Genetic Improvement of Animal Genetic Resources in Developing Countries and Countries with economies in Transition
Content

• Dynamics of livestock production systems, drivers of change

• Status of animal identification and performance recording in developing countries and countries with economies in transition – Survey results

• Genetic improvement programs in in developing countries and countries with economies in transition – Case Studies

• FAO guidelines for establishing breeding strategies
Dynamics of livestock production systems, drivers of change and prospects for animal genetic resources
Overview of the presentation

- Global drivers of change
- Livestock production systems
- Implications for animal genetic resources
1. Global drivers of change

- Economic development and globalization
- Market demand & the livestock revolution
- Environment and climate change
<table>
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<tr>
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<th>Livestock/ AgGDP</th>
<th>GDP growth</th>
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<td>9.2</td>
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<td>5,552</td>
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Market demand & the livestock revolution
Milk consumption per capita to 2050 (kg/person)
Meat consumption per capita to 2050 (kg/person)
Dynamic livestock sector

- Livestock fastest growing part of the agricultural sector, largely driven by the **Livestock Revolution** in emerging economies.

- Need to **double** livestock production in developing world by 2020 to meet rising demand for livestock products.

- Doubling livestock production puts pressure on natural resources: water, land, biodiversity.
Broad trends: soaring output and structural changes

- Growing intensities
- Increasing scales
- Vertical integration/longer food chains
- Geographic shifts / geographic concentration

Million metric tons

![Graph showing trends over time with labels developed and developing]
Livestock sector trends

- A ‘supermarket revolution’ is setting higher standards for food quality and safety.
- Market chains are lengthening, making it more difficult for small-scale producers to participate in markets.
Share of supermarket in total food retail for selected countries (2000)

- USA 80%
- Brazil 75%
- Kenya 20%
- China 30%
- India 9%
Poverty dimensions

- 1.2 billion people live in absolute poverty (on less than US$1 per day)
- 75% of poor people live in rural areas
- South Asia and sub Saharan Africa – 65-70% of rural household income comes from farming or farm labour
Livestock, poverty and livelihoods

- Over 600 m poor people depend directly on livestock for their livelihoods
- Many more poor people benefit indirectly
- Multiple roles of livestock in poverty reduction – food, shelter, traction, assets
- Roles of livestock changing with increasing urbanization, market demands.
Environmental effects and climate change
Environmental impacts of livestock production

- "Livestock’s long shadow" – livestock production driving degradation processes and also affected by them
- Livestock negative environmental effects – increasing gas emissions, water depletion, soil erosion, etc
- Need to double livestock production from same natural resource base puts pressure on systems
- Pastoral systems – changing land use for more food crops & biofuels, competition with ecosystem services
- Intensive, large scale industrial systems – negative effects (e.g. increasing methane, effluents, etc)
Livestock and climate change (1)

- Livestock both contribute to and affected by climate change
- Livestock contribute about 18% of total greenhouse gas emissions
- Climate change affects farming and livestock production systems
Livestock and climate change (2)

- Changing climate affects distribution of livestock diseases and vectors
- Increasing cyclones in South/SE Asia – e.g. hotter and wetter weather leads to more livestock helminths diseases
- Shorter growing seasons in Africa leading to reduced crop yields and less feed in rangelands
2. Livestock production systems
## Tropical livestock units by prod system (%)

<table>
<thead>
<tr>
<th>Country</th>
<th>Pastoral</th>
<th>Crop/livestock</th>
<th>Industrial</th>
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<tr>
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<td>34</td>
<td>50</td>
<td>14</td>
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<tr>
<td>Brazil</td>
<td>18</td>
<td>63</td>
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<tr>
<td>China</td>
<td>9</td>
<td>70</td>
<td>19</td>
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<tr>
<td>Vietnam</td>
<td>2</td>
<td>82</td>
<td>16</td>
</tr>
<tr>
<td>India</td>
<td>2</td>
<td>82</td>
<td>15</td>
</tr>
<tr>
<td>EU</td>
<td>9</td>
<td>67</td>
<td>22</td>
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</table>
Estimated distribution of livestock production systems
Changes in livestock production systems

- Intensification in industrial systems and crop/livestock systems to meet demand
- Market characteristics, consumer demand
  - Increasing total demand for fresh and processed animal products, especially in developing countries
  - Rising quality preferences and more stringent food safety requirements
Trends in industrial systems

- Changing quickly, expanding globally
- Narrow genetic base, few breeds
- Increasing environmental restrictions due to negative effects (waste disposal, water contamination)
- Competition for feed with alternative demands for cereals (biofuels)
Trends in crop/livestock systems

- Diverse systems, dependent on natural resource base, many breeds
- Systems intensifying in developing countries to meet demand
- Constrained by farm size and lack of access to inputs and services - e.g.
  - Limited provision of high quality feed
  - Increasing competition for land
Trends in pastoral systems

- Pastoral systems in industrial and developing countries; rangelands in marginal environments
- Industrial countries – narrow genetic base
- Developing countries – diverse genetic base, multiple uses, livestock linked to livelihoods
- Increasing competition – land, natural resources
- Policies to settle pastoralists affecting viability
- Increasing role of environmental services for viability
- Generally slower rate of change
3. Implications for animal genetic resources
Diversidad racial – visión global

7 616 razas identificadas, de las cuales 690 se han extinguido

86% 14% 100% 14% 52% 48%

local 6536 transboundary 1080 international 557 regional 523
Situación de riesgo de las razas locales por país y por región

Número de razas de ganado por país (razas transfronterizas no incluidas, mamíferos y aves combinadas):

- 1 - 7
- 8 - 21
- 22 - 42
- 43 - 274
- >275
- Datos no disponibles

Fuente: Sistema de Información sobre Diversidad Animal Doméstica (www.fao.org/dad-iss)
FAO 2008
Parte 1. Distribución de razas de mamífero por región

![Bar chart showing distribution of mammal breeds by region.](chart-image)
Situación de riesgo - visión global

20% en riesgo
30% desconocido
Implications of system changes for animal genetic resources

• Range and speed of changes mean that livestock production systems and livestock breeds no longer coevolving
• New strategies and interventions required to better manage animal genetic resources at risk
Industrial systems - strategy for animal genetic resources

- Narrow genetic base, few specialized, highly productive, commercial breeds
- Systems will continue to adapt environment to suit genetics
- Exceptions if systems need to respond to future shocks (e.g. zoonotic diseases)
- Conserving diversity of main industrial species (pigs, poultry, cattle) desirable as a public policy to insure capacity to deal with future shocks
Crop/livestock systems - strategy for animal genetic resources

