



RAAD VOOR DIERENAANGELEGHEDE

HEALTH OF PRODUCTION ANIMALS ON THE AGENDA

TOWARDS DIGNIFIED HEALTHCARE FOR PRODUCTION ANIMALS

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Procedure

This advisory report of the Council on Animal Affairs (Raad voor Dierenaangelegenheden, RDA) came about at the Council's initiative. The advisory report was prepared by a forum chaired by Dr J.W.G.M. (Han) Swinkels and further composed of the Council members G.P. (Bert) van den Berg, Prof. R. (Ronette) Gehring, Prof M.F.M. (Merel) Langelaar, Prof. T.B. (Bas) Rodenburg, Prof. Y.H. (Ynte) Schukken (until 01-03-2024), G.C. (Gijsbert) Six (MSc), J. (Jan) Staman (DVM, LL.M), J. (Jeannette) van de Ven, D.M. (Dorien) Eppink (MSc, Young RDA), along with the external members Prof. L.J. (Ludo) Hellebrekers, Prof. H. (Henk) Hogeveen, Dr I.M. (Inge) van Geijlswijk, Prof. F.L.B. (Franck) Meijboom, Prof. E.N. (Elsbeth) Stassen and Prof. J. A. (Arjan) Stegeman. The draft advisory report was submitted to the entire Council and Young RDA for assessment. As such, the advisory report is a product of the Council as a whole.

The forum held nine meetings for the purpose of preparing the advisory report. The work of the forum was supported by RDA Secretary-Director M.H.W. Schakenraad (MSc) and the committee secretaries Dr T.J. (Tamara) Bergstra and A.M.P. (Annemiek) Nap (DVM, LL.M). Dr L. (Linda) van den Berg was responsible for the editing of this advisory report.

Summary

Interests relating to the economy, food security and public health have played an important role in the design of the Dutch livestock farming sector. Animal welfare is receiving increasing social attention, however, and this is raising new challenges for this industry. The livestock farming sector is facing other significant challenges as well, including in relation to nature and the environment (e.g. the consequences of climate change). Together with globalisation, climate change may lead to the emergence of new animal health problems in our country (e.g. heat stress), or to the emergence or endemicity of infectious diseases, as was the case with avian influenza (bird flu).

The Council has introduced six guiding principles for animal welfare in the livestock farming sector: (i) recognition of the intrinsic value and integrity of the animal; (ii) good nutrition; (iii) appropriate habitat; (iv) good health; (v) opportunities to exhibit natural behaviour; and (vi) a positive emotional state. In this advisory report, we focus on one of these principles: good animal health. In doing so, we explore what is needed to maintain the current level of animal healthcare in the Netherlands, and to improve it where possible. We focus particularly on 'production diseases'. These diseases are multifactorial: they are caused by a combination of factors relating to the livestock farm (e.g. housing, barn climate and farm management) and factors in the livestock farming system as a whole (e.g. breeding and practices within the chain). These diseases may arise if some or all of these factors are not properly aligned with the needs of the animals. In many cases a germ (pathogen) or combination of pathogens may also play a role in the development of such diseases. We also address infectious diseases. Although production diseases can also be infectious, in this advisory report, we use the term 'infectious diseases' to refer to monofactorial infectious animal diseases. Each of these diseases is caused by one specific pathogen. Production-related factors (e.g. housing and management) play a less prominent role in infectious diseases than they do in production diseases. In this advisory report, we draw a distinction between 'regulated' and 'unregulated' infectious diseases. Responsibility for the control and prevention of regulated infectious diseases rests with the national government, under the national implementation of the European Animal Health Regulation. For the control of unregulated infectious diseases, primary responsibility rests with individual animal keepers or the livestock farming sector.

Although many initiatives have already been taken to improve animal health within the livestock farming sector, the Dutch system of animal healthcare should direct additional specific attention towards the approach to production diseases and unregulated infectious diseases. In recent decades, the government has focused primarily on regulated infectious diseases, with less attention to production diseases and unregulated infectious diseases.

Production diseases

The sectors have undertaken several actions to address production diseases, including mastitis (udder infection), leg and foot diseases, and respiratory diseases. Given the multifactorial nature of this type of disease, however, the approach is complex, and actions that have been taken thus far have not proven to be very effective. To properly identify production diseases and their underlying causes, it is essential to understand the animal health situation of the majority of farms in each sector. The collection of monitoring data at the farm level and the comparison of these data between farms (benchmarking) could help to identify production diseases and target problems more effectively. This could prevent a fragmented approach with insufficient results. For production diseases about which much is already known and the incidence of which varies widely between farms, current livestock farming systems often offer short-term opportunities for reducing incidence or severity (e.g. through changes in farm management and preventive measures). To reduce production diseases in the long term, it is especially important to explore how system changes (e.g. broader changes in housing and chain structure) could contribute to prevention.

The development of new, humane livestock farming systems is changing the way in which production animals are kept. This calls for knowledge development and new expertise. Due to the lack of scientific research, the development of new in-depth knowledge on production diseases is lagging behind the need. As a result, the available body of knowledge is sometimes incomplete or outdated. The lack of research also means that hardly any experts are being trained to help solve these problems in the future. It is important for new knowledge to be integrated and transferred in training within the animal sector. In doing so, it would be useful to develop a recognised higher vocational training programme to increase efficiency within the sector and alleviate the shortage of veterinarians.

Infectious diseases

It is important to properly maintain and, where possible, improve animal healthcare in relation to infectious diseases, especially with regard to unregulated infectious diseases. The risk that emerging infectious diseases will enter the country is likely to increase in the future, and proper preparation for such scenarios is necessary. Developing a proper overview of the status of unregulated infectious diseases in the Netherlands requires proper monitoring and the sharing of monitoring data. In this regard, it is useful to combine national monitoring data on unregulated infectious diseases in production animals with other data (e.g. monitoring results from wild animals, animals used for grazing, hobby animals and pets, and humans). Identified trends or sudden changes within any of these groups could contribute to the timely management of infectious diseases within the livestock farming sector.

The prevention and control of unregulated infectious diseases is not always easy, due to factors including a lack of funding for research and the absence of a party that can take primary responsibility for prevention or control. In addition, knowledge development in this area is insufficiently secured, as is that on emerging infectious diseases. The more that is known about how specific infectious diseases arise, the more effective prevention efforts can be made.

Veterinary medicinal products

Of particular concern is the shortage of veterinary medicinal products, which is likely to grow. If effective monitoring, benchmarking and prevention reduce the prevalence of animal diseases, the demand for veterinary medicinal products may decrease, thus potentially reducing the pharmaceutical industry's interest in developing and marketing them (the prevention paradox). This could further strain the availability of veterinary medicinal products, and hence curative care for production animals. At present, veterinary medicinal products for rare diseases and for less commonly kept species are already scarce, or even unavailable. In the future, the shortage of veterinary medicinal products may also play a greater role in the larger livestock farming sectors. There is a need for a list of essential veterinary medicinal products for production animals, the future availability of which should be guaranteed.

Antibiotic resistance poses a challenge in efforts to fight bacterial infections. To combat antibiotic resistance, measures are being taken with regard to both humans and animals. To prevent resistance, the government has made some groups of antibiotics unavailable for use in animals, or only under strict conditions. As a result, not all existing antibiotics are allowed for veterinary use, with the result that animals cannot always be treated appropriately.

Conclusions

We conclude that, although healthcare for production animals in the Netherlands has developed and improved considerably in recent decades — particularly with regard to regulated infectious diseases — greater attention should be directed towards production diseases and unregulated infectious diseases. Curative care for production animals is another concern.

This is having greater or lesser effects on the welfare of animals with infectious or production diseases. Given society's increasing focus on animal welfare and the government's commitment to humane livestock farming, it is necessary to find ways to reduce the prevalence of production diseases and unregulated infectious diseases. We conclude that there is a need to develop a strategy to improve and maintain animal healthcare for production animals in the future. This calls for a programme-based, public-private and cross-farm approach to reducing and, where possible, preventing animal welfare problems due to production diseases and unregulated infectious diseases. In addition to the explicit inclusion of animal health aspects in the design (or re-design) of animal housing systems, we recommend working towards a future-oriented national agenda for animal health for production animals centring on animal health.

Recommendations

1. Establish a future-oriented national agenda for animal health

The government should cooperate with the livestock farming sector, the scientific community and NGOs to capture the shared ambition for reducing the incidence and prevalence of production diseases and unregulated infectious diseases in an agenda for animal health for the future.

