting the free-flow of outside herds through areas of high animal density, such as the watering points. Furthermore, if livestock traders want to move through Kinna, CBO members must check for diseases. Since the Kinna area is passed by many traders coming from Moyale on their way to Nairobi, spread of animal diseases was a big problem before the system existed. Now if the trader's animals are sick, they can be prevented from passing through, or made to transport their animals via truck and not by trekking.

Achievements

The main achievement is that nowadays in Kinna there is plenty of milk, because people can keep their milk herd and have enough pasture for them in the vicinity of the settlements. The system has reduced conflicts both within and between the communities. Due to strong watering regulations at the wells, there are no conflicts at the watering wells between individual Boran herders. Also the relation to Somali people has improved. This can be seen from the fact that during the severe drought of 2009/10 the member of parliament of the Somali was visiting the member of parliament of the Boran in order to agreeing on joint resource use during this period of resource scarcity, which was a big achievement after the incidences of tribal clashes.

Overall natural resource management has improved. The wells are well maintained and not overused. DHEDA are also effectively reserving pasture areas further away as dry season grazing reserves for the satellite herds. Through this, they manage to control animal diseases better than before.

The DHEDA CBO is used by the government as a community entry point. For instance during the drought 2009/10, the destocking of 800 cattle from the areas was done with the help of DHEDA, who selected the beneficiaries in a fair way, as the matter was discussed and agreed on by the representatives of the whole area.

Overall, the DHEDA system is seen as a good mechanism to combat drought, since the consequences of drought such as severe lack of fodder for animals and milk in the settlements are improved or even overcome.

Challenges

Currently, the problem is that some herders from outside do not respect DHEDA regulations, which can lead to conflicts between the different communities. In general, however the system is regarded as one that improves the efficiency of natural resource use. Most outsiders who are familiar with DHEDA choose to cooperate and send representatives to explain their situation and ask for permission to use resources. For example, in 2009 the Somali Member of Parliament came to talk to the DHEDA committee to ask if Somali herders could share resources due to severe drought in the Somali region. In this way the two com-

munities who formerly suffered from tribal clashes could come to an agreement on a shared resource use.

A challenge in replicating this re-innovation is that it requires a high degree of organisation and collective action to be established and respected. However, most communities in northern Kenya have some form of institution that regulates access to natural resources. The problem is that they are weakened and need to be revived and re-organised in line with new challenges. The most important factor is that everyone has to know how the system works, so clear and extensive communication is vital. The development of the DHEDA CBO profited from the fact that they could build on regulations that were formerly used by the Boran communities.

Future plans

The DHEDA CBO is motivating many that know of its operation and success to develop similar resource management systems. Neighbouring areas that operate with the DHEDA system, which are all situated within Isiolo County, are the following: Kula Mawe, Bodji, Garba Tula.

Future plans of the CBO are to increase the political and legal weight of these traditional Boran regulations by having them made an integral part of their local laws under the new provisions that are catered for in the new Kenyan Constitution. This would solidify and properly enforce the resource management strategies of DHEDA.

Plate 1: DHEDA well

Plate 2: Cattle at the watering trough

6.2 Farakoren Ramati Livestock Marketing CBO

Innovators: Rendille pastoralists from Farakoren
Innovation presented by Joseph W. Maseyo, CBO Chairman from Farakoren

Problem tacked

Farakoren is an isolated settlement located about 5 km from Ilaut, a small town on the southern fringe of the Rendille area on the road from South Horr to Ngurunit. There is very little economic activity in and around Farakoren and even food supplies can at times be scarce, which is not the case in bigger settlement areas such as Ngurunit and Merille town. With low levels of economic activity and the area not being situated near a major trade route it was specifically difficult for pastoralists to market their livestock. People of Farakoren relied on only two Somali shopkeepers from Ilaut to trade their small-stock with. The two traders manipulated the market leading to very poor prices being offered to the pastoralists for their animals. Since the livestock keepers did not have much choice when it comes to who they trade with, especially if they are in urgent need of cash, they are likely to accept low prices for their animals. For instance, a goat worth KSh 3,000 (US$ 35) would be bought for only KShs 800 (US$ 9.30) by the trader. Often the trader did not pay in cash but would instead offer some shop items as payment, even when the goods being exchanged for the animals were not needed by the pastoralist.

