

5. Livestock and human and animal health

Innovative strategies and responses are required to meet the economic and human-health risks associated with livestock diseases. The most serious health threat is that of a human pandemic, recently highlighted by the outbreak of a new strain of influenza, A(H1N1), containing genetic material from human, swine and poultry viruses. The economic threats from livestock diseases and their treatment may be less dramatic, but they too may exact a high cost in terms of human welfare and can pose livelihood risks for smallholders.

Humans, animals and their pathogens have coexisted for millennia, but recent economic, institutional and environmental trends are creating new disease risks and intensifying old ones. Systemic risks are emerging owing to the combination of rapid structural change in the livestock sector, geographic clustering of intensive livestock production facilities near urban population centres and the movement of animals, people and pathogens between intensive and traditional production systems. Because these production systems rely on different disease-control strategies, the exchange of pathogens between them can create major disease outbreaks. Meanwhile, climate change is altering patterns of livestock disease incidence, as pathogens and the insects and other vectors that carry them enter new ecological zones.

Animal-health and food-safety systems are facing new and additional challenges as a result of the lengthening and increasing complexity of supply chains in the livestock sector that have been facilitated by globalization and trade liberalization. At the same time, increasingly stringent food-safety and animal-health regulations and private standards aimed at promoting consumer welfare are creating challenges for producers, especially smallholders who have less technical and financial capacity to comply with them.

Many national institutions for disease control are obliged to respond to an increasing number of crises instead of focusing on principles of prevention, progressive disease containment, or elimination of a new emerging disease before it spreads. Consequently, the economic impact of diseases and the cost of control measures are high and becoming higher. In addition, sometimes necessary control measures such as culling may greatly affect the entire production sector, and may be devastating for the poorest households for whom livestock forms a major asset and safety net.

This chapter reviews some of the major problems and controversies surrounding issues of animal health and food safety and discusses alternatives for controlling livestock diseases and mitigating their effects. It highlights the fact that interventions, investment and institutions have focused most strongly on trade and global food systems, and that too little attention has been paid to the concerns of the poor and the endemic diseases and unrecorded food-safety problems that affect their livelihoods. The challenge is to manage livestock diseases and food-borne illnesses in ways that optimize economic and human-health outcomes across the wide diversity of systems and for people everywhere.

Policy-makers should balance the needs of producers against consumers, those of smallholders against commercial operators, and routine animal-health and food-safety concerns against potentially catastrophic risks. This may involve measures to encourage the movement of intensive livestock production facilities away from urban population centres and to reduce the potential for pathogens to move between systems. Risk management of livestock disease risks should involve improving information and early-warning systems, and engaging all stakeholders, including poor people, in decision-making.

This includes enhanced local capacities, improved collaboration between national and international animal-health and food-safety authorities (including greater transparency on the occurrence of animal diseases), and investment in technologies to mitigate risk.

Economic and human-health threats related to livestock disease

Animal diseases pose two basic types of problem for humans: socio-economic and health. Figure 15 illustrates the pathways through which livestock diseases and the risk of livestock disease affect human welfare.

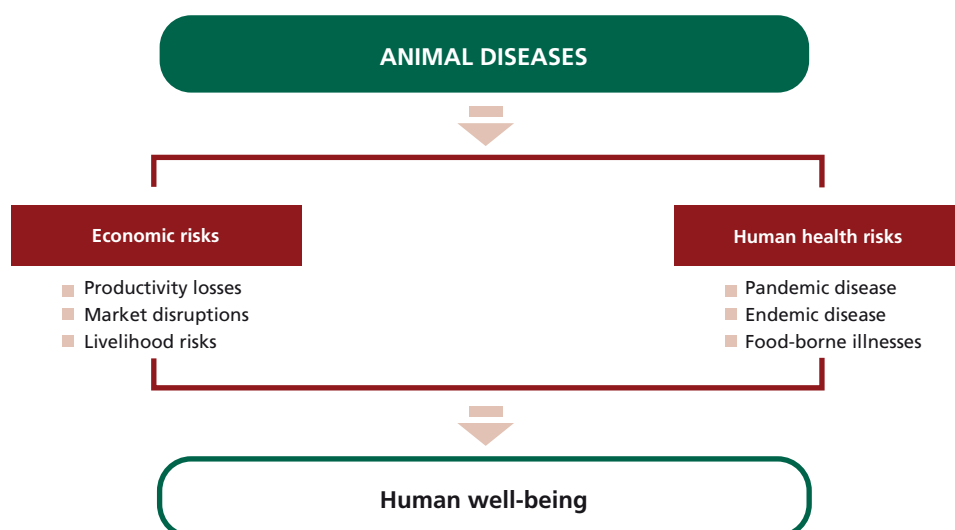
Economic and socio-economic threats from livestock diseases come in three broad categories: (i) losses in production, productivity and profitability caused by disease agents and the cost of their treatment; (ii) disruptions to local markets, international trade and rural economies arising from disease outbreaks and the control measures aimed at containing their spread, such as culling, quarantines and travel bans; and (iii) livelihood threats to the poor. Livelihood threats arise from the first two categories of threat. Because livestock serve multiple functions in the

livelihoods of poor people, livestock diseases affect poor livestock producers differently from commercial producers. The poor face different incentives and have different capacities to respond to disease outbreaks. An economic problem for some producers can destroy the livelihoods of others.

Human-health threats from livestock come in two basic forms: (i) zoonotic diseases, and (ii) food-borne illnesses. Zoonotic diseases are those that arise in animals but can be transmitted to humans. Potentially pandemic viruses, such as influenza, are the most newsworthy, but many others exist, including rabies, brucellosis and anthrax. Food-borne illness can come from disease agents such as salmonella and *E. coli* or contaminants that enter the food chain during the production and processing of animal-based foods. These illnesses and the way they are managed create problems for everyone, but smallholders are often particularly vulnerable because they are more exposed to the risk and have less capacity to respond and recover.

Livestock disease specialists differ regarding the prevalence and impacts of diseases, owing in part to a lack of information. For example, in some areas it is not clear whether the prevalence of an animal disease is actually increasing or whether more instances are being detected

FIGURE 15
Impacts of animal diseases on human well-being



because of better surveillance and diagnostic capabilities. The available evidence suggests that there has been a steady decline in the prevalence of many animal diseases in developed countries, although they still experience periodic outbreaks of some diseases and the prevalence of stress-related diseases associated with intensive production systems is increasing. In contrast, there has been very little apparent change in the prevalence of endemic livestock diseases in the developing world, particularly in many African countries. However, at the global level there is evidence to suggest that new pathogens are emerging at the human–animal–ecosystem interface.

It is inappropriate to formulate a “one-size fits all” response to disease because people and countries are affected differently depending on their economic circumstances. A disease has different impacts depending on the scale and intensity of production and the importance of commercial market outlets. Consequently, countries face different costs and incentives, just as they have varying capacities to implement control measures. Many of these differences are explained by the changing production and marketing systems, the continued coexistence of industrial and traditional systems and the resulting imbalances in national animal-health and food-safety systems. While the objective of animal disease-control measures is the protection of animal and public health, policy-makers should consider the diversity of impacts and incentives confronting different people in the sector and tailor interventions and compensation accordingly.

