

# Improved goat breeding and mixed crop farming in East Africa:

## A literature review

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August 2011

This report contributes to ongoing research on a project called *Integrating Dairy Goat and Root Crop Production for Increasing Food, Nutrition and Income Security of Smallholder Farmers in Tanzania* (2011-2014). The project is funded by the International Development Research Centre (IDRC) and the Canadian International Development Agency through the Canadian International Food Security Research Fund (CIFSRF), International Development Research Centre (IDRC).



Canadian International  
Development Agency

Agence canadienne de  
développement international



## EXECUTIVE SUMMARY

This literature review offers insights into current research topics and project developments in the area of goat breeding and mixed-crop farming in East Africa. The review is contemporary in that more recent publications are summarized and emphasized. The review is also strategic in that key areas of research and development are identified within these fields of study, but discussions in this document are somewhat preliminary and worded for a more general audience. For readers with deeper interests in this field of study, this document offers direction and references for additional reading. In bulleted format, key insights from this literature review are summarized below:

- Goats are becoming a more important feature of farming and food production systems in East Africa. There are at least four reasons for this trend. First, this trend is a component of the global “livestock revolution” that involves higher levels of meat consumption around the world. Second, goat production is associated with niche lifestyle markets, extensive agriculture systems, ethical, and fair trade production. Third, with increasing pressure for productive farmland, goats offer strategic opportunities for more intensive mixed crop farming systems. Fourth, there are noted successes in community-based goat farming methods by the NGO community in particular, and these projects have proliferated.
- There are major differences between old approaches to goat production and new approaches to goat production. The old approach, commonly called the institutional approach, involved large centralized breeding systems, but this approach eventually collapsed due to poor performance and lack of funds. The new system, commonly called the community based approach, involves participatory methods of goat breeding and a more holistic approach to goat husbandry; including health, housing and feeding through improved cropping systems.
- There are many ongoing challenges to contemporary goat breeding systems in East Africa. First, breed management problems lead to low output from cross-bred goats. Low output is associated with diluted breeds, inadequate feed, poor housing, watering and healthcare. Second, there is limited supply of feed stock to maintain cross-bred goat populations. Third, agricultural extension officers are often poorly trained on smaller livestock, with limited knowledge of cross-bred goats and mixed goat-crop systems. Fourth, goat owners are often women and children who have a full suite of labor-intensive chores and have little time to support new goat-crop systems. Fifth, the economic viability of these farming systems at the household level is an ongoing issue and is poorly understood, with current efforts focused on linking farmers to markets.

- Mixed-crop farming makes a significant contribution to poverty reduction in East Africa. Seventy percent of African food production is derived from three major annual crops-livestock systems: maize-livestock, cereal-legume-livestock, and root-crop-legume-livestock. Although these systems are a crucial component of food security, research is lacking on social aspects of space, time management and ownership and how these might be improved to enhance food security.
- In facilitating development with small-holder farmers throughout East Africa, researchers are noting a shift in the manner in which village-level participants are associated with development projects. Top-down approaches are giving way to participatory development approaches, where interventions target specific groups such as low-income farmers. Current project focus on modified cross-bred goats to meet the unique needs of biophysical and human conditions, and they work with existing cooperative networks, thus enhancing existing forms of social capital.

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## INTRODUCTION

This review of goat breeding and mixed crop farming in East Africa is intended to summarize a variety of key developments and ongoing issues for research and development within the published literature. With a renewed focus on food security worldwide and growing attention to what some authors define as the “livestock revolution,” there is growing interest in sustainable systems of livestock production in East Africa. Moreover, researchers and development agencies are giving more attention to small animal production, such as goats, as an important component of sustainable food systems for small holder farmers. Given this focus, our objectives in this review are to:

- highlight the recent accomplishments in goat production systems within East Africa
- identify lessons learned and ongoing barriers to successful goat production
- offer a summary of root crop systems and their contributions to local livelihoods
- provide insight into the social dimensions of goat breeding and mixed crop farming as an important component of local food security improvements.

With insights from the published literature in these areas, researchers and development practitioners can build on the experiences of the past; to avoid common errors and to borrow best practices within this field of work. As a general overview, this document can also provide a starting point for more in-depth reading and review of topics related to goat production, root crop farming and participatory development.

## THE RE-EMERGENCE OF GOAT SYSTEMS FOR POVERTY ALLEVIATION

Systems of goat production in sub-Saharan Africa are emerging as an important contributor to research and development initiatives that are aimed at enhancing food security and alleviating poverty. Although goats have played a key role in the livelihood strategies of small-holder farmers throughout the centuries, renewed attention to integrated small animal production within a community-based system of animal production and dissemination is a key attribute of these modern goat systems.