2. Promote the development and sharing of knowledge

- *Develop a benchmarking system for production diseases.* In a public-private partnership, objectively determine which production diseases require attention (those with the highest burden of disease), and assign a priority to each disease. Develop a benchmarking system for each production disease, with the aim of reducing the prevalence of these diseases, starting with the highest-priority disease.
- *Develop a collaborative structure for research and knowledge development.* The government should promote collaboration between the government, industries and knowledge institutions to enable fundamental research on production diseases, infectious diseases and animal health within the context of humane livestock farming.
- *Encourage training opportunities.* The government should ensure that public and/or private funding is made available to train specialists in the field of production animal health. It should also encourage the establishment of a recognised degree programme in animal health at the level of universities of applied sciences.

3. Maintain animal healthcare in relation to regulated infectious diseases

Continue prevention and control measures against regulated infectious diseases at current levels. In addition to their importance to the economy, food security and public health, these issues are also important to animal welfare.

4. Establish requirements for the prevention and control of unregulated infectious diseases

From a public-private partnership, provide opportunities to regulate measures to prevent or control unregulated infectious diseases at the sector level. In these efforts, take full advantage of the new opportunities that the Dutch Animal Health Fund (DGF) will offer from 1 January 2025.

5. Ensure the adequate availability of veterinary medicinal products

The government should consider compiling a list of essential veterinary medicinal products for production animals within the Dutch context, in order to ensure the availability of these products.

6. Integrate animal health into the animal-centred design (or re-design) of livestock farming systems

Integrate the prevention of infectious diseases and production diseases, as well as the promotion of animal health, into the design of new livestock farming systems. The government should encourage the animal-centred design (or re-design) of these systems, focusing on the six guiding principles of humane livestock farming.

Terminology and abbreviations

Explanation of terms

Production disease

For the purposes of this advisory report, a production disease means a condition:

- caused by a combination of factors (multifactorial disease);
- the occurrence of which is related to the conditions on the livestock farm where the animals are kept (e.g. housing, barn climate, farm management, animal care, quality of nutrition and feeding systems);
- the occurrence of which may also be associated with factors related to the livestock farming system as a whole (e.g. breeding, working methods within the chain, such as the way animals are grouped);
- sometimes involving specific pathogens (e.g. E. Coli in the case of diarrhoea in young animals) or a combination of different types of pathogens (as in the case of mastitis in cattle);
- for which it is usually not realistic to expect complete absence on a farm, given the multitude of causal factors (Bergevoet et al., 2010).

Examples of production diseases include respiratory diseases in pigs, veal calves and broilers; and udder infections, foot problems and lameness in various animal species.

Infectious disease

For the purposes of this advisory report, an infectious disease means a monofactorial infectious animal disease — an animal disease caused by one specific pathogen (e.g. a virus or bacterium). These pathogens may or may not be transmitted from animal to animal through specific vectors. It is usually possible to fight the pathogens — for example, with antibiotics, antifungal or antiprotozoal agents; with a vaccination strategy; or by controlling the vectors that transmit the disease. Successful control could lead to the sharp reduction or even the complete eradication of the pathogen, at least at the local level.

The Animal Health Law/European Animal Health Regulation (EU, 2016) and Implementing Regulation (EU, 2018) of the commission classify communicable animal diseases into five categories: A, B, C, D and E. This classification is based on aspects including the severity of the disease's impact on public and animal health, as well as its economic, social and environmental impact. For each category, obligations and permitted courses of action (monitoring, control, prevention) have been formulated for public authorities.

- Diseases in Category A do not usually occur in the EU. Based on international agreements, immediate eradication measures should be taken immediately upon discovery of such diseases. Examples include swine fever, foot-and-mouth disease (FMD) and highly pathogenic avian influenza (HPAI).
- Diseases in Category B should be controlled in all member states, with the aim of eradicating them throughout the EU.
- Diseases in Category C are relevant for some member states. Measures are needed to prevent their spread to other parts of the EU that are officially disease-free or in which an eradication programme for the disease in question is in operation.
- Diseases in Category D require measures to prevent their spread through entry into the EU or movements between member states.
- Diseases in Category E require surveillance within the EU, meaning that notification must be made if there is reason to suspect that the disease is present, as well as in any outbreak.

This advisory report draws a distinction between 'regulated' and 'unregulated' infectious diseases. Responsibility for the control and prevention of regulated infectious diseases rests with the national government, under the national interpretation of the European Animal Health Regulation. For the control of unregulated infectious diseases, primary responsibility rests with individual animal keepers or the industry.

Animal welfare

In 2020, the Council published a conceptual framework (Dutch Council on Animal Affairs [RDA], 2020c) to clarify commonly used concepts related to animals and the relationship between humans and animal. On the subject of animal welfare, this conceptual framework contains the following definition, as viewed from the perspective of the animal: *'Animal welfare is the quality of life as experienced by the animal itself'. An animal experiences a positive state of well-being if it is free to perform normal patterns of behaviour specific to its species and can respond adequately to the challenges posed by its environment.*

To achieve a positive state of well-being for production animals, the Council has established six guiding principles: (i) recognition of the intrinsic value and integrity of the animal; (ii) good nutrition; (iii) appropriate habitat; (iv) good health; (v) opportunities to exhibit natural behaviour; and (vi) a positive emotional state. (Dutch Council on Animal Affairs [RDA], 2021b).

Animal health

A healthy animal can be defined as one that is free from disease (such as infectious diseases or production diseases), injury, physical abnormalities or behavioural abnormalities that may impair welfare or normal functioning (including resistance to disease and diseases). Animal health is thus an essential component of animal welfare. Good animal health is one of the pillars of humane livestock farming.

Incidence

The incidence of a condition is the fraction of the population contracting the disease within a given period (i.e. the percentage of new cases within a given period).

Prevalence

The prevalence of a disease is the fraction of the population with the disease at any given time (i.e. the percentage of existing cases at any given time).

Emerging (infectious) diseases

For the purposes of this advisory report, emerging (infectious) diseases mean (infectious) diseases that are new to an area or that the incidence of which has recently increased relatively rapidly. They are diseases for which good prevention or treatment is generally not (or not yet) possible.

Minor uses

Within the context of veterinary medicinal products, minor uses mean situations in which a particular medicine is needed for the treatment or prevention of a disease or condition in certain animal species, but the market demand for that specific use is limited. This may be because it involves less common animal species, rare diseases or specific production systems. The designation of a use as 'minor' is usually based on criteria such as the number of animals affected, the prevalence of the condition or the availability of alternative treatments. Pharmaceutical companies may be less inclined to invest in the development and market authorisation of veterinary medicinal products for minor uses, due to an overly limited market demand and/or insufficient return on the investment required for the development and/or market authorisation of a veterinary medicinal product for that purpose.

Minor species

Within the context of veterinary medicinal products for food-producing animals, minor species are animal species that are currently kept less commonly than cattle, pigs, sheep for meat production, and chickens. Examples of minor species include goats, ducks, horses, camelids, rabbits and turkeys.

Livestock farming systems

In this advisory report, the term 'livestock farming systems' refers to the entire chain surrounding the livestock farming sector. A livestock farming system comprises livestock farms with their own operations and housing systems, as well as actors involved with animal nutrition, animal healthcare and retailing. The plural term is used in order to indicate the existence of livestock farming systems for different types of production animals (such as dairy cattle, poultry and pigs), as well as the existence of different types of systems (such as traditional and organic).

Zoonotic/zoonosis

An infectious animal (or other) disease that can pass from animals to humans (zoonosis) or, conversely, from humans to animals (anthroozoonosis).

Abbreviations

- AI: Avian influenza
- ASF: African swine fever
- BVD: Bovine viral diarrhoea
- COVID-19: Coronavirus disease 2019
- CSF: Classical swine fever
- DIVA vaccines: Differentiating infected from vaccinated animals
- EMA: European Medicines Agency
- EUP AH&W: European Partnership on Animal Health & Welfare
- FMD: Foot-and-mouth disease
- (Royal) GD: Animal Health Service
- HPAI: Highly pathogenic avian influenza
- IBR: Infectious bovine rhinotracheitis
- KNMvD: Royal Dutch Society of Veterinary Medicine
- LPAI: Low pathogenic avian influenza
- LNV: Ministry of Agriculture, Fisheries, Food Security and Nature, formerly LNV:
Ministry of Agriculture, Nature and Food Quality
- NVWA: Netherlands Food and Consumer Product Safety Authority
- NWO: Dutch Research Council
- PRRS: Porcine respiratory and reproductive syndrome (blue ear disease)
- RDA: Council on Animal Affairs
- SDa: Netherlands Veterinary Medicines Institute
- SPC: Summary of product characteristics
- SVD: Swine vesicular disease
- VHD: Viral haemorrhagic disease
- WVAB: Dutch Veterinary Antibiotic Policy Working Group

1. Background to this advisory report

The Netherlands aims to achieve a humane livestock farming sector in which the welfare and health of production animals are central. The interests of the economy, food security and public health have played an important role in the design of the current livestock farming systems. Currently, however, the social focus on animal welfare is increasing. Meanwhile, the livestock farming sector is also facing a variety of challenges, including the emergence of new disease risks due to climate change. In this advisory report, the Council on Animal Affairs explores the current state of animal health in the livestock farming sector, future challenges in this area, and the steps needed to achieve dignified and future-oriented healthcare for production animals.

