A Framework for Community Based Management of Indigenous Cattle Genetic Resources in Dano District, Central Ethiopia

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Abstract

This paper presents a framework for Community Based Management (CBM) of indigenous cattle in Dano district of West Shoa Zone in Central Ethiopia. Results of multi-disciplinary research conducted over three years served as a foundation for this framework. It outlines the essential activities and components needed to be considered to empower the cattle keeping community for effective collective action in the conservation and sustainable use of indigenous cattle. Community based initiatives stand a better chance of success with positive effect on the sustainable use of the genetic resources under stressful environments. CBM of animal genetic resources (AnGR) is responsive to the dynamism within the community, AnGR and the eco-system. The most important institutions with strong bearing on the community's management of AnGR are the informal institutions (herding groups, social gatherings, etc.), the formal institutions in the locality (cooperatives, financial or religious institutions, etc.), the market, the administrative (political) entities, the research and extension institutions, and the interactions among the crop, natural resource and livestock sub-systems. Assumptions of favorable political environment, complementarity among the different stakeholders, continuous capacity building, and access to comprehensive market information were made in developing this framework.

Keywords: Animal genetic resources, Community based management, Informal and formal institutions, Sustainable utilization.

Introduction

An essential element for the continued contribution of livestock to supporting rural livelihoods in developing countries is the maintenance of genetic diversity in the livestock population. Genetic diversity in domestic animals encompasses the

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spectrum of measurable genetic differences among species and across all breeds within each species as well as within each breed[2] differences which are of interest for food and agricultural production (Köhler Rollefson, 2004). Variation in the types of animal used enables the production of different combinations of products, product attributes and services that suit local community needs for consumption, savings and disposal.

The poor livestock keepers that live in usually low potential and unfavorable agricultural areas depend directly upon genetic, species and ecosystem diversity for their livelihoods (Anderson, 2003). Despite the paramount importance of diversity of animal genetic resources (AnGR) to the livelihoods of rural communities in developing countries, and the uncertainty about the actual magnitude of the loss, Tisdell (2003) argues that the continued loss of this diversity is undoubtedly of considerable significance even based on conservative estimates. According to FAO (2007), one breed becomes extinct every month and so its genetic wealth is irretrievably lost. Livestock genetic resources underlie the productivity and resilience of local agricultural systems. Thus, genetic erosion within livestock and their wild ancestors is of particular concern because of its implications for the sustainability of locally adapted agricultural practices and the consequent impact on food supply and security (Rege and Gibson, 2003).

Ethiopia is said to have the largest volume and diversity of livestock resources than any other country in Africa. An estimated number of 40.3 million cattle, 20.7 million sheep, 16.25 million goats, 6.2 million equines, and 32 million poultry were reported to exist in private holdings in 2005/06 excluding the Afar and Somali pastoral areas (CSA 2006). A conventional livestock population survey done in 2004 in the pastoral regions of Afar and Somali, reported 2.12 million cattle, 2.6 million sheep, 4.14 million goats, and 1.02 million equine populations (CSA 2004). The overall camel population was estimated to be 2.3 million in 2004 (CSA, 2004). The national AnGR status report by the Institute of Biodiversity Conservation (IBC) shows that there are at least 25 cattle, 13 sheep, 15 goat, four camel, four donkey, two horse, two mule and five chicken indigenous breeds in Ethiopia. There are also three dairy cattle, 7 sheep, 7 chicken and two goat exotic breeds used for food and agriculture (IBC, 2004). This wealth of genetic resources is reported to be shrinking due to genetic erosion (ESAP, 2004).

Major causes threatening diversity of genetic resources in Ethiopia include poorly designed and managed introduction of exotic genetic materials, droughts and consequences of drought associated indiscriminate restocking schemes, political instability and associated civil unrest, and weak development interventions (ESAP,

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2   Breed is either a homogenous, sub-specific group of domestic livestock with definable and identifiable external characteristics that enable it to be separated by visual appraisal from other similarly defined groups within the same species, or it is a homogenous group for which geographical and/or cultural separation from phenotypically similar groups has led to acceptance of its separate identity (Turton, 1974).

