

THE IMPORTANCE OF INTEGRATING ANIMAL WELFARE, ENVIRONMENTAL HEALTH AND VETERINARY LEGISLATION IN IMPROVING FOOD SECURITY AND CONTRIBUTING TO AGRICULTURAL GROSS DOMESTIC PRODUCT IN AFRICA

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Summary: *Compliance with animal welfare and environmental health principles and veterinary legislation has an impact on the quantity and quality of the animal products produced. The quantity and quality of livestock and livestock products influences demand and prices and has an effect on income from the livestock industry and ultimately on gross domestic product (GDP) and food security. Environmental health on the other hand influences either negatively (in poor) or positively (in good) environmental health situations thereby has impact on the quantity and quality of livestock and livestock products and the level of contribution to GDP and food security. Both animal welfare and environmental health principles are well adhered to when adequate veterinary legislation provisions are implemented and enforced. Good, enforceable veterinary legislation and good veterinary governance are prerequisites for ensuring secure sanitary conditions and food safety and preventing the spread of animal diseases, and ultimately they enhance incomes and ensure the availability of wholesome food, thereby contributing to GDP and food security. It is therefore important to integrate these three components, namely animal welfare, environmental health and veterinary legislation, in livestock production and marketing operations to improve the livestock industry's contribution to food security and GDP.*

This paper explores the relationship between animal welfare, environmental health and veterinary legislation and their impact on the production of livestock and livestock products, the aim being to show how the integration of these three factors in production operations can help to increase GDP and ensure food security. The inclusion of animal welfare and veterinary governance issues in chapters of the OIE Terrestrial Animal Health Code is highlighted and Member Countries are urged to draw on them in developing their risk-management-based livestock production and marketing operations.

Key words: *Africa – animal welfare – environmental health – ‘the five freedoms’ – food security – GDP – Terrestrial Animal Health Code – veterinary governance – veterinary legislation*

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1. Introduction

The concepts and principles of animal welfare, environmental health and veterinary legislation, and their application in the field of livestock production operations, have recently received considerable attention and are considered very important at the national, regional and global level [1, 2, 8, 10, 15]. Worldwide, many countries with significant levels of livestock production, marketing and trade are embracing animal welfare in its totality, including effective and efficient animal health services' delivery, good animal husbandry and due regard for environmental health concerns, all of which are being enforced and ensured through sound veterinary legislation and governance [2, 20, 22, 23].

Environmental health concerns, from an environmental health science perspective, are recent developments in the livestock industry. Environmental health science focuses on protecting human health from the environmental impacts of livestock production operations, rather than on animal welfare [7, 8, 11]. However, with the increasingly complex industrial livestock production systems, in which large numbers of animals are kept and fed in confined animal feeding operations (CAFOs), compliance with environmental health science principles is necessary to minimise or mitigate the negative impact of these systems on both animal and public health.

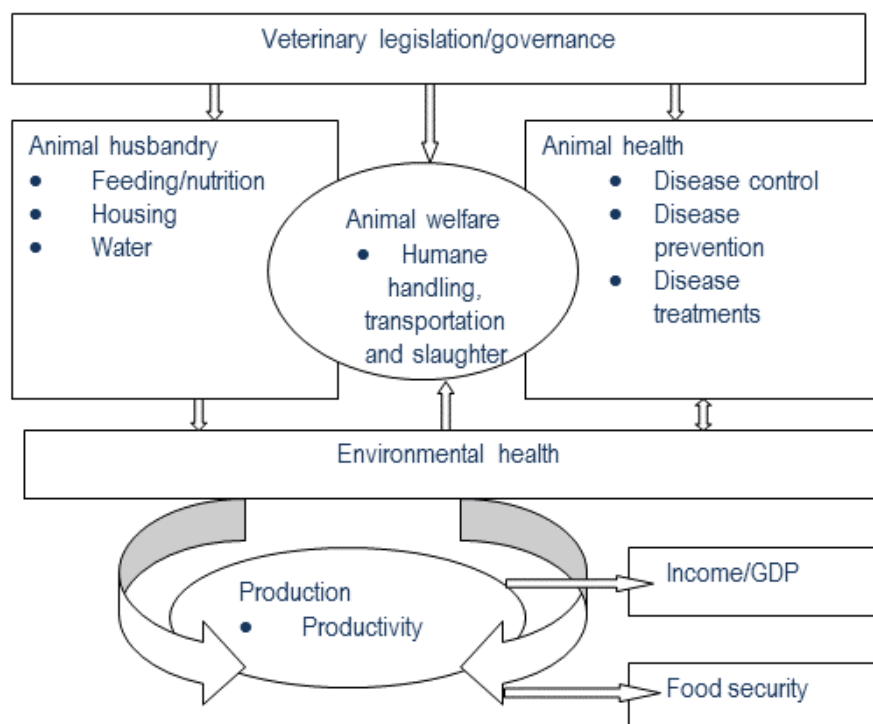
The application and implementation of and adherence to animal welfare and environmental health requirements in livestock production operations require the existence, implementation and enforcement of good veterinary legislation — a good legal and regulatory framework that provides the ingredients for good veterinary governance. Animal welfare and veterinary legislation are incorporated in the OIE *Terrestrial Animal Health Code (Terrestrial Code)*, in Section 7 and Chapter 3.4., respectively [16]. Proper implementation of and adherence to animal welfare and veterinary legislation, increase production and productivity in livestock production operations [1, 2, 14, 20]. This results in higher revenue/income for the livestock industry. The increase in production and revenue contributes positively to agriculture and national gross domestic product (GDP) and food security [3, 15, 20, 22].