- Heterogeneous systems, many breeds
- Adapt genetics to changing environment
- Sustainable use of breeds to maintain diversity as key to adapt to change
- Incentives to smallholders to maintain diversity e.g. niche markets for products
- Improve productivity of traditional breeds
Pastoral systems – strategy for animal genetic resources

- Adapt genetics to marginal environments
- Maintain diversity to reduce vulnerability of traditional livestock keepers
- Improve productivity of systems to maintain livelihoods; less people likely to be living in marginal areas
- Genetic solutions through hardier animals
- Provide incentives for sustainable use of diversity
Trends in land-use area for livestock production and total production of meat and milk

Graph showing the index of land use from 1961 to 2001 for different categories:
- Pasture
- Milk production
- Arable land for feed crops
- Meat production
<table>
<thead>
<tr>
<th>Region</th>
<th>Cattle</th>
<th>Sheep and goats</th>
<th>Pigs</th>
<th>Poultry</th>
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<tbody>
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<td>Sub-Saharan Africa</td>
<td>219</td>
<td>365</td>
<td>22</td>
<td>865</td>
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<tr>
<td>Middle-East and North Africa</td>
<td>23</td>
<td>205</td>
<td>0</td>
<td>868</td>
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<tr>
<td>Latin America and Caribbean</td>
<td>370</td>
<td>112</td>
<td>70</td>
<td>2,343</td>
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<td>North-America</td>
<td>110</td>
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<td>74</td>
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<td>East Europe and Central Asia</td>
<td>84</td>
<td>121</td>
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<td>514</td>
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<td>1,460</td>
<td>659</td>
<td>12,735</td>
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Animal identification, traceability and performance recording in developing countries and countries in transition
Livestock sector: Global context
Global context

- massive increase in demand for foods of animal origin
- longer transport and value chains
- intensification of animal production and development of industrial private sector
- privatization of government services and reduction of government investment
- awareness of consumers about food safety, quality, animal welfare and environmental impact of livestock production
Soaring output and structural changes

Meat: Million metric tons

- Growing intensities
- Increasing scales
- Vertical integration/longer food chains
- Geographic shifts / geographic concentration
Farming systems evolution

from

• smallholder mixed to large-scale industrial
• multifunctional to commodity-specific
• local market to globally integrated markets
• scattered to clustered production
• diverse breeds to narrow genetic base
• increasing dichotomy between large and small farms, middle size farms vulnerable
Animal identification, traceability and performance recording
• **Animal identification**
  means the marking of an animal, individually or collectively by its group, with a unique individual or group identifier.

• **Animal identification system**
  means the inclusion and linking of components such as identification of establishments/owners, the person(s) responsible for the animal(s), movements and other records with animal identification (OIE).

• **Registration**
  is the process by which information on animals (such as identification, animal health, events, certification, epidemiology, establishments) is collected, recorded, securely stored and made appropriately accessible and able to be used by the Competent Authority (OIE).
• **Animal traceability**
  means the “aptitude to find the history, the use or the localisation of an entity by means of recorded identifications” (ISO8402).
  means the ability to follow an animal, or group of animals, during all stages of its life (OIE)
  It is a risk-management tool that enables identified risk to be traced back to its source in order to prevent food contamination and to respond promptly and effectively to prevent contaminated food or poor quality products reaching consumers.

• **Performance Measurement**
  means the objective and systematic measurement of various indicators of animal performance.

• **Recording**
  means the process by which data including parentage, characteristics, performance and relevant events, are collected, recorded and securely stored and made appropriately accessible to the users.
AI&R: Is it an issue for developing countries?
Animal Identification and registration are used for a variety of purposes:
- Controlling stock theft;
- Subsidy Payment Schemes;
- Pedigree certification;
- Accurate identification of blood and tissue specimens used for laboratory diagnostics;
- Facilitating epidemiological investigations;
- Artificial Insemination Schemes
- Performance recording and
- Traceability.
Animal Performance Recording are used for a variety of purposes:

- **Individual animal management:**
  monitor of each animal’s performance and use that information in day-to-day farm management: to manage reproduction, to customise health care and nutrition to individual animal needs, to cull animals, to identify superior animals.

- **Genetic improvement:**
  generate the information needed for breeding toward a defined bio-economic development objective.
Animal traceability used for a variety of purposes:

- Animal production food safety and quality control
  - Globalisation of trade and industrialisation of food processing
  - Increasing concerns about food safety due to past food scares:
    BSE crisis in UK, outbreaks of *E. coli* O157:H7 in the U.S.
  - Perceived threat of zoonotic diseases, as a result of climate change

- Export certification
  - Elimination of trade barriers
  - Access to high value markets such as the European Union

- Disease prevention and control
  - Put in place measures such as surveillance, early detection and notification of outbreaks, rapid response, control of animal movements, and zoning or compartmentalisation.
Animal Performance Recording allows greater understanding of, and ability to control, the production process in order to increase production, enhance efficiency and sustainability of resource use, and identify opportunities to improve management.
Animal Performance Recording are used for a variety of purposes:

- Establishment of baseline animal performance levels:
  - know the current productive capacity of main livestock types and breeds within each of the major production systems and ecological regions
  - Identify factors that limit animal production
  - Identify opportunities for research and development

- Evaluation of production system alternatives:
  - compare specific feeding strategies, health care options, germplasm sources, housing alternatives or other management variables
Important tool for many purposes

Traceability of products
(Animal + Public Health, Product brands)

Traceability of animals
(Foot & Mouth Disease, Classical Swine Fever, Product brands)

Health certificates
(National, International)

Management on farm
(Lambing, Milk recording, Feeding)

Animal Welfare
(Transport)

Herdbook
(Pedigree, Performance)

Application of certain medicaments
(Hormones, Vaccines etc)

Eradication programmes
(Bruceillosis, Tuberculosis, Scrapie)
Multipurpose approach

- increase acceptance and distribution of costs among all stakeholders
I&R as a component of an agricultural information system

- Animal data
- Animal health
- Animal breeding
- Food safety
- Holding register
- Dataware house
- Geo-data
- Subsidy payments
Players – National level

• Breeders organisations
  – Production recording
  – Herd book and IPR
  – AI and breeding programme management

• Competent authorities
  – Traceability
  – Public health
  – Animal health and welfare
  – Animal movement

• Livestock and food industry
  – Market access
  – Traceability
  – Product branding
Players – International level

Standard and guideline setting

• OIE, Codex Alimentarius, International Committee for Animal Recording (ICAR), ISO; private/retail/processing

Support to standards implementation

• FAO, World Bank and other funding agencies Livestock and food industry
FAO’s activities in AI and recording

- technical cooperation projects to legislation and designing national I&R systems; e.g. Chile, Uganda, Malawi, Lesotho, Ukraine, etc.