2004). The effects of the misguided and uncontrolled introduction of exotic genes and that of interbreeding among indigenous breeds might require application of molecular genetics for purposes of precision. In extreme scenarios, however, it could have a drastic effect leading to extinction of a breed within few generations. The application of artificial insemination in indigenous cattle using semen from exotic cattle breeds is, for instance, resulting in unforeseen substitution of indigenous genes by exotic genes (ESAP, 2004; IBC, 2004).

More important is the fact that Ethiopia is yet to develop and enact a binding livestock breeding policy. The limitations in skilled manpower and facilities are also paramount bottlenecks for the aspired development in the livestock sector. However, the relative importance and level of threat to maintenance of animal genetic diversity in Ethiopia is not precisely known. Encouraging, but far from sufficient, effort has been made to comprehensively document the AnGR diversity in the country. In addition to their inconclusiveness, previous research and development efforts generally ignored the importance of adapted indigenous farm AnGR due to a general belief that they are not adequately productive and incapable of contributing to increased agricultural production (IBC, 2004). The past and present neglect of local knowledge regarding AnGR and traditional breeding practices causes major difficulties to develop and implement appropriate participatory strategies at national and local level (Wollny, 2003).

Conserving AnGR Diversity

The irreversibility of extinction of AnGR and continuity of the undesirable reduction of the genetic diversity necessitate holistic and participatory approaches to conservation. FAO defines conservation of AnGR as all human activities, including strategies, (management) plans, policies and actions undertaken to ensure that the diversity of AnGR is maintained to contribute to food and agricultural production and productivity now and in the future (FAO, 2000). There are strong scientific arguments for conservation of AnGR. Apart from their known use values, AnGR are carriers of numerous genes that can serve current as well as future emerging needs. There are several strategic options discussed as regards how to maintain AnGR. In the short term a pragmatic option is the conservation of AnGR by maintaining genetic diversity of local breeds within their production systems (Gandini and Oldenbroek, 1999; Rege, 2003).

It is also argued that AnGR conservation aimed at sustaining livelihoods needs to take an approach that recognizes the array of contributions livestock make to livelihoods and the genetic characteristics related to these (Anderson, 2003). There are two broad approaches through which AnGR can be conserved: ex-situ and in-situ (Rege and Gibson, 2003). Ex-situ approaches to conservation include cryopreservation of semen, oocytes and embryos, and keeping of live animals in designated localities, e.g. government

farms or ranches. In marked contrast to the situation in plants, cryopreservation is technically feasible for very few livestock species at present. In-situ conservation, also called 'on-farm conservation', can be defined as the continuous maintenance of breeding populations by farmers in the agro-ecosystems where those populations have evolved (Rege, 2003). Thus, in-situ conservation encompasses entire ecosystems, including immediately useful species of crops, forages, agroforestry species, and other plant and animal species that form part of the system.

Traditional practices of livestock keeping communities probably involve multiple breeding goals (i.e. multipurpose uses), aesthetic values and behavioral aspects. Likewise, village communities may have different needs, perceptions and preferences by which they make decisions for buying, selling or mating of animals. The bottom line here is that communities manage their livestock using a wide range of indigenous knowledge that emanate from varying socio-economic, cultural and bio-physical environmental conditions (ESAP, 2004).

Hammond and Leitch (1996) assert that although no compelling quantitative data is available, about 50% of the total genetic variation in AnGR is between species and the remaining 50% is variation among breeds within species. Yet, the focus on conservation of AnGR is on maintaining intra-specific variation (within species). The genetic variation between breeds is likely to be much more relevant when a global perspective is taken, and when more extreme traits such as adaptation to harsh environments and disease resistance are considered (Rege and Gibson, 2003). Moreover, Wollny (2003) argues that intra-specific genetic diversity in AnGR is a function of natural selection and random or systematic human interventions, hence with more direct links to current human livelihoods of poor livestock keepers.