This report notes that the *Terrestrial Code* is silent on environmental health as a distinct subject in its own right, though the relevant concerns are addressed and considered in the general principles of animal welfare in livestock production systems (Article 7.4. of the *Terrestrial Code*, 2012) and in guidelines on animal welfare in cattle production systems. It is therefore suggested that a discussion take place on extending the OIE's mandate on the standard- and guideline-setting mechanism, so as to include the development of specific guidelines on environmental health concerns in livestock production operations, to address issues such as air- and water-pollution control, waste management, animal rescue protocols in disasters and disposal of hazardous materials [12, 13]. [Figure 1](#) illustrates the conceptual relationship between the three subjects under review, animal welfare, environmental health and veterinary legislation, whose integration in livestock production operations to enhance the contribution to GDP and food security is advocated.

The main aim of this report is to explore how animal welfare, environmental health and veterinary legislation can impact on livestock production systems. The report then explains how their integration will further benefit the production performance of livestock operations and contribute to GDP and food security.

The report, including the introduction and conclusion, is in seven sections. Section 2 explores the important contribution that the livestock industry makes to GDP and food security. It reviews global trends in terms of numbers, consumption, contribution to total protein intake attributed to food of animal origin and examines the existing literature on the impact of animal welfare, environmental health and veterinary legislation on livestock production and productivity, and ultimately on GDP and food security. Sections 3, 4 and 5 focus on understanding the three concepts, animal welfare, environmental health and veterinary legislation, then illustrate how they are being observed, neglected or abused and finally present their implications for livestock productivity, GDP and food security. Section 6 explains why animal welfare, environmental health and veterinary legislation should be integrated in livestock industry production, marketing and trade operations and Section 7 presents the conclusions and recommendations.

Fig. 1.– Illustration of the relationship between animal welfare, environmental health and veterinary legislation



2. Livestock production and consumption: global trends

Livestock systems occupy about 30% of the planet's ice-free terrestrial surface area [20] and are a significant global asset with a value of at least USD 1.4 trillion [22]. Livestock play significant roles in the socio-economic arena, providing employment for at least 1.3 billion people globally, food, manure, energy and recreation [6, 20].

From a nutritional point of view, livestock products contribute about 17% to global food calorie consumption and 33% to protein consumption, with large differences between rich and poor countries [6, 22]. These consumption levels are projected to rise with the increase in the human population, which the Centers for Disease Control and Prevention (CDC) estimated would rise from about 3 billion in 1960 to nearly 7 billion in 2010, much of the increase occurring in developing countries [11, 13].

The huge human population, projected to reach more than 7 billion by 2015, will have a tremendous impact on food production systems, including livestock production. This is especially the case in Sub-Saharan Africa and South Asia, where livestock are a key part of the farming system and crucial to the livelihoods of nearly 1 billion poor livestock keepers. Improving livestock production and productivity through integrating animal welfare, environmental health and veterinary legislation and through other strategies can have a dramatic impact on the lives of small farmers in these regions.

Livestock production systems are very important for smallholder farmers and provide a range of benefits, including [14, 18]:

- household income, with improved production and marketing making a significant contribution to increased GDP;
- food security, since livestock are an important source of food and an important source of protein and micronutrients, including vitamin B-12, calcium, zinc and riboflavin;
- improvement of farm productivity through the use of manure as a fertilizer;
- draught animal power for transportation and ploughing;
- energy for cooking and lighting through the use of manure.