1.1. A changing world

Interests relating to the economy, food security and public health have played an important role in the design of the Dutch livestock farming sector, its chains and Dutch animal health policy (Koolmees, 2007). Motivated by the food shortage in Europe before and during the Second World War, the government, livestock farmers and market operators have worked to produce more and more food products of animal origin more efficiently and at the lowest possible cost (Fraser et al., 2001; Rollin, 2004). European policies have also been customised to these aims. The Dutch livestock farming sector operates within a liberal and highly internationalised market, within which margins are low. The Dutch livestock farming sector is subject to various European regulations, including the European Animal Health Regulation (EU, 2016). In addition, a variety of national laws and regulations exist with regard to livestock farming, animal health and animal welfare, including the Animals Act, the Animal Keepers Decree, the Animal Health Decree, the Animal Health Regulation and the Veterinary Medicines Regulation. Existing laws, regulations and practices within the sectors do not always take sufficient account of the interests of animals.

Shifting attitudes towards animals

In the publications *The State of the Animal in the Netherlands* (Dutch Council on Animal Affairs [RDA], 2020b) and *State of the Animal 2024* (Dutch Council on Animal Affairs [RDA], 2024) the Dutch Council on Animal Affairs (RDA, hereinafter indicated by 'we') described that most Dutch people believe that animals have their own inherent value, which is independent of their utility to humans. We have observed a growing respect for animals in society. This means that animal welfare is becoming increasingly important, and we can expect new challenges — in addition to the existing ones — with regard to the handling of animals.

Existing and future challenges in the livestock farming sector

Due in part to the increasing focus on animal welfare in the Netherlands, as well as in other EU countries, many current livestock farming systems are under discussion. These systems contain risks to the health of production animals. Examples include sub-optimal housing (e.g. slippery floors, little space to move), a sub-optimal housing climate and long animal transports (see Appendix 1). Housing, management and handling all affect the welfare and health of production animals, and they require more attention. In addition, the international context within which the Dutch livestock farming sector operates also affects the welfare and health of production animals, as this context influences the operations of livestock farmers.

In addition to challenges relating to animal welfare, the livestock farming sector is currently facing significant challenges relating to nature and the environment. Examples include adapting to the impacts of climate change, reducing the livestock farming sector's contribution to climate change, biodiversity loss and the degradation of water quality. It is important to reduce emissions of ammonia, nitrogen oxides, minerals (e.g. phosphates and nitrates) and greenhouse gases (e.g. methane). Continued attention is also needed in order to prevent antimicrobial resistance and zoonotic disease outbreaks (Bekedam et al., 2021; Holmes, 2022). Although the livestock farming sector has already made great progress in certain areas (e.g. a significant reduction in antibiotic use in production animals), further adjustments are needed to address the various challenges. In this regard, it is worth remembering that, even though systemic change can solve problems, it can also create new challenges.

Other developments will also play a role in future challenges. For example, we expect diversity in livestock farming systems to increase.¹ In addition to traditional animal species, other animal species (e.g. insects and fish) are already being kept for production purposes in the Netherlands. In the future, it is possible that — if legally permitted — additional animal species will be kept for production, each with its own animal health challenges. Climate change and globalisation may also lead to the emergence of new animal health problems in our country (e.g. heat stress), or to the emergence or endemicisation of infectious diseases, as has happened with avian influenza. Knowledge development and research are important in order to be prepared for these new challenges. New knowledge and expertise are needed in order to promote animal health and effectively address animal diseases in the diverse livestock farming systems of the future. New veterinary medicinal products and strategies for controlling animal diseases may also be needed.

¹ This expectation is based in part on the ongoing discussions relating to the covenant on humane livestock farming and the development of new concepts, such as *Herenboeren* ('Gentlemen Farmers') ([herenboeren.nl](https://www.herenboeren.nl)).

1.2. Humane livestock farming

In the advisory report *Humane livestock farming*, we recommended assigning central importance to the welfare of production animals in the livestock farming sector of the future (Council on Animal Affairs, 2021a). We introduced six guiding principles needed for animal well-being in the sector: (i) recognition of the animal's intrinsic value and integrity; (ii) good feeding; (iii) good housing; (iv) good health; (v) opportunities to perform natural behaviour; and (vi) a positive mental state. In May 2024, a bill was passed containing measures to be taken to achieve humane livestock farming by 2040 for four livestock sectors (dairy cattle, pigs, chickens and calves) (Rijksoverheid, 2024). Developments towards humane livestock farming should take place according to the six guiding principles we have drafted, which have now been incorporated into the Animals Act.

Consistent with the advisory report *Humane livestock farming*, we once again emphasise that the health of production animals should be explicitly included in the design of future livestock farming systems, as animal health is a crucial element of animal welfare. First, it is important to identify where animal health problems occur in current livestock farming systems (including the working methods within the chain). These insights should be addressed wherever possible in current livestock farming systems, and they should be further integrated into the design of future livestock farming systems. These new designs should take into account potential opportunities for and threats to animal health.

Careful consideration

Livestock farming systems can be developed to minimise the risk of introducing pathogens whilst also performing other functions (e.g. providing more space per animal and comfortable resting areas). It is important always to carefully weigh the positive and negative impacts of potential adaptations in systems and to take into account all guiding principles for humane livestock farming. This is because technological (or other) adaptations can sometimes have a positive impact on one principle whilst creating risks for another principle. For example, free-ranging meets several of the guiding principles. Research has shown that free-ranging can prevent or reduce problem behaviour in pigs and chickens (Ludwiczak et al., 2021; El-Deek & El-Sabrou, 2019). Moreover, direct sunlight provides natural absorption of vitamin D, thereby strengthening the immune systems of these animals (Cuthrell, 2022). At the same time, free-ranging also poses risks, including heat stress, poisoning by plants or surface water, uptake of contaminants that may pose a risk to food safety, and an increased risk of transmitting parasites or other pathogens through contact with wildlife or other kept animals (e.g. avian influenza and African swine fever; Sutherland et al., 2013).

Measures to reduce the impact of the livestock farming sector on the environment also pose risks to animal health. For example, consider the drastic reduction of the protein or phosphate content of feed in order to reduce emissions. Although some degree of adjustment in rations is probably possible, it is necessary to prevent animals from becoming deficient in essential nutrients (WUR, 2020). Another example could be air scrubbers that are designed to reduce ammonia emissions. These devices can sometimes worsen the climate in the barn, thereby posing risks to the health of both the animals and those who look after them (Wakker Dier, 2016). It is important to strike a balance between the benefits and potential risks of adaptation to animal health, as well as in relation to the other guiding principles and other interests. Before this balance can be achieved, it is good to explore what the optimal situation for each principle would be, what the effects of adjustments to the various principles are and how the principles affect each other. These insights could be used to assess how to achieve an optimal balance between the six guiding principles and other interests.

1.3. In this advisory report

In this advisory report, we focus on one of the six guiding principles for humane livestock farming: good animal health. In doing so, we explore what is needed to maintain the current level of animal healthcare in the Netherlands, and to improve it where possible. We discuss issues related to the monitoring, benchmarking and prevention of animal diseases; the treatment of sick animals; the development and dissemination of knowledge; and the availability and use of veterinary medicinal products. We describe the current challenges relating to animal health within the livestock farming sector and the future challenges relating to developments towards humane livestock farming and other concerns (e.g. climate change). We focus here on production animals kept on farms, but some aspects may also be relevant for hobby animals and animals used for grazing in nature reserves. This is because these animals may encounter the same diseases, monitoring systems, laws and regulations.