Goat systems are a component of what some scholars identify as the “Livestock Revolution” (Delgado et al., 1999). To a degree, the growing popularity of goat production in East Africa is associated with a global trend toward meat-based diets in India and the Middle East. With a growing demand for meat that is replacing traditional grains and cereal crops, Peacock and Sherman (2010:73) note that “a major part of the dietary transition is the consumption of more wheat-based diets even in traditional rice

eating societies and greater consumption of dairy and meat production.” This global trend toward western-oriented high-meat-protein diets is a component of the re-emergence of goats within the livelihood strategies of East African households. As a part of this thinking within the 1970s, researchers have linked goat production to a variety of negative environmental outcomes. For instance, Morand-Fehr (2005) states that in the 1970s, economic interest in goat production diminished and goats were being linked closely with issues of deforestation and desertification.

In somewhat contradictory ways, however, goat systems have also been associated with anti-productivist sentiments in agriculture and the drive toward more organic and ethical choices in food production. This more recent trend is associated with research and insights into the relative ecological benefits of goat production in many parts of the world, and a call to rethink the “blanket condemnation” of all livestock systems as being detrimental to the environment (Peacock and Sherman 2010). Unlike the above-noted link between goat systems and other systems for intensive livestock management, goat systems are described as a less intensive and environmentally friendly approach to food production. As noted by Peacock and Sherman (2010:79), contemporary goat production is associated with the following positive attributions:

- growth in so-called ‘lifestyle’ markets
- ethical, fair trade production
- eco/agro-tourism,
- alleviation of special health conditions such as allergies and AIDS
- growth in demand for cashmere products
- new environmental and biodiversity markets

Extensive systems of goat production are linked to these new ethics of production and consumption.

A third factor that is closely linked to the re-emergence of goat systems in East Africa relates to the growing demand for land throughout the region and the contribution of goats to increasingly complex mixed farming systems. “A decline in farm size with each generation inheriting land further decreases available household options” (Peacock 2008: 225) and intensive farming may be an attractive alternative for many farmers. Also, socioeconomic and health benefits are better understood than was the case in previous decades. For instance, according to Peacock (2008:226):

goat milk is a valuable source of protein, fat, calcium, iron, phosphorus, magnesium and vitamins, particularly vitamin A. Recent studies have shown that several of these minerals are more easily absorbed from goats’ milk than cow’s milk (Castro, 2007). The small fat globules of goats’ milk also make it more easily digestible than cow’s milk and therefore particularly suitable for children and the sick (Peacock, 1996).

These benefits of goat production are also noted by other researchers, who point to the multi-purpose role of goats within the household, providing food, generating cash or barter exchanges of commodities (Ahuya et al. 2005). These benefits of dual-purpose goats were becoming recognized by the research and development community in the early 1980s and the potential remains high for goat production to contribute in positive ways to food security and poverty alleviation.

Lastly, the re-emergence of goat systems in East Africa could be a function of recent successes by non-government organizations such as FARM-Africa and Heifer International in their efforts to develop and disseminate successful community-based goat breeding programs. Authors such as Peacock and Ahuya have published numerous studies over the past few years that are based on successful development initiatives; some of these publications provide models and frameworks for goat project development and they also point to real improvements in quality of life. As an example, Peacock (2008) notes that the impact of improved goat stock on farmer's income is quite dramatic. Researchers show household income increases that range from \$93 to \$995 per annum and the value of owned goat stock has also increased from \$156 to \$918 (2008:234). These demonstrated increases in income and assets offer compelling reasons for ongoing research and development in the area of integrated goat breeding at the community level.

## DIFFERENCES BETWEEN OLD AND CURRENT GOAT DEVELOPMENT SYSTEMS

There is a growing interest in livestock development systems in Eastern Africa due to the problems confronting smallholder farmers in the region (Bett, Kosgey, Kahi and Peters, 2009; Ogola, Nguyo and Kosgey, 2010a; Ogola, Nguyo and Kosgey, 2010b; Peacock, Ahuya, Ojango and Okeyo, 2011). The ongoing famine in the horn of Africa further necessitates consideration of the potentials of livestock development systems to mitigate against food insecurity and poverty. Smallholder farmers generally farm on small plots, and rely on mixed farming of livestock and food crops for subsistence as well aiming for cash crops and possible farm animal produce surplus for sale (Peacock, 2008).