Definition and Importance of CBM of AnGR

The essence of CBM of AnGR emanates from the meanings of the terms community, community-based, and management. The term community usually refers to a group of people living under similar circumstances with common primary objectives and interests in life. A community-based organization is an entity formed or recognized by a community based on communal interests and objectives and to implement agreed decisions on behalf of the community (Köhler-Rollefson, 2004). Management of AnGR is defined by Rege (2003) as the combined set of actions by which a sample, or the whole, of an animal population is subjected to a process of genetic and/or environmental manipulation with the aim of sustaining, utilizing, restoring, enhancing and characterizing the quality and/or quantity of the AnGR and their products. Thus, CBM of AnGR can be defined as a system of AnGR and ecosystem management in which the AnGR keepers are responsible for the decisions on identification, priority setting and the implementation of activities in conservation and sustainable

use of the AnGR (Rege, 2003; Köhler-Rollefson, 2004).

Community based initiatives are receiving growing attention as sources of creative and productive activities of individuals or groups in societies (Rege, 2003). Such initiatives stand a better chance of success with positive effect on the sustainable use of the genetic resources under stressful environments. The dominant contemporary arguments about maintaining domestic animal diversity advocate for support and provision of incentives to local communities so as to continue managing their AnGR in their respective ecological contexts, but with the opportunity to develop by responding to or taking advantage of changing marketing and macroeconomic situations (Köhler-Rollefson, 2003). According to Rege (2003), this is so because local communities have a vested interest in all the natural resources (including AnGR) on which their livelihoods depend, and have the most to lose in the event of loss of these resources. The communities are also best placed to conserve them and have a better understanding than any other group of what it takes to manage their traditional resources sustainably.

CBM of AnGR responds to the dynamism within the community, AnGR and the eco-system whilst keeping the current and future objectives and interests of the custodian human society. The dynamism in the framework is explained through its sensitivity for the changes in preferences of traits and or the natural or man-made changes that may occur in the AnGR populations, e.g. effects of flooding, disease epidemics, drought or market demand. Changes in trait preferences imply that transformation in the agricultural sector might alter the priorities in the current preference analyses (Girma Tesfahun, 2007). Mechanization of farms, for instance, would make suitability for plowing a less preferred trait. Establishing a CBM of AnGR is, therefore, a continuous process with its components changing in type and importance in response to decisions of the communities.

Relevance and Logical Link of CBM of AnGR to Livelihoods

Most of the livestock wealth in developing countries is owned by smallholder farmers, who are likely to maintain this essential role under prevailing socio-eco-nomic and cultural circumstances until substantial economic developments lead to drastic changes in the size and structure of household incomes. Thus, until more viable alternatives to smallholder subsistence livestock keeping come into play so as to transform rural livelihoods, the most reasonable option for sustainable use of AnGR is working with and for these rural communities who maintain them. Smallholder farmers have unique features, particularly as compared to pastoralists, in that they do not rely exclusively on livestock and therefore have to organize the management of AnGR in their possession in different ways (Bayer *et al.*, 2003).

Attempts to substitute elements of the smallholder farming system with research generated technologies are associated with risks to smallholders. For instance, the livestock resources have evolved for centuries under the custody of smallholders in response to recurrent challenges of harsh environments where the majority of poor smallholders live in. The massive efforts to replace the indigenous livestock resources with 'improved' types developed for specific traits under ideal conditions were not only ineffective (Rege, 2003) but also resulted in erosion of valuable genetic diversity (FAO, 2000)3.

The scientific community has very recently realized the flaw in the conventional approach and agreed to start with what the communities can offer and to work with them. This is justifiable as indigenous livestock breeds play an important, even crucial, role for sustainable rural livelihoods and the utilization of marginal ecological areas (Köhler-Rollefson, 2003). In addition, rural communities and their livestock breeding strategies depend not only on natural and socio-economic conditions, but also on the abilities and interests of the livestock keeping families (Bayer et al., 20003). This growing interest in working with communities with due appreciation and use of indigenous knowledge has given rise to the concept of Community Based Management (CBM) of resources. Earlier applications are in the field of forestry and other environmental resources. Application on management of AnGR started very recently. The documented experiences in Africa are the CBM project to manage poultry diversity in Malawi (Gondwe et al., 2003), the one designed to improve and conserve the indigenous Djallonke sheep breed in Ivory Coast (Yapi-Gnaore et al., 2003), and the initial efforts on CBM of local goat genetic resources in Benin (Dossa, 2007). This specific framework is to be the first of its kind in Ethiopia.