Strict biosafety and food-safety measures are used to restrict the emergence and spread of diseases in countries where the livestock sector is dominated by large-scale intensive production systems and complex processing and marketing operations. These production systems and their associated value chains roughly correspond to the “industrial” production systems described in previous chapters. They are typically supported by strong national animal-health and food-safety systems and by powerful consumer and public interest groups and food retailers that insist on high standards of public health, food safety and quality.

The overarching strategy of industrial systems is to control disease-causing

agents by eradicating them from the food chain – from feed and animal production through food processing and retailing. Strict biosecurity measures and food-handling procedures are implemented at every step in the chain. These systems generally perform well in delivering high levels of public health and food safety, but they are vulnerable when pathogens enter an otherwise secure system. For example, an outbreak of foot-and-mouth disease (FMD) in the United Kingdom in 2001 may have cost almost UK£30 billion since then in direct costs for control measures and indirect costs (lost revenues) (Table 15). Similarly, in the United States of America, outbreaks of food-borne illnesses linked to animal sources cost more than US\$8 billion per year in terms of illness, premature deaths and lost productivity (Table 16).

Many animal diseases are always present in some systems, especially where the livestock sector is dominated by “traditional” small-scale, mixed or extensive production systems. Endemic diseases are generally tolerated in countries where traditional systems dominate, even though the diseases impose economic and health burdens on producers and consumers. Such countries tend to have less robust animal-health and food-safety systems; they often focus their limited resources on the problems of the small segment of the livestock sector concerned with international trade, while neglecting the needs of poorer livestock keepers. While the small-scale systems may be less vulnerable to dramatic disease outbreaks than are industrial systems, disease nonetheless imposes large, often unmeasured, costs on producers and consumers. For example, in Africa there are several tropical parasitic livestock diseases that do not occur anywhere else, such as the tick-borne East Coast fever (*Theileria parva*) and tsetse-transmitted trypanosomiasis, both with a subcontinental scale of distribution and posing a major burden on cattle farming and rural livelihoods even when there are no precise cost estimates. Contagious bovine pleuropneumonia (CBPP) is estimated to cost almost €45 million per year in lost productivity. Table 15 contrasts cost estimates for disease outbreaks in both developed and developing countries of various diseases. The variability illustrates the magnitude of

TABLE 15
Some estimated costs of disease in developed and developing countries

LOCATION	OCCURRENCE	ESTIMATED COST
United Kingdom	FMD 2001	From UK£3 billion to the public sector + UK£5 billion to the private sector to UK£25–30 billion in total (NAO, 2002; Bio-Era, 2005)
Scotland, United Kingdom	FMD 2001	Direct cost to agriculture UK£231 million. Loss of gross revenue to tourism up to UK£250 million (Royal Society of Edinburgh, 2002)
United States of America	HPAI 1983–84	US\$65 million (USDA, 2005)
Netherlands	CSF 1997–98	US\$2.34 billion (Meuwissen <i>et al.</i> , 1999)
North America	Lyme disease (endemic)	Approximately US\$20 million annually (Maes, Lecomte and Ray, 1998)
Spain	African horse sickness 1967, 1987, 1988–90	US\$20 million (Mellor and Boorman, 1995)
European Union	BSE 1990s	€92 billion long-term cost (Cunningham, 2003)
United States of America	BSE 2003	US\$11 billion from export restrictions (USITC, 2008)
Africa	CBPP annually	€44.8 million (Tambi, Maina and Ndi, 2006)
India	<i>Theileria annulata</i> annually in traditional cattle	US\$384.3 million annually (Minjauw and McLeod, 2003)
East, Central and southern Africa	<i>Theileria parva</i> annually in traditional cattle	US\$168 million annually (Minjauw and McLeod, 2003)
Global	Ticks and tick-borne diseases in cattle	US\$13.9–18.7 billion annually (de Castro, 1997)
Uruguay	FMD	US\$7–9 million annually prior to FMD vaccination prior to eradication in 1997 (Leslie, Barozzi and Otte, 1997)

Notes: BSE = bovine spongiform encephalopathy; CBPP = contagious bovine pleuropneumonia; CSF = classical swine fever; FMD = foot-and-mouth disease; HPAI = high-pathogenicity avian influenza.

occurrences as well as the difficulty in comparing countries, diseases and their impact. The cost of food-borne illnesses is not known with any degree of accuracy in many developing countries because such incidents are rarely reported.

When industrial and traditional systems intersect through trade or travel, problems can erupt. Industrial systems are always vulnerable to the emergence or re-emergence of disease agents, for which countries with weak animal-health systems often act as a reservoir. At the same time, the high animal-health and food-safety standards required to protect livestock and consumers in countries with industrial livestock systems can serve as insurmountable barriers to trade for products from countries with weaker

systems, limiting export opportunities from poorer countries.

Economic threats

From the point of view of producers, livestock diseases are essentially an economic problem. Diseases reduce production and productivity, disrupt trade and local and regional economies and exacerbate poverty. At the biological level, pathogens compete for the productive potential of animals and reduce the share that can be captured for human ends. A sick animal produces less meat, less milk or fewer eggs. It provides less draught power and poorer-quality food and fibre. In economic terms, output declines, costs rise and profits fall.

In traditional systems, the costs of animal diseases are considerable but are rarely calculated explicitly. Veterinary services are

TABLE 16
Some estimated costs of food-borne illness in developed countries

LOCATION	CAUSE	ESTIMATED COST
United States of America	Shiga toxin-producing <i>Escherichia coli</i> O157 (O157 STEC)	US\$405 million annually (in 2003 dollars), including US\$370 million for premature deaths, US\$30 million for medical care, and US\$5 million in lost productivity (Frenzen, Drake and Angulo, 2005)
Ohio State, United States of America	All food-borne illnesses	Between US\$1.0 and US\$7.1 billion annually (Scharff, McDowell and Medeiros, 2009)
United States of America	Multiple species annually	US\$8.4 billion: salmonellosis US\$4.0 billion; staphylococcal intoxication US\$1.5 billion; toxoplasmosis US\$445 million; listeriosis US\$313 million; campylobacteriosis US\$156 million; trichinosis US\$144 million; <i>Clostridium perfringens</i> enteritis US\$123 million; <i>E. coli</i> infections including hemorrhagic colitis US\$223 million; botulism US\$87 million (Archer and Kvenberg, 1985)
Japan	<i>E. coli</i> O157-H7 outbreak	¥82 686 000. Laboratory costs, about ¥21 204 000. Also, the cost of foodstuffs that were not purchased during the suspension of the lunch service (about 19%), personnel expenses paid to lunch service employees (about 17%), human illness costs (about 15%), and the repair costs of facilities (about 15%) (Abe, Yamamoto and Shinagawa, 2002)
Belgium	<i>Campylobacter</i>	€10.9 million annually (Gellynck et al., 2008)

often not available or affordable, so the routine costs of controlling and treating disease in traditional systems are low, but the continual drain on production and productivity caused by endemic infectious and parasitic diseases reduces the ability of smallholders to lift themselves out of poverty.