- organization of joint FAO-ICAR workshops (e.g. Botswana 2009, Hungary 2008; Finland 2006, Tunisia 2004, etc.)

- support to ICAR Task Force for Developing Countries
• 38 countries (SA, A, CEE, LA)

• No regional profile/specificity

• I&R systems and their implementation vary widely from country to country

• Different I&R systems addressing different needs coexist

• Mostly for dairy cattle, but exist also for beef cattle (4), sheep (7), horses (2), buffalos (4), pigs (3)
Results of TF Survey (2)

• Motivations
  – Maintain purity of breed (8) where breed societies exist, pedigree recording, voluntary
  – Genetic improvement (11), pedigree and performance recording, voluntary
  – Export (12), mandatory and/or voluntary
  – “forced to comply with EU regulations” (4), mandatory
  – Disease control (4), mandatory
Results of TF Survey (3)

- **Funding**
  - Traceability: Government, donors
  - Pedigree recording: Government, breed societies
  - Performance recording: Government, farmers, mixture, donors

- **Coverage**
  - National
  - Regional (India)
  - Research institutes and state farms (8)
Reasons for failure

- Farmers’ perceived intrusion & non-confidentiality of information
- Initial cost and sustainability of the system
- Infrastructure and support services, farmer illiteracy
- Coordination among different players
Requirements for success

- Policy and legislative framework

- Efficiently and professionally run systems matching available infrastructure, cultural and traditional aspects
  - Government support – technical/funding
  - Development of low cost and simplified systems without compromising accuracy/integrity - KISS principle
  - Phased implementation of the program
  - Awareness and involvement of all stakeholders throughout the process

- Fair costs and benefit sharing
  - Relevant feedback of information to farmers
Requirements for success

• At national level
  – Conducting studies to demonstrate the economic benefits of I&R systems.
  – Integration of recording in a local service/extension package
  – Coordination and cooperation among responsible organizations

• At international level
  – Networking and exchange of experiences among all players: competent authorities, private sector, international agencies
Status of AI&R in the Near East and North Africa

- All countries have got some kind of recording, in state and/or research herds and flocks, commercial dairy cattle and buffalo herds, during vaccination campaign, for animal insurance purpose, delivery of subsidized inputs.

- Only 3 out of the 11 countries participating has got a functional national I&R ongoing system. These countries are Jordan, Morocco and Tunisia.

- These 3 countries got financial and technical help through bilateral and multilateral aid in the initial phase of establishing the system.

- The 3 countries emphasized the importance of the political will for initiating and sustaining the program.
• The 3 countries have legislations re I&R and 2 of the 3 countries have this legislation making I&R mandatory.

• Morocco and Tunisia have got elements of the breeding objectives and of AnGR management and livestock policy encompassed in the I&R program. I&R in these two countries are in line with the French system and to some extent comply with the EU regulations.

• The 3 countries tried more than one technique for identification but settled down on using plastic ear tags and tattooing. Electronic identification was tried but proved to be too demanding in cost and technology.
Countries that do not have I&R programs going on or even contemplated gave reasons for not having such system, among them are: unawareness, lack of finance or sustained finance, cultural/social, lack of political will, the enormity of animal to be identified, social strife. None of them stated the know-how as an obstacle.

As far as traceability is concerned, there is traceability for animals to their location and owner but little is there on traceability of animal products, e.g. in Tunisia I&R system stops at the slaughterhouse after which stage many institutions and ministries are involved in the process and marketing which adds another complication to the system.
Mandatory Identification is reported in

- 75% of countries for cattle
  - With 34% of countries identify herds

- 45% of countries for sheep
  - With 30% of countries identify herds

- 42% of countries for swine
  - With 35% of countries identify herds

- 26% of countries for poultry

Note: For many countries, this does not apply to all livestock in the country
Case studies:

A look at past livestock genetic interventions in developing countries
Case study 1: An open nucleus breeding program for Djallonke sheep in cote d’ivoire
Case study 1: An open nucleus breeding program for Djallonke sheep in cote d’ivoire

- **Objective:** To improve growth and adult live weight of the Djallonke sheep through within-breed selection

- **Species/breed:** Djallonke sheep is a compact breed with small mature height and size, and a thin tail. Believed to be adapted to humid conditions and to be trypanotolerant. Distributed throughout the humid and savannah zones of west and central Africa.

- **Start/completion dates:** Programme National de Selection Ovine (PNSO) began in 1983. Political upheavals in Côte d’Ivoire caused the program to come to an abrupt end in 2002.
Case study 1: An open nucleus breeding program for Djallonke sheep in cote d’ivoire

- **Selection process design:** selection of rams at 80, 180 and 365 days.
  - First selection on-farm; ram lambs at least one standard deviation above flock average weight selected, purchased and transferred to central testing station (nucleus), where they were maintained under zero-grazing; Non-selected rams castrated.
  - Second selection on station at 180 days; rams greater than 23 kg bodyweight classified as first category; 20 to 23 kg classified as second category – both categories maintained to 365 days. At 365 days, first category rams were 35 kg and above; second category, 30 to 35 kg. First category rams retained for rotational breeding in participating farmers’ flocks. Second category rams sold to non-project farmers.
Case study 1: An open nucleus breeding program for Djallonke sheep in cote d’ivoire

- **Selection process design:** selection of rams at 80, 180 and 365 days.
  - Outbreak of ovine brucellosis in 1990: >50% of ram breeding stock being culled ➔ almost all rams entering testing station were kept as sires, + 79 rams were bought-in from farms outside selection base to enable mating schedule to be maintained.
  - Generally selection pressure was low; some years all candidate rams were retained due to inadequate numbers.
Case study 1: An open nucleus breeding program for Djallonke sheep in cote d’ivoire

• **Outcomes:**
  – National commission on domestic ruminant genetic improvement was set up
  – Farmers organized into a cooperative to take over management of program

• **Impact**
  – Breeding values increased at average rates of 28 g (ΔG of 0.28%), 11 g (0.05%) and 14 g (0.04%) for WT80, WT180 and WT365, respectively
  – Weight of lambs declined during the project period