At present, problems confronting smallholder farmers in East Africa are manifold and stem from social, economic and natural causes both local and extraneous (Mwanyumba et al, 2010; Ogola et al, 2010a; Peacock, 2008; Sumberg, 2003). The current global economic downturn and market uncertainty has led to declines in real prices of most traditional cash crops like coffee and tea, deepening the poverty among farmers; child malnutrition has continued at the household level across Africa; decreasing plot sizes with each generation inheriting and subdividing family land has meant even

smaller areas available for household sustenance (Peacock, 2008). Additionally, the combined effects of a growing population, climate warming, soil erosion, and loss of soil nutrients arising from continuous farming over the years only exacerbate the poverty levels (Peacock, 2008) and increase demand for food (Peacock and Sherman, 2010; Peacock et al 2011). It is against such socio economic and environmental conditions that many researchers view small-scale sustainable intensification through mixed crop and livestock farming as a sustainable way to ensure subsistence in developing countries (Ogola et al, 2010a,b).

Renewed interest in small-scale agriculture, labeled “Livestock Revolution” (Delgado et al, 1999, as cited in Peacock and Sherman, 2010, p. 73) by some, is distinct from the wave of smallholder farming initiatives of the 1980s-1990s in East Africa (Ahuya, Okeyo, Mwangi-Njuru and Peacock, 2005; Peacock, 2008). The distinctions, to be illustrated in the following sections, contain significant improvements from the earlier initiatives, and form the strengths of the smallholder mixed farming initiatives of the present, which are the focus of this review.

#### EARLIER GOAT BREEDING INITIATIVES (1980s-2005) – INSTITUTIONAL APPROACH

In 1980-1992, the government of Kenya implemented the development of a new goat breed, the Kenya Dual-purpose (meat and milk) goat (KDPG), with support from the USAID-Small Ruminant Collaborative Research Support Program (SR-CRSP) (Peacock, 2008). The KDPG was a synthetic breed that was designed to be suitable for smallholder farming systems in East Africa (Peacock, 2008). The crossbreeding mechanism was however, complex, and implementation faced logistic obstacles leading to the end of the initiative (Peacock, 2008). The synthetic KDPG breed was developed by crossing two local (Small East African and Gala) and two European breeds (Toggenburg and Anglo-Nubian) (Peacock, 2008). The breeding station was run by the government and based in Naivasha. The goats were then tested in another region of the country, Western Kenya, and performance was poor (Peacock, 2008). The distribution of crossbred goats in this project was market driven: the government planned to contract commercial farmers to reproduce the breed (Peacock, 2008) for sale, with the market regulating price based on demand and supply. Eventually, donor funding for the project ended, with very few KDPGs currently in the country (Peacock, 2008).

From 1983-1989 the Kenya Ministry of Livestock Development, supported by the British Government’s Overseas Development Agency (ODA), attempted to develop a different type of dual-purpose goat for arid and semi-arid areas. This initiative took off from a well-funded station but did not materialize as the manager left the station as soon as project funding ended. The goats also developed beznoites disease (Peacock, 2008).

In the 1980s and 1990s the German Government, through GTZ, funded two major goat-breeding initiatives in Burundi and Kenya (Peacock, 2008). The project in Burundi pioneered the buck station as an economical way of breeding (Peacock, 2008). The source of the breeding bucks however was a breeding station managed by the project, which imported German Alpine goats and unfortunately introduced the disease Caprine Arthritis Encephalitis (CAE) into Burundi (Peacock, 2008). Once the project ended, farmers were not able to replace their bucks, leading to breed dilution (Peacock, 2008). The goat breeding project in Kenya was established using Alpine bucks imported from Germany without females until towards the end of the project when 10 females were imported. Farmers in the Meru region where the buck station is based have upgraded their goats but the lack of a secure supply of locally bred replacement bucks could threaten sustainability of the project (Peacock, 2008). Over the past 30 years NGOs have introduced European dairy breeds on relatively smaller scales compared to the government projects described above. Many NGOs have also distributed local goats as part of development or rehabilitation programs especially following displacement due to droughts, or war (Peacock, 2008).

These small-scale breeding programs have however not brought about beneficial impacts to their full potential because they have not been delivered with accompanying improvements in health care, feeding, and overall management needs required (Peacock, 2008). These early breeding interventions also have the inability to ensure a secure supply of the improver breed as a major weakness, compromising the sustainability of the initiatives. Similarly, the large-scale donor-supported programs, implemented by governments have not been able to proceed after withdrawal of donor funding. They have also not been able to overcome logistic difficulties of successfully handing over breeding management to communities in a way that enables them to carry on with the initiative independently and productively.

