Section C

Implications of the changes in the livestock sector for genetic diversity

In land-based livestock production systems, livestock species and breeds have been selected for a wide range of criteria including adaptive traits related to a variety of environmental challenges. By removing environmental stresses, industrial systems allow a focus on a narrower range of selection criteria. Industrial systems are characterized by the standardization of production and by a high degree of control over production conditions. These systems are also highly specialized: they optimize production parameters with regard to a single or reduced number of outputs. The animal genetic requirements of industrial systems are thus characterized by:

- less demand for species and breeds adapted to local environments;
- less demand for disease resistance or tolerance as animal are raised in closed systems and farmers rely on intensive use of veterinary inputs;
- more demand for efficiency, and especially feed conversion ratio, to maximize benefit per animal place (in industrial systems, feed typically represents 60 to 80 percent of production costs); and
- more demand for quality traits due to consumer demand and technical requirements related to standardization, size, fat content, colour, flavour, etc.

The industrialization of livestock production is most advanced in the pig and poultry sectors. Particularly in Europe, North America and Australia, pork production is highly industrialized, and a few transnational breeding companies dominate production chains. The poultry sector, in turn, is the most industrialized of all forms of livestock production, and large-scale production is now widespread in many developing countries. Dairy production is also increasingly reliant on a limited number of breeds. The trend is most advanced in developed countries. In most parts of the developing world, dairying is dominated by small-scale producers, but in peri-urban areas the use of exotic or cross-bred animals to supply expanding urban markets is increasing. As well as being driven by demand, such changes may also be promoted by improvements in the availability of animal health provision and other services and technologies, which allow the keeping of animals less adapted to local production conditions. Industrial systems and the associated private breeding companies have the resources to develop breeds that match their requirements. They have developed highly specialized breeds, which enable them to maximize productivity in the context of current consumer requirements and resource costs. As a consequence, substantial erosion of breeds has already occurred in developed countries, where livestock production has been industrialized for three or four decades (see Part1 – Section B).

However, in the medium or long term, breed selection criteria in industrial systems may have to be revised. At present, industrial production takes place in a context that is characterized by low input prices (e.g. grain, energy and water); locally deficient environmental and public health policies; and in developing countries, a generally low level of public concern about the conditions in which animals are reared. As public policies are put in place to adjust the price of resources to

reflect their social costs, and consumers become more interested in agro-ecological and welfare aspects of animal production, the economic context may change.

In parallel to the development of industrial systems, low to medium external input production systems persist, particularly where there is no strong economic growth, or where the resources and support services required for industrialization are lacking. These conditions are found in areas with harsher environmental conditions (e.g. drylands, mountains or cold areas), or in rural areas with poor connection to centres of demand. In these circumstances, production systems continue to deliver a wide range of outputs to local communities, and livestock usually have multiple purposes (see Part 1 – Section D). Livestock keeping is often intimately linked to traditional ways of life and culture, particularly in pastoral systems. As such, low to medium external input production systems have specific requirements for AnGR. They rely on native breeds, or in some cases, on cross-breeds or composite breeds that contain genetic material from local breeds.

Despite their adaptation to the production environment, the AnGR associated with grazing and mixed farming systems face substantial threats. Problems are often driven by inappropriate livestock development policies. Moreover, in a context of population growth and climate change, small-scale grassland-based and mixed production systems face increasing pressure on resources, which may threaten the associated AnGR. For example, shortages of feed resources may lead to a shift towards keeping sheep and goats rather than large ruminants, or to the use of donkeys rather than oxen for draught power. To make the systems sustainable, their efficiency needs to be improved, especially with regard to the use of land and water resources. Moreover, efforts are likely to be necessary to enhance the production of marketable livestock products as a source of income, which in turn may facilitate the investments needed to improve the productivity and sustainability of the systems (e.g. soil conservation measures).

If wider markets are to be accessed, meat and milk production from these systems will have to meet the quality standards required by the consumers. Achieving these objectives while improving productivity traits, and maintaining multifunctionality and adaptation to local environments, is a challenge. In this context, local livestock genetic diversity is likely to be a key resource to be drawn upon. The basis for evaluating individual animal performance should include criteria such as lifetime productivity (e.g. number of offspring per female), economic returns from the herd or flock (as opposed to individual performance), and biological efficiency (output/input). In essence, recommendations for breed development will be of little value if they do not take account of the specific environment in which the animals are expected to perform. The specific environment is a combination of climate, availability of feed resources, and disease challenge on the one hand, and the degree of management control of these conditions on the other. Moreover, socio-economic and cultural factors also affect choices regarding species, breeds, products and product quality. The resulting variety of situations gives rise to the need for a large range of breeds.

Even in developed countries, or developing countries with strong economic growth and a well-developed infrastructure, traditional, extensive production continues to supply informal markets and niche markets, such as local food specialities, high-quality products and organic food. An example of the persistence of a local informal market can be found in Thailand, where it is estimated that 20 percent of poultry production will remain independent of large operators. Organic farms in Europe and other parts of the world are characterized by a high integration between crops and animals, the use of limited chemical inputs, and often by the use of typical native breeds. The production philosophy generally does not allow for scaling-up, which is also constrained by the low volumes – in 2003, organic milk and eggs represented only 1.5 percent and 1.3 percent respectively of overall production in the European Union.

In the case of grassland-based production systems the delivery of environmental services is increasingly becoming a focus of national policies in developed countries. In these circumstances, producers have to tailor practices to maximize service delivery rather than the output of conventional livestock products. Breed selection criteria may have to adapt to these new objectives. Selected traits in these circumstances would relate to the consumption of biomass from different sources (grass, shrubs, or trees) and its effects on functions such as landscape preservation, biodiversity conservation, carbon sequestration, soil conservation and nutrient cycling.

Breed development has always been highly dynamic and driven by strong interactions between specific environments and human needs. A large genetic diversity, relying more on differentiation within species (breed diversity) than on the domestication of additional species, has been created over a long period. Recently, the industrialization process has led to a narrowing of the genetic pool. However, it is genetic diversity which provides livestock keepers with the opportunity to match genetic resources to the specific requirements of production systems – now and in the future. In parallel, the existing diversity of production systems offers scope for keeping a high diversity of livestock genetic resources in use. A prerequisite for this is that the necessary breed-related information is made available and that access to and exchange of genetic material is ensured.

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