



INVESTING IN SUSTAINABLE LIVESTOCK GUIDE: PRINCIPLES FOR ANIMAL HEALTH

This document provides an overview of the ISL Guide and outlines the ISL Guide principles for Animal Health.



INVESTING IN SUSTAINABLE LIVESTOCK GUIDE: PRINCIPLES FOR ANIMAL HEALTH

Table of Contents

| | |
|-----------|--|
| 03 | Introduction to the ISL Guide |
| 04 | Introduction to Animal Health Principles |
| 05 | Overview of 7 Animal Health Principles |
| 06 | Principle 1: Contribute to a Sustainable Food Future |
| 09 | Principle 2: Prevent and Control Animal Diseases |
| 15 | Principle 3: Ensure the Welfare of Animals |
| 18 | Principle 4: Healthy Animals for Safer Food |
| 21 | Principle 5: Reduce the Risk of Zoonosis |
| 25 | Principle 6: Prudent and Responsible Use of Antimicrobials |
| 28 | Principle 7: Foster an Enabling Environment |

INVESTING IN SUSTAINABLE LIVESTOCK GUIDE: PRINCIPLES FOR ANIMAL HEALTH

Introduction to the ISL Guide

The online ISL Guide (www.sustainablelivestockguide.org) is an information resource and interactive platform for designing and implementing sustainable livestock development projects. The guide’s interactive component provides context-specific guidance, suggested activities, and indicators to help livestock projects contribute to sustainable development outcomes; it also includes references for further investigation.

The ISL Guide is grounded in tested theory and evidence organized into 14 principles for sustainability in the livestock sector. The World Bank, with the support of experts from a range of institutions and international organizations, specifically developed these principles for the guide. They include principles for sustainability in environment and animal health. Guidance and principles on equity are forthcoming.

Overall, these principles offer a concise blueprint with which to view how investment decisions will affect the sustainability of livestock projects and offer a set of “should-haves” to achieve sustainable development goals. They aim to outline key

aspects to consider in what are highly complex issues. Ultimately, the technical guidance provided in the guide, which offers more in-depth reports, manuals, handbooks and external guides, follows this blueprint. Below is an outline of the principles for sustainable livestock that have been developed thus far.

Principles 1 and 7 take into account all three dimensions of livestock sustainability: environment, animal health, and equity. Principles 2 through 6 are unique to each dimension of sustainability and offer aspects to consider for technical project design (see table below).

The principles have relevance for project conceptualization (Principle 1), technical project design (Principles 2–6), and the broader socio-cultural, political, and economic context in which the project will be implemented (Principle 7).

In due course, the ISL Guide technical team will expand its scope to include guidance for addressing equity issues in livestock projects.

| PRINCIPLE 1 | |
|--|---|
| Contribute to a Sustainable Food Future | |
| ENVIRONMENT GUIDE | ANIMAL HEALTH GUIDE |
| PRINCIPLE 2 | PRINCIPLE 2 |
| Enhance Carbon Stocks | Prevent & Control Animal Diseases |
| PRINCIPLE 3 | PRINCIPLE 3 |
| Improve Efficiency at Animal & Herd Levels | Ensure the Welfare of Animals |
| PRINCIPLE 4 | PRINCIPLE 4 |
| Source Feed Sustainability | Healthy Animals for Safer Food |
| PRINCIPLE 5 | PRINCIPLE 5 |
| Couple Livestock to Land | Reduce the Risk of Zoonosis |
| PRINCIPLE 6 | PRINCIPLE 6 |
| Minimize Fossil Fuel Use | Prudent & Responsible Use of Antimicrobials |
| PRINCIPLE 7 | |
| Foster an Enabling Environment | |

Introduction to Animal Health Principles

Livestock are a critical part of food, health, economic and environmental systems. Widely known for providing food and nutrition (e.g., milk, meat, eggs, honey), farm animals can also contribute to other types of assets and livelihoods, providing services and products (e.g., fiber, leather, transport, draft power) that can be exchanged for goods or cash. If the need arises, breeding stock, an economic asset for smallholder producers or households, may also be consumed as food. For these reasons mainly, an estimated 1.3 billion smallholder farmers continue to rely on livestock for their livelihoods, food, income and insurance against crop losses and other calamities (Herrero et al., 2009).

Animal health is key to livestock production and productivity. Improper animal health practices can lead to major productivity and economic losses on the farm, with compounding effects across value chains. Often, the most vulnerable communities are also most exposed to the consequences of poor animal health because of their limited resilience (Stringer, 2017). Delivering good animal health may be particularly challenging in times of hardship, drought, flooding or natural disaster, as well as in situations of fragility, conflict and violence (FCV). Investments aiming at promoting livestock production should mitigate risks related to poor animal health.

Animal health and public health are inextricably linked. Through biosecurity measures, good animal husbandry practices (GAHPs) and ensuring the nutritional value of animal-source food, animal health promotes safer and more resilient public health systems in multifaceted ways. Safeguarding animal health is a public good that benefits all segments of society; animal welfare is another dimension of this public good. Investments in sustainable livestock should consider all aspects of health and welfare pertaining to animal production systems and practices.

Environmental and animal health are also critically linked through biodiversity and ecosystem integrity, as well as conditions resulting from livestock interacting with wildlife and the risks arising at the human-animal-ecosystem interface (World Bank, 2018) (FAO, 2008).

As they are linked to livestock systems, ecological approaches to studying zoonosis as well as considering the role of wildlife and other environmental drivers in emerging infectious diseases can ensure healthier lives by preventing the spread of disease and limiting the risk of global health pandemics.

The critical links between animal, human, and environmental health as outlined above are all recognized by the One Health approach, which considers all three to be integrally connected. This interdisciplinary approach underpins this Guide to Investing in Sustainable Livestock throughout the environment, health, and equity guides, and leans on the operational framework developed through the World Bank (World Bank, 2018). This second guide in particular will cover animal health; however, will recognize links to both the first guide on environment and the upcoming third guide on equity, and the human dimension.

Drawing on a broad review of scientific evidence and experience in project management, technical teams at the World Bank consolidated five principles for animal health for the Guide to Investing in Sustainable Livestock. These underpin the guidance provided through the guide's interactive component. These five principles are in addition to the five principles developed for environmental sustainability. Principles 1 and 7 offer a framework in which to guide the overall sustainability of livestock investments, considering all three dimensions.

These seven principles for animal health serve as a framework for assessing the health dimensions of livestock production systems as well as opportunities for livestock to contribute to sustainable outcomes. Each was based on a review of literature on livestock and animal health, project experience, and consultations with potential users.

Below, is a list of the Seven Principles for Animal Health followed by a detailed overview of each principle, a look inside as applied in the field, and a summary of variables and trade-offs to consider in livestock development projects.



Overview of the 7 Animal Health Principles

Principle 1. Contribute to a Sustainable Food Future

Engage stakeholders and undertake preparatory analysis to evaluate the comparative advantage of livestock production systems in relation to project objectives.

Principle 2. Prevent and Control Animal Diseases

Good health of livestock requires prevention and control of animal diseases, including major transboundary animal diseases, endemic diseases and production diseases.

Principle 3. Ensure the Welfare of Animals

Animal welfare is a key component of the economic, social and environmental dimensions of sustainability. Good animal welfare contributes to improving animal health and productivity. It is also an ethical responsibility.

Principle 4. Healthy Animals for Safer Food

Good animal health and welfare are part of food safety management along the food chain, from farm to fork. On-farm food safety and meat inspection are critical to prevent foodborne diseases, build resilient agri-food operations, protect the health of producers and consumers while enabling market access through compliance with relevant international standards.

Principle 5. Reduce the Risk of Zoonosis

Livestock development projects present an opportunity to prevent and control diseases potentially transmitted to humans. Prevention, early detection and response are key components of global health security. Particular care should be taken to reduce risks of emerging disease resulting from livestock contact with wildlife and disturbance of ecosystems.

Principle 6. Prudent and Responsible Use of Antimicrobials

Livestock development projects present an opportunity to address the emergence of Antimicrobial Resistance and spread in an integrated manner to protect both animal and public health, as well as to reduce environmental contamination.

Principle 7. Foster an Enabling Environment

Enabling institutions, policies, knowledge, and awareness are necessary for achieving Principles 1–6.



Principle 1: Contribute to a Sustainable Food Future

Engage stakeholders and undertake preparatory analysis to evaluate the comparative advantage of livestock production systems in relation to project objectives.

INTRODUCTION

Livestock play an important role in livelihoods and nutrition throughout the world, particularly in addressing many challenges that low- and middle-income populations face. Ensuring sustainability of livestock systems will be critical in safeguarding this role. Livestock production generates income, jobs, economic growth, and exports. Livestock in some regions are also culturally significant, central to local diets and social events. Animal-source foods are key sources of protein and micronutrients across the globe, playing a vital role for food and nutrition security. They are also sources of resilience through risk management and asset building in harsher, water-scarce environments.

At the same time, infectious and other diseases in livestock production may pose serious risks to livestock welfare and productivity as well as public health, and often disproportionately affect the most vulnerable communities. In addition to infectious and production diseases, the widespread overuse and misuse of antibiotics, hormones, and growth factors is contributing to the emergence of antibiotic resistance and posing risks to food and environmental safety. Livestock investment project objectives should aim to promote livestock production where it is needed, while mitigating risks concerning human and livestock health. Unmanaged risks can have significant consequences on animal health, production and welfare with consequences on livelihoods, food and nutrition security, public health, biodiversity, and ecosystem services. These could greatly undermine projects and the long-term objectives of improving livelihoods, managing risk, and ensuring resilience.