Producers in industrial systems view the costs of controlling and treating animal diseases as part of the economic cost of production. The disease burden *per se* is relatively low, but the costs associated with maintaining biosecure production facilities and paying for veterinary services and medications can be significant. These costs affect the overall profit of the firm.

Production, productivity and profitability

Many diseases affect livestock productivity. Some are discussed below as transboundary and emerging diseases or as food-borne illness, but the same diseases can also persist in an endemic form, posing a constant drain on productivity. Causes of loss of productivity include death of the animal or illness leading to condemnation at slaughter, as well as reduction in weight gain, milk yield, feed conversion, reproductive capacity and work capacity for ploughing and transport.

Treatment costs, where veterinary services are available, include direct financial costs and indirect costs of time taken up by seeking or providing treatment. The

increase in production costs is expected to be compensated by reduction in productivity losses, but this may not be the case if animal-health-care services are of poor quality and the treatment is not applied correctly. This is a serious problem in many remote regions in developing countries, where veterinary services are scarce.

Livestock in developing countries are exposed to a range of diseases that affect productivity. For example, in Africa, CBPP and peste des petits ruminants (PPR) affect cattle and sheep, respectively; both diseases now appear to be spreading, killing local livestock. In Viet Nam, classical swine fever (CSF) causes serious losses to small-scale pig producers but has little impact on export trade as Viet Nam exports only small amounts of pig meat. Foot-and-mouth disease in India and elsewhere in Asia causes considerable loss of production; it is a particular problem when it infects draught animals during the ploughing season, limiting their ability to work. This reduces farmers' incomes from renting out draught animals and causes a reduction in the area of land that can be planted to staple food crops.

Markets, trade and rural economies

Animal diseases that cause high mortality in animals and spread rapidly nationally and internationally into disease-free areas can exact particularly high economic costs.

BOX 16

Animal health and welfare

The way people treat animals is influenced by beliefs and values regarding the nature of animals and their moral significance, which vary from culture to culture. The view of animals as “sentient beings” is spreading through scientific and veterinary education and provides an additional impetus to safeguard animal welfare.

Good animal welfare management includes implementation of practices that prevent and mitigate pain and distress, prevent and treat diseases and injuries and provide living conditions that allow animals to express natural behaviours. Often, such practices have multiple benefits for people as well as animals: they can contribute to productivity, livelihoods, food security and safety, human health and psychological well-being. However, they can also carry costs in the form of investment for welfare-friendly animal housing and training of staff, longer time periods to produce outputs or less output per unit space allocated to animals. An approach to animal welfare that focuses on benefits to people, rather than to the animals, is more likely to succeed, especially in parts of the world where many people suffer from poverty and starvation.

A wide range of standards and programmes have been created to ensure the implementation of good animal welfare practices, including: voluntary welfare codes, often created by industry organizations; corporate programmes; product differentiation programmes that allow consumers to purchase selectively; legislated standards; and international agreements created by treaties or intergovernmental organizations. The different types of programme serve different political and commercial purposes and have different strengths and weaknesses; a legislative approach, for example, will be effective only if sufficient resources are devoted to its administration and enforcement.

Animal welfare is increasingly being linked to trade and market access. There is a concern in some developing countries that animal welfare may become another non-tariff barrier limiting their access to markets. Developed-country producers, on the other hand, are concerned that the extra costs they incur to comply with legislation and standards in their domestic markets makes their products uncompetitive compared with imports. However, meat, eggs and dairy products produced in compliance with high animal-

These so-called transboundary and emerging diseases can be vectored by birds, rodents and insects and carried by live animals and animal products or on the clothes, shoes and vehicle tyres of people moving through an affected area. The emergence of new diseases that are not understood or for which control technology is not available are of particular concern. Because of their dramatic effects on animal mortality and their high economic costs, they tend to attract the greatest attention from public animal-health programmes and national and international regulations.

The main strategy used to reduce the impact of transboundary and emerging diseases involves eliminating them from

a population and then preventing their reintroduction, for example, through vaccination and sanitary measures aimed at protecting susceptible species from exposure from infected populations. The international institutions most directly involved are the Agreement on the Application of Sanitary and Phytosanitary Measures (SPS) of the World Trade Organization (WTO) and the OIE. The framework for international trade in livestock and livestock products allows countries that are free of a given notifiable disease to require their trading partners to have equivalent disease-free status. This system, based on strict definitions and evidence, works well for protecting trade, but it creates a major market barrier for

welfare standards can provide access to new, valuable market opportunities. Capacity needs to be built in lower-income countries to ensure that producers in these countries are better positioned to participate in such trade. Capacity building is also needed to prevent small- and medium-scale producers from being put at a competitive disadvantage relative to large, industrialized producers.

Currently, standards are being applied primarily in large-scale intensive systems, with poultry and pig systems being strongly targeted for improvements at the farm level. However, welfare concerns also apply to the animals kept by small-scale producers. With the increasing shift toward larger-scale livestock production in developing and emerging economies, there is an urgent need to work with producers and governments in such countries to improve animal health and welfare. The World Organisation for Animal Health (OIE) identified animal welfare as a strategic priority in 2001 and produced a set of standards for animal transport and slaughter in 2008 (OIE, 2008b). These are currently being expanded to cover on-farm animal welfare as well. The endorsement by the 2nd Global Conference on Animal

Welfare, entitled "Putting the OIE Standards to Work", held in Cairo in October 2008, represented a significant step in the direction of global awareness in animal welfare. However, efforts need to be made to ensure implementation, compliance and enforcement of these standards.

FAO is committed to raising awareness, strengthening synergies and fostering partnerships, building capacities and creating and disseminating information related to animal welfare. As a starting point, FAO, in collaboration with key international partners in animal welfare, including the European Commission, OIE, animal welfare non-governmental organizations, producers and professional associations, launched in May 2009 a participatory portal to facilitate information sharing and improve access to knowledge and capacity building tools (www.fao.org/ag/animalwelfare.html).

Sources: FAO, 2008a; OIE, 2008b.

countries with weak animal-health systems. Such countries are rarely if ever free of all notifiable diseases.

The discovery of a notifiable disease in a country that exports livestock or livestock products can create severe market shocks. Control measures typically include market and trade bans, restrictions on the movement of livestock and culling of affected herds or flocks. Consumers may also shun products of the livestock species involved if the disease is perceived to have possible human-health implications. Sharp falls in consumption can affect producers and traders far outside the area where the outbreak occurs (Yalcin, 2006; Hartono, 2004). Control measures can also devastate tourism and associated industries.

It may take weeks or months until markets and production cycles are re-established, and producers may lose market share to others in the meantime.