3. Animal welfare: concept, fundamental principles, standards and guidelines

Animal welfare is the physical and psychological state of an animal as regards its attempt to cope with the environment [1, 2, 3, 12, 13, 14]. An animal's welfare is a human responsibility that encompasses all aspects of animal well-being, including proper housing (where relevant), management, nutrition, disease prevention and treatment, responsible care, humane handling, and when necessary, humane slaughter [10]. It is therefore regrettable that, in many ways, animals suffer as a result of their interaction with humans. The concept of animal welfare has gained recognition by governments, national and international bodies, academic institutions and individuals the world over. The relationship between humans and animals, their reactions towards one another and the treatment of animals have long historical backgrounds and differ from one society or country to another [14]. Biblical teachings tell us that humans alone are made in the image of God, have the capacity for reason and have feelings and mental activity, whereas animals lack any kind of mental activity or subjective experience and were put on earth for human use. This is an old way of thinking and lies behind the exploitation of animals without due regard for their welfare. Modern thinking, which forms the basis for the animal welfare concept and is scientifically proven, is that some animal species are sentient (i.e. they can feel pain, suffering, love, hate, and even reason, though in a more imperfect manner than man) [1, 2, 13].

Since the universal acceptance that some animal species can feel pain and experience suffering, the science and discipline of animal welfare has evolved and developed, and it is now taught up to university level and included in animal trade standards. Animal welfare is now taken to be a scientific discipline dealing with applied aspects of aetiology, bioethics and the concept of sentience. In this context, sentience can be defined as the capability to feel pain and suffering.

It is imperative to have a common understanding in international communication and standard-setting and in this regard animal welfare has to be specifically defined. For the purpose of this paper, the OIE definition given in Chapter 7 of the *Terrestrial Code* has been adopted.

Article 7.1.1 of the *Terrestrial Code* [16] states that "animal welfare means how an animal is coping with the conditions in which it lives. An animal is in a good state of welfare if (as indicated by scientific evidence) it is healthy, comfortable, well nourished, safe, able to express innate behaviour and if it is not suffering from unpleasant states such as pain, fear, and distress." This corresponds to a previous statement that good animal welfare is about the absence of suffering, including a wide range of unpleasant emotional states including fear, frustration and pain [14]. Biologically, an animal is assumed to be in a good state of animal welfare if its physical and physiological systems are functioning well and it is coping with its environment [14].

Further recent developments indicate that animals are in a good welfare state if they are accorded five freedoms [1, 12], namely:

- 1) freedom from hunger or thirst through provision of ready access to water and a diet to maintain health and vigour;
- 2) freedom from thermal or physical discomfort attained through provision of a suitable environment;
- 3) freedom from pain, injury and disease attained through disease prevention or treatment;
- 4) freedom from fear and distress attained through provision of conditions which avoid mental suffering; and
- 5) freedom to express and indulge in normal behaviour patterns attained through provision of sufficient space and adequate facilities.

When these five freedoms are not provided, animal welfare is said to be compromised or abused. Animal welfare abuses abound in many countries, both developed and developing countries, but they are currently more common in developing countries [3, 14]. Abuses can result from: neglect; malicious physical injury; starvation; confinement; use of inappropriate modes of transportation/transportation facilities; manhandling during transportation; overcrowding; overloading; overworking; inhumane treatment at slaughter/slaughter facilities; inhumane treatment during capture; branding and; inappropriate working tools, injuries during off-loading; etc. [1, 2, 3, 9, 14]. The abuses are occasioned by: inadequate legal and policy provisions; inadequate capacity to monitor and minimise cruelty to animals; limited animal extension services;

and inadequate training in animal welfare and supervision of service providers. Figures 2 and 3 show various types of animal welfare abuses in transport of animals on land in photographs taken by the author.

Fig. 2.– Cattle being transported in a small vehicle and cattle being transported while tied up (Note the extended neck, distended eyes and drooling saliva, indicating severe stress)



Fig. 3.– Chickens and pigs being inappropriately transported



4. Animal welfare compliance and livestock productivity, quality of livestock products, food security and increased income/GDP

Compliance with animal welfare in livestock and livestock production operations has a significant influence on the production and quality of livestock products [15]. This can be explained from a physiological and biochemical point of view. Physiologically, the welfare of an animal is a reflection of its physical and mental health and general well-being. If an animal is in a poor state of welfare, suffering from discomfort, distress, or pain, this may compromise its ability to grow, survive, and produce or reproduce. Animal welfare is therefore also important for humans, for reasons of food security and nutrition. Better management and care of livestock can, in many situations, improve productivity and food quality, thereby addressing nutritional deficiencies and food shortages and ensuring food security [1, 2, 5, 13, 15].

