

Socio-economic Drivers of Successful Breeding Programs in Developing Countries

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Introduction

A major challenge to breeding programs in developing countries is the general lack of strategic and long-term sustainability. Moreover, only a few programs have been successful in the short and long term, owing to many reasons, socio-economic factors playing a bigger role. It is important to recognize that successful breeding programs are not necessarily sustainable. Sustainability has several other definitions, “the extent to which animal breeding and reproduction, as managed by professional organization, contribute to maintenance and good care of animal genetic resources for future generations” (SEFEBAR 2002) is more relevant to breeding programs. The environmental, ethical and socio-economic aspects are implicit in this definition.

To clarify the above arguments, this part presents three important stages during breeding program implementation in developing countries. The first stage is the development of membership or participation in breeding programs i.e. farmers, farmer groups/organizations and other interested stakeholders. Second, is the development of animal populations i.e. genetic improvement. Lastly, is the development of utility benefits (tangible and intangible). Depending on the development objectives, success can be accomplished by either stage 1 or 2. For example, several reports have been documented on breeding programs in developing countries with similar or more related statements to this: “*The breeding program has been a success because several number of animals have been improved based on certain breeding objective and selection criteria traits, several farmer groups have been formed and the operations of the program are managed by farmer’s organizations*”. Information of this sort is sometimes contentious. For instance, some of the breeding programs in practice have one improved animal per farmer (e.g. consider 500 farmer groups each having 20 members and keeping 10,000 animals), which purportedly is to yield sufficient additional income to the household. Some programs “disregard” the needs and expectations of the livestock owners; therefore, farmers do not understand or are not in agreement with the objectives of the program. Some farmer/breeders organizations are established at a far much later period when only dissemination is required, rather than at the onset. There is also a difference between farmers that organize themselves (existing) and those organized in groups by external actors in a breeding program. The latter are more prone to difficulties (conflict of interest, trust, commitment etc.) and can easily crumble immediately the initiating organization pulls out. In contrast, sustainability is derived when the breeding program is in that stage when it has the

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capacity to generate continuous and acceptable benefits to the livestock owners. Note that breeding programs set-up in the commercial production system context may be different.

This paper provides an overview of the socio-economic drivers of successful breeding programs in developing countries. Table 1 gives examples of drivers of successful breeding programs for selected livestock species in developing countries some of which are discussed below.

Financial sustainability of breeding program components

In developing countries, establishment of a financial base for breeding program components (e.g., selection, registration, performance recording, evaluation etc.) is vital for it to succeed. Often, financial support is secured through bilateral, public or own resources. Evidence from successful breeding programs is overwhelming that adequate external inputs from bilateral or public resources are necessary at the inception of the program in order to offset the initial financial needs. In the long term, significant contribution by participating farmers through individual payments or cost-sharing (group schemes) towards covering the operation costs of the program is required. There is always a risk of relying exclusively on individual contributions to pay for the program expenses. The truth is that farmers may not always afford to pay or may be unwilling to pay. According to *Livestock in Development (LDI)* (1999), two of the fundamental constraints that the projects came against in the 1980s and 90s were failure of the organizations to supply services which clients were willing to pay for and the lack of institutional, financial and human resources for putting newly acquired skills into practice. What appears to be a more feasible arrangement in the breeding programs is to derive utility benefits from it as a source of funding. Some of the benefits are; a) Use values derived from direct consumptive products (meat and milk), byproducts like manure and hides/skins, and sale of breeding stock in terms of live animals, semen or embryos, and b) Option values derived from the conservancy programs.

Provision of services

Apart from financing, separate organizations or stakeholders, if possible, should be responsible for delivery of important services (e.g., animal health-care, extension, marketing and sire services, recording etc.). The type of services to be administered and how determines to a greater extent whether farmers can live up to the objectives of the breeding program (Bett et al. 2009a). Therefore, there is a need to re-appraise and implement workable modalities for provision of livestock services that take into account local contexts where breeding programs operate.