Foot-and-mouth disease, a well-known disease of ruminant livestock and pigs, has caused serious trade disruptions in several meat-exporting countries of Europe and South America over the past 20 years, but most of these countries have managed to regain disease-free status. However, the costs of FMD outbreaks and control measures are significant, reaching perhaps €90 billion for countries in the EU since 2001 (Table 15). In much of Africa and Asia, FMD is endemic and remains a perpetual obstacle to the export of meat and other livestock

products. Other transboundary diseases can be equally devastating. Thailand lost its export market for unprocessed poultry meat in 2004 during the first wave of highly pathogenic avian influenza (HPAI) outbreaks. It has since recaptured some markets by exporting processed poultry meat. Some countries in the Horn of Africa depend on livestock exports to the Near East, but periodic outbreaks of Rift Valley fever and the resulting trade bans can seriously harm livestock producers. Bovine spongiform encephalitis (BSE) has infected relatively few animals, but its association with the human variant Creutzfeldt-Jakob disease has had a huge impact on international beef trade, estimated at US\$11 billion for exports from the United States of America alone (see Table 15). Control measures aimed at tracing and eliminating animals infected with BSE have imposed regulations that poorer countries find difficult to meet.

The OIE recently defined the concept of “compartments” to help countries overcome trade barriers associated with notifiable diseases (OIE, 2008a). While some countries may be unable to attain full disease-free status, they may be able to eliminate notifiable diseases from some subpopulations of animals. A compartment is a subpopulation held under a common biosecurity management system for which disease-free status can be certified. In theory at least, animals could be traded from a disease-free compartment even if the rest of the country were not free of disease. An even more recent idea is that of “commodity-based trade”, which would allow a livestock commodity to be certified as safe because of the particular conditions under which it was produced and processed, no matter the overall disease status of the country.

Livelihoods

Animal disease affects all livestock-owning households by threatening their assets and making their income less secure. For many families in the poorest quintile, livestock disease is particularly damaging because it threatens the very asset that they use for dealing with other crises. It also affects people who are employed by livestock owners, small-scale traders of livestock and poor consumers. The measures used by veterinary authorities to combat disease can

have severe consequences for people living in poverty, including depriving poor producers of their livelihoods, in the case of culls, and driving up costs of livestock products to poor consumers.

Some diseases that can be prevented or controlled by wealthier farmers are a continuing problem in the flocks and herds of poor households. For example, brucellosis is often present in sheep and goat flocks under extensive management in many parts of the world, but vaccination is not widely practised by extensive herders because of the high cost.

Likewise, Newcastle disease in poultry is kept under control by segregation and vaccination in commercial flocks but no economically viable control system has yet been found for scavenging flocks. Peste des petits ruminants (PPR) causes high mortality in sheep and goats, and, while it is preventable by vaccination or by keeping infected flocks away from healthy ones, it is still capable of taking communities by surprise as the outbreaks in North and Eastern Africa in 2007–08 demonstrated.

Other diseases affect rich and poor alike but have very particular effects on the poor. For example, FMD, a disease that disrupts international trade, is not usually a major cause for concern among extensive herders and mixed farmers, but it does have a large impact when it occurs in traction animals during land preparation (Thuy, 2001). Classical swine fever is a problem for pig producers who want to trade on the international markets, but at a very low level of incidence it is an accepted risk for small-scale pig producers.

Diseases affect the amount, timing and certainty of income from livestock enterprises, depriving small producers in particular of access to credit to buy feed, animals or their replacements. Poor people are more likely to be chronically affected by health problems that can be caused by contact with sick animals, such as brucellosis or internal parasites. Many poor people earn wages from working in intensive livestock production or marketing enterprises. Animal disease can jeopardize this source of income.

For these reasons, reducing the incidence of livestock diseases can help alleviate poverty. However, as noted above, livestock

keepers have different objectives and face different risks and incentives. Policy-makers need to consider these differences in formulating responses, even as health objectives remain foremost. It must be recognized that poorly planned and executed measures may seriously harm poor livestock owners and fail to achieve animal health objectives. For example, a hastily introduced ban on poultry keeping in a Southeast Asian capital resulted in a loss of income for many families, but failed to eradicate poultry from the city because of incomplete compliance (ICASEPS, 2008).

In recent years, the scientific community has developed a variety of animal-health technologies and interventions that can reduce the threat of disease. However, these have tended to overlook the specific animal-health requirements of poor livestock keepers in developing countries. In addition, there are financial and institutional constraints that impede the delivery of new technology to small-scale producers.

Developing countries, and particularly their poorer farmers, are suffering from a contraction of government services and intervention in the last two or three decades. Government veterinary services are very poorly funded, legislation governing the livestock sector is often out of date, and private animal health services are very limited. Many farmers never call a veterinarian, particularly in remote rural areas, and they may need to travel far to obtain access to drugs or vaccines. In addition, when there is a crisis that the government veterinary service needs to respond to, the service is hard-pressed to mobilize the people, transport and equipment to deal with it. Similarly, nations with limited resources that focus their efforts on supporting food exports may neglect the infrastructure needed to ensure domestic food-safety systems. In order to be able to sustain the infrastructure required for overall food safety, nations must have food-safety systems that work for both their domestic and export markets.

Despite the global shift towards intensive livestock production, the many poor people who will continue to rely on small numbers of poultry or other livestock for income diversity and security still require better animal-health services than those available

at present. One of the greatest challenges will be to find ways to provide and sustain these services in countries where investment in such services has been falling for many years. Recently, for example, funding that was made available to tackle HPAI helped to strengthen support for community-level animal-health services in a number of countries by providing training and support programmes for community animal-health workers; however, unless financial support is sustained, these gains could be short-lived.

In Africa, where the shortage of public funds for agricultural services is particularly acute, the advent of structural adjustment programmes led to the withdrawal of highly subsidized animal-health services, including communal dipping of cattle and provision of clinical services and drugs. The reach of clinical veterinary services became restricted, in particular failing to cover remote and marginal areas of arid and semi-arid lands where the majority of pastoralists live. Prices of veterinary drugs increased and support services formerly provided by government during droughts were withdrawn. Community-based organizations and non-governmental organizations often step into the existing institutional voids left by retreating public services. Incorporating these organizations more fully into national animal-health systems represents a further challenge that needs to be addressed.

A priority in the development agenda must be to understand the relationship between animal health/disease and the livelihoods of poor livestock keepers. Moreover, animal-health concerns need to be integrated in overall rural development policy, because failure to consider disease can seriously reduce rural growth.

Human-health threats

Threats to human health from animals arise mainly from existing and emerging zoonotic diseases (those that pass between animals and humans), from food-borne illnesses and from residues left by the improper use of veterinary medicines (e.g. antibiotics), hormones and toxic substances.

During the early stages of intensification of livestock production, large-scale livestock production units tend to be established near to growing urban centres, which places large livestock populations in close proximity to

large human populations. This brings both public-health and environmental hazards. In some cities in poorer countries, a significant proportion of city-dwellers keep livestock, often in cramped and unsanitary conditions and in close proximity to people. This can foster the emergence and spread of diseases affecting both animals and humans (Waters-Bayer, 1995).

Zoonotic diseases and pandemic threats

Emerging zoonotic diseases (from wild or domestic animals) can spread out of their natural ecosystem due to many reasons, such as human and animal demographic changes, ecosystem encroachment, climate fluctuations and trade flows. These diseases cause sickness and death in humans and are an issue of growing importance to medical and veterinary authorities. A very large number of new diseases in animals are able to infect and affect humans. At least half of the 1 700 known causes of infectious disease in humans have a reservoir in animals, and many new infections are zoonotic diseases. More than 200 zoonotic diseases have been described, caused by bacteria, parasites, viruses, fungi and unconventional agents (e.g. prions). About 75 percent of the new diseases that have affected humans over the past ten years are caused by pathogens originating from animals or from products of animal origin. Many of these diseases have the potential to spread by various means over long distances and to become global problems. Treatment can be costly or long-term; some, such as new-variant Creutzfeldt-Jakob disease and rabies, are incurable. Highly infectious zoonotic diseases have received a considerable amount of attention because of their sudden appearance and potential high impact, while vaccines and effective treatments may not be available.