Due to these challenges, the people of Farakoren started to think about how they could improve their situation and bargaining powers. In 2004, the community came together and asked the following questions: "Why are we always selling our animals to these shops? Can we take our animals to markets where we can get the cash and not the items in compensation?"

Description of the innovation

The community decided to pool their animals together and take them to better markets. A group of community livestock traders from the Farakoren was formed. This was originally comprised of 10 people and then grew to 15. Each group member paid a one-off membership fee of 1,500 KShs (US$ 17.5) and the pooled funds were used to buy animals and sell them at distant markets such as those of Merille and Isiolo.

In 2005, researchers from KARI and the University of Hohenheim (Germany) started working in the area and approached the Farakoren community suggesting that they form a community-based organisation (CBO) that would allow them to conduct activities collectively. They trained the group on how to open a bank account, keep record books and develop a formal group structure. They now have a group constitution, a secretary, treasurer, and elected chairman amongst other officials. The group is very grateful for this training, as it may have broken down had it not have been for this assistance.

The CBO has 40 members (15 women and 25 men of all ages) that come from Farakoren and the surrounding area and meet regularly at common places such as animal watering wells and under specific trees (trees of elders). The information discussed is then shared with all villages through informal channels.

The CBO was granted a one-off sum of KSh 300,000 (US$ 3,490) by the research project to conduct the activities they had decided upon in order to improve their livelihoods. As part of their action plan, the group decided to use the funds for livestock marketing and for providing members with small loans. KSh 150,000 (US$ 1,744) was put aside as a revolving fund and used to purchase livestock, which were then sold in faraway markets.

Buying of animals was done as follows:

- When individuals wish to sell some livestock they spread the information throughout Farakoren.
- The CBO assigns some people to buy in animals from the whole community. They obtain the funds to buy animals from the community account and can directly pay for the goats when purchasing them. The goats are bought at a realistic and fair price.
- Once the group has bought animals they are considered community animals and are branded with an 'x' at the neck. These animals are divided among the CBO members for herding until they are sold.
- About 3 group members are chosen to track the animals to a faraway market to trade. They receive 3,000 KShs as compensation for their time and effort. The CBO decides which market the animals will be taken to depending on information about the prices of small stock at the given time.
- Due to banditry in the area, the number of animals trekked together is limited to about 100 - 150 to reduce the risk of losing many animals to banditry attacks.
- In the faraway markets, there are numerous traders therefore competition. The seller can subsequently choose to trade with those that offer favourable prices.
- The amount earned from selling the goats is returned to the treasurer of the CBO.
- After 3 – 4 months the process is repeated.

The collective marketing of the small stock has allowed the pastoralists to sell their animals at better prices. In addition, anyone in the Farakoren area who is urgently in need of money/cash can sell an animal at fair prices to the CBO. They receive the payment directly and the animal will be part of the next communal sale. The CBO therefore acts as a platform through which the community can support their members.

The second main activity of the CBO was giving out a limited number of loans to members. Loans are han-

ded out on the condition that the money is used for livestock related activities such as trading in livestock skins or buying veterinary products. Loans ranged from 1,000 - 5,000 KShs at an interest rate of 10 %. Both the loan and interest is to be re-paid within six months.

Loan applications and disbursements work as follows:

- An application is formally made to the loans committee of the CBO.
- The loans committee assesses whether or not the group-member is eligible for a loan.
- Those who apply for loans must also have two guarantors who are group members. The guarantors are responsible for re-paying the loan should the borrower fail to repay.
- Guarantors should be free of debt and able to guarantee the repayment of the loan at the time of loan approval.
- Consequently, all group members actively try to show their credit worthiness and tend only to apply for a loan if it is really necessary.
- Guarantors are not able to apply for a loan themselves until the loan for which they are guarantors to has been repaid.
- Moreover, loans are granted to ten members at a time, and no further loans could be obtained until the previous ten had been repaid.

Achievements of the CBO

Through the CBO, their collective actions of livestock marketing and loans administration, four problems faced by many in the Farakoren area have been reduced:

- Where to sell the animals?
- Members are now able to sell their animals to faraway markets without the need to travel there personally. Instead, some group members take it in turn to travel to distant livestock markets.
- How to get fair prices for livestock sales?
- Monopolistic trading practices have been overcome.
- Where to sell other animal products such as skins?
- Group members who are offered loans are able buy animal products from the community.
- How to access veterinary drugs?
  Loan holders who purchase veterinary products indirectly bring veterinary services to the community.