When making decisions about investments in livestock production, project managers should consider the long-term feasibility of sustainability and the ability to manage risks to animal and human health, in addition to environmental impacts. Such considerations should be a key part of short-term and long-term project objectives and essential to sustainable livestock investments.

POINTS OF CONSIDERATION

Sustainable livestock sector investment will undertake stakeholder engagement and preparatory research as early as possible in the project conceptualization process. This will consider the development objectives of the proposed project and the role of livestock in achieving those objectives. This will include exploring synergies and trade-offs of investing in different food sources and the risks associated with them and taking advantage of opportunities that lead to sustainable outcomes. Doing so offers a significant opportunity for livestock investment to go beyond the traditional objective of fulfilling demand for livestock products, but also looks to achieve overall food security and livelihood objectives. By considering the full range of locally-suitable food sources and the capacity to mitigate risk associated with those sources, investments can respond more strategically. This incentivizes growth in specific livestock species where it can be sustainable while achieving development objectives through the production and consumption of other foods where it cannot.

APPLYING THE PRINCIPLE

Approaches and Tools

Managing risks to animal health is critical in achieving sustainable food systems locally, regionally and globally, and is crucial along lengthening and increasingly complex supply chains. Managing and monitoring risk, as well as developing locally-relevant livestock supply chains, depends inherently on the capacity of local institutions to do so. Therefore, in the project conceptualization stage, a critical tool and approach needs to include an analysis of animal health institutions and their risk management strategies, which could play a pivotal role in the sustainability of investments. This principle comes first, as it asks project managers and investors to first consider the ability of local institutions to meet sustainability objectives, and the impact decisions will have on the rest of the principles in the guide. Thus, when making livestock investment decisions in terms of animal health, institutions in the project area need to be assessed for their capacity to address:



PRINCIPLE 1: CONTRIBUTE TO A SUSTAINABLE FOOD FUTURE

- Prevention, traceability, monitoring and surveillance, early detection, and rapid response (Principle 2. Prevent and Control Animal Diseases; Principle 5. Reduce the Risk of Zoonosis)
- Animal welfare (Principle 3. Ensure Welfare of Animals)
- Compliance with food safety standards and best practices (Principle 4. Health Animals for Safer Food)
- Antimicrobial use (Principle 6. Prudent and responsible use of Antimicrobials)
- Proposed policy or institutional solutions, access to services (Principle 7. Foster an Enabling Environment)

Addressing each of these factors will have implications depending on the context, especially when implementing projects in FCV countries. Project managers should also look to the environment guidance to assess ability to address environmental principles.

Sustainability in terms of animal health often focuses on reducing risk where possible. Since reducing risk is the responsibility of every agent/actor along the value chain, from production of inputs, to production, to transportation and retail, and finally consumption, it is important to evaluate the ability and awareness of managing risk at each stage. For example, poor awareness of product handling at the farm level can lead to health risks, economic losses, and wasted precious natural resources that undermine the entire supply chain. As such, investors in food production, in particular animal-source foods, have key responsibilities in ensuring a proper risk analysis is conducted. This is a critical component in assessing the comparative advantage of investing in a particular sector.

At the project level, investment decisions can play a pivotal role in farm production outcomes and methods used. Considering a diverse array of factors will be critical to setting up sustainable livestock projects.

These include:

- Proper location
- Suitable livestock species for the location
- Sustainable access to resources for nutrition (i.e. good quality feed, water)
- Maintaining genetic diversity
- Proper production methods (i.e. farm management, biosecurity practices)

The above examples are critical in setting up investments that have inherently minimum risk, are resilient, and can better promote long-term sustainability. The guidance, which these principles underpin, will expand on these examples and provide specific tools given a set of contexts, objectives, and interventions. However, in the early stages of considering a livestock project or a project with livestock components, this guide invites users to consider the following guiding questions, which aim to lead to a more sustainable food future.

Guiding questions for stakeholder engagement may include:

- What is the social and economic role of livestock in local food preferences and culture?
- What is the social and economic role of livestock in the country/province's development agenda? (i.e., rural livelihoods, job creation, trade, agricultural sector growth).
- What are the nutritional needs of the project area? Do relevant populations meet national dietary recommendations for the consumption of animal-source foods?
- Historically, what have been the major animal and human health risks in the project area?



PRINCIPLE 1: CONTRIBUTE TO A SUSTAINABLE FOOD FUTURE

- What is the institutional capacity (refer to Principle 7) to mitigate and address animal and human health risks?
 - What current support exists to manage and monitor animal and human health risks at each stage of the supply chain (refer to Principles 2 and 4)?
 - What early planning decisions are critical in building investments that are of inherently low risk to animal and human health? (i.e. which past investments have failed to mitigate these risks; what factors were at play?) Early decisions need to be taken on issues like location, species, type of production system, sustainable access to resources, etc."
- other investments that still might meet development objectives except with lesser risks
 - Environmental factors that affect resilience of ecosystems and their ability to maintain sustainable level of resource use, such as water, feed, land use, and managing pollution. (see Environmental guidance)
 - Disruptive technologies in livestock development

VARIABLES TO CONSIDER

As the team assesses the comparative advantage of livestock to the development goals of the project, it may be worth considering the following elements:

- The number of kilograms (kg) of additional animal products (e.g. protein) and/or milligrams (mg) of micronutrients made available to project beneficiaries, and how they contribute to current diets, reduce potential deficits, and/or add to overconsumption
- The number of livestock-related jobs and amount of income generated among the poor in the project scenario, compared to alternative investment options
- Risk management assessment of current institutions/ systems and their capacity to deal with risks that might arise from the project scope
- Current access to quality veterinary services and products
- Gaps, if any, in meeting international animal health best practices and standards regarding and the capacity of the national quality infrastructure to meet standards and technical regulations
- The risk to animal and human health, particularly when expanding livestock capacity compared to

TRADE-OFFS

Principle 1 offers a framework for broadly considering the role of livestock in the context of a potential development investment. It applies to the early stages of project conceptualization and early decisions in planning and requires an analysis of potential negative trade-offs or positive synergies with other health and environmental principles.

Principle 1 applies to broad development objectives, as formulated in the 17 Sustainable Development Goals (SDGs) of the United Nations, and to how livestock production systems may contribute in unique ways to each of the SDGs (FAO, 2018).



Principle 2: Prevent and Control Animal Diseases

Good health of livestock requires prevention and control of animal diseases, including transboundary animal diseases, endemic diseases, and production-related diseases at the farm level.

INTRODUCTION

Animal production systems generate economic and social goods to farmers, their communities and their countries. Animal diseases, however, hamper normal animal development and animal welfare, and can lead to fatalities. The effects of animal diseases on livestock productivity include reduced feed intake, changes in digestion and metabolism affecting the feed conversion rates, increased morbidity and mortality, impaired reproductive performance, and reductions in egg production and milk yield, amongst others. Thus, the impact of animal diseases on productivity is reflected in loss of production, increased disease control costs and loss of assets, marginalizing producers from higher-priced livestock markets and restricting their access and capacity for value-added trade. Furthermore, the impact of animal diseases should be regarded from a more holistic point of view, as besides animal health, they can also impact community livelihoods, public health, tourism and wildlife (Perry and Grace, 2009) (FAO, 2016).

Occurrence of major transboundary animal diseases greatly impact livestock production and can result in restrictions to international trade in livestock and livestock products. TADs refer to diseases with high transmissibility and morbidity, such as foot-and-mouth disease (FMD) or avian influenza, or with high mortality, such as peste de petit ruminants (PPR) or Newcastle diseases. Many of those diseases, exotic to developed countries, are endemic to developing countries. In addition, these countries have endemicity for other diseases, both infectious, such as brucellosis, tuberculosis, hemoparasites, gastrointestinal helminthiasis, etc., and non-infectious, many of which are referred to as “production diseases” since are typically associated with intensive production. This latter group includes metabolic disorders (e.g. hypocalcemia, ketosis, etc.), abomasum displacement, laminitis, prolapses, dystocia, etc. Metritis and mastitis can also be considered part of this group (Sundrum, 2015). While

infectious diseases are more associated with deficient biosecurity or poor disease transmission control (e.g. vaccination and medical treatment), production diseases are more related to husbandry practices.

As an example of the introduction of a TAD, the Foot-and-mouth disease (FMD) outbreak in the United Kingdom in 2001 caused a crisis in British agriculture and tourism. Over 10 million sheep and cattle were killed with the intention of controlling the spread of the disease, and public rights of way across land were closed by order. By the time the disease was halted in October 2001, the crisis was estimated to have cost the United Kingdom US\$16 billion. A more recent FMD outbreak in Colombia in 2017 caused major decreases in exports, from US\$3.7 million and 844 tons in November 2017 to US\$1.4 million and 316 tons in the same month of 2018, a 64 percent drop in value and 62 percent drop in volume (Agronegocios, 2019). Another important TAD is African swine fever (ASF), which has been responsible for serious production and economic losses affecting domestic and wild pigs. Since its discovery in August 2018, ASF has spread to every province in mainland China. With ASF affecting an estimated 150-200 million pigs as of February 2020, simulation with the expected 30 percent loss in pork production suggests a reduction of Chinese GDP by approximately 1 percent (Mason et al, 2020). It continues to be a serious and highly contagious disease, easily transmitted through direct or indirect contact. The disease can devastate pig populations and trade, and outbreaks remain difficult to control (OIE, 2018), affecting the livelihoods of millions of pig producers.