• **Scale:**
  – From 1992 to 1999, number of farms involved increased from 69 to 143; and breeding ewes increased from 12,000 to 17,000
  – Nucleus had 153 breeding rams in 1992, later expanding to between 180-200
  – Each year, 100-120 second category rams sold to farms not in selection base

• **Sustainability:**
  – Program ended due to political crisis in 2002

  ‘The political situation put an end to the program. Most farmers lost their animals. The selected rams used for mating have been stolen; just a few were saved and kept in Toumodi. There is nothing really going since 2002.’
Case study 1: An open nucleus breeding program for Djallonke sheep in cote d’ivoire

• Lessons learned:
  – Over lifetime of program, genetic contribution to growth had either slightly improved or been maintained but environmental contribution had declined. Poor nutrition and general animal management were considered major factors
  – Weak and inconsistent selection intensities made it impossible to achieve high genetic gains; selection pressure appeared to decline with time; low ranking and untested rams were used at times; mortality rates of rams were high
  – Most lambs have had unknown sires because of group mating

• Future prospects:
  – Abrupt termination of program and loss of most of the rams during civil disturbances makes future prospects look bleak.
Case study 2: The Kenya dual purpose goat development program

- **Objective:** To develop a synthetic goat breed (the Kenya Dual Purpose Goat) combining environmental adaptability of indigenous breeds, and growth and milk producing abilities of exotic dairy goat breeds.

- **Species/breed:** Local Small East African and Galla, and imported Toggenburg and Anglo-Nubian goats.

- **Location and implementing organization(s):** Western Kenya. Small Ruminant-Collaborative Research Programme (SR-CRSP), operating under the auspices of the then Ministry of Livestock Development (MLD) and funded by the United States Agency for International Development (USAID).

- **Start/completion dates:** 1980 to 1991
Case study 2: The Kenya dual purpose goat development program

- **Technology/approach:**
  - The KDPG was developed based on crossbreeding and within-breed selection, after stabilization of the breed. Foundation parents included 250 Small East African and 200 Galla, mated to different batches of Toggenburg and Anglo-Nubian bucks, and later inseminated using semen imported from bucks in the USA.
  - A *nucleus breed* was then established.
  - Both on-farm and on-station testing of the animals was carried out with small-holder farmers participating in the project.
  - Choice of farmers was from two contrasting cultural/environments. Each farmer was provided with 2-4 breeding does, depending on the number of animals they could support on their land.
  - Breeding bucks were availed to groups of farmers on a rotational basis. The animals belonged to the project; however, any products such as milk and manure belonged to the farmers.
Case study 2: The Kenya dual purpose goat development program

• **Outcomes:**
  – Knowledge and information on the production and management of goats was disseminated.

• **Impact:**
  – A synthetic goat breed, the KDPG, was developed and proved to be able to survive and produce under restrictive conditions. It was able to produce 1.5-3 litres of milk/ doe/day [= East African Zebu cows, around 1 litre per day for the F1 and 2 litres for 75% exotic dairy goats in the Meru dairy goat project.

• **Scale:**
  – A breeding population of KDPG established, which expanded to 1800 animals by 1998; however, this population now stands at no more than 400 animals.

• **Sustainability:**
  – In 1991, there was a re-organization of MLD: activities were taken over by the new Kenya Agricultural Research Institute (KARI). Employees of the SR-CRSP project remained on the payroll for MLD, yet were accountable to KARI, a situation which was untenable and led to the abandonment of the breeding stations as well as the KDPG breeding program. Today, it is believed that fewer than 400 KDPG survived.
Case study 2: The kenya dual purpose goat development program

- **Lessons learned (1):**
  - The project successfully developed KDPG, well suited to low-input systems and reported to be in demand by farmers, but the failure to support or continue the breeding program means < 400 animals survive today.
  - Sustainability was not adequately considered in the design of the program. Questions on who would be involved in multiplication of the KDPG, how they would be delivered to farmers, and at what cost were not adequately addressed.
  - Breeding programs (long-term) require sustained commitment and funding in order to develop and disseminate results and outputs for impact on farmers.
  - Provision of animals ‘in trust’ to farmers in a development project (i.e. without claim on ownership) is not advisable. When, at the end of the project, farmers could no longer receive the free animals, many lost interest and move on to other endeavours.
  - A weakness of the SR-CRSP was that input from extension services was not integrated into the research program. The whole process of developing, testing, evaluating and disseminating an agricultural technology should not be left to one institution. Close collaboration between research and extension from the onset would have improved dissemination of the KDPG.
Case study 2: The kenya dual purpose goat development program

• **Lessons learned (2):**
  – Absence of national policy on goat milk as a commercial product hindered marketing goat milk and derived products. At that time, the only milk permitted to be marketed in Kenya was milk from cows – this has now changed.
  – Unclear national policy on livestock importation led to restrictions which hindered sourcing of additional goat germplasm for expanding the base population.
  – A study reported in 2005, showed that the developed KDPG composites were still segregating and have not stabilized into a new breed as was the aim of the breeding program (Mugambi et al 2005).

• **Future prospects:** Since 2005, within KARI there has been renewed interest in the surviving KDPG flock, resulting in studies on the numbers and characteristics of the remaining population, and a re-evaluation of possible breeding strategies for the KDPG
Case study 3: The Meru goat project

- **Objective:** To enhance livelihoods of the rural poor by improving the low milk yield and slow growth rate of indigenous goats.

- **Species/breed:** Crossbreeding East African indigenous goats with imported purebred Toggenburg goats.

- **Location and implementing organization(s):** Meru District, Kenya; FARM-Africa.

- **Start/completion dates:** Initiated by FARM-Africa in 1997. Project was handed over to the communities in 2004 and is still on-going.
Case study 3: The Meru goat project

**Technology/approach:**
- Based on participatory approach from outset. Farmers formed groups of 25 members each.
- Training provided to different group members on different topics, e.g. on basic husbandry or animal health: latter served as community-based animal health workers.
- Some farmers received additional training and were supplied, on credit, with four pure Toggenburg does and one buck and served as purebred breeding units.
- Each farmers group received a pure Toggenburg (T) buck which was used for crossbreeding with local (L) does: F1s were backcrossed to unrelated Toggenburg bucks to produce ¾ T and ¼ L goats. Backcrossed bucks were evaluated and superior ones used to breed with ¾ T and ¼ L does.
- Buck selection was done by *mass selection*. In this way a *dispersed nucleus breeding* unit was established and operated. Each group was the custodian of their buck, female goats were owned by individual farmers, and the bucks and breeder units were collectively owned and managed by the group on a contractual basis.
Case study 3: The Meru goat project

• Outcomes:
  – A Kenya Goat Development Network was founded
  – The model has now been replicated in other parts of the country
  – Following policy change on milk marketing, a pilot farmer-owned goat milk processing plant was set up to help market goat milk from members.