However, a big challenge remained, which is the long distances to track the animals to faraway markets. This exhausts accompanying group members and is also a stress to the animals. There is also the risk of being attacked by predators and bandits. When the information on the market price was not correct, animals could not be taken back but needed to be sold at the lower prices offered. These hardships led to innovative action - the creation of a new market in the nearby small town of Ilaut.

In 2010, the group got together with others in the region and approached the chiefs of Ilaut who then approved their requests and plans. In July 2010, the group began to spread the news of developing a new market in Ilaut to other settlement areas like Korr, Ngurunit, Namerai, and South Horr through letters and by word-of-mouth. They announced there would be a market on every second Tuesday of the month (Plate 3). The site chosen offers tree shade and water so that livestock and traders can rest and rehydrate (Plate 4). In December 2011, the market opened and many animals and traders came from Korr and South Horr especially (Plate 5). The market does not charge any fees and anyone is allowed to sell animals or other items. However security is provided (Plate 6). They negotiated with the county council so that they did not build stands and fences. Through this, the charges that come with using such facilities are avoided. Those who attend the market are allowed to develop stands and offer the services they believe are required. The Ilaut market has been nicknamed ‘Nairobi one-day’ in reference to the mass of people that gather

in the area on market day and the diverse goods being sold and transaction being made. The market offers refreshments and foodstuffs as well as household items such as clothing and electrical equipment (Plate 7 and Plate 8).

The following points turned out to be essential for the functioning of the market:

- It was important to spread the information about the development of the market in advance so that people have time to prepare and attend.
- It is important not to have market days too frequently, as there may not be enough animals in the region to trade every week. If the market attracts only a few animals, this information would spread and it may give the market a bad reputation and lead to its failure.
- Market days have to be attended by the chiefs of the participating communities, the police and the selected market committee. This helps ensure security and prevents conflicts. The absence of conflicts is essential for the functioning of the market.

Plate 3: Ilaut market from afar

Plate 4: Goats in a "boma" at the market

Plate 5: Buyer inspecting a sheep

Plate 6: Market security

Plate 7: Radio in soup kitchen stall

Plate 8: Household goods trader

Achievements of the Ilaut market

The development of the Ilaut market and the group-trading scheme has benefitted the people of Farakoren in many ways:

- The group traders only have to travel 5 km to sell their animals every two weeks. This also means that if prices are not favourable animals can be returned home.
- The market fee asked for at distant markets can be avoided.
- The travel fee paid to the group traders that took the group's livestock to market of 3,000 KShs is no longer required, hence savings of equivalent amounts are being made.

In general, the formation of the group, the loan scheme, and the bi-weekly market has helped the communities around Ilaut to focus on livestock activities and developed economic activity in the region.

6.3 Chain-link Boma Fence

Name of Innovator: Mrs Matasian from Merille

Problem tackled

Predators, such as hyena and leopards that hunt at night around the settlement areas are a challenge for many of livestock keepers in Marsabit County. Such animals try to enter the livestock enclosure *(boma)* and kill mainly small stock. This means livestock keepers need to guard their animals overnight if they want to prevent predator attack.

Within Marsabit county livestock *bomas* are typically constructed with acacia branches (Plate 9). These *bomas* are not completely hyena proof. The reason is that within a relatively short time (about 2 months) acacia branches become brittle and weak through weathering, allowing easy access for livestock predators. Due to the concentration of people around the settlement areas, acacia trees are no longer abundant (Plate 10). The cutting of acacia branches has therefore been banned around many settlement areas by Environmental management committees (EMC). When building *bomas*, branches need to be collected from areas that tend to be far away. This increases the time and effort needed and hence the costs of the *bomas* made from acacia branches.

Mrs Matasian is a widow and has taken over all family tasks and responsibilities, as she is the sole head of her household (Plate 11). In other households it is the men's task to guard the livestock at night. Guarding livestock at night on top of her every day work to earn a living for herself and her children was a burden to Mrs Matasian, which is why she looked for a solution. She searched for a hyena-proof *boma* fence so that she does not need to guard her small stock throughout the night.

Description of the innovation

The chain-link *boma* fence (Plate 12) consists of approximately 2 meter high wooden posts from Salvadora persica trees and chain-link fence roll bought from a local market in Isiolo town.