Peste des petits ruminants is another highly contagious viral disease that mainly affects sheep and goats. Heavy losses can be seen, especially in goats, with morbidity and mortality rates sometimes approaching 80-100 percent (OIE, 2008). A study from 2017 showed that expected annual economic loss due to PPR in India, where the disease is endemic, ranges from as little as



PRINCIPLE 2: PREVENT AND CONTROL ANIMAL DISEASES

US\$2 million to US\$18 million and may go up to US\$1.5 billion. (Govindaraj et al. 2016). PPR causes an estimated US\$1.45 billion to US\$2.1 billion in worldwide economic losses each year, due to reduced production, animal deaths and the cost of caring for sick animals, including vaccination. Almost half of these losses are in Africa, with a further quarter in South Asia (OIE and FAO, 2015). There have been several attempts to estimate the impact of endemic diseases, but these are context-specific and depend on the diseases present in the area, the intensification of the production system, availability of veterinary services, farm size and level of technification. We have examples of tropical countries in the Americas which, due to their relative isolation in the animal trade, are free from most of the major transboundary diseases and even others such as bovine tuberculosis and brucellosis. In these places, tropical hemoparasites and other production diseases are considered to be of greater importance.

On the other extreme there are many African and Asian countries in which FMD is endemic that are often affected by highly pathogenic avian influenza, and where production diseases might be neglected as a national priority.

In many of those countries, infectious diseases such as contagious bovine pleuropneumonia, East Coast fever, FMD, hemorrhagic septicemia, helminthiasis and trypanosomiasis are regarded as the most important for now, however, as more intensive farming systems are implemented, the production diseases start to gain more relevance. Although disease burden figures will vary largely among countries there are some overall estimations on the incidence: clinical mastitis could range from 1.7 to 54.6 percent (Sundrum, 2015), and the costs associated with premature culling due to this condition could amount to of 28 percent of production costs (Heikkila et al., 2012). Lameness, another metabolic disorder associated with intensive dairy production, has

an incidence from 1.8 to 54.6 percent (Sundrum, 2015). Milk yield reduction associated with this pathology can start four months before the lameness is evident and last for up to five months after treatment, leading to a mean 360 kg of reduction in milk yield per lactation (Green et al., 2002).

Prevention, preparedness, control and eradication of animal diseases are critical for ensuring food security in any development project involving livestock. It is also worth mentioning that the benefit of the investment in animal disease control is going to generate synergies. Thus, the impact of any strategy implemented that aims to reduce production diseases, for example by using GAHPs, will impact the control of infectious diseases, and the zoonoses as mentioned in the FAO/OIE Good Farming Practices Guide (FAO and OIE, 2008) and described in Principles 3 and 5.

POINTS OF CONSIDERATION

When a project involving livestock is going to be implemented in a country or subregion, it should include animal disease strategies that consider:

- Animal diseases and the One Health approach. When dealing with projects involving livestock and animal disease control, the One Health approach should be inherent. Thus, any intervention aiming at controlling animal diseases in the farm will also impact the control of the zoonoses present, contributing, thus, to a gain in animal health and public health. Moreover, the potential impact of livestock farming and animal disease control on the environment should not be neglected. This includes the impact on land use and deforestation due to grazing, the impact of carcass and animal byproduct disposal, and the release of medicaments



PRINCIPLE 2: PREVENT AND CONTROL ANIMAL DISEASES

- and antimicrobials into the environment (Principle 6).
- Disease burden and impact. It is important to have a closer look at the diseases present and their relevance, utilizing available information on farmers' perceptions, combined with local expert knowledge, since farmers tend to underestimate the impact of subclinical/ chronic diseases. The prioritization of diseases should consider:
 - Frequency and distribution in the country
 - Current and potential economic impact
 - Zoonotic importance
 - Trade restrictions
 - Capacity to confirm/identify disease-causing agents
 - Feasibility of implementing successful control/ eradication programs
 - Animal management, nutrition and genetics. Substantial productivity and economic gains will not necessarily be achieved by disease control alone. Equally important are Good Animal Husbandry Practices (GAHPs), including those relating to feeding, provision of water, biosecurity and reproductive management programs. There are strong interactions between disease prevention and good animal management and substantial variation between countries and farms about what is the major bottleneck for improved productivity. Sometimes it is infectious diseases; sometimes poor reproductive management; and sometimes inferior genetics or low-quality feed, etc.
 - Input services and products. Strategies that aim at increasing the availability of input services such as vaccines, prophylaxis treatment, clinical treatment, and others, are highly recommended, particularly to reach smallholder farmers and marginalized populations (Donadeu et al., 2019).
 - Consideration of the environment. Species and breeds should be chosen according to their adaption to area-specific farming conditions, particularly in areas with difficult conditions such as drought, different altitudes, flooding, dramatic temperature changes, etc. Thus, in many developing countries with harsh pasture conditions, goats are chosen due their adaptive capacities (Silanikove, 2000). The ability of an animal to cope with environmental pressures can significantly impact upon its normal development, welfare and immunity, which would lead to reductions in productivity, increased susceptibility to sickness and might facilitate the spread of a disease across populations.
 - Veterinary services. Development or access to good quality veterinary services is a key component for livestock projects to ensure strategies of prevention, preparedness, control, and eradication of animal diseases. Veterinary services must have a comprehensive structure and robust operability to ensure effectiveness. Along with this, they should have a legal framework to organize and establish rules for different actors or public and private entities involved in the system. The responsibilities of the health authority and its ability to enforce laws and standards should be evaluated in detail.
 - Epidemiological surveillance. Epidemiological data gathered through information systems and epidemiological analyses will provide an overview of the animal health status of a territory. This information should be available and accessible so that it can be part of health surveillance work and used in decision-making to support the development of health strategies that contribute to establishing the local and national health status.
 - Key practices to incentivize notification of diseases at farm level. Encourage the recording of disease events and production traits on paper or ideally in ad hoc databases and provide training on the use of recording tools and ready-to-use recording software (ideally for cellphones). This should be a key component of a broader traceability program and supported by legislation to compensate for animal culling.
 - Effective laboratories and testing. The capacity of the official diagnostic laboratories and its private and



PRINCIPLE 2: PREVENT AND CONTROL ANIMAL DISEASES

international networks must be included in any animal disease strategy. Establishing the diagnostic capacity in terms of personnel, equipment and infrastructure is essential, as well as overall management that includes comprehensive quality assurance and quality control.

- Quarantine facilities. Imported live animals should be kept in quarantine on ad hoc premises for a period defined according to the risk of disease introduction and incubation period. This also applies when moving livestock from one part of the country to another. On-farm quarantine facilities or action plans should also exist to isolate potentially infected animals early on.

APPLYING THE PRINCIPLE

Approaches and Tools

This principle is focused on enhancing farmers' practices and strengthening veterinary services and to improve animal health, with strategies focused at the national, local or farm level.

Production diseases are often multifactorial and independent relationships among them must be established, so that direct and indirect causal associations, and incidental relationships can be differentiated. Control of production diseases often involves various disciplines and therefore calls for a "multivariate approach". Such an approach, centered on the herd, has led to the adaptation of integrated programs for herd health that are characterized by the adaptation of multidisciplinary, multifactorial, and a population approach to clinical entities. Preventive measures and routine examinations are the focus of programs, but greater inclusion of nutrition, production and economics is called for (Markusfeld, 2003).

When establishing a livestock project in a particular area, it is recommended to include capacity building activities to identify the presence of infectious and production diseases and acquire the capacity to control them. Disease control strategies may incur at different levels including at reservoir level, transmission level and at host level as mentioned in Principle 5 (Risk of

Zoonosis). These should also be included in animal disease strategies. Moreover, the capacity building strategies focused on the farm level would require inputs from social science to be able to change farmer's behavior, as some can be reluctant to change their habits even when potential advantages have been technically demonstrated. In fact, the production systems in use would have been chosen according to their affordability, so some farmers might be unwilling to make even small additional investments (Perry and Grace, 2009).

Veterinary services are provided by the working community that protects the health and welfare of animals. This consists of public and private sector veterinarians and associated staff responsible for preparing and enforcing the laws governing disease control, food safety and safeguarding biodiversity. To perform their duties satisfactorily, those providing veterinary services need to have specific tools, capacities and infrastructures that any investment needs to consider. These include access to technology for epidemiological studies, accommodating the tools to the needs of the countries, sufficient diagnostic capacity and availability of quarantine facilities. In addition, any intervention that aims to strengthen veterinary services should also include capacity building activities that are based on risk assessment or international tools such as the OIE Performance of Veterinary Services (PVS) tool (OIE, 2019).