In recent years, the world has experienced the emergence of severe acute respiratory syndrome (SARS), HPAI (caused by the A[H5N1] virus) and an influenza caused by the A(H1N1) virus, all causing considerable concern about the risk of a major global pandemic. Major national and international efforts have succeeded in containing SARS effectively. However, although H5N1 HPAI has disappeared from most countries, it is stubbornly persisting in several countries.

The influenza caused by the A(H1N1) virus has recently been declared a worldwide pandemic by the WHO; infections and deaths continue to rise. The worldwide dispersal of BSE was avoided, but occasional cases continue to be detected beyond the British Isles. The end of 2008 marked the detection of the Ebola Reston virus circulating in pigs and pig workers in the Philippines. In addition, outbreaks of the Ebola virus flare up occasionally in the Democratic Republic of the Congo, Uganda and other countries in Africa, killing humans and large numbers of great apes.

Some zoonotic diseases are being brought under control in some countries and yet are expanding in others. Rabies has been largely controlled in Europe since the introduction of oral vaccines to control the disease in foxes, the main reservoir of the virus. For example, in France, the number of rabies cases in domestic animals fell from 463 in 1990 to a single case in 2007. In contrast, rabies is growing in importance in many developing countries. A recent outbreak in Bali, Indonesia, appears to be difficult to control because of a lack of general awareness about the outbreak and the challenge to agree on a strategy that works: the choice of the right vaccine and whether to vaccinate, sterilize or cull stray dogs.

Another group of zoonotic diseases, often referred to as "neglected" because of their endemicity, includes cysticercosis, echinococcosis and brucellosis. Little attention is paid to them, and they often persist in the poorest and most vulnerable populations. The lack of awareness and government commitment tends to aggravate the situation.

Food-borne illnesses

Although several of the diseases previously mentioned can be transmitted through food, food-borne diseases are considered as a specific group. Organisms such as salmonella (particularly *S. enteritidis* and *S. typhimurium*), *Campylobacter* and *E. coli* O157:H7 are major food-borne threats, causing illness in millions of people worldwide every year.

The global incidence of food-borne diseases in foods of animal origin is difficult to estimate. However, Maxwell and Slater (2003) found that up to 30 percent of people

in industrialized countries suffer from food-borne illnesses every year. Consumer attitudes to risk, as well as the food-safety risk levels, priorities and approaches to food safety and quality vary significantly between developed and developing countries. Countries have responded in different ways to growing public concerns over food safety. Some have approached the problem from the perspective of domestic consumer welfare, while others with a strong export orientation have addressed the issue as a threat to their export markets.

The major food-safety hazards in livestock products are biological and chemical contaminants. These contaminants can originate from air, soil, water, feedstuffs, fertilizers (including natural fertilizers), pesticides, veterinary drugs or any other agent used in primary production, or from diseased animals.

Biological contaminants in livestock products include: abnormal proteins, such as those associated with BSE; bacteria, such as *Salmonella* and *Brucella* species and some types of *E. coli*; and parasites, such as *Echinococcus* species. Chemical and biological contaminants include: veterinary drug residues, such as antimicrobials, and pesticides; chemicals; heavy metals; and naturally occurring mycotoxins and bacterial toxins.

In developing countries, the quality and safety of food supplies are put at risk by demands for more, cheaper food, driven by growing population and increasing urbanization, combined with a lack of resources to deal with issues related to food safety and lower or less rigorously enforced regulatory standards. Human and financial resources that are dedicated by national authorities to the support of regulatory and non-regulatory food-safety programmes generally fall well short of needs. Commonly, many of the resources available are used for quality control of food for export, rather than products for domestic consumption, leaving the domestic market more vulnerable to unacceptable levels of food-safety hazards. In many developing countries, there is a substantial informal market that generally escapes any food-safety controls.

Informal food production systems, such as unregulated slaughter in developing

countries, make available food that has not met food-safety standards. Many rural and urban poor people buy food in informal and uncontrolled markets and, therefore, face a higher chance of contracting zoonotic and food-borne diseases, resulting in illness and wage loss as well as medical expenses to treat the illnesses (FAO, 2005). Moreover, food-borne illnesses often affect aged, young and malnourished people most severely. The failure by national governments in developing countries to invest adequately in food-safety systems has greater impact on the poor than the better-off.

The ultimate goal of food-safety management systems is to prevent unsafe food from entering the food supply. This is achieved by applying good hygiene practices at all stages of the food chain. The role of national authorities is to define the food-safety standards that the industry must meet and to provide the necessary oversight to ensure that the standards are met. Development of appropriate food-safety management and information strategies also depends on a thorough knowledge of the market and of the forces affecting stakeholders' behaviour and choices. The ability of both public and private sectors to carry out their roles effectively depends on the availability of adequate facilities for food processing and handling and of enough appropriately trained people.

The FAO/WHO Codex Alimentarius Commission develops internationally agreed standards and guidelines for safe food that provide the benchmark for food-safety regulation in international trade. However, governments vary in their investment in developing an internationally acceptable food-safety system. Many developing countries focus their efforts on meeting the requirements of importing countries for selected key exports, motivated by the desire to maximize export earnings and trade-led growth. However, neglect of food safety on domestic markets has its own cost. Food-safety concerns about domestic products can lead importers to question a country's ability to impose and enforce acceptable food-safety standards on any food product.

Increasingly, private food-safety standards are being imposed by buyers. These prescribe food-safety management procedures to

be followed that are consistent with the principles laid out in Codex standards and guidelines but generally go further. While these private standards are “voluntary”, the concentration within the retail sector is such that many producers in developing countries are forced to comply with them in order to be able to export.

As economies develop, food processing and preparation tends to shift outside the home, and supermarkets increasingly dominate urban food retailing. In many developing countries, this has led to demands from the growing affluent middle-class driving improvements in food safety.

For example, the Government of China has established “green food” certification for a wide range of products, including beef, in response to food-safety concerns raised by affluent urban consumers. A survey revealed that affluent consumers are prepared to pay premiums of 20–30 percent for “green foods”. At the production level, the certificate prohibits use of growth promoters, imposes withholding periods for some veterinary products and sets national standards to be met on the use of feed additives and antibiotics (Brown and Waldron, 2003).

Developing countries commonly lack the technical and institutional capacity – food laboratories, human and financial resources, national legislative and regulatory frameworks, enforcement capacity, management and coordination – to ensure compliance with international standards, which compromises food safety. Such systemic weaknesses not only threaten public health but may also reduce access to global food markets. Umali-Deininger and Sur (2007) also noted that cultural issues, such as religious beliefs, may constrain the adoption of appropriate food-safety measures.