- Mrs Matasian needed about 100 posts to fence a herd of about 100 goats and it took her two weeks to gather them. The Salvadora tree is favoured as it is hard, strong and abundant in the Merille area and very importantly relatively termite resistant.
- The holes for the posts are dug as deep as the length of an adult's forearm and dug two hands apart (Plate 13). Mrs Matasian uses a machete to dig the holes.
- The posts are then put into the holes and soil is gradually added. After every few inches of soil a large stone is used to compact the soil. Small stones are also used with the soil mixture to ensure the posts are firmly in the ground.
- The two-metre high chain-link fence material can be bought from Mangaza Traders, Isiolo (Plate 14). To fence Mrs Matasian's *boma* she needed one roll that cost 3,600 KShs (about the price of two

goats). The chain-link fence material is not barbed and is coated with plastic – this is longer lasting than chain-link fence without a plastic coating. It is sold in the form of a coiled roll and is very stiff and difficult to bend.

- Once the posts have been put into the holes and are securely in place, the chain-link wire is wrapped around the *boma* structure, ensuring the chain-link material reaches the peak of the posts.
- The fence material is tightly tied three times to each Salvadora post with three long pieces of wire: once at the top, the middle, and at the bottom of the post. No nails are used to construct the *boma*, meaning the construction can also be moved if necessary. It is important to fix the fence material tightly to the posts and make sure that the knots are tight.
- The chain-link material is not dug into the ground, but soil is heaped up on either side of the bottom of the fence to ensure there are no gaps for predators to gain access to the livestock within the fence.
- A door is also made from the chain-link material, with a large piece of wood fixed to the ground under the door. The door is fastened shut with two ropes, one at the top, and one at the bottom of the door. The door is fortified by a frame with wooden slats (Plate 15).
- One row of acacia branches is placed around the fence for extra security (Plate 16).
- Time taken: two weeks for material collection, two weeks for construction.

Approximately one year ago Mrs Matasian came up with this idea because as hyenas would enter the *boma* and kill her animals. As livestock is Mrs Matasian's main livelihood source, she views any threat to them as a threat to her and her family's livelihood. Mrs Matasian's children are small and as a widow she has no one to protect her livestock at night. Although the chain-link wire costs some money, Mrs Matasian believes it is better to sell animals and invest in the fencing material and ensure the safety of her livestock.

Achievements

Since constructing this chain-link fence *boma* none of Mrs Matasian's animals have been killed by hyenas, and she has no worries at night. It is due to this innovation that Mrs Matasian now also feels comfortable travelling through Marsabit County to share her knowledge, as opposed to being concerned over the safety of her livestock overnight and having to remain at the homestead.

A disadvantage of the commonly used acacia branch *boma* is that livestock can injure themselves with the acacia thorns as they brush up against them while playing and mating. These injures can be avoided with the new fence.

Environmental Management Committee(s) EMC) in Marsabit County have set up rules to protect the environment around the settlements. For the common acacia fences a high amount of acacia branches is needed throughout the year. Such branches do not last as long as fencing material does because they quickly wear out and can be eaten by termites. Salvadora persica is more resistant to termites. When the posts are long they can also be re-used after the bottom part has been destroyed or rotted. Up until now, the *boma* from Mrs Matasian has lasted for one year without repairs. Once the effort to build the *boma* is made, its upkeep clearly saves time and resources. One negative aspect is that Salvadora trees are not found everywhere in Marsabit County in high numbers, so suitable tree alternatives would need to be identified to enable more livestock keepers to benefit from this innovation.

Constraints

A restriction is that this innovation is only useful for livestock keepers who have permanently settled in a specific place and do not move at all. This is not very common. Even moving the *manyatta* some hundred meters would be a problem, because the *boma* cannot be easily shifted. However, theoretically the construction can be dismantled and moved, although this must be done with a team of people due to the heavy weight of the fence materials.

In areas where there is a high incidence of leopards, the livestock keepers will still have to guard their animals at night. This type of fence does not protect the animals from such predators, as they can jump over it and still attack the livestock.

Plate 9: Traditional acacia branch boma

Plate 10: Damages to acacia tree from branch collections

Plate 11: Mrs Matasian

Plate 12: Chain-link boma fence

Plate 13: Salvadora posts

Plate 14: Chain-link fence material

Plate 15: Secure boma door

Plate 16: Surrounding acacia branches

Future improvements

During the exchange sessions, additional improvements to the current system were suggested. One was that the door might be closed with a padlock to stop people from entering the *boma* to steal livestock. To protect fenced livestock against leopards, participants proposed the use of additional chain-link fencing material fixed as a roof over the construction so that leopards cannot enter.