Workshops that combine theory and practical exercises should address basic epidemiological analyses and the use of accessible tools. This can strengthen the capacity of countries through their veterinary services and help analyze their own health data, which contributes to informed decision making and risk analysis based on their epidemiological situation. Regarding the training, simulation exercises play a key role in the development and implementation of preparedness and response capacities at all levels (national, regional, community and global) and have been identified as a key component in the validation of core capacities under the International Health Regulations (IHR) monitoring and evaluation framework (2015). Aside from examining health issues



PRINCIPLE 2: PREVENT AND CONTROL ANIMAL DISEASES

within a constrained environment such as a single event, simulation exercise scenarios are being developed that reflect a more complex, real world, operational environment. This includes health events in natural disasters and complex emergencies and the role that health plays in wider emergency response.

Key factors for deciding on the implementation of a control program include the prevalence/incidence of the disease, the feasibility of any successful implementation given the country conditions and/or the assessment of the risk of reintroduction. It is essential to first know which diseases are present and their level of occurrence before designing and implementing any control program. The recommendation is for veterinary services to develop a risk matrix for each region in the country, including the risk of release and exposure to different exotic and endemic diseases. Its preparation should mainly consider animal movement, places of concentration of animals and present animal populations, identifying their production systems, their biosafety levels, and both public and private human capacities to support a strategy. This information will be the basis for developing the strategy and actions, including active and passive surveillance, and the following:

- Timely identification of the entry of exotic diseases
- Supporting the emergency response process when emergencies occur
- Assisting disease management programs
- Auditing health programs
- Providing guarantees to export and import processes
- Contributing to the knowledge of disease epidemiology

Variables to Consider

- Farm-level variables:
 - Herd size
 - Type of farm
 - Food animal species involved
 - Details of data capture at farm level for diseases and production traits
 - Farm biosecurity
 - Animal and feed sourcing
 - Control use of drugs and antimicrobials (Principle 6)

- Local/national level of disease reporting/notification; suspicious cases ruled out versus those confirmed
 - Number of veterinarians and veterinary paraprofessionals
 - Veterinary drug suppliers
 - Endemic diseases diagnosed
 - Transboundary diseases present
 - Population present (farm/animal register)
 - Local/national disease information system utilized to support surveillance
 - Local/national disease programs
 - Local/national passive and active surveillance strategies
 - Local/national laboratory capacity
 - Level of epidemiological knowledge training within the local/national official veterinary services
 - Animal movement tracing
 - Prevention strategies at borders
 - Emergency response preparedness and contingency plans

TRADE-OFFS

Cost effective interventions: At farm-level, considerable costs may be incurred in controlling animal diseases, and sometimes the control measures chosen are not always the most cost effective. This is particularly true for smallholder farmers, who often lack of information on the appropriate measures and have limited diagnostic data to make disease control and treatment decisions. The overall impact of control measures may be constrained by noncompliance of a significant proportion of the community, which highlights the need for regulatory veterinary services supported by legislation and incentives to comply.

Synergic results: Any prevention and control program for animal diseases is likely to work best if it targets multiple diseases a broader spectrum of benefits as farmers are usually dealing with multiple animal health problems and it is rare that one is consistently at the top of their priority list (FAO, 2016).



PRINCIPLE 2: PREVENT AND CONTROL ANIMAL DISEASES

Environmental impact of animal diseases: Animal carcasses that are improperly disposed of (dead animals being dumped in rivers or improperly buried) due to the fear of consequences when declaring an outbreak can cause major pollution issues and health consequences. This is in addition to a high cost of proper disposal or inadequate financial compensation mechanisms for farmers that must have their animals culled during eradication programs or in response to emergencies related to transboundary diseases introduction. The improper disposal of carcasses can pollute water sources and drinking water, threatening the lives of both people and livestock. Also, the uncontrolled use of therapeutic drugs and antimicrobials can have an undesirable impact on the environment, as described in Principle 6.

Role of women: Women comprise approximately 70 percent of the world's poor, as well as most poor livestock keepers. Poultry, pigs, and small ruminants are the livestock species usually preferred by women because they can be more easily managed, and in many instances, the income generated goes directly to them. Any intervention aimed at improving animal health in poultry, pigs, and small ruminants, such as vaccination is likely to provide benefits particularly to women small holder farmers (Donadeu et al., 2019).

International status recognition: While obtaining international (e.g. OIE) free status recognition for a territory is overall conceived as an advantage due the aperture of certain international markets, there are also some handicaps that need to be acknowledged. For example, when an area within a country is declared a disease-free zone, certain farming practices are restricted, with strict constraints on movement of animals and livestock products into the zone. Thus, farmers or traders cannot access the grazing lands that they formerly used or move their animals into or across the zone to sell them.

Overall impact on smallholders: The livestock sector is dynamic – it changes with or without disease control – but if disease control measures speed up the changes in the sector, the people who may suffer most are poor farmers who need time to make changes to their livelihood activities (Donadeu et al., 2019). TADs control strategies result in long-term changes in the livestock sector structure. The strategies might include policies on where livestock can be kept and how they are managed, establishing minimal standards, movement controls that are routinely enforced even in the absence of disease outbreaks, and regulations on the operation of livestock markets. Over time, these factors create conditions that make some smallholders' livestock enterprises illegal or unviable. The sector scales up and former small-scale producers lose a livelihood they once had.



Principle 3: Ensure the Welfare of Animals

Animal welfare is a key component of the economic, social and environmental dimensions of sustainability. Good animal welfare contributes to improving animal health and productivity. It is also an ethical responsibility.

INTRODUCTION

According to the World Organisation for Animal Health (OIE), animal welfare relates to how an animal is coping with the conditions in which it lives. An animal in a good state of welfare is healthy, comfortable, well-nourished, safe, able to express innate behavior, and is not suffering from unpleasant states such as pain, fear, and distress. Good animal welfare requires animal care, disease prevention and veterinary treatment, appropriate shelter, management and nutrition, humane handling and humane slaughter for consumption or killing for the purpose of disease control, as per Principles 2 and 5.

Poor welfare in livestock, in working animals and food-producing animals, can cause suffering, and impact their ability to provide expected services or products. Improvements in animal welfare have the potential to reduce stress-induced immunosuppression, reduce incidence of disease on farms (de Pastille and Rushen, 2005), reduce shedding of human pathogens by farm animals, and reduce antibiotic use and antibiotic resistance. Well-cared-for animals are productive animals; similarly, improving animal welfare enhances health, sustainability and production, opening up new trade opportunities for farmers and other actors along the value chain.

Animal welfare is linked to the wellbeing of the farmer (FCN, 2016; FAWC, 2016); this is partly related to increased productivity associated with welfare-friendly systems. Superior meat yields are achieved when pre-slaughter stress and trauma is minimized and increased milk yield in relation to the absence of claw problems are a few examples of this link (Pinillos et al., 2016). In addition to quantity, quality can also be improved by welfare. Pre-slaughter stress, for instance, will increase acidity of meat, which decreases quality (Dokmanović et al., 2014). A potential consequence is lower profit due to a lower selling price in relation to decreased quality.

Stress and poor welfare can also influence the release and virulence of some zoonotic diseases through the excretion of specific pathogens, causing a higher risk of disease transmission to humans (Pinillos et al., 2016), as covered in Principle 5.

Projects should ensure that animal welfare is integrated into, and contributes to, their existing programs in areas such as animal health and nutrition, livestock development, sustainable livelihoods, and emergency responses where animals are involved (FAO, 2008).

POINTS OF CONSIDERATION

Good animal welfare practices have shown to significantly reduce stress (Grandin, 1987) and improve yield (Hemsworth et al., 2000) but the welfare and health of animals also reflects the wellbeing of humans. For example, the abuse of or violence against animals has been linked to family and social violence (Ascione and Shapiro, 2009). Multiple studies show that training in animal-friendly handling can support a decrease in violent and aggressive behavior towards the animals. It is likely that the abuse of vulnerable animals could be reduced and prevented by improving animal welfare among abusers (Pinillos et al., 2016).

Likewise, there is evidence that a farmer's intention to treat animals humanely is significantly positively correlated with psychological and social factors (FAWC, 2016). Signs of poor welfare could therefore be indicators for detecting poor farmer wellbeing and vice-versa (Pinillos et al., 2016).

The links between human wellbeing, the environment and animal welfare are captured in the concept of One Welfare. The integration of this concept into livestock investment decisions could not only improve human and animal welfare, but also support food security and safety, improve productivity within the farming sector, benefit environmentally friendly animal keeping systems



PRINCIPLE 3: ENSURE THE WELFARE OF ANIMALS

and increase resilience and security for communities in low- and middle-income countries. These initiatives to improve animal welfare are multifaceted international and domestic public policy issues that must take account of not only scientific, ethical and economic issues, but also religious, cultural and international trade policy considerations (Bayvel and Cross, 2010).

Communities that care for their animals, not only secure the availability of animal-derived products, but they also tend to work on sustainable farming with care for the environment. The protection of soil, safeguarding of water, supporting biodiversity, introducing local food sourcing, establishing local carbon-neutral energy schemes and housing and creating community initiatives around sustainability partnerships are examples (O’Riordan, 2004).

In emergencies or crisis situations, animal welfare might be relegated or particularly neglected as it is not understood as an immediate priority.