It is always advantageous for services to be delivered through the participatory sector (farmer groups/organizations) and maybe jointly with the private sector, with government facilitation and support wherever required. Services provided in this way are more likely to be “non-excludable” (not possible to prevent farmers who have not paid or cannot afford to pay from accessing the services), reliable and affordable, and as well as fitting to the economic and social circumstances of the farmers. Consequently, incidences of undesirable breed improvement practices in the program are likely to be avoided.

Table 1: Examples of drivers of successful breeding programs for selected livestock species in developing countries

Breeding programs	Drivers of success
Dairy goats programs in East Africa ^a	<ul style="list-style-type: none"> • Initial financial support from bilateral sources and income generating capacity of the program through sale of breeding stock. • Government's facilitation and support on legislation, and involvement of private sector. • Participation and commitment of stakeholders • Some degree of capacity building. • Presence of organizational set-up and service delivery e.g., animal health- care, extension, marketing and recording.
Martinik hair sheep program in the French West Indies ^b	<ul style="list-style-type: none"> • Existence of a strong professional structure for maintenance and management of sheep. • Active technical extension services and initial funding from European structural funds.
Trypanotolerant N'dama cattle and Djallonké sheep, and West African Dwarf goat, International Trypanotolerance Centre (ITC), The Gambia ^c	<ul style="list-style-type: none"> • Building of capacity of local staff and the income generating capacity of the program through sales of breeding stock. • Local ownership, consideration of the refinancing potential of breeding program and their connection to marketing. • Breeder associations responsible for ensuring public awareness, organization (participation and service delivery) and dissemination of breeding males to the needy farmers.
Nguni cattle of southern Africa ^d	<ul style="list-style-type: none"> • Presence of the studbook and breeders' association, which supports performance recording and organized breeding.
Breeding programme of the Brazilian milking hybrid (MLB) ^e	<ul style="list-style-type: none"> • Farmers and government (technical support) involvement • Production of semen for sale to meet operation expenses of the program. • Farmers' satisfaction with the progeny performance contributed greatly to maintaining interest.
Buffalo breeding programs in India ^f	<ul style="list-style-type: none"> • Implementation of all the activities by a single organization (dairy cooperative organization). Technical guidance and initial funding of the program was from the National Dairy Development Board. • Participation of farmers in the program at village level through independent village cooperative societies. • Financial independence; programs meets their costs from the interest earned from the long-term investment of the corpus fund and doesn't depend on any external agency for funding.

^aAhuya et al. (2005); Bett et al. (2009b).

^bNaves et al. (2000); Kosgey et al. (2006).

^cBosso (2006).

^dNguni Cattle Breeders Society (2006).

^eMadalena (2000).

^fTrivedi (2000).

Sustainable livestock and land use

Successful breeding programs in developing countries are limited by knowledge about the interactions of environment (climate) with other drivers of change in farming systems and on broader development trends (De Haan et al. 1996). Such work is increasingly important for evaluating how livestock production systems may evolve and perform in the future. For example, in many countries subdivision of land is escalating due to the clamor for individual land access and ownership. This trend is often indiscriminate and policy frameworks necessary to support use of these lands sustainably are scarce. Salient issues that need to be addressed are review of land-use policies, practices that fail to account for human-livestock population increases and practices that are restricting livestock farmers to increasingly smaller, drier or even more fragmented rangelands. These concerns should be streamlined with country specific livestock policies.