Production diseases

A significant part of this advisory report concerns 'production diseases'. These diseases are multifactorial: they are caused by a combination of factors on the livestock farm (e.g. housing and farm management) and/or in the livestock farming system (e.g. working practices). These diseases may arise if some or all of these factors are not adequately arranged for the animals. In some cases, a specific pathogen plays a role, whilst in others, a combination of several pathogens is at issue.

Some production diseases occur in several animal species (e.g. diseases of the legs or respiratory tract, and health problems in young animals). Other diseases are more species-specific, as is the case for mastitis (mainly in cows) and ectoparasites (mainly in poultry). The incidence of production diseases can be reduced by modifications to housing and/or operations and/or the chain. Although several sectors have made efforts in this regard in recent years, the prevalence of these diseases has often not decreased much, if at all throughout the sector as a whole. This is partly because veterinary care has often focused on controlling the pathogen that was known as the primary pathogen. This approach has not proven very effective, due to the multifactorial nature of this type of disease.

Infectious diseases

In this advisory report, we also focus on infectious diseases. Although production diseases can also be infectious, in this advisory report, we use the term 'infectious diseases' to refer to monofactorial infectious animal diseases. Each of these diseases is caused by one specific pathogen. That said, the spread of infectious diseases is affected by a variety of factors, including transport and/or hygiene measures, and the severity of the disease is affected by factors including the animals' general health and immunity to disease. For infectious diseases, farm-related factors (e.g. housing and management) – with the exception of biosafety measures to prevent the entry or spread of pathogens – play a less prominent role than they do for production diseases.

This advisory report draws a distinction between 'regulated' and 'unregulated' infectious diseases. Responsibility for the control and prevention of regulated infectious diseases rests with the national government, under the national interpretation of the European Animal Health Regulation. For the control of unregulated infectious diseases, primary responsibility rests with individual animal keepers or the industry. The prevention of infectious diseases almost always requires a collective sector-wide (and sometimes even cross-sectoral) approach, regardless of whether the disease is or is not one for which the government takes responsibility. Individual livestock farmers can take biosafety measures and ensure that the animals have strong immunity to disease (e.g. by vaccination), but this also depends on the actions of others in keeping the farm free of the disease. For example, this is the case for infectious bronchitis in chickens.

Challenges and opportunities for improvement

Many initiatives have already been taken to improve animal health in the livestock farming sector. Examples include the development of animal health monitoring by the Animal Health Service (GD) and Track 4 of the Dutch Coalition of Vital Pig Farming. Nevertheless, even more attention should be devoted to addressing production diseases and unregulated infectious diseases within the system of animal healthcare in the Netherlands. In recent decades, the government has focused primarily on macroeconomics/microeconomics, food security and public health, with less attention to

production diseases and unregulated infectious diseases. To address societal concerns about animal welfare in the livestock farming sector, it is important to explore where improvements could be made. In this advisory report, we explore the current state of animal health in the livestock farming sector, the future challenges in this area, and the steps needed to achieve animal-friendly and future-oriented healthcare for production animals.

2. Animal health in livestock farming in 2024

Considerable progress has been made in the field of animal health in recent decades, especially in the control of infectious diseases. In the process, the government has focused mainly on highly contagious infectious diseases that pose a risk to macroeconomics (exports and trade), food security or public health (zoonoses). In addition, much has been achieved in reducing veterinary antibiotic use in order to decrease the risk of antibiotic resistance. There is nevertheless still much to be gained in terms of reducing production diseases and unregulated infectious diseases, as well as in care for individual animals.

2.1. Production diseases

Despite efforts from within sectors, the prevalence of production diseases — such as mastitis (udder infection), leg and foot diseases (see Box B), respiratory diseases, reproductive health problems, non-hereditary metabolic disorders, various diseases and excess mortality in young animals and gastrointestinal diseases — has declined to only a limited extent, if at all, in recent decades. Production diseases occur to some extent on almost all farms. Depending on the farm, the animal species involved and the nature of the disease, production diseases can lead to relatively high levels of disease incidence, disease burden, disposal and mortality (Bruijnis et al., 2012; WLR, 2020). Production diseases have a negative impact on animal welfare.

In the past, the approach to production diseases often focused primarily on controlling the pathogen known to be one of the causes of the disease in question. This approach has not proven very effective, however, due to the multifactorial nature of this type of disease. The onset and incidence of production diseases depend on many factors, including the quality of housing (e.g. the hardness and slipperiness of floors), the quality of care (e.g. the amount, composition or method of feeding), barn climate, hygiene, water quality, density of animal stock, genetic factors affecting the animals' immunity to disease, the functioning of the chain and the pathogens present on the farm (Van Klink & Van Roermund, 2021). Controlling one type of pathogen thus does not guarantee that the disease will disappear, as another pathogen could take over the role of the controlled pathogen. The prevalence of the disease cannot be reduced effectively until the other underlying factors (e.g. breeding, housing and nutrition) have been addressed as well.

Although veterinary care currently has a strong focus on farm management, paying close attention to farm conditions, the incidence of production diseases in production animals remains high. More attention is needed to addressing the various causal factors simultaneously in order to achieve a true reduction of these diseases. When addressing production diseases, it is important to consider multiple causal factors, in addition to addressing the suspected primary cause (e.g. a pathogen). The prevalence of the disease cannot be reduced effectively — and the welfare of individual animals can thus not be protected — until the other underlying factors (e.g. breeding, housing and nutrition) have been addressed as well.

Change in ownership

Individual livestock farmers bear primary responsibility for the health of their animals. They are the ones who should make efforts to prevent and solve production diseases as soon as possible. In practice, however, it is sometimes very challenging for them to meet this responsibility, as the incidence of production diseases is influenced by several factors. In addition, there are hardly any guidelines for monitoring and controlling production diseases. Some certification systems do include the incidence of certain production diseases, however, and an incidence above a certain lower limit may have implications for a livestock farmer. To date, the government's policy has not called for imposing any additional animal health rules on top of European rules. This could complicate the mandatory monitoring and control of production diseases. In the Netherlands, the prevention and management of production diseases in the livestock farming sector are seen as a private or sector-specific responsibility. For this reason, initiatives by actors in various sectors (e.g. livestock farmers, suppliers of animal housing or equipment, the feed industry, the pharmaceutical industry, research institutions, supermarkets) — both individually and in partnerships — are decisive.

Until 2015, there were product boards (public-law organisations of companies within the same production column) that were authorised to impose levies on companies affiliated with the product board (e.g. to finance research on production diseases). The product boards were also empowered to adopt binding rules on matters including monitoring and vaccination. On 1 January 2015, however, they were abolished by law. This shifted the funding, communication and central control of the approach to production diseases to parties within the sector.

Various sector parties are taking initiatives to research production diseases and improve prevention or approaches to addressing them. There are nevertheless major differences between the livestock farming sectors in terms of financial space, level of organisation and clout, and there is often a lack of coherence between initiatives. Sector parties like ZuivelNL (dairy farming), AVINED (poultry farming), Covina and the Dutch Veal Industry have established research programmes that include activities to address production diseases. If these sector parties are sufficiently representative of their sectors, the central government may authorise them, if desired, to levy a contribution from all

livestock farmers within their sectors to fund these research programmes. For smaller sectors (e.g. the dairy goat, beef cattle and rabbit farming sectors), this route has proven more difficult, and it provides fewer resources.

Insufficient knowledge and monitoring

Scientific knowledge concerning the multitude of factors that influence the onset, incidence and prevalence of production diseases — and especially on the interaction between various factors — is largely fragmented and incomplete. As a result, it is not always possible to manage these diseases effectively. This is partly because investment in research on production diseases is not always interesting from an economic perspective. Reducing the prevalence of production diseases nevertheless requires knowledge. The acquisition of such knowledge requires collecting and analysing data on production diseases. This is already being done for several diseases in the GD's Animal Health Monitoring, in which livestock farmers can participate anonymously and on a voluntary basis. It is important to realise that the data obtained through this instrument are not suitable for making statements about the prevalence of certain production diseases in the Netherlands unless all farms participate in the study or a representative sample of the livestock is taken. Major differences between sectors exist in terms of voluntary monitoring and data collection in relation to production diseases. Initial steps towards monitoring are being taken in some sectors. For example, bacteriological and virological monitoring are being encouraged in the insect farming sector.