• Impact:
  – Milk production increased from ~ 250 ml/ day/ indigenous goats to 1 liter by F1s and 2 liters by 75% exotic goats.
  – Pure Toggenburg population grew from initial 130 to > 1000 in 10 years.
  – Individual farmers were able to own productive assets (dairy goats).

• Scale:
  – By 2007, 160 farmer groups were active in Meru District with 4000 farmers benefiting. Additional 56 groups formed outside the project area.

• Sustainability:
  – New farmer groups are still being formed within the region, under the auspices of the MGBA, several years after FARM-Africa ceased managing the project. FARM-Africa maintains an advisory role to the MGBA.
Case study 3: The Meru goat project

• **Lessons learned (1):**
  – Planning the intervention with key stakeholders and partners is important. In this project, joint planning ensured that the target group was reached.
  – Goats were provided to farmers on credit, to be repaid over time in cash or kind. The farmers thus valued the goats and adhered to the guidelines to maximize outputs from the animals reared.
  – Working with small farmer groups ensured accountability; good practice was recognized and rewarded from within the communities.
  – Capacity building within the community in animal management, and provision of affordable animal health services, helped ensure sustainability.
  – An enabling policy environment can define success or failure. Had the ‘anti-goat milk policy’ not been addressed the project would not have succeeded.
Case study 3: The Meru goat project

• **Lessons learned (2):**
  – Popularity of MG crossbreds led to a high demand for breeding animals, pushing up the price of goats five-fold. This has had a negative impact on the population over time; the faster growing animals tend to be sold → negative selection for growth rate.
  – Maintaining and conserving the pure indigenous breeds by the smallholder farmers is a challenge; require public investment.
  – While the project has tried to address health and breeding services, attention is still needed to ensure access to these and other inputs (e.g. feed resources).
  – Government restrictions on livestock imports need to be addressed; this is preventing importation of new Toggenburg bucks which could severely affect the project.
Case study 3: The Meru goat project

• **Future prospects:**
  
  – Introduction of basic recording systems to provide feedback on both productivity and pedigree information should be considered.
  
  – Introduction of new bucks from outside the country is essential to broaden the genetic base of the exotic breed. Current lack of clarity on germplasm import policy is a challenge
  
  – Use of alternative breeding methods, such as AI, in order to expand the exotic gene pool should be considered in the expansion strategy.
Case study 4: The mpwapwa composite cattle breed of Tanzania

- **Objective:** To produce cattle with the hardiness, longevity and milk production potential needed by smallholder and semi-pastoralist in climatically difficult zones of Tanzania.

- **Species/breed:** Local Tanganyika Zebu cows crossbred with a variety of exotic bulls including: Red Sindhi, Sahiwal, Ayrshire, Jersey and Boran.

- **Location and implementing organization(s):** Originally the colonial government extension service at the Livestock Production Research Institute, Mpwapwa, Tanzania.

- **Start/completion dates:** 1940s; on-going
Case study 4: The mpwapwa composite cattle breed of Tanzania

- **Technology/approach:**
  - The first crosses were generated between local Tanganyika Zebu cows and Red Sindhi and Sahiwal bulls imported from Kenya. Later, some *Bos taurus* (Ayrshire and Jersey) as well as Boran and other breeds were incorporated.
  - Mid-1960s, the breed contained approximately 20% Tanganyika Zebu, 10% Boran, 5% Ankole, 55% Red Sindhi and Sahiwal, and 10% Ayrshire.
  - In 1965, selection was directed towards Sahiwal lines and by 1988 the Sahiwal content had increased to 75%.
  - From 1968-1971, some Mpwapwa cows were crossed to Ayrshire, Friesian, and Jersey bulls using AI. The F1 males were sold to local farmers while F1 females were backcrossed to Mpwapwa bulls to produce the first backcross (R1) males and females.
  - From 1975-1980 *inter se* mating was practiced among backcross offspring. The breed is still being developed at the breeding station.
Case study 4: The mpwapwa composite cattle breed of tanzania

• **Outcomes:**
  – The performance of the Mpwapwa under village conditions, with poor nutrition and health management, seems satisfactory.
  – It performs better in terms of milk yield and weight gain than local zebu in harsh semi-arid conditions
  – Based on on-station records, performance are:
    • age at first calving 45.4 months
    • calving interval 447 days
    • lactation milk yield (short lactations deleted) 1447 to 1628 kg
    • daily gain 259g; carcass weight of steers (four years) 229 kg

• **Impact:**
  – It is claimed that ownership of the Mpwapwa breed increased income from milk and cattle sales; more milk and better price when sold as meat or breeding animals. However, because of the limited scale, even if this was true, it would have made little overall impact in the target population.
Case study 4: The mpwapwa composite cattle breed of tanzania

• **Scale:**
  – The Mpwapwa population size by 1997 was between 1000 and 1500. The number is less today.

• **Sustainability:**
  – A breed development process which started nearly 70 years ago seems to have gone back and forth over the years, with different iterations of crossing.
  – Changes in policy in Tanzania in the recent years resulted in further infusion of European blood into the already developed Mpwapwa cattle.
  – Active multiplication of the breed on-station came to a halt; at the same time there was no systematic pure-breeding of the Mpwapwa on-farm. Other than animals on government stations, there are now no ‘purebreds’ left on farms.
Case study 4: The mpwapwa composite cattle breed of tanzania

- **Lessons learned:**
  - Although the breeding program was apparently successful in producing a composite cattle breed that was suited to the local environment, not enough animals were generated to constitute a sufficiently large population that could sustain itself.

- **Future prospects:**
  - Farmers have recently put pressure on the Government, which has renewed attention for the development of the breed. This is manifest in a breeding and selection program of Mpwapwa cattle on-station (based on the remaining 300 animals) involving generation and multiplication using the original parental breeds (Boran heifers and Sahiwal bulls) and the available Mpwapwa bulls. The expectation is to have animals with genetic composition close to Mpwapwa (about 93.75 Mpwapwa)
Case study 5: Village chicken improvement programs in Africa, with a focus on the cockerel exchange model

- **Objective:** To incorporate exotic genes into indigenous breeds so as to produce birds which combine the hardiness of African chickens with the high performance of the exotic types. The focus has almost invariably been on producing a hardy, dual-purpose egg and meat bird.