Poor transportation standards can often have detrimental effects on animal welfare, which manifest as bruising, broken limbs (Figure 4) or wounds that occur either when animals are being handled, loaded, transported and unloaded prior to slaughter or during slaughter [17]. This often leads to downgrading of carcasses and thus lowers the value of the animal and the quality of the meat obtained from the animal. From a biochemical point of view, bruised meat (and the carcass) has a higher pH value and may be considered unfit for human consumption. Bruised chicken meat is more prone to microbial contamination [1, 2, 18]. Animals stressed prior to slaughter tend to have depleted glycogen stores in their muscles, leading to meat that has a higher pH value and is more likely to be dark-cutting, objectionably dark in colour and prone to microbial spoilage.

Fig. 4.– A bovine animal injured during off-loading, due to poorly constructed and maintained loading/off-loading chutes



Higher animal welfare standards are also increasingly seen to be a prerequisite for enhancing, in many situations, business efficiency and profitability, satisfying international markets and meeting consumer expectations [12, 18]. The enhancement of animal welfare creates growing market opportunities due to the demand for food produced in animal welfare friendly systems.

Fig. 5.– Examples of well-maintained and poorly maintained livestock loading and off-loading chutes



Compliance with animal welfare in the whole livestock value chain undoubtedly has a positive bearing on GDP and ensuring food security. Operators involved in the production of livestock and livestock products should therefore take this into account and governments should support such initiatives [2, 18]. The OIE has developed animal welfare standards and guidelines on the following: transport of animals by sea (Article 7.2. of the *Terrestrial Code*), by land (Article 7.3.) and by air (Article 7.4.); slaughter of animals (Article 7.5.), killing of animals for disease control purposes (Article 7.6.); stray dog population control (Article 7.7.); use of animals in research and education (Article 7.8.); and animal welfare and beef cattle production systems (Article 7.9.). Governments should develop and apply their own national animal welfare standards and guidelines and apply the international standards and guidelines issued by the OIE, as well as other relevant national or regional specific animal welfare standards on farm animal housing, feeding, transportation, slaughter, killing of animals for disease control purposes, etc. Animal welfare guidelines on dairy cattle production systems, sheep and goats' production systems, pig production systems and poultry production systems have yet to be produced by the OIE.

Considering that significant animal welfare abuses are encountered in other production systems, the OIE is recommended to produce and publish guidelines to cover them. In the absence of these guidelines, the general principles for the welfare of animals in livestock production systems elaborated in Article 7.1.4. of the *Terrestrial Code* [16] should apply.

5. Environmental health and impact on livestock production systems

Environmental health is concerned with all aspects of the natural and built environment that may affect human health and animal health. It addresses the physical, chemical and biological factors external to the person and all the related factors impacting behaviour and health of humans and animals [10, 12, 21, 23]. Some of the issues that environmental health is concerned with include:

- air quality;
- climate change;
- disaster preparedness and response;
- food safety;
- hazardous materials management;
- housing;
- liquid waste disposal;
- noise pollution and vector control;
- biodiversity.

The aforementioned environmental factors may have positive or negative impacts on human and animal health and, in terms of livestock, may result in good/increased or poor/reduced productivity and thus influence GDP and food security. Industrial agriculture operations—including intensive livestock operations—that are improperly managed without sound environmental health principles often contribute to numerous forms of environmental degradation, including air and water pollution, soil depletion, diminishing biodiversity and fish die-offs [7, 8, 10]. The proliferation of factory-style animal production has been blamed for creating environmental and public health concerns, including pollution from high concentrations of animal waste and extensive use of antibiotics. Humans residing near large intensive livestock production operations have been reported to be affected, with illnesses from airborne emissions and the negative impact of noxious odours [7, 8]. Livestock health and welfare is also compromised if good environmental health principles, such as good waste management, are not adhered to. Waste should be managed and disposed of in accordance with the appropriate guidelines for hazardous and non hazardous materials.

It is thus essential that, in addition to animal welfare, livestock production operations should also address environmental health concerns. Integrating these two sets of principles will result in higher productivity (increased GDP and greater food security). Management of storm water in cattle kraals to avoid muddy conditions (Figure 6) and of excess manure in intensive and extensive livestock production systems that subject animals to considerable stress and distress are also animal welfare and environmental health issues.