APPLYING THE PRINCIPLE

Approaches and Tools

Although animal welfare problems are extremely diverse, several problem areas stand out as high priority across many regions and production systems. These areas are on-farm, during transportation, and at slaughter (including pre-slaughter management). On-farm issues particularly, include food and water intake, handling/herding methods, culling and disposition of animals that are sick or of low commercial value, and the keeping of animals under conditions to which they are not genetically suited. These problem areas provide logical starting points for capacity building efforts for implementing good animal welfare practices, which involves the following elements:

- Enable policy and regulations for increasing animal welfare
- Education to create awareness of animal welfare and an understanding of its significance for successful animal production

- Engagement to foster active involvement of people who work with animals
- Training in specific procedures
- Communication among different stakeholders

The OIE has published several standards on animal welfare that can be used as a basis to develop relevant indicators. Welfare indicators can be conveniently divided into indirect or “resource-based” and direct or “animal-based” indicators. The indirect group of indicators analyzes the causes that could affect animal welfare, while the direct indicators analyze the effects.

It is commonly accepted that a robust assessment of animal welfare is achieved when direct and indirect parameters are combined (Sorensen et al, 2001). Recent animal welfare evaluation criteria also take into account the biosafety factor (Bertochi and Fusi, 2014).

Many countries are showing increased interest in creating and/or revising animal welfare legislation, in some cases to comply with international standards as well as private standards. The OIE PVS Pathway provides such assessment and should be included in projects upon countries’ request.

One way to improve the welfare of animals is to use the Five Freedoms as benchmark for meeting animals’ needs. These cover:

- The need for a suitable environment to ensure freedom from discomfort: including appropriate access to shelter, temperature, humidity, and a comfortable resting area;
- The need for a suitable diet to ensure freedom from hunger and thirst: including easy access to fresh water and a nutritionally balanced diet to support health;
- The need and the freedom to exhibit normal behavior patterns: including sufficient space, facilities, and appropriate housing with, or apart from, other animals;
- The need for protection and for freedom from fear and distress: including during farming, transport and slaughter;



PRINCIPLE 3: ENSURE THE WELFARE OF ANIMALS

- The need for protection and for freedom from injury and disease: including access to veterinary care for prompt prevention, diagnosis, and treatment of disease or injury here.

Variables to Consider

“Resource-based” indicators:

- Size and design of the enclosures where animals are kept
- Water provision or environmental enrichment
- Quality of forage and silage
- Percentage of forage in the overall diet

“Animal-based” indicators fall into three main categories: behavior, physiology, and health. Some examples of measurable of such parameters are:

- Levels of hormones related to stress, fear and abnormal behavior
- Specific signs of diseases or morbidity (e.g. footpad dermatitis, lameness)
- Mortality
- Body index

TRADE-OFFS

As previously stated, welfare includes the physical, emotional and behavioral health of the animals, and there is no single indicator that can provide enough information to thoroughly assess animal welfare. For this reason, animal welfare can only be properly assessed using a combination of several indicators (Salas and Manteca, 2016).

To meet growing consumer needs, voluntary certifications have been introduced both in the environmental (Castoldi et al, 2010) and animal welfare sectors. Market mechanisms, legal restrictions, and economic incentives therefore play a pivotal role in influencing producers to adopt sustainable production methods.

A legislative approach, for example, will only be effective if sufficient resources are devoted to its administration

and enforcement. Analysis is needed to determine what programs would be most effective in promoting good animal welfare practices and how implementation of such programs could benefit animals and people.

Animal welfare assessment should be done with the full participation of all relevant actors, in a process that also attempts to understand the perceptions and traditional practices of participants, and the social and material assets that they can bring to bear in solving animal welfare problems (FAO, 2008).



Principle 4: Healthy animals for safer food

Good animal health and welfare are part of food safety management along the food chain, from farm to fork. On-farm food safety and meat inspection are critical to prevent foodborne diseases, build resilient agri-food operations and protect producers and consumers health while enabling market access through compliance with relevant international standards.

INTRODUCTION

Contaminated food can cause over 200 different diseases, sickening 600 million people and causing over 400,000 deaths every year (WHO, 2015). Using 2016 data, this amounts to US\$95 billion in productivity losses a year in low- and middle-income countries (Jaffee et al., 2019). Foodborne diseases (FBD) continue to be a heavy global burden, with children under five years of age disproportionately affected. While patterns vary considerably among countries, several studies have estimated that animal-source foods account for half or more of the burden of FBD (Jaffee et al., 2019).

Bacteria, viruses, parasites, and chemical substances can be passed on to people from unsafe food at any step of the food chain, from production, transport, processing and storage, all the way through to consumption. While safe food can often be taken for granted, it continues to be a growing public health concern worldwide, especially for vulnerable populations (i.e. the very young, old, or immunocompromised). Ensuring healthy, nutritious, safe food are foundational components of healthy, sustainable food systems. Furthermore, foodborne illnesses can harm national economies by straining healthcare systems, impacting trade and tourism, and overall stalling socioeconomic growth.

Microbial pathogens are associated with almost 80 percent of the burden of FBD (Jaffee et al., 2019). Salmonella, Campylobacter, and Escherichia coli are a few of the most globally important foodborne pathogens that can have severe or fatal outcomes. Contaminated foods that contain these pathogens can be of animal origin, for example eggs, poultry, raw milk, or undercooked meat. Thus, the livestock sector has a shared responsibility in ensuring the food it produces is safe. Other hazards that can cause FBD are pathogens such as tapeworms and viruses; chemical hazards such as veterinary drug residues or pesticides; or environmental pollutants such as dioxins (OIE, 2020).

An integrated, multidisciplinary and holistic approach at all stages of animal production is critical to ensure food safety and foster a sustainable food system. A comprehensive strategy for food safety will include ensuring those involved in all stages of the supply chain are aware, and comply with required food safety regulations, standards, and best practices. A key aspect of this approach is risk analysis, which rolls out to prevention, detection, and control measures to identify hazards and prevent them from becoming food safety risks. Enabling efforts at the primary production phase to reduce the burden of animal disease can contribute to reducing the risk of human illness at a later stage. As standards and regulations are strengthened and food safety is ensured on-farm, producers, processors, retailers, and suppliers may be able to access new high-end markets both at local and international level, improving socioeconomic wellbeing, provided food safety is also ensured along every step of the food chain.

POINTS FOR CONSIDERATION

Given that the contamination of food may occur at any stage in the process from food production to consumption (“farm to fork”), food safety is best assured by an integrated, multidisciplinary approach that considers the entire food chain (OIE, 2020). Therefore, any project involved with production, handling, processing, or distribution of food should consider the following points:

Country-level recommendations:

- Assess production/processing/transportation/retail processes and harmonize standards and regulations with international standards and best practices
 - Codex Alimentarius for food safety and OIE international standards for animal health and zoonoses (Chapter 6.2)
- Ensure robust ante-mortem and post-mortem meat inspection systems (OIE, 2004)



PRINCIPLE 4: HEALTHY ANIMALS FOR SAFER FOOD

- Develop capacity building and technical assistance programs targeting smallholders to improve their compliance with food safety regulations.
- Develop detection, animal traceability, and tracking systems
- Develop rapid response systems to safety risks in food and feed

Project-level recommendations

- Develop training/awareness programs and extension services on food safety
- Ensure open and transparent access to project information and updates
- Establish clear roles and responsibilities across producers, veterinarians, and other stakeholders.
- Ensure equitable access to infrastructure that is key in maintaining food safety, i.e. transportation, refrigeration, and processing facilities
- Consumer awareness on safe food handling/ consumption

APPLYING THE PRINCIPLE

Approaches and Tools

Production, processing, transportation, and retail of animal products entail risks of FBD, given a variety of factors, including faulty production methods. One Health is an integrated approach that considers the links between animal health, environmental health and public health. Under the One Health umbrella the interplay between animal health and food safety is understood from the perspective of preventing public health issues that could stem from food animals and their products. Thus, there are a number of interventions to improve food safety that need to be adopted by different stakeholders at different levels of the production chain. Such interventions include:

At the policy level:

- Explore the adoption of disruptive technologies, like blockchain, which enable traceability and tracking of products across the supply chain
- Support the establishment of integrated national programs under the One Health umbrella

At the regulatory level:

- Risk analysis (risk assessment, risk management and risk communication) according to the OIE Terrestrial Code that details prevention and control measures for various diseases in poultry, cattle, and pig production systems and the standards and guidelines of the Codex Alimentarius Commission
- Existence of a traceability system
- Laboratory Quality Assurance Systems that help authorities implement monitoring and surveillance through sound food sampling and analysis. The system shall be based on a strong and effective laboratory network for testing pathogens and antibiotics
- Existence of a rapid alert and response system to food safety risks in food and feed

At operators' level, including producers, transport agents, and retailers:

- Food safety compliance mechanisms implemented by food operators to manage production in accordance with the food safety regulatory framework
- Food safety measures along the cold chain
- Control mechanisms to ensure compliance and remove dangerous products, if any, before they reach the market
- Hazard Analysis and Critical Control Point (HACCP) systems

VARIABLES TO CONSIDER

- Prevalence and concentration of various pathogens that could safely exist on farm
- Feasibility of implementation of tools at the field level, such as testing for critical pathogens across the food chain and appropriate methods of analysis and sampling to ensure regulatory compliance
- Early detection and on-site capacity to control such risks (i.e. access to refrigeration, distance to processing facilities, etc.)
- Traceability systems for food products, which is a key aspect for minimizing both risks of contamination and consequent economic losses of contamination further along the production process.