6.4 Namarai Partitioned Cordia Boma

Name of Innovator: Mr Nayapa Charkole from Namarai

Problem tackled

Mr Charkole is a livestock trader and shopkeeper who has lived in Namerai for twenty years. He lives away from the *manyattas* on a separate piece of land on the way from Namarai to Ngurunit. Because Mr Charkole is a livestock keeper and trader he has a large herd that requires a lot of fencing material to help keep the animals near his homestead.

In this area acacia trees are rare and are protected by the EMCs. Since acacia fences need to be redone regularly, Mr Charkole found it costly to hire people or take time to do the work himself. Instead, he came up with the following innovation.

Description of the innovation

Mr Charkole uses posts from the *Cordia sinensis* tree (local name: gayeer) to build a fence (Plate 17). He was inspired to do so through seeing another pastoralist using this technique while travelling from Namarei to a livestock market near Isiolo. Once the posts have been placed firmly in the ground they are tied closely together with rubber rope and surrounded by piled acacia branches as an additional security measure.

The steps to create cordia post fenced *bomas* are:

- Cordia posts (branches, stems) are often found along rivers. It is important to choose the longest and thickest cordia posts possible. If a long post becomes damaged it can be removed and the damaged part thrown away. The healthy part of the post can still be used. If short cordia posts are damaged, they are thrown away and replaced individually
- Cordia material is collected until there is enough to build the *boma* – the amount required depends on the size of the *boma* to be built. One can accurately estimate how much material is needed through first digging the holes the posts will be put in. The collection of enough cordia posts may take several days and necessitate the help of family members
- Holes are dug with a spearhead or knife two-hands deep in a circle large enough to fence the desired number of animals. One hole is required per post and should be close to one another (around 5-10 cm apart) so the cordia posts are tightly placed next to one another, 'like fingers' (Plate 18 and 19).
- Cordia posts are then put into the holes. Earth is packed using stones around the posts to stabilise them.
- Thinner posts are placed horizontally one foot from the bottom and top of the fence around the entire structure. These are bound to the vertical posts with rubber rope made from old vehicle tyres (Plate 20)
- Larger posts are used as a gate for the entrance to each *boma*. If the entrance gap is around 30 cm, 3-4 removable posts with widths of 5 cm are put through the thinner horizontal posts at the top and bottom of the structure within the space (Plate 21)
- A layer of acacia branches surrounds the cordia post *bomas* as a deterrent against predators (Plate 22)

- Finally, *bomas* are cleaned on a weekly basis, with the dung being dug out with a shovel, swept with a brush, and piled away from the plot. *Bomas* are dug until fresh earth is reached (Plate 23). Sand from a nearby riverbed and salt is sometimes used to top-up the bed of the *boma*. This is said to control foot rot and the infestation of ticks and lice.

Plate 17: Cordia post boma

Plate 18: Digging hole with spearhead

Plate 19: Individual hole, two hand lengths deep

Plate 20: Rubber binds cordia branches

Plate 21: Boma entrance

Plate 22: Surrounding acacia branches

Plate 23: Cleaning of the boma

Plate 24: Young animals are kept seperately

Mr Charkole divides his herd into seven compartmented *bomas*, and in so doing, has developed a system that makes it easier for him to manage his livestock. Five of these *bomas* are directly next to one another and differ in size. Four of the five neighbouring *bomas* are small (4 - 5 metres in diameter) and are used to separately house young animals (Plate 24). Lactating goats and those with small kids are kept in separate *bomas* to save time in finding mother and offspring. The larger *bomas* (8 - 10 metres in diameter) are used for the main herd.

Achievements

This innovative way of fencing and managing livestock is a response to the difficulties experienced by Mr Charkole, such as the presence of predators (hyenas in particular). Since the implementation of using cordia post based *bomas*, Mr Charkole says he has not lost a single animal to hyenas.