Fig. 6.– Environmental health concerns in cattle production: mud in cattle kraals, with animals that are severely stressed and prone to foot rot infections



6. Veterinary legislation: importance and impact on livestock production systems

Sustainable livestock production, even at backyard level, needs an adequate level of animal health services to avoid animal diseases jeopardising the sustainability of the livestock producer [4, 18]. Efficient and effective disease control at national, regional and international level requires good governance of Veterinary Services and thus appropriate and enforceable veterinary legislation. Veterinary legislation gives national Veterinary Authorities and the relevant Competent Authorities the legitimacy and powers they need to carry out their mandated activities, which include: implementing and coordinating the epidemio-surveillance system, early detection and rapid response to disease outbreaks, veterinary laboratory diagnostic services, transparency, certification trustworthiness and notification of any changes in sanitary status, as well as animal welfare and some aspects of environmental health. The implementation and effectiveness of these mandates require appropriate human and financial resources, a good organisational structure and a national chain of command with clearly defined and documented roles and responsibilities.

The efficiency and trustworthiness of national Veterinary Services across the world vary between those in the developed world in parts of Europe and America that are highly developed and endowed with adequate financial, human and physical resources and those in developing countries [18]. However, even in developing countries, there is much variation in this respect, with some countries that are doing well in terms of beef exports to Europe, such as Botswana and Namibia, having credible, independently audited national Veterinary Services. These countries have invested considerably in animal health services, such as the establishment and maintenance of veterinary cordon fences (Figure 7), livestock identification and traceability systems, abattoirs, animal welfare, veterinary laboratory diagnostic services and training of veterinarians and veterinary para-professionals.

Fig. 7.– Investments in animal health: crushes and veterinary cordon fence (Botswana)



The OIE addresses veterinary legislation and veterinary governance through Article 3.4. of the *Terrestrial Code* (2012), which provides advice and assistance to OIE Member Countries in formulating and modernising their veterinary legislation so as to ensure good governance of the entire veterinary domain. As defined in the *Terrestrial Code*, veterinary legislation “means the collection of specific legal instruments (primary and secondary legislation) required for the governance of the veterinary domain”. Veterinary domain “means all the activities that are directly or indirectly related to animals, their products and by-products, which help to protect, maintain and improve the health and welfare of humans, including by means of the protection of animal health and welfare, and food safety” [16]. Comprehensive veterinary legislation formulated along the lines recommended in the *Terrestrial Code* Chapter 3.4 addresses aspects of the veterinary domain ranging from animal health, disease control, laboratory diagnosis, veterinary medicine and biologicals, and veterinary professionals and their training requirements to animal welfare. The issue of a working and effective national chain of command, which in some countries has been eroded by a move towards decentralisation, is addressed. The advice given is that, regardless of the organisational structures of their government administration, Member Countries must ensure through written statutes that the technical line of command of the national Veterinary Authority is preserved and functional. The Veterinary Statutory Body, in its capacity as the independent body responsible for overseeing the veterinary profession, registering veterinarians and veterinary para-professionals and looking after their initial and continuing education requirements, can help to ensure the effectiveness of the existing line of command.

Veterinary legislation is therefore important and should be integrated with animal welfare and relevant environmental health concerns in livestock production systems, given that it impacts on animal health delivery system and status.

7. Conclusion

Animal welfare, environmental health and veterinary legislation are important and are being addressed not only by governmental agencies and standard-setting bodies but by a growing number of stakeholders in the agricultural supply chain. A number of national, regional and global initiatives have therefore emerged to provide standards and guidance on acceptable practices. Animal welfare brings important benefits for humans in terms of food security, nutrition and increased income, thereby contributing to GDP and improved livelihoods through higher productivity and quality. On the other hand, livestock production operations, in particular industrial intensive operations, are confronted with environmental health impacts that need to be managed for the sake of both human and animal health. Environmental health practices in livestock production operations that should be considered include waste management, disaster prevention and response, biodiversity, disposal of hazardous materials, air pollution control and surface and ground water pollution control, and these must be integrated with animal welfare management practices. To ensure that animal welfare and environmental health principles are adhered to and are fully implemented, it is imperative to have good veterinary governance and enforceable veterinary legislation.

Investment in animal welfare, environmental health and animal health produces economic benefits through a wide range of factors, including the following:

- increased livestock productivity through higher carcass yields, reduced losses of meat due to bruises caused by in appropriate pre-slaughter animal handling and transport;
- higher quality of animal products, hence wider market access, higher prices and earnings and increased contribution to GDP;
- greater efficiency of draft power through the use of animal-welfare-compliant equipment;
- fewer risks to public health, and sustainable use of natural resources;
- accessibility to higher-end market opportunities requiring animal welfare compliance, sound environmental health and animal health assurance schemes.

It is thus recommended that animal welfare, environmental health and veterinary legislation be integrated in livestock production operations to ensure efficient and cost-effective livestock production, for the livestock industry to contribute significantly to food security and the agriculture GDP.

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