#### NEWER INITIATIVES (2007-PRESENT) – COMMUNITY-BASED APPROACH

Proceeding from the earlier decades of failure and learning, many NGOs, including, but not limited to FARM-Africa and Heifer International, are now engaged in community-based goat breeding programs designed with significant improvements over the earlier initiatives, and are proving to be relatively more successful (Ogola et al, 2010a). The first focus in these newer initiatives is making the goat breeding programs as participatory as possible by involving farmers early on in the planning through to the implementation stages. Farmers are encouraged to organize and self manage through cooperatives or general groups (such as women's trade groups, female breadwinners' groups, etc.) through which breeding interventions are introduced and carried out, and act as implementation partners rather than recipients of intervention (Peacock, 2008). These farmer groups strive to serve as all-round support systems to fully realize the benefits

from goat breeding systems. Organizing into farmer managed groups provides a venue for the pooling together of human, financial and other in-kind resources such as credit for purchasing goats and insurance systems, information translation and record keeping assistance for illiterate members, use of local skilled members such as PhD and MS students within the communities, communal strategizing for goat feeding and watering, and dissemination of general information on health care and accessing extension services (Peacock, 2008). Social learning is an aspiration of new goat breeding initiatives, whereby social learning involves learning within a community context with attention to peer communities, history, and local knowledge (Wenger 2009). Peacock (2008) noted, “. . . attitudinal changes may need to take place among staff of implementing partners” (p. 229), in order to fully realize the potential of the breeding project. The small, localized scale at which community breeding projects operate allow for clarification of responsibilities and roles among community members, and between community members and partnering agencies.

To address the challenges of accessing the improver breed and sustaining buck stations, the community-based approach to breeding selects a buck station within reach by those targeted in the breeding intervention, preferably on a selected set of members’ farms. A differential fee is charged for each mating—lower fees for those targeted and higher fees for those interested but not in the target group(s) (Peacock, 2008).

Current community-based approaches to goat breeding also differ from earlier goat breeding systems in their emphasis on feeding and health care of goats as part and parcel of the breeding system, and not as separate or non-related aspects. Rather than stopping at establishing mechanisms for distribution of goats to communities, this approach gives significant consideration to the complete suite of animal management needs. Housing of goats is encouraged, and the cooperative nature in which the projects are implemented enables communities to strategize on communal feeding arrangements and on gathering material for construction of housing units, feeding pens, etc (Peacock, 2008). Additionally, the breeding systems are increasingly coupled with improved crop-farming systems to provide food for goats and feed for households (Lenné and Thomas, 2006).

Unlike earlier donor-government large scale predetermined projects, small-scale community breeding projects are flexible enough to allow for targeting specific segments within a community, e.g. women-headed households, households affected by HIV/AIDS or lowest income households (Peacock, 2008). At this scale, the community-based approach allows for collection of household-specific baseline data before commencing on an intervention. This in turn enhances chances of monitoring any real impacts the projects are having, especially on poverty. The targeting and selection process is small and localized enough and is carried out with local leaders from the community and governing agency to ensure that the process is not coopted by local elites. The scale is also small

enough to take into consideration individual circumstances such as livestock ownership, landholding size, quality of house, number of dependents, engagement in other employment, among others (Peacock, 2008), and to use this data in further modifying implementation steps accordingly.

Lessons from the breeding failures of early interventions are now used to inform cross breeding. Some technical improvements adopted by NGOs in new initiatives endeavor to take into account breed performance. In more than 20 years of operation in rural Africa, FARM-Africa for instance observed the Toggenburg breed to be hardier, and more successful than Anglo-Nubian breed and uses this knowledge in its ongoing breeding programs across Kenya (Peacock, 2008). The above improvements constitute some of the best practices in goat breeding initiatives currently being applied to maximize benefits from goat farming in East Africa.

#### ONGOING BARRIERS TO SUCCESSFUL GOAT BREEDING PROGRAMS

Smallholder farmers in East Africa continue to face severe limitations to their livelihoods and often live in cycles of poverty despite advancement in farming technology. As illustrated in the section preceding, some of the barriers to adoption of advanced farming techniques are extraneous, stemming from donor and government institutional structures, global climate change patterns, while others stem from farmers' capacities and limited nature of their resource base, whether human or financial. This section further elaborates the challenges experienced in the dissemination and adoption of goat breeding systems in East Africa.