Other benefits of the *boma* construction and partitioning system are:

- The construction is similar to that of building a traditional home, so all pastoralists are familiar with the methods.
- It does not require a lot of maintenance, as the materials are strong and less prone to damage and decay - Mr Charkole states that cordia posts can last for many years - some of his *bomas* were made around 11 years ago. Mr Charkole states that the *bomas* have needed minor repairs during their lifetime.
- *Bomas* are stronger and higher than the traditional acacia branch system, leading Mr Charkole to worry less about the safety of his livestock concerning predator attacks.
- Damage to the environment is reduced and allows tree species to grow for longer.
- Stock taking (counting the animals) and examining a herd is easier and quicker, as livestock can be separated and re-grouped easily. Milking is made simpler, as lactating animals are partitioned separately. Time is saved, as one does not have to search for animals within a larger herd.
- Mating can be controlled, as certain males and females can be brought together and separated from the other animals.
- Diseased animals can be kept separate from those not infected. Young animals might also be vulnerable to foot rot during the wet season and partitioning allows extra care to be taken to ensure that the *boma* for the young is clean. This can reduce the possibility of infection.
- As less acacia branches are used for fencing, there are fewer thorns that can injure children when walking bare-foot near the *bomas*

The main reasons why people liked this innovation after it had been presented to other pastoralists in the exchange meeting were:

- Cordia post *bomas* last a long time, thus significantly reducing the frequency of collecting acacia branches for *boma* construction.
- The resulting fence is strong and effectively keeps predators at bay.
- Mating, contagious disease, and milk rationing can be monitored and influenced, hence planned breeding can be practiced through the use of partitions.

Challenges

- Plenty of trees are required to sufficiently provide material for *boma* construction.
- Collecting enough cordia posts for *boma* construction takes several days.
- Digging the required holes and inserting the posts can take a long time, depending on the size of the herd to be fenced. Once material has been gathered, a small *boma* of around 4 - 5 metres in diameter may need around 16 hours, or 2 days to be build. To construct Mr Charkole's partitioned *bomas*, 3 - 4 weeks may be required, meaning labour can be a big constraint.

- The cost of buying the rubber ropes and accessing them might require travel to a town like Marsabit.
- The system does not offer much mobility to those who keep moving and is therefore only really a management option for those that do not shift with a *manyatta*.

Future plans

Potential improvements suggested by the participants include:

- The use of living posts, although the species used must not be attractive to small stock as fodder, otherwise they may be eaten and cannot stay.
- The *boma* doors could be made more secure by using a metal door instead of cordia posts. Empty oil tins can be panned out together and used as door material. Additionally, if a metal door is used then it could be further secured using a padlock, thus protecting livestock against thieves as well as wild predators.
- Although rubber rope works well to tie the posts together, binding metal wire may also be an option.

Most people in Namarai have replicated the use of cordia posts to build the separate small *boma* for young shoats, but not for the entire herd as practised by Mr Charkole. Dividing a herd into several partitions may only be necessary for larger herds/flocks that are kept near the homestead, as in the case of the livestock trader.

6.5 Ngurunit Grass Garden

Name of Innovator: Mrs Rasayon from Ngurunit

Problem tackled

A big challenge for settled pastoralists whose herds have limited mobility is the lack of animal feed during the dry seasons, especially in times of drought. During dry periods, women of the Ngurunit area often go to the surrounding mountains in search of fodder to cut and bring home to their animals. However, due to the high demand, this fodder is nowadays only available in locations higher up the mountains, which are difficult to reach. Searching for fodder in the mountains is time consuming, difficult and risky given the steep and slippery slopes that have to be navigated while transporting fodder. This has apparently led to many accidents.

Mrs Rasayon thought that if an area close to her homestead can be fenced off, protected and left undisturbed during the rainy seasons, then she would have easy access to fodder in times of need without having to take risks and climb the steep mountain slopes. As Ngurunit is situated at the base of mountain slopes it receives higher rainfall than the lowlands of Marsabit County. Conditions for growing fodder may therefore be more favourable.

Description of the innovation

Mrs Rasayon's grass garden is circular and approximately 20 m in diameter (Plate 25). The plot is directly next to her homestead. The grass seeds used by Mrs Rasayon were originally sourced from the naturally growing grasses in the area as well as from a KARI workshop. Some of the species present in her garden are *Cenchrus ciliaris*, *Panicum coloratum*, and *Chrysopogon plumulosus*.

The development of the garden is explained below:

- First the dedicated area has to be fenced off to avoid animals from grazing. Dead logs found lying along the river Ngurunit were put into holes dug forearm deep, close together to form the main barrier of the fenced area. Additionally, *Acacia reficiens* tree branches are gathered and put in a circle around the area of land to be conserved as an additional barrier to the dead log posts. The combination of logs and tree branches is used to reduce the amount of one type of fencing material. It is important that there are no gaps in the fence to prevent animals from invading the grass inside.