- **Species/breed:** Local, indigenous chickens and commercial hybrids.

- **Location and implementing organization(s):** Throughout SSA and other developing regions. Mostly national governments; some NGOs.

- **Start/completion dates:** Past 50 years/on-going
Case study 5: Village chicken improvement programs in Africa, with a focus on the cockerel exchange model

- **Technology/approach:**
  - Crossing village/backyard chickens with exotic birds, and then leaving the hybrid offspring to natural selection. Cockerels of ‘improver’ chicken breeds are introduced and village households are required to get rid of the indigenous cockerels in their flocks.
  - Alternatively, pullet exchange or hybrid hatchable eggs (instead of live birds) programs have been employed. In many cases, there is little else in the ‘package’: it is simply assumed that the chicks hatched in subsequent generations, sired by the exotic cockerel, will progressively be higher producers and increasingly dominate the flocks.
Case study 5: Village chicken improvement programs in Africa, with a focus on the cockerel exchange model

• **Impact:**
  – There have been no major changes in the production levels of village chickens as a result of these programs in Africa.

• **Sustainability:**
  – Improved crossbred birds represent only a small sub-population and are quickly ‘swamped’ by the larger indigenous gene pool: there is usually little to show after the project ends.
Case study 5: Village chicken improvement programs in Africa, with a focus on the cockerel exchange model

• **Lessons learned:**
  – Genetic improvement of village chickens through the cockerel (or pullet) exchange model has failed to achieve sustained impact.
  – Raising the management level of the village chickens, especially through reduced mortality, appears to form the best basis for improved production.
Case study 5: Village chicken improvement programs in Africa, with a focus on the cockerel exchange model

- **Future prospects:**
  - The objective for scavenger, free-range systems has to be the reduction of mortality especially in growing period (where mortality rates can reach 60-70%).
  - Mortality can be reduced through farmer training on health and overall flock management, and by ensuring access to input services - health (vaccines for ND), and nutrition.
  - Experiences from other developing countries (e.g. Bangladesh) show that introduction of a few, low-cost technologies can double the family income from poultry. Just keeping the chickens in confinement (under a basket) for the first four weeks of life, and providing them with supplemental feed will reduce the mortality rate by >50%.
Bangladeshi model

- Two-way cross
- Sonali: Fayoumi x RIR
- highest yielding bird in semi-scavenging conditions
- good reputation among small-holders
Bangladeshi model

• The period was characterized by the involvement of many enthusiastic people and good support from several large scale donations.
• Became clear that the structure was too complex and ambitious, where crucial inputs such as quality feeds and timely medication could not be relied upon.
• Flow through the multiplication and cross breeding often went wrong, as new parent stock was not readily available.
• The farmer’s acceptance of the Sonali hen also changed over time as they discovered that they could not reproduce the good performance of the Sonali, which as F1 cross had a considerable heterosis.
• New development programs decided to use pure bred Fayoumi hens with which the smallholders can continue to breed continuously without the need of buying new chicks each generation.
• To run crossbreeding programs there should be staff involved at all levels of the organization/project with a deeper understanding of the various mechanisms, all the way from breeding and keeping the parental lines to organization of the multiplication through the parent stock.
Desafíos y lineamientos estratégicos en programas nacionales de mejoramiento genético
Situación actual

- 2/3 de las razas están localizadas en los países en desarrollo
- 60% de los países en desarrollo declararon no tener programas de mejoramiento para ninguna de las especies mayores de ganado (bovino, ovino, caprino, cerdo, aves).
- 90% de los países desarrollados declararon tener programas de mejoramiento para al menos una de estas especies

¿Por que los países en desarrollo no han tenido éxito en sostener programas de mejoramiento estructurados?

¿han iniciado pocos programas o los que iniciaron no son sostenibles?
razones principales (1)

- Falta de capacidad técnica y operacional
- Políticas que favorecen la introducción de RG sin evaluar sus consecuencias a largo plazo
  - adaptación a sistemas de producción difíciles
  - diferentes objetivos de mejora: simples vs múltiples propósitos
- participaron inadecuada de los productores en las fases de planificación y de elaboración de los programas de mejoramiento
  - los animales mejorados no respondieran a sus exigencias
razones principales (2)

- Falta de documentación detallada de los planes de operaciones acordados
  - sólo pocos técnicos han comprendido claramente las direcciones del desarrollo, o lo que se iba a desarrollar en el campo, por quién y cuándo

- Las actividades de mejoramiento genético se han iniciado a través de proyectos a corto plazo
  - las estrategias a largo plazo, con la participación de los sectores público y privado, pueden ser de mucho éxito

_Cuales son los requisitos para desarrollar un programa de mejoramiento sostenible?_
Enfoque estrategico de MG sostenible

- Basarse en objetivos de desarrollo ganadero sólidos y en estrategias de desarrollo ganadero bien integradas y realistas, capaces de lograr estos objetivos.

- Tomar en cuenta las principales diferencias ambientales, estructurales y socioeconómicas entre los sistemas de producción

- Garantizar la consulta y participación de los usuarios finales (los productores)
Enfoque estratégico de MG sostenible

- Contar con los fondos adecuados;
- facilitar paso a paso el desarrollo y permitir una acción sostenible;
- Estar bien documentados, con enfoques que hayan sido comprendidos y acordados por todas las partes interesadas en cada etapa;
- Tomar en cuenta los principios y consecuencias de los aspectos técnicos fundamentales asociados con el mejoramiento genético
Directrices para establecer estrategias de mejoramiento genético

de qué hablan estas *directrices*?

Contribuir a la planificación e implementación de estrategias de mejoramiento animal

- Acompañar al usuario en un proceso de toma de decisiones paso a paso, que lleve a la formulación de la estrategia
- Explicar cómo planificar e implementar técnica y operacionalmente los programas de mejoramiento genético
- Favorecer la interacción entre el conocimiento teórico y autóctono para decidir sobre el desarrollo de los RZ
- Suministrar información sobre las condiciones necesarias, consecuencias y posible horizonte temporal en los cuales las actividades planificadas deberían alcanzar resultados palpables
¿cuál es el grupo destinatario?

- para países o organizaciones que desean desarrollar sus RZ a través de programas de mejoramiento, pero tienen poca experiencia y cantidad limitada de personal

- para todas las personas y organizaciones que trabajan y participan en la planificación e implementación del mejoramiento genético: funcionarios de gobiernos nacionales y regionales, institutos de investigación, organizaciones de ganaderos...
¿En cuáles condiciones se utilizan las directrices?