Components of CBM of Indigenous Cattle in Dano District

Empowering, motivating, informing and building the capacity of the community for a sustainable management of the AnGR is the main purpose of a CBM of AnGR. For instance, in Dano district of central Ethiopia, smallholders own the entire cattle population. Thus, community refers in this case to these smallholders. The focus of the CBM framework discussed hereafter is on cattle, basically for two reasons. First, the study focused on cattle as these are by far the most important species of farm animals in the district. Second, this is the first initiative to implement a CBM framework in the country and so would be sensible to start with one priority species.

CBM of AnGR starts with careful analysis of the prevailing production system. The livestock production system in Dano district can generally be described as semi-subsistent,

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3   In fact, in transforming or reorienting production systems, crossbreeding and AI can be implemented in a controlled manner to create the access for animals with functions and products the markets demand.

resource-constrained, cattle dominated and risk prone (Girma Tesfahun, 2007). The most important institutions with strong bearing on the community's management of AnGR are the informal institutions (herding groups, social gatherings, etc.), the formal institutions in the locality (cooperatives, financial or religious institutions, etc.), the market, the administrative (political) entities, the research and extension institutions, and the interactions among the crop, natural resource and livestock sub-systems. The sketch below shows the confluence of these forces (Figure 1).

Social institutions, both formal and informal, play a significant role in determining the effectiveness of a CBM of AnGR. These institutions can influence farmers' access to, and management of, household and community–level resources affecting their action regarding the farm animal genetic diversity. The way herding groups, religious institutions, and social norms and values operate determines the size and characteristics of livestock a household is willing to keep. For instance, in areas where black or white coated cattle are considered culturally or religiously bad, a selective culling would eventually minimize the numbers of cattle with undesirable coat colors in the herd[4]. This deliberate exclusion of animals based on a single attribute might eventually influence other characteristics. The effect of a single trait selection is prominent for a trait which has a negative correlation with a trait under selection. A two pronged intervention is required in this regard; i.e., first, identifying and analyzing the important traditional norms regarding management of AnGR; second, enhancing the useful traditions to make them quickly rewarding and sensitizing the community against harmful traditions. The emphasis should, however, be on harnessing the social institutions for the sustainable management of the genetic resources by the people.

Formal institutions such as cooperatives and rural credit institutions will also have a paramount role in conserving and sustainably using the communally managed AnGR. Voluntarily established cooperatives increase the bargaining power of smallholders and the access to inputs and intermediary outputs. Therefore, smallholders would be able to reduce unfair payments and can opt to postpone selling decisions thereby saving genetic resources from desperate and less rewarding marketing. Valuations of the unique traits, labeling products accordingly, and, if possible, certification of genetic property rights would obviously increase the market margins of smallholders at the same time improving marketability and hence utilization of the genetic resources.

Another crucial component influencing the community - AnGR nexus is the marketing system. The market forces do challenge conservation by smallholders of the genetic resources with no easily tradable uses and no immediate benefits. As a result, identifying sound reasons why society should preserve genetic resources that specialized formal markets have abandoned for some reasons is still an important challenge in conservation

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4 Farmers in Dano believe that black coated cattle are susceptible to trypanosomosis and white coated cattle are considered inappropriate for fattening.