Ahuya et al (2005) identified breed management as a main barrier to the success of breeding interventions, and consequently to adoption of the breeds. Thus far, many farmers have experienced low output from their crossbred goats, to their disappointment. Such negative past experiences slows down adoption of the crossbred goats across communities. Genetically improved goats require additional know-how on farmers' part, and do not perform well under husbandry practices used for non-genetically improved goats (Ahuya et al, 2005). Crossbred goats require additional management approaches to feeding, housing, watering, and healthcare. Resource-poor communities therefore face challenges on such aspects as amassing material for goat housing, accessing health care, drugs, and availing the fodder needed especially during low rainfall seasons (Massawe et al, 1997; Nakiganda et al, 2006). Feeding has particularly been identified as a major deciding factor, and sometimes the only factor, used by farmers to decide against adopting genetically improved breeds (Small Ruminant Research, 2008). Natural factors such as the limits to energy-dense feed in tropical and arid environments, and socioeconomic factors like the unaffordability of proper feed such as concentrate and

preserved forage due to high cereal prices compromise the quality and quantity of output farmers receive from their animals (Alexandre and Mandonnet, 2005).

The income category and lifestyle of goat owners also affects the extent to which crossbred goats receive husbandry: many households leave the care of small livestock to women and children (Ministry of Agriculture and Rural Development et al, 2006; Owen et al, 1996). In the face of competing laborious and time-intensive chores like fetching water, firewood, attending school, and other household chores, husbandry to crossbred goats is of least priority (Ministry of Agriculture and Rural Development et al, 2006; Owen et al 1996). Collective organization of farmers to assist each other around husbandry needs is recommended as the best way to allow for farming alongside other household engagements (Ahuya et al, 2005). Lack of financial resources to acquire breeds and other input as well as for marketing output has been identified as a challenge to adoption (Ahuya et al, 2005). Given these challenges, farmers' cooperatives for pooling together credit for such needs is recommended (Ahuya et al, 2005; Peacock, 2008).

A major challenge to adoption of crossbred goats is unsustainability on a number of scales. First, there is unreliability of sources of breeding stock. As discussed in the previous section, batches of dairy goat breeding stocks have been imported from Europe to East Africa by development agencies and private farmers over the last 30 years, but this has not translated into a reliable supply of breeding stock within the region (Peacock, 2008). Sometimes the breeding stocks were not used in a way to multiply them quickly and efficiently, and in other cases well-meaning farmers in Europe have donated goats of unknown pedigree and poor quality. Poor management and oversight by the government contributes to adoption of poor breeds leading to disappointing results for farmers. The earlier breeding interventions discussed in the previous section did not give consideration to continual genetic improvement and sustenance of crossbred animals after they had been introduced, leading to breed dilution. These early breeding efforts were characterized by government run "station-based" breeding initiatives that were resource intensive and difficult to sustain over the long run (Ahuya et al, 2005). Since supply of breeding stock is dependent on financial resources available to NGOs and other well-meaning farmers from abroad, it is difficult for countries to plan on systematic diffusion and adoption of the breeds.

Other factors influencing adoption of the breeds relate to information, training and skill set availability and accessibility. In Kenya, it has been mistakenly believed that livestock extension officers are well versed in both large livestock (cattle) and small livestock (goats, sheep) matters, and that information for managing cattle is the same as that for goats and sheep (Ahuya et al, 2005). Research from selected projects indicates that this is not always the case (Ahuya et al, 2005). Lack of specialized knowledge means that farmers do not have the best information with which to manage their

crossbred goats, leading to poor performance and more hesitation towards adoption of genetically improved goat breeds. Ahuya et al (2005) and Peacock (2008) have identified the need for specialized training of frontline extension agents to provide appropriate counsel to farmers engaged in community-based goat breeding initiatives.

At the national level, governments in East Africa generally look down upon small livestock, and give preference to dairy cattle systems (Ahuya et al, 2005; Small Ruminant Research, 2008). This has direct trickle down consequences, including the sidelining of small livestock courses and teaching in local universities, reduced or absolute lack of funding for small livestock research, and lack of policy development to incentivize small livestock farming and/or development of a robust small livestock industry (Ogola et al, 2010a; Peacock, 2008). These have the effect of reproducing the cycles of poor goat performance, and low output, making farmers believe that goat initiatives are unreliable. Compounding the problem of adoption and diffusion is the gap between innovative research in academia and farmers in the field (Small Ruminant Research, 2008). Apart from the difficulties in accessing innovative ideas especially by extension workers in developing countries, extension officers interested in innovative scientific solutions find the results in journal publications difficult to apply on the ground, and its often difficult to customize innovations to match the resources available (Small Ruminant Research, 2008). In relation to goat and sheep sector, information on optimal utilization of pasture, for instance, is scarcely diffused and difficult to apply (Small Ruminant Research, 2008).