Even when a large amount of knowledge on addressing a production disease is available, this knowledge is not always sufficiently applied in practice. For example, there is a large body of knowledge about the prevention of health problems in young animals, but intervention is often not carried out until these health problems have already occurred, instead of engaging in structural prevention measures (see Appendix 2). In a 2012 report on production diseases on sheep, goat and horse farms, researchers from Wageningen Livestock Research wrote the following: *'Implementation of these "technical" solutions on the livestock farm hinges on acceptance by the individual livestock farmer and the overall chain structure within which the individual livestock farmer acts as a link. The way in which animal health issues are viewed within the overall sector plays a role as well.*

Knowledge transfer and communication can play an important role amongst livestock farmers. Especially in production diseases, breaking fixed patterns and routines (corporate blindness) can be decisive' (Bokma-Bakkers et al., 2012). Although this report is now 12 years old, these conclusions remain as relevant as ever.

2.2. Infectious diseases

In our densely populated country, in which livestock density is high and in which many national and international transports of animals and animal products take place, there is a significant risk of outbreaks of regulated or unregulated infectious diseases. For example, this was demonstrated once again by the outbreak of bluetongue disease in the summer of 2023. In addition, there is always a chance of a zoonotic outbreak; consider the epidemic of Q fever in 2007. It is therefore necessary to closely monitor both regulated and unregulated infectious diseases and take preventive measures to minimise the risk of animal-to-animal or animal-to-human transmission (Bekedam et al., 2021; Royal GD, 2023).

The European Animal Health Regulation requires countries to report all cases or suspicion of certain contagious animal diseases and take measures to prevent further spread (EU, 2016). A list of animal diseases that are subject to mandatory notification has also been compiled in the Netherlands. Diseases on this list include anthrax, VP/ASF, HPAI and FMD (NVWA, 2024). In case of clinical signs suggesting an animal disease that is subject to mandatory notification, animal holders, veterinarians or laboratories should report to the national animal disease hotline. The Animal Health Regulation also requires each member state to establish a system for monitoring designated and emerging (new) animal diseases in production animals and horses. In the Netherlands, this monitoring is carried out by the GD, which is designated as a legal entity with a statutory duty for this purpose. The GD collects signals from the field both reactively and proactively, and it analyses them, prepares reports with conclusions and recommendations, and informs relevant parties about the findings.

Monitoring programmes

In several livestock farming sectors in the Netherlands, considerable progress has been made in monitoring both regulated and unregulated infectious diseases in recent decades. For example, market players in the dairy sector have established monitoring and certification programmes for various pathogens that can cause disease symptoms in animals or humans, including salmonella, paratuberculosis, infectious bovine rhinotracheitis (IBR) and bovine viral diarrhoea (BVD). In the poultry sector, salmonella and campylobacter are monitored, and there are initiatives to conduct research with sector funds based on the Research and Innovation Agenda for the Netherlands Poultry Sector (AVINED, 2023). The rabbit farming sector monitors for VHD, myxomatosis and intestinal health (including coccidiosis). Within the sheep farming sector, maedi-visna, foot rot and scrapie are monitored. For pigs, there is monitoring for Aujeszky's disease and salmonella. The GD's Online Monitor is used to monitor the health of pigs, cattle, poultry, small ruminants and horses (Royal GD, 2024). Some of the pathogens listed here (e.g. salmonella and campylobacter) are alimentary zoonoses, meaning that people can be infected by them if they eat contaminated products, possibly resulting in illness and, in some cases, even death. These pathogens thus have an impact on public health.

Animals carrying such a pathogen do not necessarily become ill (at least, not seriously ill) themselves. In such cases, therefore, the animals themselves have no direct interest in the control, but the measures taken against the infectious disease can nevertheless have an effect on their welfare.

Some initiatives of market players are cross-sectoral (e.g. the Dutch Coalition of Vital Pig Farming), and others are not. As with production diseases, the degree of organisation and the financial strength of sectors determine the extent to which they are able to initiate their own research or establish monitoring programmes. Although larger sectors tend to have financial clout, the collective base of support in several sectors is under pressure, making it difficult or impossible for programmes to get off the ground. Small sectors often do not have the resources to establish this kind of monitoring (WLR, 2021), but the small scale sometimes makes it easier to reach agreements.

2.3. Care for individual animals

With economies of scale in the livestock farming sector, the focus of livestock farmers has shifted in recent decades from the individual animal to the flock (a group of animals kept together) or all the animals on the farm. Preventing disease in a flock has been receiving more attention, and there is less focus on individual animals. Nevertheless, it remains the responsibility of a livestock farmer to provide adequate care to individual sick animals.

Sector parties within the Dutch livestock farming sector have already taken steps and continue to make efforts to further improve animal health — not only at farm level, but also for individual animals. Examples include sector-specific animal health programmes, like *KalfOK* in the dairy farming sector (ZuivelNI, 2023) and the PRRS approach in the pig farming sector (Dutch Coalition of Vital Pig Farming, 2023). Other examples include labels, such as the Better Life label (Beter Leven, 2023) and 'On the way to Planet Proof' (PlanetProof, 2024), which have included criteria for the health of individual animals in their animal welfare standards. Participation in such programmes and labels requires livestock farmers to make farm adjustments (e.g. adjustments to animal housing and farm operations). Important factors that play into decisions concerning whether to make such adjustments include the extent of organisation within the chain (with highly organised chains having more direction and power to follow through), the personal capabilities of individual livestock farmers and the extent to which higher costs for farm adjustments can be recovered in the market. Some developments have taken place in the use of measurement systems that also collect information at the level of individual animals. Provided this information is properly interpreted and followed up, it can improve monitoring of individual animals.

Attitudes of individual livestock farmers

Because livestock farmers bear primary responsibility for the health of their animals, it is essential for them to be aware of the animal health problems that their animals may face. It is important for livestock farmers and their advisers to recognise and acknowledge animal health problems, to know how to address them effectively and to act accordingly. The actions taken depend heavily on the awareness, attitude and action perspective of the livestock farmer. Livestock farmers vary in terms of their willingness to take certain measures, depending on the situation and possibilities. Recent research on addressing excessive antibiotic use highlights the importance of also including the knowledge, attitudes and behaviour of livestock farmers in animal healthcare (Prinsen et al., 2024; Lesscher, 2023). In earlier studies, Valeeva and colleagues (2007) and Huijps and colleagues (2010) report that dairy farmers in the Netherlands follow advice to prevent mastitis to only a limited extent. In a questionnaire study, Bruijnis and colleagues (2013) examined the intention of dairy farmers to improve the foot health of their dairy cows. Most livestock farmers were apparently satisfied with the status of foot health status on their farms. Although they considered it important to provide good care to their cattle, the cost-effectiveness of measures in that study seemed to outweigh improving foot health (see Appendix 3 for additional details).

3. Future prospects for production diseases

In Chapter 2, we concluded that, despite efforts by the sectors, there are areas for improvement in the prevention and management of production diseases. Developments in the direction of humane livestock farming and external factors (e.g. climate change) will also bring new challenges. Additional efforts will therefore be needed, both now and in the future, to reduce the prevalence of these diseases in order to improve the welfare of production animals. These efforts include monitoring and benchmarking, prevention and knowledge development. A multifactorial approach focusing on the entire livestock farming system is needed. Some improvements can already be implemented in current systems. Other improvements will require a concerted effort by all national and international actors to enable humane livestock farming.

3.1. Monitoring and benchmarking

Proper monitoring of animals is important to the objective and timely identification of animal health problems, both in current livestock farming systems and in the transition to future systems. Data collection and analysis can be used to evaluate the effects of adjustments in systems, and the results can then be used to make targeted adjustments in operations to keep animals healthy. Although many monitoring efforts are already being made in various sectors within the current livestock farming industry and many technological developments are taking place (e.g. in relation to digitisation [RDA, 2020a]), many gains remain to be made in the deployment of monitoring methods and data.

To properly identify production diseases and their underlying causes, it is essential to understand the animal health situation of the majority of farms in each sector. Proper monitoring of key health problems can allow farms to be compared with each other (benchmarking), and successful practices (e.g. on farms with low incidence) can be more easily shared with farms where the incidence of certain production diseases is high. One example is the KalfOK programme (ZuivelNL, 2023), in which livestock farmers gain insight into the mortality and health problems of young cattle on their own farms, as compared to other farms. Such programmes could also be set up in other livestock farming systems and for specific production diseases.

Sharing and combining data

At present, only limited information is known about production diseases at the farm level. For example, less than 10 percent of dairy farms record the incidence of leg and foot defects through DigiKlauw (DigiKlauw, 2024). Through benchmarking with other farms, this registration system enables dairy farmers to gain insight into the foot health of their animals and adjust their foot management where necessary (e.g. through

adjustments in rations, housing, medication or breeding decisions). For pigs, horses, poultry, sheep and goats, hardly any data are available on the occurrence of leg and foot diseases at the individual farm level.