PRINCIPLE 4: HEALTHY ANIMALS FOR SAFER FOOD

- The establishment of clear food safety objectives and risk prioritization as a starting point of food safety management systems
- Production of educational and communications materials to support behavior change
- GAHPs for food safety for primary production stages

TRADE-OFFS

Compliance with food safety standards and best practices offer many benefits. However, to do that, regulations have to be risk-based and implementation must consider the capacity of farmers to comply with the regulatory framework. The inability to do so will result in major economic losses, particularly for small and medium-sized farmers, who may not have the financial means to upgrade facilities. Thus, implementation of stricter food safety standards and best practices should be coupled with investments in extension services, technological programs and capacity building targeted at farmers to ensure compliance. Projects should focus on the desired level of protection and consider, whenever feasible, traditional practices that accomplish the same level of protection as the official regulatory framework but do so in a more culturally and environmentally-friendly manner.

Adoption of stricter standards should be accompanied by other measures to monitor and prevent inappropriate practices regarding animal welfare, as per Principle 3, and in the use of chemicals or medicines that could increase pollution or antimicrobial resistance, as per Principle 5, such as education and awareness of how to comply while minimizing negative consequences elsewhere.



Principle 5: Reduce the risk of zoonosis

Livestock development projects present an opportunity to prevent and control diseases potentially transmitted to humans. Prevention, early detection and response are key components of global health security. Particular care should be taken to reduce risks of diseases emerging as a result of livestock contact with wildlife and the disturbance of ecosystems.

INTRODUCTION

The interaction between humans, animals and the surrounding environment is particularly close in many Low-and-Middle-Income Countries (LMICs), where animals provide transportation, draft power, fuel, clothing and are a source of protein (i.e. meat, eggs, and milk). In this context, the zoonoses, those infectious diseases transmitted between animals and humans, can lead to serious public health risks which translate into huge economic consequences and obstacles to development efforts (WHO, 2010). For example, just rabies, tuberculosis, brucellosis and anthrax alone are responsible; for 2.2 million human deaths and 2.4 billion illnesses each year (Grace et al., 2012). Furthermore, 75 percent of emerging pathogens fall within the category of zoonotic diseases (WHO, 2020) and although arising from wildlife mainly, livestock may serve as an intermediary. Many of these diseases have become major global health threats in the recent past (e.g. Nipah, H5N1 and H1N1 influenza, MERS-CoV, Rift Valley fever) and continue to undermine our global health system as seen during the COVID-19 pandemic.

Along with the public health impact, zoonoses also impose considerable economic losses in the livestock sector, which are associated both directly and indirectly with livestock health and production. The presence of zoonosis in livestock can lead to trade barriers, control costs, increased costs due to processing and monitoring to ensure food safety, as well losses due to lack of consumer confidence. The burden of zoonoses tends to fall most heavily on developing countries and contribute to an already burdened public health system.

Both the public and animal health impacts underscore the connectivity between human and animal health, as well as the roles of ecosystem alteration and disruption, climate change, globalization of trade and travel or inadequate biosecurity, among others, that are the main drivers for disease emergence and spread. From 2000–2030, demographic pressures are projected to lead to progressive expansion of densely populated

land-use systems. While croplands will encroach on pastoral systems which will expand at the cost of forested systems. Projections to 2030 are that forested systems will be replaced by croplands on 1.5 million square kilometers and by ruminant livestock systems on 2.7 million sq. km (FAO, 2015). Epidemiology states that the transmission of a pathogen tends to increase with host density (Kilpatrick and Altizer, 2012) but this risk of transmission to humans is not only determined by host abundance, but also by the indirect transmission path, largely controlled by climatic factors and soil characteristics influencing the pathogen's survival in the environment or reservoir (Lambin et al., 2010).

While the emergence of zoonotic pathogens and the scale of their effect cannot be predicted, many links between the two are obvious. Therefore, staying alert as well as prevention, early detection, and response are key components of global health security.

POINTS OF CONSIDERATION

In livestock production the risk of zoonosis always exists, whether it is through livestock-human transmission, or transmission from wild animals to humans. Any livestock project should, therefore, follow the concept of One Health, which emphasizes the relationship between its three main elements: animal, human, and environmental health. It can help to tackle challenges in a more comprehensive, cross-sectoral, collaborative manner that strengthens overall systems to prevent, prepare for, and respond to infectious diseases.

To start, project design should consider the human-livestock-ecosystem interfaces (Hassell et al. 2017) and implement a risk-based approach that addresses existing zoonoses, potential zoonotic infections, and the risk of spillover.



PRINCIPLE 5: REDUCE THE RISK OF ZOOONOSIS

In project design there should also exist:

- General awareness and knowledge about the presence, burden, and impact of zoonotic diseases in the project area for the establishment of a feasible and successful strategy.
- Priority analysis of known zoonotic diseases in the area, whether that is due to public health concerns (e.g. dog-mediated rabies, tuberculosis, brucellosis), livestock economic issues (e.g. Bovine spongiform encephalopathy, H1N1), and others where the concern is evenly shared between public and animal health (e.g. highly pathogenic avian influenza, anthrax)
- Based on the project area and priorities, decide which key interventions for prevention are needed in project design to tackle reservoirs, prevent transmission, and establish early on-site detection systems.

Decisions around production methods can have serious impact on managing the risk of zoonosis. Therefore, decisions need to take into account the capacity to manage any risks that could arise.

- Assess institutional capacity to deal with an outbreak, including early detection, rapid response, as well as extension services programs that could sustainability support prevention methods.
- Take into account institutional capacity when designing projects and choose approaches at the project level that aim to prevent risk where possible.
- Establish good practices for overall project management (i.e. avoid choosing high-density farming if responsible farm management, prevention, and response cannot be upheld long-term).
- Public health interventions for occupational diseases of workers involved in the animal food chains (i.e. farmers, abattoir workers, butchers, truck drivers, meat handlers, or market sellers) should also involve zoonosis that can affect workers.

- Minimize disruption to the surrounding environment and ecosystem where possible, and limit interactions between wildlife and livestock (and humans).

APPLYING THE PRINCIPLE

Approaches and Tools

Basic animal disease strategies (prevention, preparedness, control and eradication) are applicable to zoonotic diseases, as indicated in Principle 2. However, the basic principles of zoonoses management and control are focused on breaking the chain of transmission at its epidemiologically weakest link. Three factors are involved where interventions are critical: the reservoir, transmission from the reservoir to the susceptible hosts, and the susceptible hosts. Though no intervention is perfect, below are the general approaches available at each key link of transmission.

Interventions at the reservoir:

The primary source of zoonotic infection is the infected reservoir host, which could be either a domesticated or wild animal.

- **Testing and culling.** Infection is controlled by removing the animal or herds found to be infected.
- **Environmental manipulation.** Methods that break the link of transmission by reducing survival of the agent through its vehicle (e.g., water, food, soil, vegetation) wherever the agent may be found outside the host. Also restricted to local situations. For example, proper fecal disposal, or pasture rotation.
- **Wildlife intervention/population control programs.** Broader interventions that control/reduce the population (i.e. control of rabies transmitted from wildlife), mass vaccination, or biological controls such as using natural predators or pathogens of vectors.

Interventions at transmission:

Interrupting the transmission by reducing the opportunity for contact between a potentially infected individual and susceptible host.



PRINCIPLE 5: REDUCE THE RISK OF ZOOONOSIS

- **Good on-farm management and biosecurity practices.** Good on-farm management along with education and awareness of producers and workers are key to preventing transmission of both known and unknown disease-causing agents. For example, provision of adequate and clean toilet facilities - including education and supervision - will prevent the spread of *Taenia saginata* from feedlot employees to cattle.
- **Isolation of an infected individual.** This reduces the probability of contact and facilitates treatment and disinfection. Depends on early, accurate diagnosis and effective disease control programs.
- **Quarantine.** Based on the segregation of the incoming animal for a period of time, normally defined by two incubation periods of the disease in question to see if the suspected individual develops the disease.

Interventions at the susceptible hosts:

Increasing host resistance is a key intervention for controlling zoonoses at the final link of transmission. Preventing infection (at the reservoir or at transmission) is ideal but not always possible. Increasing host resistance can either prevent or lessen the severity of the disease.

- **Immunization.** Vaccines are used to protect susceptible individuals from infection or from the infection developing into a clinical disease, as well as to prevent transmission by creating an immune population (known as herd immunity) which minimizes the opportunity for transmission between susceptible hosts.
- **Chemoprophylaxis.** Attempts to prevent infection or reduce the severity of disease through a passive means of using medication to increase host resistance, lasting only as long as the drug lasts. This use is vigorously debated because it involves a mass consumption of antimicrobials that favors the emergence of resistant pathogens (Principle 6).
- **Early detection/enhance surveillance.** Target or risk-based strategies, including sero-surveillance.

- **Raising awareness and education.** This can improve sensitivity of the population to potential disease as well as improving laboratory capacity for diagnosis to support surveillance.