The complexity of food safety makes it difficult to identify the right policies to alleviate problems in the sector, especially where little is known of the magnitude of the problems. While food-safety risks can be minimized, we cannot expect risk to be eliminated when it comes to food safety – implying that policy-makers, together with scientists and the food industry, will have to define acceptable levels of risk.

Disease control and risk management

Managing livestock disease and improving social welfare requires action on several fronts. Dealing with transboundary diseases requires regional cooperation or “cluster” approaches that take into consideration the rapid spread and evolution of these diseases. Mechanisms for reducing risks from livestock diseases include: relocating intensive livestock production facilities away from urban population centres; strengthening animal-health and food-safety systems, including information and early warning; engaging all stakeholders, including poor people, in decision-making on animal-health programmes; developing animal-health strategies tailored to specific local circumstances; improving collaboration between national and international animal-health and food-safety authorities; and investing in technologies to mitigate risk.

Location of production

The geographic concentration of production units near urban centres increases the risks of epidemic disease outbreaks in the livestock population, especially when people and animals move between traditional and intensive production systems, and increases the exposure of the urban population to livestock diseases. Animal-health protection in large, clustered livestock production units is straightforward in some respects. There are few units to monitor and it is cost-effective for veterinarians to visit them or to be employed by them. If there is a disease outbreak, there are relatively few critical points for timely intervention and proper monitoring. There is also a strong incentive for farmers to invest in disease prevention, reducing the range of animal-health hazards. It may be necessary, however, to encourage the relocation of these units away from urban centres in the interests of human health. It is important to recall that pathogens that are circulating in smallholder livestock, including in scavenging poultry, are not normally seen to jump to a higher level of virulence. A mutation into a more aggressive disease agent is far more probable where pathogens gain access to

an abundance of susceptible host animals, as may occur in medium- to large-scale commercial plants if biosecurity measures are breached. Most extensive livestock production is characterized by relatively small herds and flocks of genetically diverse, robust and more disease-resistant animals.

Meanwhile, backyard livestock production continues in many urban and peri-urban areas. There have been instances where governments have tried to ban such enterprises in light of human-health concerns. This has been the case, for example, in recent efforts to control HPAI (ICASEPS, 2008). Where implemented without careful consultation with producers, this approach has damaged livelihoods and resulted in non-compliance. Some governments have modified or removed these restrictions and are trying instead to provide incentives to encourage safer production practices.

Animal health, food safety and early-warning systems

Many developing countries lack mechanisms for gathering information about the incidence of animal-health and food-safety problems or any form of early-warning system for disease outbreaks. This limits their ability to diagnose and prioritize animal-health problems and deliver appropriate interventions.

Many of the basic elements for a global information system already exist. Regional organizations in Southeast Asia and South America for instance, have played an important role in promoting cross-border and regional animal-health surveillance programmes. The Global Early Warning System (GLEWS), operated by FAO, OIE and WHO, provides warnings based on the most up-to-date scientific information available; these permit national decision-makers and the international scientific community to make more accurate assessments of risks of disease outbreaks. Global and regional networks of laboratories and epidemiologists – for example, the OIE/FAO Network of Expertise on Animal Influenza (OFFLU) and regional laboratory and epidemiology networks in Africa and Asia – have also been set up to facilitate the sharing of information and samples.

However, these systems function where reliable local information is available. Gathering such information requires an effective surveillance system based on a sensitized, alert and engaged community, suitably trained and equipped staff and well-equipped laboratories. Regrettably, few developing countries have such systems in place. Some developing countries have had successful experiences with participatory disease surveillance involving villagers or community animal-health workers, for example in Africa during the 1990s to detect residual pockets of rinderpest (Mariner and Roeder, 2003) and in Indonesia in 2004–05 to discover the extent of H5N1 HPAI infection (Alders *et al.*, in press). However, sustained investment and government commitment are needed to create such systems, and given the contribution that good disease intelligence makes to global public goods, at least part of the investment should come from the international community.

Strengthening animal-health and food-safety systems requires consistent, sustained funding. This will have to be provided at the local and national levels as well as by the international community. Stronger planning, advocacy and monitoring of impacts of the systems will be important, together with closer engagement between public and private sectors in countries where the private sector is sufficiently robust. There are a few examples of combined public and private animal-health funds, but none are in developing countries. The best known example is in Australia, where a not-for-profit public company has been established by the federal government, state and territory governments and major national livestock industry organizations to manage national animal-health programmes on behalf of its members (AHA, 2009). Responsible behaviour by individuals is needed to reduce externalities, and a shared public-private fund ensures that both risks and responsibilities are shared. Many disease-control issues represent a mixture of private and public goods. Private actions taken by livestock owners to preserve their own herds and flocks, such as voluntary vaccination, or the application of biosecurity measures can also create a public benefit

BOX 17

Global Rinderpest Eradication Programme (GREP) – elements of a success

The virus that causes rinderpest is arguably the most dreaded cattle disease on account of its epidemic history that caused massive depopulations of livestock and wildlife in three continents and was responsible for several famines in agricultural communities of the eighteenth, nineteenth and twentieth centuries. With the launching in 1994 of the Global Rinderpest Eradication Programme (GREP), FAO spearheaded an initiative to consolidate gains in rinderpest control and to move towards disease eradication. In close association with the World Organisation for Animal Health (OIE), the International Atomic Energy Agency (IAEA), the African Union's Inter-African Bureau for Animal Resources (AU-IBAR) and other partners, the GREP, a key unit within the Emergency Prevention System for Transboundary Animal and Plant Pests and Diseases (EMPRES), was conceived as an international coordination mechanism to promote the global eradication of rinderpest and verification of rinderpest freedom, while providing technical guidance to achieve these goals. From the outset, the GREP was a time-bound programme, with a focus on global declaration of freedom in 2010.

Target achieved. The last reported outbreak of rinderpest was in Kenya in 2001 and the last known use of vaccines against this disease was in 2007. Not only has eradication proved feasible, it is probable that it has been achieved. However, the process for international

recognition must be upheld and processes respected to ensure that country dossiers are submitted for evaluation by the international community as determined by the OIE. An international declaration of Global Rinderpest Freedom is expected to be made in 2010. This would be only the second time that a disease has been eradicated worldwide (the first being smallpox in humans).

Partnership and donor support. The GREP has been able to count on the partnership with the OIE, economic blocs and regional specialized organizations (e.g. the African Union and the South Asian Association for Regional Cooperation) and numerous donor agencies, such as the European Commission, United States Agency for International Development, Department for International Development (United Kingdom) and the Governments of Ireland and Italy. However, the most important partners of the GREP have been the countries themselves. In several situations, FAO's Technical Cooperation Programme project funding has been used to control rinderpest outbreaks rapidly or undertake activities to promote diagnostic laboratory strengthening, emergency preparedness planning, surveillance and capacity building. The GREP has also been instrumental in drafting and revising the OIE Pathway (a standard-setting activity to determine international disease status as it relates to rinderpest viral activity), surveillance strategies and other guidelines that lead to confirming eradication.

by limiting disease spread to animals or people.