- Soil preparation involves removing existing vegetation with a machete to reduce the competition between the grass and herbage growth. Stones are also removed from the site to reduce barriers to plant growth. Index finger deep trenches are dug in straight lines across the garden in rows about a foot apart.
- On the arrival of rain, grass seeds are sprinkled in the trenches. The grass garden is not irrigated but sowing is timed to coincide with rainfall onset. After sowing the trenches are lightly covered with soil.
- Mrs Rasayon recommends weeding of the garden to ensure that unwanted plant species do not grow taller than the planted grasses and out-compete them (Plate 26). This is particularly important during the establishment stages.
- Some *Acacia tortilis* plants are left to grow inside the grass garden from which seedpods are harvested to provide additional supplemental feeds.
- Grasses may be harvested with a machete, either once they have seeded and dried, or when needed. The grasses are not to be de-rooted but cut above the roots to allow them to re-grow. The harvested material is then put into bags and stored in a cool, dry place. Mrs Rasayon has built a raised storage house especially for this purpose (Plate 27 and Plate 28). She often seeks the help of neighbours when harvesting.
- Seeds that fall on the ground during harvesting are left to germinate in order to reseed and invigorate the pasture.
- Mrs Rasayon does not allow animals to enter the garden, as it is not to be used as a grazing area.

Achievements

Mrs Rasayon began her grass garden five years ago and has realised that it works very well, with plenty of pasture grass species growing within the fenced plot. Furthermore, as acacia trees are growing around and within the plot, she can also collect acacia pods that act as additional supplementary feed.

The grass harvested from the garden is only used during the peak of the dry season and is almost solely for lactating, home-based animals. In such times, grasses and acacia pods are fed to animals in the evening. Animals are not allowed to directly graze the grass garden, as they may over graze and trample the vegetation. The grass garden allows Mrs Rasayon to keep a small home-based lactating herd. This supplies her home with milk for consumption and sale, thus providing her with additional income.

Some people in Ngurunit who know of Mrs Rasayon's grass garden plan to adopt the new practice. Initially, many people did not believe in the innovation, but they saw the benefits especially during the 2009 - 2010 drought. During this drought Mrs Rasayon's 8 calves and 10 female goats with their kids survived comfortably on the produce of the grass garden, while other people's animals starved and died.

Challenges

Land is informally acquired in the Ngurunit area and can simply be claimed by the area's inhabitants. Until now there has been enough land for people to claim and establish their homesteads even within the town. In order to protect the garden from grazing animals it is important that it is close to the homestead so it can be easily guarded. The development of such a garden may therefore be difficult in more built up and heavily populated areas, where there is little space for such extended gardens.

A problem with the grass gardens is that the cutting of the appropriate fencing material is very time-consuming and needs to be regularly repaired and replaced. Poor fencing can increase the risk of animals entering the grass garden, so it is important to check fences regularly to ensure there are no gaps.

In addition, the storage of the dried grass may also prove difficult because fodder stored on the floor is prone to termite damage. Mrs Rasayon had tried to store her hay harvests in trees to prevent animals from accessing it, but this does not restrict termite access. Lack of storage facilities may also lead to forced hay

sales in an attempt to avoid spoilage and wastage. To combat the storage problem, traditional domes built on stilts to protect against termites can be used.

Future plans

Recently, German Agro Action (Welthungerhilfe) came to Ngurunit to promote the cultivation of vegetable crops in this area. They said that livelihoods could be improved through the production of crops such as spinach and tomato. Mrs Rasayon tried this idea but found the water demand too high. Mrs Rasayon already has to collect water for her family to drink and wash with and for her animals to drink and does not have enough time to fetch water to irrigate vegetables. The contrast of labour and water requirements between grass and vegetable production led Mrs Rasayon to appreciate her grass garden system even more so, and she now plans to dedicate as much of her land as possible to grass production.

Plate 25: Acacia fenced grass garden

Plate 26: Weeding grass garden

Plate 27: Stilt storage

Plate 28: Hay storage in bags

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Contact

DITSL GmbH
Steinstrasse 19 | 37213 Witzenhausen | Germany
Phone: +49 5542 607 29 | Fax: +49 5542 607 39
email: info@ditsl.org | Internet: www.ditsl.org