- Ausencia de infraestructuras desarrolladas para el mejoramiento de la raza. Por lo tanto, no será posible la adaptación directa de los enfoques de situaciones más desarrolladas.

- Cuentan con políticas y estrategias generales para el desarrollo ganadero y las completan en cuanto al mejoramiento de la raza.
¿cómo están estructuradas las *directrices*?

- Estructuradas por secciones

  **Sección A:** Creación del grupo de trabajo para la elaboración de las estrategias de mejoramiento genético

  **Sección B:** Definición de los objetivos y estrategias del desarrollo ganadero

  **Sección C:** Compatibilidad entre RZ y sistemas de producción para lograr los objetivos de desarrollo de la ganadería

  **Sección D:** Elaboración de programas de mejoramiento en raza pura

  **Sección E:** Elaboración de programas de cruzamiento

  **Sección F:** Evaluación de decisiones de inversión
¿cómo están estructuradas las directrices?

- estructuradas por secciones

- Cada sección está introducida por una justificación, objetivo(s), elementos de apoyo y fuentes potenciales, resultados esperados y tareas a realizarse para lograr los resultados

- Cada tarea está compuesta de una serie de acciones
¿cómo están estructuradas las *directrices*?

- se ofrecerá a los usuarios un conjunto de preguntas para que juzguen la importancia del tema para su situación y la forma de abordarlo.
- se usan Tablas, figuras y cuadros de texto con ejemplos de diferentes países para una mayor explicación.
- se describen opciones y se discutan las potenciales consecuencias de diferentes decisiones.
- no se dan soluciones preformadas, en última instancia, *los usuarios tomarán sus propias decisiones*.
Objetivo:
Crear un grupo de trabajo para la elaboración del *Documento de estrategias de mejora del ganado*, con su programa de trabajo y asignación de responsabilidades. Además, levantar un inventario de las partes interesadas y demás colaboradores para la elaboración e implementación de la estrategia de mejoramiento genético

Tareas:
1. Levantar un inventario de todas las partes interesadas
2. Identificar las partes interesadas y representantes clave, y crear el grupo de trabajo
3. Discutir el programa de trabajo con los representantes
4. Asignar responsabilidades a los representantes y partes interesadas
• Ejemplo de composición dinámica de un grupo de trabajo y sus actividades
Sección A: Creación del GT la elaboración de las EMG

Equipo operativo para elaboración PMG: ejemplo de Kenya

- En mayo de 2007, el MDGP convocó una fuerza de tarea y estableció sus TdR

- Este equipo operativo, bajo la dirección del Jefe de Producción Animal del MDGP, está compuesto del MDGP, de la Corporación para el Desarrollo Agrícola, del Instituto de Kenia para la Investigación Agrícola, del ILRI, de la Universidad de Nairobi, de la Universidad de Egerton, de la Organización de ganaderos, y de FARM–Africa (ONG)

- varias visitas de campo y quatro talleres regionales

- apoyado por el FIDA, el MDGP y FAO, el proyecto había sido concebido para un año pero ha necesiado dos años. El documento es sometido al parlamento
Objetivo:
Establecer ODG factibles para el país (región) y elaborar las SDG correspondientes para cumplir con estos objetivos en todos los sistemas de producción importantes del país (región), con énfasis particular en la identificación de los requerimientos para la estrategia de mejoramiento genético.

Tareas:
1. Preparar el Marco ganadero y de políticas favorables (4).
2. Preparar el Marco de sistemas de producción (5).
3. Preparar el Marco de tendencias (5).
4. Preparación de los objetivos de desarrollo ganadero (ODG, 2).
5. Elaboración de las estrategias de desarrollo ganadero (SDG).
Escollos en políticas – raza Nagauri en Rajasthan

- La demanda de la raza de bovinos Nagauri es alta en los estados vecinos - para los cultivos de arroz. Las normas de bienestar animal prohíben el transporte de los animales más allá de las fronteras. Estas limitaciones hacen que los productores dejen de trabajar con esta raza poniendo en serio peligro el uso sostenible de los Nagauri.

- Tras décadas de promoción de programas de cruces, el Departamento de Ganadería de India ha cambiado su política hacia un reciente apoyo de las razas autóctonas. Los veterinarios del gobierno, sin embargo, siguen obligados a desarrollar una cuota determinada de IA para la cual se dispone solamente de semen de razas exóticas.
Sección B: Definición de los ODG y SDG

Riesgo asociado con unos ODG o SDG inapropiados

- No se cumplan los LDO establecidos total o parcialmente, debido a barreras imprevistas o expectativas irracionales sobre la capacidad de los productores y su motivación para administrar los cambios deseados;

- Los beneficios en materia de mitigación de la pobreza o de desarrollo social sean menores de lo esperado;

- Los costos económicos, sociales y ambientales sean mayores de lo esperado;

- Los LDO generen consecuencias inesperadas y no deseadas debido la desatención de algunos papeles de la agricultura.
Objetivo:
Definir el objetivo global de mejoramiento, describir las razas disponibles en la localidad y las alternativas posibles y suministrar argumentos para decidir sobre las razas a utilizar y el programa de mejoramiento a desarrollar.

Tareas:
1. Definir el objetivo global de mejoramiento para el sistema de producción de interés (3).
2. Compaginar la información disponible sobre experiencias con programas de mejoramiento.
3. Compaginar la información disponible sobre los roles y características de las razas locales (2).
4. Analizar las posibles razas disponibles (2).
Objetivo:
Definir el objetivo global de mejoramiento, describir las razas disponibles en la localidad y las alternativas posibles y suministrar argumentos para decidir sobre las razas a utilizar y el programa de mejoramiento a desarrollar.