Engaging the poor in animal-health programmes

Consultative processes are required to ensure that government, non-governmental organizations, academia and the private-sector groups involved in community-based programme development collectively

provide inputs into the animal-health and food-safety management process. High priority should be given to research that emphasizes both basic and applied aspects of food quality and safety. Countries need to pursue the development of simple, inexpensive analytical methods/techniques for all hazardous substances and micro-organisms. These should be applicable in wider community contexts in order to

Promoting vaccination. The strategy adopted early in the global rinderpest eradication was the implementation of widespread vaccination campaigns of cattle and buffaloes; this has entailed the use of heat-stable vaccines and, most importantly, the determination of post-vaccinal immunity, which has been carefully monitored to make sure that the campaigns covered the appropriate proportion of cattle population.

Virus characterization. Following molecular analyses, rinderpest virus strains were grouped into three distinct lineages: lineages I and II in Africa, and lineage III consisting of virus strains isolated from Asia and the Near East.

Rinderpest eradication campaign coordination. It was agreed during the FAO Expert Consultation meeting held in Rome in 1992 that regional coordination of campaigns would be the only realistic approach to rinderpest control, as isolated national actions would only lead to sporadic and unsustainable or temporary improvements. The GREP incorporated the concept of a coordinated Pan-African Rinderpest Campaign (PARC), which covered 34 countries in Africa until 1999, and a West Asian Rinderpest Eradication Campaign (WAREC), which covered 11 countries in the Near East region. The WAREC coordinated activities between 1989 and 1994. The PARC has been followed by the programme for Pan-African Control of Epizootics (30 countries),

while the Somali Ecosystem Rinderpest Eradication Coordination Unit (SERECU) regrouped Ethiopia, Kenya and Somalia as an area that showed the possible maintenance of viral activity. These efforts include epidemiological support and technical assistance in collaboration with the Pan-African Vaccine Centre based in Debre Zeit, Ethiopia, and those of the joint FAO/IAEA Division in Vienna, Austria.

Network in epidemiology and laboratories. Only through international coordination can transboundary animal diseases such as rinderpest be eliminated. It is concerted efforts by national authorities that have placed the world on the threshold of worldwide eradication of rinderpest. Their efforts have benefited from the assistance of reference laboratories (for confirmatory diagnosis, vaccine development and quality control) and from investment by the international community (for the establishment of regional approaches and networks of laboratories and epidemiological units).

Disease surveillance and participatory disease search. Aspects of epidemiology, risk-based surveillance and participatory disease search techniques have been developed and proved essential for detecting the last foci of rinderpest, for providing the epidemiological understanding of disease maintenance, and for gaining assurance of the disappearance or eradication of the disease.

offer both cultural and economic advantages.

Efforts to reduce the impacts of livestock disease on people living in poverty must take into account the wide range of diseases that affect the lives of poor people, including currently neglected diseases. They must also aim to minimize damage done by control measure used to deal with outbreaks of emerging zoonotics and transboundary

diseases. Achieving these goals will require the close engagement of poor people and their representatives in planning and delivery of disease-prevention and control measures; this will help ensure that more of the solutions proposed will be appropriate to, and wanted by, local communities.

This approach is essential both to protect the livelihoods of poor people and to increase the likelihood of disease-control

efforts succeeding. Several examples have been cited above of the problems that may arise when the poor are not engaged in the planning and delivery of disease-control measures, ranging from non-compliance to creating household food-security problems.

It must be recognized, however, that the approach is particularly difficult to apply when faced with a rapidly developing disease threat, because of the urgency of the need to halt a growing problem before it becomes too great. For example, poor livestock keepers were hardly engaged in planning and delivering the emergency measures used to combat HPAI, but a great deal of effort is now going into finding ways to prepare for emergencies that will allow local conditions to be considered, and to plan for a smoother transition from immediate crisis response back to development efforts.

Measures that will help poor livestock keepers include: reducing the shock of control measures, e.g. avoiding extensive culls where possible; compensating those affected; and investing more heavily in local institutions that will help to provide better coping mechanisms. Public-private partnerships need to create space for the poor to become more engaged in order to capture local knowledge about prevailing diseases and impacts, and, where possible, to encourage them to develop their own measures to prevent and control livestock disease outbreaks.

Developing animal-health protection tailored to local circumstances

Animal-health protection should be tailored to specific local circumstances. Blanket solutions work well for some but not for others, setting up the conditions for tensions and non-compliance. Vaccination, for example, is relatively simple to apply in large, intensively managed flocks and herds, but tends to be much less cost-effective in small-scale systems because of the costs of delivering it to many small production units. Smallholders may be reluctant to participate in vaccination programmes when they perceive little immediate benefit. Much of the information that is currently available on financially viable protection measures is relevant only to large-scale, intensive farms – a gap that the international community is

attempting to fill, for instance for poultry in the wake of H5N1 HPAI (FAO, World Bank and OIE, 2008).

A more nuanced set of responses is needed that takes account of the needs and strengths of small-, medium- and large-scale producers in different types of production and marketing chains. Animal-health solutions need to be developed in and for local situations, and they must be seen in the context of wider developments in the livestock sector and beyond. Experience also underlines the need for those involved in animal-health systems to be constantly evaluating and learning from experience.

In all of these efforts, two-way communication is essential. Communication strategies to promote behaviours at the community and household levels aimed at preventing and controlling outbreaks of livestock disease include: informing communities of new or emerging health threats and how to recognize them; engaging local people in responding to such threats and in developing preventive practices for new diseases; and national public education campaigns to promote awareness of the impact of livestock diseases and what the public can do to help prevent and control outbreaks.

Improving collaboration between national and international animal-health and food-safety authorities

Efforts to control zoonotic diseases and food-safety problems related to the livestock sector must involve both human- and animal-health sectors. There is also a need to collaborate with wildlife or environmental experts in order to understand the origins and reservoirs of diseases. For this reason, many current efforts are focused on improving collaborative arrangements at the national, regional and international levels.

“One World, One Health” is an interdisciplinary and cross-sectoral approach to dealing with emerging infectious diseases, developed by the Wildlife Conservation Society (see Box 18). It has been adopted by a number of recent initiatives against zoonotic disease that bring together a wide range of stakeholders from human- and animal-health sectors, medical and veterinary communities, wildlife and environmental organizations, the private sector and advanced research

BOX 18

One World, One Health

“One World, One Health” is an interdisciplinary and cross-sectoral approach aimed at promoting and developing a better understanding of the drivers and causes surrounding the emergence and spread of infectious diseases (www.oneworldhealth.org). The concept was developed by, and is a trademark of, the Wildlife Conservation Society. It was adopted in October 2008 as the basis for a strategic framework for reducing risks of infectious diseases at the animal–human–ecosystems interface by a group of international agencies – including FAO, the World Organisation for Animal Health (OIE), the World Health Organization (WHO), the United Nations Children’s Fund (UNICEF) – and by the World Bank and the UN System Influenza Coordinator (UNSIC) (FAO *et al.*, 2008).

The main goal of the One World, One Health approach is to reduce the risk and global impact of disease outbreaks by improving livestock and wildlife intelligence, surveillance, and emergency response through stronger public and animal health systems. The approach calls on broad cooperation among disciplines and sectors and puts a high priority on “hot spots” for emerging infectious diseases.