Economic viability is a key factor in farmers' consideration when adopting improved breed goat farming (Nakiganda et al, 2006; Ogola et al, 2010a). Just as with any other group, interventions aimed at farmers must be economically viable to be successful, especially if the interventions have poverty reduction as a goal. Economic viability of improved dairy goat farming in East Africa is an issue that is not fully understood because of lack of research and information on performance and profitability at the household level. This is partly so because of the low status of goats compared to cows in agricultural research and development priorities (Ogola et al, 2010a). A growing number of researchers on East Africa smallholder farming are looking into ways of developing the goat industry by giving considering options and means of linking farmers to markets. Most of these efforts run on the premise that access to higher value markets will mean higher prices for farmers' products and thus higher returns on their initiatives (Njuki, Kaaria, Chamunorwa and Chiuri, 2011; Mwanyumba et al, 2010). Within the current framework of an undeveloped goat product industry in East Africa, farmers experience high transaction costs associated with fragmented production, high costs of collection and transportation to urban areas, and less customer demand for goat milk compared to cow's milk and beef (Bett et al, 2009). These factors partly contribute to the slow crossbreed goat farming adoption rates in the region.

## MIXED CROP-LIVESTOCK SYSTEMS IN EAST AFRICA: ROOT CROPS

In the face of challenges such as reduction in land sizes, droughts, and unaffordability of farming inputs as highlighted in the first section, research and interventions into improving mixed crop-livestock systems has been identified as one of the ways to increase farming output in Sub-Saharan Africa (Lenné and Thomas, 2006). According to the Organization for Economic Cooperation and Development (2011), “mixed cropping is a system of sowing two or three crops together on the same land, one being the main crop and the others the subsidiaries.” This section reviews current literature on crop-livestock systems to outline why and how they are being promoted, current strengths and weaknesses of mixed crop-livestock systems, and the modifications being applied or promoted to enhance success of the systems. Given the growing focus on community-based livestock systems as discussed above, and the need for integrated feeding systems for cross-breed goats, this section provides insight into recent opportunities and challenges in root crop research and development for food and feed.

In an analysis of the contributions of crop-livestock systems of over 100 projects implemented by the UK Department for International Development, Lenné and Thomas (2006) noted that even though challenges remain to make such systems perform at their full potential, they have still made significant contributions to poverty-reduction among smallholder farmers in Africa. A combination of local and external factors makes mixed farming approaches most suitable in Africa. First, as far as financing crop-livestock systems, most donors supporting agricultural research and development have derived, and oriented their funding policies in line with the 2015 Millennium Development Goals (MDGs). Successful crop-livestock systems can contribute to these millennium goals: eradication of extreme poverty and hunger (MDG1), promotion of gender equality (MDG3), and reduction of child mortality and improvement of maternal health (MDG4) (Lenné and Thomas, 2006).

Second, mixed crop-livestock farming systems are not an entirely foreign concept to farmers in Africa. Over 70% of African food production derives from three major annual crop-livestock systems: maize-livestock, cereal-legume-livestock, and root-crop-legume-livestock systems (Lenné and Thomas, 2006). These same systems are considered to have the most potential for increasing food security and contribute to poverty alleviation in the continent. The rich nutrient content of residue from dual-purpose crops like root crops (cassava, sweet potato, yam), legumes, cereal (maize, sorghum, millet), vegetables, for both food and feed and have been adequately documented (Dung et al, 2010; Lenné and Thomas, 2006). Dual-purpose crops are the only way to making for provision of food and feed possible in a small land area without necessitating an increase in farm inputs, including water. The key challenge is to

integrate agricultural and development research relevant to enable optimal system performance (Lenné and Thomas, 2006). Preexistence of these mixed farming systems in Africa means that farmers already have a knowledge base, which, if harnessed, allows scientific research to build upon, rather than begin experimenting anew.

In East Africa, root crops, especially cassava, are encouraged and have already been widely adopted due to several advantageous aspects: high carbohydrate yield per unit of land and labor from the root, high production of leaves per hectare from the stem, high adaptability to poor soils and water stress (able to withstand dry periods up to 5 months), among others (Dung et al, 2010; Food and Agricultural Organization, n.d.). Roots and tubers also save on storage space as they can be left in the ground until needed in the absence of insects and diseases (Lenné and Thomas, 2006). By 2007, cassava farming had grown from 1-11 to 16-55% in East Africa (Fermont, van Asten and Giller, 2008). Current research in the region is focused on improving resistance to disease and searching for precise genetic suitability according to climatic and topographic regions.