Similarly, recommendation domains showing optimal geographic areas for different livestock/breeds, and livestock population structures (also breed/genotype proportions) that would best fit the current and future environmental and livelihood circumstances is required in the breeding programs. For example, *“In Morocco since 1980, sheep breeding has been organized by breeding zone. Only specified indigenous breeds are permitted in each zone, and crossbreeding with imported breeds is restricted to zones designated for this purpose”* (FAO, undated). Such arrangements bequeath more attention to sustainable use and development of breeds with little external inputs, and focuses more on long-term strategic production and the collateral consequences. Wilson (2009) has discussed widely on this subject in the publication *“Fit for purpose- the right animal in the right place”*. The author argues that, food production systems in developing countries are moving into marginal areas of which sustainable farming systems and the most adapted species and breeds of livestock have yet to emerge. Consequently, consideration on the development of adapted animals needs to pay attention to the environment, economic and equity aspects of the ecosystems. He notes that it is not obvious that the right animal is the one that produces most, or may not even be a “conventional” species or breed. Breeding programs designed for the prevailing circumstances in several regions in developing countries would therefore be more relevant to the animal keepers. For instance, in Fayoum oasis of Egypt it is buffalo that produces milk and draught power, also in some parts of India (Trivedi 2000), the Guinea pig is best suited in the Bolivian Andes for peasant families with limited labor and access to resources, and in Peru and Chile it is the Alpaca that is the right animal for very high altitudes (Wilson 2009).

Institutional and organizational arrangements

Institutions are “rules of the game” in a society e.g., formal legislation, guidelines, informal agreements and unwritten rules, while organizations are “players and structures” operating under these rules. Both are important complementary elements of a practical breeding program. Institutional and organizational packages in a breeding program can either be old (i.e., indigenous) or new (i.e., introduced/external input).

Traditional or indigenous knowledge systems. Understanding the socio-cultural underpinnings of breed development is of foremost importance before any execution of

breeding programs. Indigenous institutions and cultural traditions provide the context that determines animal management choices available to farmers (Rege 2001). Selection of animals for specific traits of importance, identification using names/notching or branding, mental record keeping of pedigrees, animal handling practices and breeding practices to control inbreeding, are examples of important components of a breeding program in traditional management systems. It is therefore erroneous to assume that breeding programs within these systems are non-existent, yet such programs are practiced unconsciously. These structures are necessary when building upon a foundation program that will create an opportunity for a sustainable genetic improvement. One good example of an indication of indigenous knowledge and capacity of traditional livestock owners were reported by Dinucci and Fre (2003) and Wilson (2009). The Barka pastoralists of Eritrea have selected their cattle over years for milk production and docility. However, in recent times, the Barka people desired for more suspicious and less tractable animal to strangers because of the unsettled conditions in the war torn country. The Barka cattle were out-crossed to the Dohein breed from Sudan notably an animal with these desired characteristics. The outcome was a breed that is difficult to control, produces less milk, and requires more labor for herding and taking it to the market. The Barka considers these efforts valuable in reduction of losses due to theft, at least for now.

Structured breeding systems. Whether open/closed nucleus, government/state or community operated, are convenient for breed improvement. There is overwhelming evidence that those under farmers/breeders organizations have been successful for several livestock species in developing countries. However, strengthening (legal framework) and facilitation (i.e. government support on technical and infrastructure) of such organizations are important prerequisites for them to succeed and be sustainable. In the Brazilian Milking Hybrid (MLB) program, technical support from the government and linkages with other organizations made the program really happen (Madalena 2000). Lack of legal frameworks unfortunately held back commercial exploitation of genetic improvement. There were instances where *“lay off bulls in the progeny testing scheme had to be returned to their owners and cases in which they could not be recovered for semen production after becoming proven”*. In East Africa, it was the governments’ facilitation and support on legislation and investment in rural infrastructure, and the involvement of private sector that emerged as being essential for dairy goat breeding programs (Ahuya et al. 2005; Bett et al. 2009b).