of AnGR (Mendelsohn, 2003). Efforts are needed in valuing the different attributes and functions of the AnGR owned by the smallholders as well as in availing timely, adequate, and precise (tap) market information for the community.
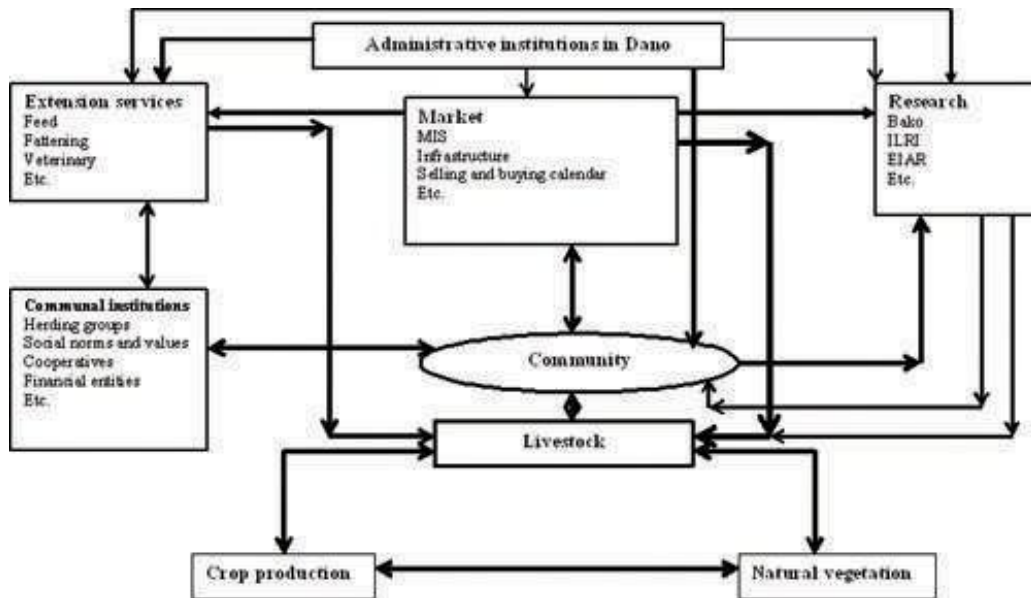

Figure 1: Schematic representation of the important actors and their interactions in the CBM of AnGR in Dano district

Source: Authors' formulation

Proper identification, characterization and valuation of the non-tradable traits of the genetic resources might facilitate the recognition and legal protection of livestock keepers' entitlements for the important characteristics of their genetic resources thereby securing a continuous market. Otherwise, the conservation of AnGR option values through livestock husbandry by the poor is a hitherto unrecognized and unrewarded service to society (Anderson and Centonze, 2006). Hence, all improvements that can be introduced into the production system based on the relative economic values of the traits of the indigenous AnGR might increase the marketability of the indirect and/ or long term values of the AnGR. Inter-temporal and spatial patterns of supply and demand need to be analyzed and made available to the community to enable them to decide with full information. Equally important is identification or creation of niche markets and the development of the market infrastructure to avoid undermined prices as well as forced selling as the transaction costs are often unbearable in such remote rural areas.

Research and extension institutions are expected to describe and analyze the dynamism and the interactions within the livestock production system. Only after thorough

understanding of the system should interventions be made with a clear objective of empowering the community to sustainably generate greater benefits from their AnGR. Bayer *et al.* (2003) strongly advised that the current breeding strategies and breeding objectives of the smallholders should be clear before support is given to any specific type of breeding operation or suggestions are made for improvement. Interventions that have a bearing on CBM of AnGR cannot be confined to issues of breeding and have to fit into the wider livelihood systems of smallholders.

Research and extension procedures need re-designing so as to allow communities take greater roles in initiating the research process. The focus of research and extension has to be on the gaps and interests of the community. Concerted effort is needed among the research institutions (in this particular case, the International Livestock Research Institute (ILRI), Bako Agricultural Research Center (BARC), and the Ethiopian Institute of Agricultural Research (EIAR) and between the research institutions and the District Office of Agriculture and Rural Development (DOARD) which handles all extension related activities in the district. A list of sample activities identified based on the discussions made with the community and that can be incorporated in the implementation of the CBM of AnGR are indicated in Table 1.

The administrative entities are also very powerful part of the system enormously influencing the community and the AnGR through the official policies and strategies they implement. The most important influences are related to rights to own and use the basic means of production such as land and credit. Farmers in Ethiopia have only usufruct right on the land and hardly have access to affordable rural credit scheme. Changes that empower the smallholders for a better utilization of the basic resources would significantly contribute to the success of the communal management of the animal genetic resources.