Research on mixed crop-livestock farming in East Africa is still lacking on social aspects of space, time, management and ownership and how these might be improved or modified to further enhance their contribution to poverty reduction and food security (Fermont et al, 2008; Sumberg, 2003). The lack of integrated disciplinary input into research and development of crop-livestock systems has also been identified as a significant contributor of low outputs from the systems despite growing research indicating their tremendous potential in poverty alleviation and elimination of food insecurity (Lenné and Thomas, 2006).

#### HUMAN AGENCY, PARTICIPATION AND EQUITY

This section outlines the ways in which current goat breeding interventions interact with the themes of social capital under the framework of development. This is done through an evaluation of the evolution of participation as has been harnessed and applied in livestock interventions in Africa over the years. The section elaborates on the growing recognition of the role of individual agency in the delivery of goat breeding as well other development interventions, and the implications on collective capacity and breeding interventions in the future.

Generally, current research on delivery of development (e.g., Cohen, Higgs, Sanyal, & Harris, 2008; Dale and Newman, 2010; Duguma et al, 2010; Ravensbergen and Vanderplaat; 2009; Schuftan, 1996; and Weyers, 2011) places significance on individual agency in sustainable development. Starting with now classic texts called *Putting People First* by Michael Cernea (1991), development scholarship endeavors to

appreciate the place of individuals in society on par with the technical expertise and financial resource aspects of development. In the past, as illustrated through the government-donor livestock interventions discussed earlier, expertise and non-human resources were treated as being more significant components to be addressed within a development project (Ahuya et al, 2005). The focus of attention was uncritically placed on management improvements and little else (Peacock 2009). But in recent years, there is increasing emphasis on human components of development, even with livestock oriented journals and publications. A popular way of bringing human agency into the development context is through concepts of human capital and social capital, and the broader livelihood framework for development studies. This framework is increasingly popular in development studies as a holistic and balanced approach to understanding the diversity of resources (both physical and social) that are required for sustainable development. And given this popularity, the concept is also under sharp scrutiny on several fronts (van Dijk 2011; Prowse 2010), but this analysis extends beyond the scope of this literature review.

Social capital refers to “connections among individuals – social networks and the norms of reciprocity and trustworthiness that arise from them” (Putnam 2000:19), and is closely linked to concepts such as civic virtue or social cohesion. Even though social capital by itself is not always sufficient to develop and sustain communities without economic and human capital, it is increasingly being recognized as important in effecting a safety net that plays a key role in community members’ ability to engage with development interventions (Dale and Newman, 2010). In this section current literature on delivery of development is summarized to outline how current livestock breeding and multiplication interventions interact with emerging themes of individual agency under the broad framework of sustainable development. Concepts of individual agency extend to concepts such as participatory development and pro-poor developed as discussed below.

In attempts to effect more sustainable positive changes in resource poor farming communities, the ongoing Livestock Revolution (Peacock and Sherman, 2010) is distinct from earlier farming interventions in its aspirations to be as inclusive as possible. In essence, the community based approach to introducing and diffusing genetically improved goats strives to modify exclusionary procedural practices of old. The realization in the 1970s and 1980s that resource-rich farmers benefitted from farming innovations more than resource-poor farmers contributed to Farmer Participatory Research and Participatory Technology Development in the 1980s and 1990s (Conroy and Sutherland, 2004).

Interest in participation as a necessary component of poverty alleviation has not been embraced in farming interventions alone. Sustainable development in general experienced its ‘participation turn’ after observations that its approach was ‘top-down’ (Heffernan, 2008; Msukwa and Taylor, 2011). Participatory development has however also exhibited its limitations, including, but not limited to cooptation by elites in the name

of community stakeholders (Heffernan, 2008). Furthermore, as more understanding of the problems with ‘community’ are brought to light, the dynamics of heterogeneity within groups originally treated uniformly as communities and the extent of their influence on the uptake of development interventions is increasingly taken into consideration. These considerations call for even more robust forms of participatory research and development along with participatory project evaluation. At the same time, persistence of poverty together with growing research on poverty has also meant changes in research and in the expectations of interventions designed for poverty alleviation (Heffernan, 2008). The factors above have continued to shape, and in turn continue to be affected by, participation as it is employed in livestock as well as other development interventions.