The collection of farm-level monitoring data and comparing between farms within a given sector could make it possible to identify the causes of production diseases and to target problems at the farm level. This could prevent a fragmented approach with insufficient results. For diseases affecting multiple species of animals, monitoring data from different livestock farming sectors could be compared in order to find possible solutions. The timely availability of sufficient monitoring data is necessary for effective control. It would also be desirable for privacy-sensitive information to be made available to parties who need such data to assess situations properly and act in a timely manner. This should include consideration of whether and how this could be arranged within the prevailing legal frameworks, including the General Data Protection Regulation (GDPR). The data might be anonymised by a 'trusted third party'. After the calculations are completed, livestock farmers receive information on the value of their own farms, benchmarked against those of other farms. Thereafter, researchers from the benchmarking institute would not be able to trace the data back to individual livestock farmers. Livestock farmers would play a crucial role in this process, as it is necessary for them to share their data with third parties in order to make this possible.

Identification and registration data (Netherlands Enterprise Agency [RVO], 2023) and registrations of medication use can allow some inferences about the prevalence of production diseases. This is nevertheless insufficient to obtain a complete overview and develop good prevention programmes. Data collected by the Netherlands Food and Consumer Product Safety Authority (NVWA) and slaughterhouses are still underused. For example, leg and foot diseases and residual signs of lung diseases can be detected in slaughterhouses. Incidentally, several developments are ongoing in the field of farm-level monitoring, including a pilot with 'dip stations' (veterinary practices taking measurements) by Utrecht University (commissioned by the NVWA), as well as the development of a benchmark on 'care for young animals' and several sector-specific initiatives. Data ownership remains a concern when sharing data. Livestock farmers fear that data may be misinterpreted by other parties, used for other purposes or, for example, used by the government to impose measures.

Digital technologies

In the current livestock farming systems, where large numbers of animals are often kept on each farm, it is challenging (and sometimes even impossible) for a livestock farmer to monitor all animals individually for production diseases. However, digital technologies that could support such monitoring are in development. For example, sensors and cameras can collect a large amount of information about an animal and its environment. In addition to sensors that record aspects of the barn climate (e.g. temperature, humidity and concentrations of carbon dioxide and ammonia), there are also sensors

that take measurements directly on the animal. Examples include the use of sensors (and biosensors) or cameras to record skin or ear temperature; to detect activity, lameness, coughing, draught and aggressive behaviour; or to determine hormones.

In practice, however, the implementation of these technologies can pose several challenges. For example, implementation can be costly, and many technologies are still in the early stages of development. With cameras to monitor animal behaviour, for example, technological limitations in the algorithms continue to pose a challenge. This is because animal behaviour is influenced by various factors (e.g. social interactions, environmental temperature and housing), such that each algorithm must be customised to the specific situation (Arulmozhi et al., 2021). Other challenges have to do with reading, interpreting and sharing data. For livestock farmers, it can be difficult to interpret sensor data correctly and to conclude from these interpretations what concrete actions to take. As a result, early signs of animal health problems may be missed. The use of sensor data should be made easier (e.g. by using artificial intelligence to translate data into useful information). For example, techniques are currently being developed to translate camera images into information on animal behaviour (Dutch Council on Animal Affairs [RDA], 2020a).

In addition, the problem of limited data sharing that we outlined above often keeps data within the farm. This is a missed opportunity, as there is much to be learned by sharing data (benchmarking, signalling). There are developments in this area, however, including the JoinData platform, which allows livestock farmers to decide with whom (e.g. colleagues, consultants, government, suppliers, customers) they wish to share their farm data (JoinData, 2024). In the pig farming sector, the Sustainable Pork Chain (Keten Duurzaam Varkensvlees) programme focuses on aspects including the collection and sharing of data (KVD, 2024). To further improve and safeguard the health of production animals (whether individually or in groups) in the future, it is important to continue to encourage digitisation and data sharing, including in the field of production diseases — as we also indicate in the Council advisory report *Digitisation of the livestock farming sector* (Dutch Council on Animal Affairs [RDA], 2020a).

3.2. Prevention

For production diseases about which much is already known and the incidence of which varies widely between farms, current livestock farming systems already offer opportunities for reducing incidence or severity. This can be done by taking short-term measures (e.g. operational adjustments, including hygiene) and preventive measures. The effectiveness of these adjustments has been demonstrated by the udder health study conducted between 2005 and 2010 by the Netherlands Udder Health Centre (Uiergezondheidscentrum Nederland, UGCN). In a nationwide programme, dairy farmers were encouraged to make improvements on their farms, including better management concerning the dry-off period, improved resting areas, enhanced hygiene and adapted feed (Booij, 2019). This resulted in a significant decrease in somatic cell count, thus indicating better udder health.

Similar measures could be taken in the short term to prevent a variety of diseases, including foot defects, respiratory diseases and metabolic disturbances. Foot defects are common on dairy farms, with significant negative consequences for animal welfare, as well as financial losses for livestock farmers. (Bruijnis et al., 2012; Edwardes et al., 2022). Short-term measures to reduce foot defects could include improving hygiene, adapting barn floors (e.g. applying a rubber top layer), enabling grazing or adjusting breeding policies. In piglets, neonatal diarrhoea is a common problem, as their gastrointestinal systems are not yet accustomed to solid feed at a young age. Neonatal diarrhoea can be reduced by increasing weaning age, adjusting management with regard to weaning and improving feed management.

It is important to encourage livestock farmers to take such measures. Good cooperation between different actors is indispensable in this regard, as the knowledge and experience of one party can contribute to the awareness of others. For example, studies have shown that the use of colistin to treat birth and neonatal diarrhoea in pigs can be reduced by optimal feed management, for which close cooperation between the feed consultant, veterinarian and livestock farmer is essential (Van Bijnen-Hendrikx, 2023).

Longer term

To reduce production diseases, it is especially important to explore how system changes can contribute to prevention. For example, in the veal sector, reducing the mixing of animals from different origins can help reduce respiratory diseases and gastrointestinal problems. This is because calves from different farms of origin have different microflora (including pathogens) and immunity. When these animals are mixed, this often leads to disease. To reduce the number of respiratory diseases, it is also necessary to focus on improvements in housing and air quality. With regard to foot defects, hard floors and the presence of manure and urine on the floor are risk factors to consider when designing new housing systems (Hut, 2022).

Motivating livestock farmers

One key question concerns how livestock farmers and their advisers can be encouraged and supported in their efforts to identify production diseases in animals and apply the available knowledge on the prevention of these problems in practice. Decisions concerning whether to implement certain measures are influenced by the awareness, attitudes and action perspectives of individual livestock farmers. Finances (cost-benefit) and the impact of measures on the objectives of other livestock farmers (e.g. emission reduction) play an important role in their considerations (Erismanen Poppe, 2020). It is important for livestock farmers to continue to have sufficient perspective for action to treat individual animals.

As suggested by Valeeva and colleagues (2007) and by Huijps and colleagues (2010), fines could encourage desired behaviour amongst livestock farmers. According to a study by De Lauwere and colleagues (2020), some dairy farmers are encouraged by fines or rewards to participate in an animal health programme, whereas others are unwilling to participate regardless of fines or rewards. As asserted by Bruijnis and colleagues (2013), dairy farmers can be encouraged to improve foot health on their farms by providing them with more information on the effects of intervention measures. In addition, a study by Santman-Berends and colleagues (2014) indicates that customised advice based on factual data, epidemiological data and sociological factors helps to reduce calf mortality on farms where it is high. These studies are a first step towards identifying what might encourage or hinder livestock farmers with regard to implementing animal health improvements at the farm level. Data sharing (benchmarking) could also encourage livestock farmers by comparing their own performance with others, which could raise awareness and intrinsic motivation to make improvements.

3.3. Research and innovation

In developments towards future livestock farming systems, both the handling of production animals and the conditions in which they live will change. This calls for knowledge development. In the past, research has been conducted on animal health in current livestock farming systems. For production diseases, such studies have often focused on identifying the pathogens involved in the onset of diseases. It is now clear, however, that adjustments at the farm level or in the chain are essential to the effective reduction of production diseases. Although knowledge on how to achieve such reductions is available, this knowledge is not always widely applied. This is because not all livestock farmers are aware of the possibilities, because practical or economic considerations prevent them from applying them, and because individual livestock farmers are unable to make chain adjustments. The available knowledge is therefore not being used to its full potential. We have also identified gaps in knowledge development that could have major future implications for animal health in the livestock farming sector, at the level of both the farm and the individual animal.