On the other hand, although Ethiopia is yet to enact a livestock breeding policy, the overall tendency for the last four decades in the area of genetic improvement has been limited to loose AI services and crossbreeding of some indigenous breeds with supposedly improved exotic breeds to increase milk production with little (if any) consideration to other production and service functions of cattle. Sustainable management of the AnGR requires policy formulation to be based on the objectives of the livestock keepers and their manifestations through trait preferences for bulls and for cows. Suggesting such a major re-orientation of the policy setting procedure in developing countries like Ethiopia is easier said than done in practice. Nonetheless, it would be much less costly to carefully design the policies that help avert the continued loss of genetic diversity in indigenous cattle.

In general, the important components of the livestock production system and their interactions have both direct and indirect influences and they need to be manipulated

to enable the community own, manage and benefit from the AnGR in a sustainable manner. As the genetic resources are crucially important to the livelihoods of the community in all aspects of the socioeconomic setup, CBM of AnGR appears to be a promising alternative as compared to the traditional approaches which focused less on the immediate and long term objectives of the communities they were supposed to benefit. In fact, capacity building and awareness creation on all aspects of the CBM of AnGR framework are essential for the community in order to boost confidence and transparency. Similarly, modalities for communication and protocols of accountability among the stakeholders need to be clearly stated and made known to all.

Table 1: Sample activities in the CBM of AnGR in Central Ethiopia

Interventions	Leading Stakeholders
Empowering	Community
Sharing the results of technical analysis of livelihood systems	Research and extension organizations
Developing existing communal bylaws	
Capacity building in resource management	
Develop a manageable monitoring and evaluation system	
Research and extension assistance on, for instance, Improved forage species	
Efficient use of crop residues and natural vegetation	
Disease monitoring and veterinary service Sustainable use of AnGR	
Tailored training for the community	Community
Feed management Disease management	Research and extension organizations Brokers and traders
Controlling and recording animal movement	
Community based genetic improvement	
Safe management of newly introduced genetic resource	
Livestock marketing Market intelligence	
Market demand and supply assessment Identifying markets and time for marketing	
Communicating timely, adequate, and precise (tap) information	Community
Access to tap market information	Brokers and traders
Developing the traditional information management system	Research and extension institutes
Looping in brokers and traveling traders	
Access to tap research and extension information about Feeds and nutrition	
Disease management Maintaining preferred traits Livestock marketing	
Policies and strategies and their implication	

Genetic Improvement and Management Interventions

Empirical analysis of preferences done in the markets within and around Dano district show that cattle buyers assign high values for good traction potential, big body size, disease resistance, calf vigor and for places of origin when choosing bulls in the market (Girma Tesfahun, 2007). A similar study on traits of cows indicates

that fertility, disease resistance, and calf strength are equally or more important than milk (Girma Tesfahun, 2007). These results need to be used to articulate the improvements to be made on the AnGR owned and/or used by the community.

The operational unit for the appropriate interventions needs to be the herding group for the following two basic reasons. First, almost everyone in the group knows which animal belongs to whom and how many animals a household owns. Second, members know when new animals are brought in to the group and when animals are taken away for any reason. Accordingly, leading farmers within the herding group in collaboration with leaders in the cooperatives should be helped to select, develop, and share breed stock of cattle based on the preferred traits identified. Cattle herd formation and composition management needs high emphasis to ensure that the preferred traits of the cattle keepers are maintained with mechanisms in place to reduce the likelihood of inbreeding. The replacement rate and the dynamism in the preferences of the different adaptive and productive traits will have to be carefully investigated to understand the pattern in the genetic resources and the requirements for new trait introductions that might develop over time.

The research and extension institutes need to render assistance to the community in issues related to record keeping, developing and using breeding indices – with due consideration of preferred traits, performance evaluation, distribution and marketing management and controlling the use and conservation of AnGR. The record keeping shall be designed in a comprehensive and systematic way so that the not-so-literate community can easily manage it. Establishing a pilot breeding centre managed by leading farmers in particular and the community in general appears to be the best way to start up.

Implementing the CBM Framework in Dano District

Community based organizations principally aim at harnessing resources to achieve the short and long run objectives of the community they stand for. Therefore, the initial step in implementing a community based organizations like the CBM of AnGR has to be the full awareness, empowerment, and ownership of the whole process by the community. The communities, therefore, need to be assisted to develop breeding structures of their target AnGR so that breeding is fully controlled and parents of the next generation of animals can be selected from within the breeding population.