The strategic framework focuses on emerging infectious diseases at the animal–human–ecosystems interface, where there is the potential for epidemics and pandemics that could result in wide ranging impacts at the country, regional and international levels. The objective of the framework is to establish ways to reduce the risk and global impact of epidemics and pandemics of emerging infectious diseases. This requires better disease intelligence, surveillance and emergency response systems at all levels, which, in its turn, calls for strong public and animal health services together with effective communication strategies.

National authorities play a key role in devising, financing and implementing these strategies.

There are five elements to the strategic framework:

- to build robust and well-governed public- and animal-health systems compliant with the WHO International Health Regulations (WHO, 2005) and OIE international standards, through the pursuit of long-term interventions;
- to prevent regional and international crises by controlling disease outbreaks through improved national and international emergency response capabilities;
- a shift in focus from developed to developing economies and from potential to actual disease problems, as well as an enhanced focus on the drivers of a broader range of locally important diseases;
- to promote wide-ranging collaboration across sectors and disciplines; and
- to develop rational and targeted disease-control programmes through the conduct of strategic research.

The overall objective of the strategic framework represents an international public good. While it does not prioritize diseases to target, it does have a clear aim to benefit the poor by helping to reduce the risks of infectious diseases that are important locally – e.g. Rift Valley fever, tuberculosis, brucellosis, rabies, foot-and-mouth disease, African swine fever and peste des petits ruminants. The One World, One Health paradigm is aimed at improving global, national and local public health, food safety and security and the livelihoods of poor farming communities everywhere while protecting fragile ecosystems.

Source: FAO *et al.*, 2008.

institutions at the country, regional and international levels (Box 18).

In most countries, sector-specific institutions have clear roles and responsibilities, but mechanisms for cross-sectoral collaboration are not clearly identified or developed. However, significant progress in cross-sectoral collaboration has been achieved regionally and at the international level. Regionally, collaboration occurs through organizations such as ASEAN, ECO, OIRSA, IICA, APEC, SAARC and AU-IBAR,⁵ among others. Internationally, collaboration exists among many organizations or institutions, such as WHO, FAO, UNICEF, OIE, WWF, WCS and IUCN⁶ and advanced research organizations and laboratories, including those of the Consultative Group on International Agriculture Research (CGIAR) system. FAO, the International Atomic Energy Agency (IAEA) and OIE reference laboratories and collaborating centres support diagnostic services, research in epidemiology and development of vaccines. OIE and FAO promoted joint Regional Animal Health Centres to support harmonized strategies and approaches for transboundary animal diseases and emerging infectious diseases across countries in regions with similar problems and challenges.

The more localized or endemic human-health problems of animal origin have so far received less attention of this nature, although there is growing awareness that the control of endemic human diseases of animal origin may contribute cost-effectively to poverty alleviation. Control of neglected zoonotic diseases requires coordination between veterinary and human-health services. Where cost recovery is not possible and the diseases particularly affect poor people, government funds are needed to support their prevention, detection and control.

⁵ ASEAN: Association of South East Asian Nations; ECO: Economic Cooperation Organization; OIRSA: Organismo Internacional Regional de Sanidad Agropecuaria; IICA: Instituto Interamericano de Cooperación para la Agricultura; APEC: Asia-Pacific Economic Cooperation; SAARC: South Asian Association for Regional Cooperation; AU-IBAR: African Union Inter-African Bureau for Animal Resources.

⁶ UNICEF: United Nations Children's Fund; WWF: World Wide Fund for Nature; WCS: Wildlife Conservation Society; IUCN: International Union for Conservation of Nature.

A risk management approach to food-safety risks from animal products is essential to allocate efficiently the limited funds available for food-safety systems. Involvement of all members of the food supply chain in understanding risks and identifying priority areas for controls and mitigations will go a long way to ensuring social acceptance of, and responsibility for, food safety along the food supply chain. This cross-sector involvement helps to deal with business practices that may threaten food safety.

Technological innovation

New technologies can support better management of animal-health risks. Advances in proteomics, transcriptomics and genomics will probably result in many new products in the next few years. The recent rush to develop a vaccine following the outbreak and spread of bluetongue serotype 8 (not previously seen in Europe) in Belgium, France, Germany, the Netherlands and the United Kingdom in 2006 has shown that the pharmaceutical industry can respond rapidly when appropriate incentives are in place. The Government of the United Kingdom issued a tender in November 2007 to develop and supply 22.5 million doses of bluetongue vaccine. The company that won the tender developed the vaccine in just two years.

The market for animal-health inputs such as vaccines and pharmaceuticals is not large in the developing world. This is not surprising given the low incomes of the majority of livestock producers. As a result, there is little incentive for international pharmaceutical companies to develop new technologies to address livestock health in the developing world.

This raises two questions. First, how can pharmaceutical companies be persuaded to invest in the development of new products suited to poor livestock keepers who have limited resources? Second, what can governments do to assist the spread of technology to control the diseases that are a priority for the poor? Workable solutions to these questions are key to progress towards improved animal-health services for all.

For example, in large tracts of the developing world, there is scope to contain transboundary animal diseases at the regional level, involving groups of countries

that share livestock production challenges and disease risks. In these situations, there is often a need for customized vaccines protecting against several transboundary animal diseases. These may be manufactured by the industry on a sustainable basis provided that prior public agreement has been reached by the countries involved to progressively control and eliminate the concerned disease.

Key messages of the chapter

- Animal diseases, the lack of adequate food hygiene and resulting food-borne illnesses are a problem for everyone because they can threaten human health, disrupt markets and trade, reduce productivity and deepen poverty. Improving the management of livestock with a view to preventing and controlling diseases can provide significant economic, social and human-health benefits for the poor and for society at large.
- Pathogens evolve unpredictably, and it is impossible to prevent this. New pathogenic agents will continue to emerge, and the risk of spread has to be addressed specifically. An adequate global framework is necessary to address emerging zoonotic and transboundary animal diseases.
- Public animal-health and food-safety systems need to recognize that the impacts of livestock disease and food-borne illnesses vary across countries and production systems depending on their economic status. The capacities of different groups to respond to these challenges, and the incentives needed to encourage them to do so, must be considered in the design of disease-control and risk-management strategies.
- Large, strategic and sustained investment is needed in national animal-health and food-safety infrastructure in developing countries to reduce the risks to human health and to allow growth in trade and markets, in ways that can contribute to lifting small livestock keepers out of poverty.
- The capacity of poorer countries to participate in the design of animal-health and food-safety standards should be enhanced so that they are better able to improve their animal-health and food-safety systems and gain greater access to markets for their livestock products.
- Producers of all levels and capacities must be engaged in the design and implementation of programmes to prevent and control animal disease and improve food safety. Poor livestock keepers need to be more engaged in disease-control efforts, to the benefit of themselves and others.
- Location matters. The concentration of intensive production systems in close proximity to urban population centres increases the risk of emergence of diseases and their transmission, both among animals and to humans. This is particularly the case when people and animals move between traditional and intensive systems. Incentives and regulations may be required to encourage the location of livestock production units in less densely populated areas.