Stratification of farmer groups. Distinguishing between characteristically different livestock farmers i.e. livestock users, livestock keepers, livestock producers and livestock breeders, is critical before the design of breeding programs (Neidhardt et al. 1996). Livestock users are defined as those having purely exploitative relationships with animals, livestock keepers are those employing basic husbandry practices, livestock producers are those supplying additional inputs to improve animal production, while livestock breeders are farmers that carry out integrated herd management focusing on disease control, feeding and reproduction. Application of genetic improvement practices without consideration of these differences generally leads to failure. The group that is most likely to respond to systematic breeding practices is probably the livestock breeders. Sölkner et al. (1998) observed that the step from livestock user to livestock breeder is large and must first be preceded by the step from livestock user to livestock keeper. The difficulty in converting from user to keeper relates to their productivity and ultimately to capital availability (Rewe et al. 2009).

Livestock users achieve high work productivity due to their extremely low inputs (almost zero capital), even though product output is low compared with livestock keepers (Neidhardt et al. 1996). Increase in human population, in demand for products and reductions in available land area favor the change from user to keeper or producer. Market-oriented groups such as breeders and producers, have been regarded as a primary target for establishing genetic improvement programs (Kahi et al. 2005). One reason for this is the inclination of these people towards technology adoption and transfer of genetic material. The traditional groups such as nomadic pastoralists could also benefit from genetic improvement without necessarily increasing their input levels, if genetic improvement were directed towards their needs. In some cases, interactions between the pastoralists and breeder/producer groups exist (Rewe et al. 2009). This could allow for improved genetics to flow across different production systems (Kahi et al. 2005).

Capacity building

In many breeding programs capacity building mainly takes the form of individual skill-building measures (i.e., training on animal husbandry etc.). This is of high significance to selection programs targeting participatory approaches and engaging farmers with low literacy levels. Capacity building however has several other dimensions. In most cases there is a need to reinforce the programs capacity in terms of organizational management, networking/linkages with interested partners, value chain linkages and value addition, improving on institutions and business skills.

Building capacities at production level. Livestock farmers involved directly in primary production should become a target of deliberate and long-term education, even throughout-scaling of indigenous knowledge commonly in the hands of innovator farmers. Simple techniques such as controlled mating through the use of chosen males may not be common knowledge to all traditional farmers. Farmers have planned agricultural production and conservation of natural resources by adopting and sharing indigenous knowledge whose management and knowledge systems have become a matter of survival to the people who generated these systems. In effect, indigenous knowledge are therefore used by all farmer categories, due to its dominance, easy accessibility, safety for man and animals, promotes social cohesion due to the informal village-based mechanisms of dissemination (Akullo 2007). Incorporating indigenous knowledge and practices into contemporary research and training could enable farmers compete and respond to global opportunities and challenges.

Building capacities at organizational level. Higher education institutions, national research organizations, breed societies, government and non-governmental organizations form the body of stakeholders through whom successful breeding program can be managed. In the recent past, the capacity of these stakeholders has gradually diminished especially with respect to animal breeding and genetics. Fewer and fewer students are gaining access to animal breeding information leading to the lack of experts in this critical field of livestock agriculture, not only in developing countries but also in developed countries. This has led to the crippling of capacities of client organizations that rely on university trained staff in provision of vital services to farmers. Curriculum developers of the future must now focus on emerging opportunities for training in animal breeding and genetics while utilizing the

opportunities for change given the previously unforeseeable challenges related to socio-economics, molecular biology and climate change. There is need for use of methodologies that enhance the development of soft-skills in students to be able to incorporate economic and social skills when implementing breeding programs in future. The focus should be on global challenges facing utilization of animal genetic resources and stimulating the design of local solutions.

Conclusion

Socio economics defines the mode upon which agricultural activities can be sustained under human management. Livestock production *vis a vis* livestock breeding programs can only be successfully sustained with profound understanding of fundamental drivers of success. This paper presented socio-economic drivers while giving strategic options for use in mitigating the persistent problem of failed or unsustainable breeding programs. Proper administration of finances, services, livestock and land, institutional organization and capacity would be necessary to avert the cycle of failure that has continued to strain the process of establishing sustainable breeding programs in developing countries.

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