Concomitantly, communities will be encouraged to set minimum standards of management of their animals to improve efficiency of production and eventually increase level of production. In this way a village-as-a-herd scheme of breeding structures are organized within the village on voluntary basis. The community would then be able

to prioritize and refine the potential interventions to increase the productivity and marketability of the indigenous cattle population it owns. A participatory ex-ante evaluation of the identified interventions needs to follow to foresee the potential costs and benefits associated. Implementation plans will have to be developed for the interventions to be made at the end. A community managed participatory monitoring process needs to be established as well. Finally, evaluations will be made and plans will be designed to replicate the positive lessons to similar production systems. This will be a cyclical process in each community as long as the community keeps on benefiting from the collective action.

Usually the best way to enhance ownership and responsibility in such community based initiatives is to build up on the informal institutions and organizations governing the access, ownership and use of the resources in the community. Hence, clear understanding and promulgation of these informal entities of the community need to be given priority in the implementation of this framework. Moreover, building the communities in data and information management will need to be started at the outset of the implementation. This capacity is very important to make inter-generational transfer of knowledge and the resources associated with it.

A formidable challenge in continuously and effectively running a CBM of AnGR will be the access and use of local level financial resources. As indicated above in the sample list of activities, the way to start will be to invest on the traditional financial institutions which are usually meant to supporting mourning or wedding families. Small scale revolving financial schemes can be developed based on the traditional practices which are quite common in Ethiopia. The second option is to build the capacity of the cooperatives to manage small scale financial services for the community based on terms agreed by the community. Both options indicated above need intensive capacity building interventions from resourceful institutions particularly in the field of financial management. The last and most costly option is accessing financial resources from the formal rural financial institutes.

Finally, this framework is developed with the following assumptions.

1. Stakeholders with the financial resources would support and pursue the implementation of the CBM of AnGR framework developed based on over three years of multi-disciplinary participatory research.

2. The simmering political instability in the region would not interfere with effective implementation of the framework.

3. The research and extension institutions would keep up the collaborative and complementing activities in support of the collective action in CBM of AnGR.

4. The community and other stakeholders will have the required capacity to observe clearly the dynamism within the livestock production system and to deal with the emerging market trends.

5. Continuous and comprehensive market information will be available for the community and for the research and extension institutes to gauge the responsiveness of the marketers.

Acknowledgement

References

Anderson, S. 2003. Animal Genetic Resources and Sustainable Development. Ecological Economics, 45: 331 – 339.

Anderson, S., and Centonze, R. 2006. Property Rights and the Management of Animal Genetic Resources. CGIAR System wide program on Collective Action and Property Rights. CAPRi Working Paper # 48. IFPRI, Washington DC, USA.

Bayer, W., von Lossau A.., and Feldmann A. 2003. Smallholders and Community-Based Management of Animal Genetic Resources. In: Community-Based Management of Animal Genetic Resources. Proceedings of the workshop held in Mbane, Swaziland, 7 –11 May 2001. Pp. 13-26.

CSA (Central Statistical Authority). 2004. The 2004 National Statistics. Available at http://www. csa.gov.et/text_files/2004_national_statistics.htm (Last accessed in November 2007).

CSA (Central Statistical Authority). 2006. The 2006 National Statistics. Available at http://www. csa.gov.et/text_files/2006_national_statistics.htm (Last accessed in November 2007).

Dossa, L. H. 2007. Small Ruminants in the Smallholder Production System in Southern Benin: Prospects for Conservation through Community-Based Management. Institute of Animal Breeding and Genetics, Georg-August University Goettingen, Goettingen, Germany. PhD Thesis.

ESAP (Ethiopian Society of Animal Production). 2004. Farm Animal Biodiversity in Ethiopia: Status and Prospects. Asfaw Yimegnuhal and Tamrat Degefa (eds.). Proceedings of the 11th Annual conference of the Ethiopian Society of Animal Production (ESAP) held in Addis Ababa, Ethiopia, August 28 –30, 2003. ESAP, Addis Ababa.