VARIABLES TO CONSIDER

Each program involving zoonotic diseases will need to be designed according to these disease specifications:

- Nature of etiologic agent
- Reservoir host
- Life cycle of the infecting organism

In the event of an outbreak, mechanisms and education should be in place to deal with consequences:

- Frequent testing of on-farm reservoirs where there is regular contact with susceptible hosts
- Regular testing of animals
- Quarantine facilities appropriate to the size/production methods of the project
- Capacity building for good on-farm management and hygiene practices
- Access to quality veterinary services and medicines for animals as well as health services of producers and workers
- Proper isolation, removal of animal, and disposal of carcasses to avoid pollution

Specific interventions in communication channels and simulation exercises should be made to ensure a One Health approach between public health, environmental and veterinary services, to tackle zoonoses from all sources.

TRADE-OFFS

When the risk to human health is either not that high, clear or apparent, an animal disease may often be neglected as a zoonosis and thereby not treated as a public health threat. However, interventions to improve animal health should not be neglected, and can still lead to secondary economic benefits (e.g. brucellosis and tuberculosis).



PRINCIPLE 5: REDUCE THE RISK OF ZOOONOSIS

Likewise, intervention and surveillance for controlling certain diseases in food animals might be driven by public health concerns but are not regarded as a serious problem for livestock production (e.g. non-typhoidal Salmonella, which has a high impact in humans but is normally subclinical in poultry).

Work with public health institutions can be a struggle as they sometimes lack the appropriate platforms and cross-sectoral communication protocols.

Immunization as a method of disease control is generally so effective and commonplace that all too often, the many variables associated with the procedures are ignored. Immunization failures may occur as the result of failure of the delivery system or failure of the immune response, or they may be iatrogenic in origin.

A high cost of proper disposal of carcasses, or inadequate financial compensation for farmers can result in improper disposal that pollute water sources and drinking water, threatening the lives of other livestock, as well as having severe public health consequences.



Principle 6: Prudent and responsible use of antimicrobials

Livestock development projects present an opportunity to address emergence of Antimicrobial Resistance and spread in an integrated manner to protect both animal and public health, as well as to reduce environmental contamination.

INTRODUCTION

Maintaining animal health and welfare by ensuring that animals are free from diseases is one of the main objectives for the use of antimicrobials (Gelband et al., 2015). Beyond therapeutic use, antimicrobials have been also used as feed additives for growth promotion and improved productivity (Chattopadhyay, 2014). Although these practices have been phased out in several high-income countries (OIE, 2019), they are still in use in LMIC countries, which is why interventions need to be context-specific (World Bank, 2019). In addition, the use of antimicrobials in livestock production involves particular circumstances intrinsic to the production systems, which determine the drug selected and its administration route. Administration can be applied individually (e.g. by injection) and by choosing the best option for the condition requiring treatment. But sometimes antimicrobials are delivered orally through water or food intake as a pragmatic solution when animals are kept in larger groups.

Globally, it is estimated that more than 70 percent of all antimicrobials sold are used in animal production (World Bank, 2019). Inappropriate use of antimicrobials can promote resistance in bacteria, which then will not respond to antibiotic treatment. This is called antimicrobial resistance (AMR) and is a major concern for human and animal health, posing a threat to disease control throughout the world (WHO, 2015). These consequences could be vast, while the economic consequences of ignoring the threat of AMR could be tremendous and never-ending. Estimates of the costs of failing to address the threat of AMR translate into global GDP shortfalls anywhere between US\$1 trillion and US\$3.4 trillion annually after 2030, based on an optimistic scenario of low AMR impact, or a high AMR-impact scenario respectively (World Bank, 2017). Notably, livestock production may be cut by 10 percent in low income countries (World Bank 2017).

Strategies that improve animal health and welfare such as disease prevention through immunization, improvement of husbandry practices, and good

biosecurity practices are encouraged as alternatives to antimicrobial use. Alternatives to antimicrobials exist, such as the use of zeolites as a feed additive for chicken, the use of phytochemicals with antimicrobial properties, the use of recombinant enzymes that inhibit bacterial biofilm formation and accelerate infection clearance have shown promising results by being combined. There is still a need for further research to better understand the modes of action of many of these compounds that can be used as alternatives to antibiotics in animal feeds. (Hassan et al., 2018).

Moving forward, ensuring appropriate use of antimicrobials by raising awareness and promoting policies to reduce overprescription and control access will also be a critical component of any animal health and welfare strategy (WHO, 2015, FAO and OIE).

Strategies will require multidisciplinary collaboration, adequate surveillance systems, and strong laboratory capacity, many of which are challenges for LMICs (WHO, 2015). These efforts to improve public health from a One Health perspective seek to minimize risks that arise from the interface between humans, animals, and the environment (Nadimpalli et al., 2018).

POINTS OF CONSIDERATION

Adopting GAHPs should be one of the first steps in developing any project involving primary production of livestock. Developing and adopting a code of GAHP is critical in setting out the general principles of good practice and the minimum requirements necessary for different types of animals and different production systems. An agreed set of good practices ensures that farming practices of the project provide greater confidence for the health, safety, and quality of animals, their products, as well as workers involved.

Feed manufacturers have a key role to play in preserving antimicrobial efficacy and availability. By limiting the access of medicated feed to veterinary prescription,



PRINCIPLE 6: PRUDENT AND RESPONSIBLE USE OF ANTIMICROBIALS

they can counter the overuse and misuse that leads to increased AMR. Producers of animal feed containing antimicrobials should adhere to best practice guidelines in order to combat antimicrobial resistance (OIE, 2019).

Any project involving primary production of livestock should foresee the medical treatment of animals to secure their health and welfare, and should therefore consider the following points:

- Promote the regulation of the manufacturing, circulation, and use of antimicrobials in animals, according to international standards and best practices
- Mandate official veterinary supervision of antimicrobial use in animal health to ensure they are used prudently and responsibly
- Where possible, monitor AM use and the development of AMR by implementing surveys and creating laboratory capacity
- Build capacity among animal health professionals and producers on prevention of infectious diseases including:
 - Training animal health professionals and producers, including feed producers, on responsible use of antimicrobials and their alternatives (Ghosh et al., 2016), as mentioned before
 - Raising awareness among stakeholders and promote the use of animal medicine record keeping
 - Making high-quality products and their alternatives accessible

APPLYING THE PRINCIPLE

Approaches and Tools

Despite current knowledge gaps, there are several practical actions that can be taken to minimize the use of antimicrobials and limit environmental contamination, where possible. One of the basic tools should be emphasis on disease prevention. Another is to include monitoring programs that record the use of antimicrobials at purchase and during production as well as cover emerging resistance through surveillance,

particularly farmers' logbooks. This would give a better sense of the abuse or overuse of antimicrobials, and fill data gaps that are often lacking in key decision-making. Other actions include:

- **For disease prevention.** Use vaccination, immune modulators, good farm practices and biosecurity as alternatives.
- **For growth promotion.** Implement bans on the use of antimicrobials for growth promotion and promote the use probiotics, prebiotics, organic acids or zeolites as alternatives.
- **Effectively treat waste to eliminate residual antimicrobials.**

Subsequently, effective treatment of wastes to reduce and eliminate residual antimicrobials will reduce environmental contamination. Since most waste treatment protocols were not designed specifically to address antimicrobial residues, their efficacy to mitigate these residues is highly variable depending on the treatment process and the specific antimicrobial in question. A more effective approach will need to overcome challenges of limited or absent waste treatment facilities and standard operating procedures, limited awareness, resources and infrastructure, and weak or poorly enforced regulations.

- **Improving access to safe drinking water and sanitation** are policy priorities in many LMICs. These public health measures significantly reduce diarrheal disease, the second-largest cause of mortality among children in LMICs (O'Neill, 2016). However, these measures are also important in the context of reducing AMR. Although 70 percent of diarrheal diseases in LMICs are caused by viruses, antibiotics are often used for treatment (O'Neill, 2016). Thus, improved water and sanitation can drastically reduce antibiotic consumption (Araya et al. 2016).



PRINCIPLE 6: PRUDENT AND RESPONSIBLE USE OF ANTIMICROBIALS

- **Implement a program that monitors the occurrence and development of AMR.** Programs monitoring the occurrence and development of resistance are essential to determine the most important areas for intervention and to monitor the effects of interventions. When designing a monitoring program, it is important to define the purpose of the program. Thus, there are major differences between programs designed to detect changes in a national population, individual herds or groups of animals. In addition, programs have to be designed differently according to whether the aim is to determine changes in resistance for all antimicrobial agents or only the antimicrobial agents considered most important in relation to treatment of humans.

VARIABLES TO CONSIDER

- Type of farm (monogastric versus ruminants, herd size, current on-farm production practices)
- Amount of regulations or standards put in place for monitoring/controlling antimicrobial use
- Improved quality of antimicrobials
- Decreased level of use (amount of antimicrobials used per head)
- Increased access to veterinary/extension services available
- Improved data collection for AMR monitoring
- Increased awareness on the appropriate use of AMR

TRADE-OFFS

Antimicrobial use in animal agriculture contributes to a rise in AMR in humans, even though the quantitative contribution to this failure remains unclear. This justifies improved policies to decrease antimicrobial use in animal production (Tang et al., 2017). Nevertheless, the potential economic impacts of regulatory instruments should be tracked in detail, as well as the need for compensation (Bonnet et al., 2018; Lhermie et al., 2018).