Knowledge development

Based in part on the results of the Animal Content test (Dierinhoudelijke toets) for the roundtable on the Covenant on Humane Livestock Farming (Convenanttraject dierwaardige veehouderij, 2023), we note that there are currently gaps in provisions for research and innovation relating to the health of production animals. The government invests very little in knowledge to reduce the incidence of production diseases. Due to the lack of scientific research, the development of new in-depth knowledge on production diseases is lagging behind the need. As a result, the available body of knowledge is sometimes incomplete or outdated. The lack of research also means that hardly any experts are being trained to help solve these problems in the future.

To effectively improve the health of animals in the livestock farming sector, there is a need for practical research and monitoring, as well as for basic veterinary research on production diseases and ways to increase animal resistance. Examples could include fundamental research on the effects of simultaneous or consecutive infections with different pathogens on respiratory diseases, or on the effect of the density of animal stock on the spread of production diseases within a given farm. Production diseases often have a complex combination of causes that must be investigated both individually and holistically to achieve successful interventions and prevention. These include genetic factors, pathobiological and epidemiological mechanisms, and environmental factors (e.g. housing, care and farm management). Once the causes are clear, it will be possible to examine aspects including how to increase animals' immunity to disease (health promotion), how to prevent the transmission of pathogens between animals (kept and wild), and what would constitute appropriate treatment. In addition, research is needed on how to encourage and support livestock farmers, chain partners and advisers in their efforts to identify health problems and apply the available knowledge on prevention.

Limited funding opportunities for research on production diseases

Opportunities for funding research on animal health and production diseases are limited. Public money is available for policy-supporting research. In recent decades, however, it has shifted heavily towards the top sectors and public-private funding. This has led researchers to focus largely on relatively small-scale innovations within the current system, with primarily incremental improvements for animals. Research grants for universities of applied sciences also require a contribution from the sectors. Practice-based research with sector parties is nevertheless easier to realise at universities of applied sciences, as payment can also be made in kind (e.g. by contributing hours or materials). Universities deploy government funding (the funding they receive directly from the Ministry of Education, Culture and Science) primarily in areas for which they expect to obtain external research funding. These are usually diseases that are relevant to public health and/or the economy, and most are infectious diseases. This results in a lack of the fundamental veterinary research that is needed for large-scale improvements and system changes to reduce animal health problems at the level of sector, farm and individual animal.

To expand the research space, the Netherlands could learn from other European countries. Some countries have long-term scientific research funding programmes that focus on the connection between animal health and animal welfare. One example is Sweden's Animal Health and Welfare Call (Formas, 2023). These countries opt for specific programmes, as small areas of knowledge (e.g. animal health) can easily become snowed under in general funding programmes, where assessment panels consist mainly of scientists from areas of knowledge with a large critical mass. It can be difficult for a physician or biologist to appreciate the scientific importance of research on specific problems (e.g. mastitis in dairy cattle).

In the Netherlands, we could consider research programmes that could be easily established from within the Dutch Research Council (NWO) and the Ministry of Agriculture, Fisheries, Food Security and Nature (LVVN), as has previously been the case with the animal welfare programmes *Grenzen aan Welzijn en Dierlijke Productie* (Limits to Welfare and Animal Production; 2000–2004) and *Waardering van Dierenwelzijn* (The Value of Animal Welfare; 2008–2014; NWO, 2023). These two programmes have made an important contribution to knowledge development and the training of young researchers in the field of animal welfare. The recently launched European Partnership on Animal Health & Welfare (EUP AH&W) is expected to play an important role in animal health and animal welfare within the European context in the coming years (EUP AH&W, 2023; Imberechts et al., 2022). This programme aims to stimulate research and encourage cooperation between all actors involved. Although its primary focus is on preventing infectious diseases, it can also contribute to solutions for production diseases, as animal welfare and animal health are central.

3.4. Education and training

Shifts in the manner of keeping production animals calls for new expertise. It is important for new knowledge to be integrated and transferred in training within the animal sector. Additional knowledge is needed with regard to keeping animals in new livestock farming systems. More attention should also be directed towards awareness and recognition of the intrinsic value of animals, and how these aspects play into issues concerning animal welfare and animal health. In 2022, the former Ministry of Agriculture, Nature and Food Quality (LNV) commissioned two research reports on veterinarians as a profession (Parliamentary paper 29683). Based on the recommendations from these reports, the government expressed the intention to work with the veterinary profession to strengthen its role and position, with the aim of achieving a widely supported plan by 2024. This process was launched in 2023 with the first step: drafting a vision document for the broad veterinary field (BOVP, 2024). The results of the surveys, together with dialogue with the profession and the plan, are intended as input for new policies for the veterinary profession starting in 2024 (Tweede Kamer, 2023–2024).

Training of first-line veterinarians

Changes in the way production animals are kept may be accompanied by different risks to animal and public health, and they may lead to different pathologies. Moreover, climate change and globalisation are causing the emergence of new diseases in the Netherlands. Examples include emerging infectious diseases (e.g. the Nipah virus disease, tularaemia and parasitic diseases) and poisoning by plants, algae and fungi that are new to the Netherlands. Veterinarians will therefore be confronted with new (or re-emerging) syndromes, and they must therefore continuously develop their knowledge and expertise on possible diseases. In addition, there is a chance that an increasing number of new animal species will be kept in the Netherlands that the current degree programmes in veterinary medicine pay little attention to, such as insects, alpacas and water buffalo (Dutch Council on Animal Affairs [RDA], 2020c).

Veterinarians will continue to need knowledge of both the health and disease of individual animals and of animals in flocks; of curative and preventive care; of animal welfare and the natural needs of animals; and of the relationship between the situation on the farm and broader societal issues (e.g. climate change and antibiotic resistance). This requires both specialised and broad knowledge. It also requires knowledge on the basis of which veterinarians can act, both as individual veterinarians on the farm (for advice and care provision) and within the profession (e.g. when advising on policy, including the design and implementation of quality policy within the field of veterinary medicine).

Meanwhile, however, the number of first-line veterinarians with expertise in production animals is decreasing, as is the number of veterinarians specialising in this field (Van Vuren, 2022). In other parts of Europe as well, the interest of veterinarians in training is increasingly shifting towards companion animals (FVE, 2024). In a 2022 report on the labour market for veterinarians, researchers link this development to public dialogue on intensive livestock farming, animal welfare and animal rights (Van Vuren, 2022). Other contributing factors might include the gravity of the profession and the method of selecting students. The retention of a sufficient supply of veterinarians for the livestock farming sector will require increasing interest in this profession and limiting the early exit of veterinarians as much as possible. The Faculty of Veterinary Medicine seeks to increase student interest by offering new courses in the Bachelor's phase, developing a new Master's course and strengthening cooperation with Wageningen University & Research. It is also investigating whether a mentoring scheme for young veterinarians could be a possible solution to reduce early exit (Parliamentary paper 29683).

Training of veterinary specialists

The number of specialists in cattle, pigs, poultry, small ruminants, veterinary pathology and infectious diseases is also decreasing (Van Vuren, 2022). To become specialists, veterinarians must take additional training amounting to about three years after completing their degree in veterinary medicine. Unlike programmes in human medicine, this veterinary specialist programme is not centrally funded with a contribution from the Dutch government. This makes the successful training of veterinary specialists largely

dependent on the personal commitment and funding of knowledge institutions and individual veterinarians.

A shortage of specialists could have major long-term consequences for animal healthcare, as specialists often contribute to solutions to new animal health problems, in addition to engaging in the transfer of knowledge and the development of guidelines and education.

Training of other actors in animal healthcare

Although several research groups and degree programmes in universities of applied sciences exist in the field of animal and livestock farming, there are no recognised positions for graduates of higher professional education programmes in animal healthcare. Legal competences are currently established only at the level of secondary vocational education and at the university level. In 2022, researchers from SEO Economic Research concluded that developing a higher professional degree programme and the organisation of positions at this level and paraveterinarians could increase efficiency within the sector and alleviate the shortage of veterinarians (Van Vuren, 2022). However, the development of a degree programme at a university of applied sciences takes time, and will thus not be able to reduce workloads until the longer term. In addition, the general intake of students for degree programmes in animal and livestock farming in higher education is low, and there are hardly any graduation assignments that focus on the implementation of theoretical knowledge on animal health and how this could be applied on farms. In addition, opportunities for field trips and guest lectures are decreasing, due in part to limited financial possibilities. These developments are placing a strain on education.