FAO (Food and Agriculture Organization of the United Nations). 2000. World Watch List for Domestic Animal Diversity, 3rd Ed., FAO, Rome, Italy.

FAO (Food and Agriculture Organization of the United Nations). 2007. The State of the World's Animal Genetic Resources for Food. Rischkowsky, B. and D. Pilling (eds.) FAO, Rome, Italy.

Gandini, G.C., and Oldenbroek, J. K. 1999. Choosing the Conservation Strategy. In: Oldenbroek, J.K. (eds.) Genebanks and the Conservation of Farm Animal Genetic Resources. DLO, Lelystad, Pp. 11 - 31.

Girma Tesfahun. 2007. Economic Valuation of the Preferred Traits of Indigenous Cattle in Ethiopia. Department of Food Economics and Consumption Studies, Christian-Albrechts University, Kiel, Germany. PhD Thesis.

Gondwe, T., Wollny, C.B.A., Safalaoh, A.C.L., Chilera, F.C., and Chagunda, M. G.C. 2003. Community-Based Promotion of Rural Poultry Diversity, Management, Utilization and Research in Malawi. In: Community-Based Management of Animal Genetic Resources. Proceedings of the workshop held in Mbane, Swaziland, 7 –11 May 2001. Pp. 69-76.

Hammond, K. and H. Leitch. 1996. The FAO Global Program for the Management of Farm Animal Genetic Resources. In: Miller R., V. Pursel, and H. Norman (eds.), Beltsville Symposia in Agricultural Research. XX. Biotechnology's Role in the Genetic Improvement of Farm Animals. American Society of Animal Science, IL: 24-42.

IBC (Institute of Biodiversity Conservation., 2004. State of Ethiopia's Animal Genetic Resources -Country Report. A Contribution to the First Report on the State of the World's Animal Genetic Resources. IBC. May 2004. Addis Ababa, Ethiopia.

Köhler Rollefson, I. 2003. Community-Based Management of Animal Genetic Resources – with Special Reference to Pastoralists. In: Community-Based Management of Animal Genetic Resources. Proceedings of the workshop held in Mbane, Swaziland, 7–11 May 2001. Pp. 13-26.

Köhler-Rollefson, I. 2004. Farm Animal Genetic Resources. Safeguarding National Assets for Food Security and Trade. A Summary of Workshops on Farm Animal Genetic Resources Held in the South African Development Community (SADC). GTZ, BMZ, FAO, CTA., SADC. Eschborn, Germany

Mendelsohn, R. 2003. The Challenge of Conserving Indigenous Domesticated Animals. Ecological Economics, 45: 501 – 510.

Rege, J.E.O. 2003. Defining Livestock Breeds in the Context of Community-Based Management of Farm Animal Genetic Resources. *In*: Community-Based Management of Animal Genetic Resources. Proceedings of the workshop held in Mbane, Swaziland, 7 –11 May 2001. Pp. 27
-35.

Rege, J.E.O., and Gibson, J. P. 2003. Animal Genetic Resources and Economic Development: Issues in Relation to Economic Valuation. Ecological Economics: 45, 319 – 330.

Tisdell, C. 2003. Socioeconomic Causes of Loss of Animal Genetic Diversity: Analysis and Assessment. Ecological Economics, 45: 365 – 376.

Turton, J.D. 1974. The Collection, Storage and Dissemination of Information on Breeds of Livestock. Proceedings of the 1st World Congress on Genetics Applied to Livestock Production, II, 61-74.

Wollny, C. B. A. 2003. The Need to Conserve Farm Animal Genetic Resources in Africa: Should Policy Makers be Concerned? Ecological Economics, 45: 341-351.

Yapi-Gnaore, C. V., Dagnogo, B., and Oya, B. A. 2003. Community-Based Livestock Improvement and Conservation: Experiences from Open-Nucleus Breeding Programs in West Africa. *In*: Community-Based Management of Animal Genetic Resources. Proceedings of the workshop held in Mbane, Swaziland, 7 –11 May 2001. Pp. 89-95.