Regardless of the intensification of farming systems, antimicrobials represent a tool that farmers use for

animal health, welfare and production purposes, enabling them to control the damage generated by the occurrence of disease. Changes to policies will likely impact farmers, many of whom may be unable to maintain their level of production as they do not have the capacity to change production practices. Ultimately, this also raises concerns about fairness with regard to food affordability, and ensuring small producers continue to have equitable market access.

Another trade-off to consider would be impacts on the environment when reducing antimicrobial use. Possible interventions to reduce greenhouse gas emissions are to a large extent based on technologies and practices that improve production efficiency at animal and herd levels. Improved breeding and animal health interventions to allow reductions in herd sizes (meaning fewer, more productive animals) are an example (Gerber et al., 2013). If it is assumed that other approaches and tools are not put in place, and that antimicrobials are often used to promote productivity in terms of both growth and increased animal health, policies that deter the use of antimicrobials could reduce livestock productivity. A decrease in productivity could therefore mean an increase in emissions intensity or greenhouse gas emissions per kilogram of product. Notwithstanding its complexity, evaluating the sustainability of antimicrobial use is necessary for advising policymakers on the potential impact of regulations, particularly in the context of the One Health approach.



Principle 7: Foster an Enabling Environment

Enabling institutions, policies, knowledge, and awareness are necessary for achieving Principles 1–6.

INTRODUCTION

Decision making about Principles 1–6, taken at project initiation and at the farm level, while considering the entire supply chain, will be highly dependent on local political, institutional, and economic contexts. Ensuring that the institutional, knowledge and economic environment enable decision making and innovation for improved sustainability is key to enhancing outcomes, both during and after the project. A strong enabling framework is also key to evaluating the many synergies and trade-offs related to livestock development and require evidence- and consensus-based decisions. Thus, Principle 7 takes a step back and looks at the importance of fostering an enabling environment for sustainability as a whole, with animal health as only one critical aspect.

Fostering an enabling environment is a critical component of taking the One Health approach. The concept of One Health emphasizes the relation between its three main elements, which mirror the structure of this guide: animal, human, and environmental health. It creates a framework for tackling challenges in a more comprehensive manner, beyond the borders of just one element. Therefore, it is critical to foster an enabling environment that allows for cross-sectoral, collaborative interventions for strengthening systems that prevent, prepare for, and respond to challenges - such as infectious diseases - with the aim of improving global health security and achieving gains in sustainable development.

POINTS OF CONSIDERATION

Is there potential to improve the enabling environment for sustainable livestock investment in the project country? If so, include project resources to:

- Identify and analyze the knowledge, awareness, policy, and institutional challenges to implementing the relevant principles at the project concept stage
- Include resources to address these challenges at the project design stage, through:

Awareness:

- Shape the livestock and health narrative strategically, flagging synergies and trade-offs
- Raise and leverage producer and consumer awareness of key issues and challenges
- Build consensus and political will
- Build ownership in that every player has a responsibility to protect animal and human health and prevent disease

Knowledge:

- Support local pilot programs and extension research to identify appropriate solutions
- Utilize risk-based assessments and analysis to make sustainable health investment decisions within the project context

Policy:

- Establish prevention and early detection programs, and market differentiation for sustainable livestock products
- Pilot programs to incentivize good on-farm management and hygiene practices.
- Establish and clarify regulations for animal health and welfare, adopt relevant international standards and best practices
- Redirect subsidies toward sustainable outcomes

Institutions:

- Establish a unit within the relevant government ministry to perpetuate the enabling environment.
- Develop country capacity for monitoring and evaluation to establish baseline data.

APPLYING THE PRINCIPLE

The principle can be applied through various avenues, in this case using the framework of an enabling environment that includes awareness, knowledge, policy and institutions.



PRINCIPLE 7: FOSTER AN ENABLING ENVIRONMENT

Awareness

- Strategically shape the livestock and sustainability narrative

Some of the literature on livestock considers animal-source food production to be unsustainable and high risk. However, considering the contributions that livestock make to a broad range of development outcomes conveys a more realistic view. These outcomes include improved food and nutrition security; crop productivity; jobs and income diversification; asset saving and risk management; and biodiversity conservation and carbon stock enhancement on well-managed grasslands. Awareness raising in projects about the importance of sustainable livestock should objectively balance these contributions and account for them in efforts to quantify livestock impacts on animal and human health, as well as on the environment and economy.

- Raise and leverage consumer awareness

Consumers increasingly are becoming aware of the health and environmental implications of animal-sourced food consumption. Investment in livestock can benefit from this awareness by linking producers who adopt sustainable practices to demand for sustainable products. Projects can include resources for awareness raising among consumers to help producers under the project link to this demand. Consumer demand may also influence political support for adopting the principles.

- Build consensus and political will

Adoption of the principles may not benefit all stakeholders and will often generate costs. Adoption of rigorous standards and costly practices, for example, may adversely impact producer incomes, especially small and medium-sized producers who could have a hard time bearing the cost of adoption. On the other hand, adoption of internationally recognized standards can facilitate trade. Strong political consensus around the importance and urgency of sustainable livestock production practices may be necessary to enable a balanced assessment of

synergies and trade-offs and put in place the regulations, subsidies, and market-based instruments that can shift production practices. Development investment can contribute to building such consensus and political will for adopting the principles by accounting for risk management, health, or environmental costs in the economic assessment of projects.

- Build ownership and responsibility

A One Health approach requires the ownership and responsibility of every player that takes part in the food and health system. Farm operators, workers, processors, transporters, sellers, and consumers all need to take ownership in preventing infections and disease while promoting both animal, human, and environmental health. This can only be done through raising awareness of the various forms of risk across levels and institutions, and ways to best manage them.

Knowledge

- Support local pilot programs and extension research

While the literature provides considerable technical guidance to support adoption of the principles, projects will need to provide support for piloting and adopting improved practices for local conditions. Projects should include technical assistance and extension services where necessary to support each principle adopted. Consolidating knowledge and evidence for the local applicability of the principles can help encourage further farmers to adopt them.

- Support education and research in the area of sustainable livestock systems

While knowledge is progressing at the global level, it is mostly advancing in high-income countries. The growth of animal production is, however, much more robust in low- to middle-income countries, and much work is still needed to properly grasp livestock-health-environment interactions in these regions, and to establish the



PRINCIPLE 7: FOSTER AN ENABLING ENVIRONMENT

technical itineraries that can bring livestock development on a more sustainable path.

Policies

- Establish prevention and early detection programs, and market differentiation for sustainable livestock products

Prevention and early detection programs are key for managing animal and human health risks, as well as coordinating responses. Certification programs can help link consumer demand for sustainable products to producers who are adopting the principles. Projects may include resources to support producers in adopting existing certification programs, as well as to develop and pilot new, voluntary certifications for products that promote a One Health approach.

- Pilot programs to incentivize good on-farm management and hygiene practices

LMICs often have limited funds for incentive-based environmental programs. Pairing project investment with policy instruments to pay or in other ways incentivize producers to adopt the principles may significantly enhance project outcomes. Payments for environmental services programs have proven successful in protecting natural areas in Costa Rica. Carbon offset and other emissions reduction programs in the livestock sector should be linked to national targets for greenhouse gas emissions reductions and accounting under Nationally Determined Contributions to the United Nations Framework Convention on Climate Change.

- Establish and clarify regulations for animal health and welfare, adopt relevant international standards and best practices

Widely recognized international standards and best practices, such as those found under the Codex Alimentarius are key to both promoting health and facilitating economic growth through trade. Many countries today lack an effective regulatory framework

for environmental, health, and welfare issues related to livestock. Pairing project investment with policy investment can significantly enhance the long-term outcomes of the project and of the broader sustainability agenda. Adoption of well-recognized and extensively-used international standards also provides well-established guidelines, transparency, and capacity building through already tested avenues and case studies.

- Redirect subsidies toward sustainable outcomes

Agricultural subsidies worldwide amount to about US\$1 billion per day and have a range of impacts on animal and human health, as well as natural resources. Current subsidies are often directed towards specific land uses, price, income support for specific agricultural products and practices, and agricultural inputs. Redirecting subsidies to incentivize sustainability can result in positive health and environmental outcomes in livestock investment projects.

Institutions

- Develop country capacity for monitoring and evaluation to establish baseline data and to track and capture investment benefits

Many countries do not collect detailed data on their livestock sector and often fail to collect accurate and consistent data on livestock health management. Projects may include resources to develop monitoring and evaluation capacity to create livestock information systems, drawing on novel information technology options. Projects may also provide training in survey methodology and in data collection and analysis for livestock numbers, herd structure, disease tracking, monitoring of veterinary services and use of medicine, and production practices, as well as for cost, income, and other economic data.

- Establish a health unit within the relevant government ministry/department responsible for livestock.



PRINCIPLE 7: FOSTER AN ENABLING ENVIRONMENT

While projects may hire a health expert during implementation, the knowledge and capacities gained through the project may dissipate without a permanent, dedicated office. The project may thus include resources for the establishment of a permanent unit to continue to advance the livestock and health agenda after the project closes. The capacities of such a unit would be developed as part of project activities and may serve to perpetuate the enabling environment for investing in sustainable livestock past the duration of the project. This unit should collaborate with other relevant units, such as environment, for a comprehensive approach that minimizes trade-offs and enhances synergies.