Tareas:
5. Decidir sobre las razas y los programas de mejoramiento
6. Elaborar un estudio de factibilidad para la introducción de razas alternativas (3).
7. Preparar el Plan de introducción de germoplasma (7).
8. Implementar el Plan de introducción de germoplasma (5).
El caso del bufalo Chilika de India

- prevalecen en las islas y en los entornos del lago de Chilika, en las costas orientales de la India;

- adaptado perfectamente a las aguas estancadas del lago donde se adentran hasta las rodillas en busca de su alimentación, de malezas y de hierbas

- tienen una función ecológica importante –su estiércol y orina sustentan el zooplancton que, a su vez, sustenta la población de peces del lago que, a su vez, sustentan los medios de vida de los entornos del lago

- Su función múltiple en este sistema de producción no puede ser cubierta fácilmente por otras razas. El búfalo de Murrah o los cruces Murrah-Chilika, por ejemplo, no sobreviven en este ambiente, ya que se adaptan menos a la humedad y a la disponibilidad de agua salobres del lago.
Objetivo:
Elaborar un programa sostenible de mejora en raza pura utilizando la variación genética intra raza(s) seleccionada(s)

Tareas – fase de comienzo del programa:
1. Revisar el objetivo de mejoramiento y decidir sobre las responsabilidades para la planificación e implementación del programa (2)
2. Evaluar la situación actual para las prácticas, capacidad e infraestructuras de mejoramiento (4)
3. Preparar el Programa de mejoramiento en raza pura (12)
4. Establecer las estructuras financieras y organizacionales (2)
5. Implementar el Programa de mejoramiento en raza pura (4)
Objetivo:
Elaborar un programa sostenible de mejora en raza pura utilizando la variación genética intra raza(s) seleccionada(s)

Tareas – fase de optimización:
6. Aprir el núcleo a animales con valor genético superior (1)
7. Mejorar la propagación y distribución (2)
8. Mejorar la recogida de datos y evaluación (3)
9. Optimizar la intensidad de selección y intervalo de generacion (5)
10. Garantizar la ejecución del programa (2).
Open nucleus – maximizing community involvement

Present Breeding Structure

Genetic merit

- 200 ewes
  - Communal multiplier
  - 3,000 ewes

- 200 ewes
  - Central nucleus
  - 3,000 ewes

- 200 ewes
  - Multi-communal multiplier
  - 3,000 ewes

- Multi-communal multiplier
  - 60,000 ewes

15 Communal general flocks

Rams

Ewes

Multi-communal general flock
Objetivo:
Elaborar un programa de cruzamiento utilizando la variación genética entre razas seleccionadas

Tareas:
1. Revisar las metas de mejoramiento y decidir sobre las responsabilidades para la planificación e implementación del programa (2)
2. Evaluar la situación actual para las prácticas, capacidad e infraestructuras de mejoramiento (5).
3. Preparar el Plan del programa de cruzamiento para empezar (9)
4. Establecer las estructuras financieras y organizacionales (2)
5. Implementar el Plan del programa de cruzamiento (5)
Objetivo:
Elaborar un programa de cruzamiento utilizando la variación genética entre razas seleccionadas.

Tareas:
6. Organizar e implementar los servicios de cruzamiento (4)
7. Promover la respuesta a los servicios de cruzamiento (5).
8. Evaluar los beneficios del cruzamiento y de su sostenibilidad (4)
9. Informar sobre el progreso
En la región de Bresse, los productores emprendieron la protección de una raza local de pollo asociada con la tradición de productos de calidad.

Establecieron un programa de GI y elaboraron estrategias de comercialización para diferenciar el poulet de Bresse del broiler.

Se aplican condiciones específicas de crecimiento, un periodo estándar de finalización y un procesamiento bien reglamentado.

El resultado es un producto con una etiqueta de Designación de origen protegido (DOP), que permite un precio más del doble del broiler.

Las ventas se realizan casi exclusivamente por medio de pequeños detallistas y restaurantes y no por medio de supermercados.
Sección F: Evaluación de decisiones de inversión

**Objetivo:**
Ofrecer una idea clara al inversionista (gobierno o privado) sobre los beneficios que genera la inversión en los programas de mejoramiento genético

**Tareas:**
1. Identificar las perspectivas y criterios de evaluación (3)
2. determinar y calcular los costos e ingresos (2)
3. Analizar la relación costos-beneficios (5)
4. Evaluar los beneficios y decidir (6)
### Análisis económico expandido a nivel nacional

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Fuente: Mueller 2009, sin publicar. En dólares US.
Desarrollo y validación de la Directrices

- Una primera versión fue preparada in 2002 pero su desarrollo fue interrumpido por causa de la preparación de la SM-RZ y por falta de personal.

- La segunda versión fue preparada a finales del 2006, y fue probada, evaluada y finalizadas en varios talleres realizados en:
  1. Francia (Setiembre 2006)
  2. India (Noviembre 2006)
  4. Tanzania (Marzo 2008)
  5. Perú (Marzo 2008)
  6. Italia (Julio 2008)
Agradecimientos

In total, 120 scientists, technicians and policy-makers, from all regions, contributed to their development and validation

— Keith Hammond
— John Woolliams, Salah Galal y Joaquin Mueller
— Vincent Ducrocq, Suresh Gokhale, Okeyo Mwai, Sachindra Das and Gustavo Gutiérrez and William Vivanco
— Ben Kubblega, Marie-Louise Beerling, Regina Laub
— Irene Hoffmann
— Los miembros del grupo RZ de la FAO
Overview of Guidelines

Guidelines to assist the preparation of national strategy and action plans

**Strategic Priority Area 1**
Characterization, inventory and monitoring of trends and associated risks

- Survey and monitoring
- Characterization - phenotypic
- Characterization - molecular

**Strategic Priority Area 2**
Sustainable use and development

- Breeding strategies for sustainable management of animal genetic resources
- Animal identification and performance recording

**Strategic Priority Area 3**
Conservation

- Cryoconservation guidelines
- *In vivo* conservation guidelines

**Strategic Priority Area 4**
Policies, institutions and capacity-building

- Institutional arrangements for the implementation of national strategy and action plans
Muchas gracias por su atención

Animal genetic resources for food and agriculture (AnGR) provide crucial options for the sustainable development of livestock production. The erosion of these resources globally, and particularly in many developing countries, has accelerated in recent years as a consequence of the rapid changes affecting livestock production systems (intensification and industrialization) as they respond to surging global demand for animal products. Disease outbreaks, other disasters and emergencies (armed conflicts, droughts, etc) and the degradation of grazing land are also threats.

FAO’s work in the field of AnGR management takes a broad approach – addressing technical, policy and institutional issues, and taking account of interactions with other aspects of natural resource management, production system dynamics and general economic development.

The State of the World’s Animal Genetic Resources for Food and Agriculture identified significant gaps in capacity to manage AnGR, particularly in developing countries. In response, the international community adopted the Global Plan of Action for Animal Genetic Resources (GPA) at the International Technical Conference on Animal Genetic Resources for Food and Agriculture in September 2007. The GPA was later endorsed by the 34th FAO Conference. It includes 23 strategic priorities for action grouped into four priority areas: characterization and monitoring, sustainable use, improvement and development, and communication, coordination and capacity building.