In a detailed analysis of participation in the livestock sector in Africa, Heffernan (2008) analyzed the shift in the manner in which participation of stakeholders has been conceptualized and applied over the years. The traditional top-down approaches used in livestock breed improvement programs that were developed and implemented by donor-government partnerships (Ahuya et al, 2005; Peacock, 2008) were followed by participatory development programs in the late 1980s and 1990s as discussed in the sections preceding (Conroy and Sutherland, 2004; Heffernan, 2008). Poor outcomes and persistence of poverty despite this initial incorporation of participation have led to the current wave of modifications on ways in which stakeholder participation is conceptualized, harnessed, and applied in the present livestock revolution. Heffernan (2008, p. 687) characterized this metamorphosis of participation in development interventions as one effecting “demand-led” development. Principles behind demand-led development are widely identified throughout current literature and case studies on community-based goat breeding interventions. The following paragraphs recap a few of these recent trends.

As mentioned earlier, NGOs involved in current goat breeding interventions, such as FARM-Africa, do not merely seek the inclusion of stakeholders to implement models driven by external actors and agents. First, their interventions target specific groups most in need of them, such as lowest-income farming groups, female-headed households, groups with highest rates of malnourishment and nutrition needs such as those affected by HIV/AIDS, among others, within a given community (Peacock, 2008). Due consideration is given to match demand with service. There is deliberate effort to desist from broad regional/national implementation goals to small-scale implementation frameworks with flexibility for modifications to suit individual groups even within the same community (Peacock, 2008).

Refined, demand-led technical specificity is also an aspiration in new community-based farming interventions. Rather than introducing crossed breeds into the East Africa region as a whole, Peacock (2008) has argued for modifying the crosses according to

performance based on locales within the region. There is also an emphasis to use technical skills already within the community first, such as MS or PhD students, and only using imported skill sets to supplement deficiencies, rather than completely sidelining the local skill set (Ahuya et al, 2005).

Second, among the groups targeted, care is taken to deliver development ideas, equipment, and/or services in a manner not to further compromise the dignity of a people whose dignity is already compromised by dire poverty. In its delivery of goat breeding intervention services to communities, FARM-Africa for instance emphasizes not offering any equipment and/or services for free, but rather have communities pay modestly in cash or in-kind (Peacock, 2008). People's sense of responsibility, initiative and self-respect is enhanced when they pay for goats or other related equipment and/or services than when these are handed out to them (Peacock, 2008).

Social capital is another aspect emphasized in these new models of delivery of development and livestock interventions (Dale and Newman, 2010). In Kenya, delivery and implementation methods used by both FARM-Africa and Heifer International for example not only target community-wide farmers' cooperatives but are also flexible enough to use specific networks within those cooperatives (Ahuya et al, 2005; Peacock, 2008). Such networks within a given cooperative could include groups like women's basketry groups, families affected by HIV/AIDS, and others. Where such networking does not exist, the current best practice is to have community members self-organize to forge such support networks as part of the process of partnering with a development agency before implementation begins (Peacock, 2008).

The aspiration for participation in these new methods of delivering farming interventions is to not only appreciate its role but also to seek ways to allow it drive these interventions in a more significant manner. Practitioners seek to harness and apply participation in ways that respect citizens' right to self-determination. When harnessed successfully, these processes ultimately build up capacity both at the individual and community levels, resulting into more dynamic agency at the individual level. When individual agency is enhanced socially and economically, collective capacity is augmented and social capital can then be harnessed and applied more dynamically. Ogola et al. (2010b:abstract) aptly observed, "for sustainability of dairy goat multiplication and breeding programmes targeting poverty alleviation, the initiative should be commensurate with the farmers' capacity."

At advanced stages of success, demand-led development then transforms, leading to "joined-up" approach (Heffernan, 2008; p. 687), where the quality of participation is refined through mutual *social learning* to a more enhanced partnership. From observations of livestock interventions in Africa for over 30 years, Peacock (2008) made note of attitudinal changes that often have to take place between implementation partners

before embarking on intervention operations. In *The Habits of Highly Effective Practitioners*, Weyers (2011) has also documented the appreciation of the importance of social learning and its impact on the uptake of development interventions from a content analysis of development literature in the past decade. *Community coaching-based delivery strategies* (Cohen et al, 2008) in sustainable development is increasingly being encouraged and applied to invoke and also accelerate social learning. The focus of current research is to examine ways of translating the evolving concepts of participation summarized here into practice, keeping in check factors at the community levels that could potentially undermine citizen participation, and in turn conceptual gaps within participation that could potentially undermine citizen participation at the community level.

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