4. Future perspective on infectious diseases

As we have described in Chapter 2, much has already been achieved in terms of the prevention and control of regulated infectious diseases in the Netherlands. There is a good organisational structure for this segment of animal healthcare, including monitoring and control (crisis organisation), and veterinary care is of a high standard. It is important to properly maintain and, where possible, improve animal healthcare in relation to infectious diseases, especially with regard to unregulated infectious diseases. The risk that emerging infectious diseases will enter the country is likely to increase in the future, and proper preparation for such scenarios is necessary.

4.1. Challenges relating to unregulated infectious diseases

A livestock farmer cannot prevent and control infectious diseases alone: the extent to which production animals are exposed to pathogens also depends on the actions of other livestock farmers. If not controlled in time, some unregulated infectious diseases could threaten the sector as a whole. Examples include porcine epidemic diarrhoea, coryza, mycoplasma bovis and infectious ethmoid sinus tumours. Effective control requires a regional or national approach, and the timely availability of sufficient monitoring data is crucial.

Due to the intensive trade between the Netherlands and other EU member states and beyond, global warming (the consequences of which include changes in vector populations) and changes in biodiversity are likely to increase the risk of emerging infectious diseases in the future. In addition, depending on their design and location (e.g. where there is a high concentration of farms with animals susceptible to the same infection), future livestock farms may face an increased risk of infectious diseases due to increased interactions with livestock from other farms or with wild fauna. In the future, sufficient attention will have to be paid to these developments in order to continue to ensure an adequate level of animal healthcare in relation to infectious diseases. With the appearance of new infectious diseases, the period immediately after the introduction of the disease in the Dutch livestock population is crucial to effectively stopping the spread. Clear agreements on roles and responsibilities are at least as important in this regard as technical courses of action are. Other areas of concern are discussed below.

4.2. Data collection and sharing of monitoring data

To arrive at a good overview of the status of unregulated infectious diseases in the Netherlands, it would be useful to adopt the concept of 'One Health', which focuses on the connection between the health of humans, animals and ecosystems (One Health, 2024). In this regard, national monitoring data on unregulated infectious diseases in production animals could be combined with other data (e.g. monitoring results from wildlife, animals used for grazing, hobby animals and pets, and humans). Identified trends or sudden changes within any of these groups could contribute to the timely management of infectious diseases within the livestock farming sector. Examples include BVD in deer, neospora infections in dogs, and salmonella and influenza in humans. In companion animals and wildlife, there is currently only minimal monitoring. Because microbiological diagnostics in companion animals are left to the market, information does not automatically reach the Faculty of Veterinary Medicine or the GD, thus removing an important signalling opportunity. It is desirable to investigate the possibility of finding a solution to this issue. Linking to data from human diagnostics is important to obtaining a good overview of emerging zoonoses, although the need to ensure information security and cybersecurity poses a considerable challenge in this regard. It could also be useful to share monitoring data at the international level.

4.3. Other areas of concern in relation to infectious diseases

The prevention and control of unregulated infectious diseases is not always easy. This is due to factors including a lack of funding for research and the absence of a party that can assume primary responsibility for prevention or control. In addition, knowledge development in this area and on emerging infectious diseases is insufficiently secured. The more that is known about how specific infectious diseases arise, the more effective prevention efforts can be made. Vaccine development is also important to the prevention and control of infectious diseases. The development of knowledge on vaccines for infectious diseases that could pose a potential threat to the Dutch livestock population (e.g. certain emerging infectious diseases) also plays an important role in this regard.

The Netherlands has had an Animal Health Fund since 1998. Both the government and livestock farmers pay money into this fund, which can be used in the event of a contagious animal disease outbreak. The parties contributing to the fund agree on how this money should be spent (covenant). As stated in the draft Animal Health Fund Covenant 2025, the purpose of the Animal Health Fund is 'to pay costs and expenses related to the control, monitoring and prevention of, and research on animal diseases, zoonoses, disease manifestations and resistance in the broadest sense' (LNV, 2024). Section 7.1(1) states that the minister will sympathetically assess requests from sector parties to implement a national programme on a contagious animal disease, zoonosis or pathogen, as well as requests for full or partial funding for such programmes from the

Animal Health Fund, taking into account the utility, necessity, proportionality and effectiveness of the programme. If properly exploited, this possibility offers opportunities for further strengthening the prevention and control of unregulated infectious diseases.

5. Veterinary medicinal products

Although there have been many developments in the field of veterinary medicinal products in recent years, several challenges remain with regard to their use and application at the sector, farm and individual animal levels. Of particular concern is the shortage of veterinary medicinal products, which is likely to grow. If effective monitoring, benchmarking and prevention reduce the prevalence of animal diseases, the demand for veterinary medicinal products may decrease, thus potentially reducing the pharmaceutical industry's interest in developing and marketing them (the prevention paradox). This could further strain the availability of veterinary medicinal products. In the future, the prevention of serious disease through vaccination could play a greater role (e.g. in the event of the threat of an outbreak of an emerging infectious disease). It is therefore important for the Netherlands to have sufficient fundamental and/or applied knowledge and capabilities to contribute to the development of vaccines and veterinary medicinal products.

5.1. Limited availability of veterinary medicinal products

The Medicines Evaluation Board Agency/Veterinary Medicinal Products Unit (aCBG/BD) at the national level and the European Medicines Agency (EMA) at the European level assess submitted products and determine which can be authorised. The Committee for the Authorisation of Veterinary Medicines (Ctd) can be consulted concerning how livestock farmers can access these drugs. The assessments consider relevant aspects for humans, animals and the environment, including efficacy, safety and quality of veterinary medicinal products, food safety (waiting periods) and environmental effects. After authorisation, it is mandatory to report any adverse reactions so that the market authorisation can be adjusted if necessary.

Although pharmaceutical companies develop a variety of veterinary medicinal products, they focus primarily on products that they expect to sell well or that have a high profit margin. In a limited market, the costs of development (up to and including market authorisation) and the cost of adapting an existing market authorisation often pose an excessively high threshold (LNV, 2009). This makes veterinary medicinal products for rare diseases (i.e. minor uses) and for less commonly kept animal species (i.e. minor species) scarce, or even unavailable. This is despite the fact that the European Veterinary Medicinal Products Regulation is intended to improve the availability of veterinary medicinal products (EU, 2019).

Cascade Regulation

The 'Cascade Regulation' in the European Veterinary Medicinal Products Regulation systematically provides possible solutions in the absence of an authorised veterinary medicine for a given species or indication. First, there is the possibility of diverting to veterinary medicinal products that are authorised in other EU member states. If these are not available, it is possible to resort to medicinal products that are registered for human use, provided that maximum residue limits are set for the active substances. If this also fails to provide a solution, pharmaceutical compounding (a remedy prepared personally by a veterinarian or pharmacist) may be an option, provided a maximum residue limit is set for the active substances. Although agents from other EU member states are often a good addition for the treatment of production animals, the last two steps of the Cascade Regulation are often not applicable in the case of production animals, due to the lack of maximum residue limits for pharmacologically active substances. If none of the three Cascade steps listed above provides a solution, an agent from a third country may be used, provided the relevant use is authorised there for the animal species concerned. The veterinarian should report its use to the Veterinary Medicinal Products Unit. It is not always possible to obtain products from third countries, however, as wholesaler support in this area is not uniformly regulated.

List of essential veterinary medicinal products

In the future, the shortage of veterinary medicinal products may also play a greater role in the larger livestock farming sectors. If the prevalence of animal diseases declines due to proper monitoring, benchmarking and prevention, this will increase the risk that the pharmaceutical industry will invest less in the development of new veterinary medicinal products or the further development of existing veterinary medicinal products. There is a need for a list of essential veterinary medicinal products for production animals, the future availability of which should be guaranteed. This list should be comparable to the list that the Therapeutic Guidelines Group of the World Small Animal Veterinary Association (WSAVA) has compiled for companion animals (Steagall et al., 2023). On 28 March 2024, the World Veterinary Association published an initial version of the Essential Veterinary Medicines List (WVA, 2024) for the health and welfare of production animals. In addition, the need for veterinary medicinal products in future livestock farming systems is expected to change. This requires efforts to expand and develop new veterinary medicinal products and treatment strategies that meet these needs.

5.2. Antibiotics

Antibiotics are the drugs that are most commonly used to fight bacterial infections. To combat antibiotic resistance, measures are being taken for both humans and animals. Examples include surveillance of resistance and antibiotic use; reducing and improving antibiotic usage (antibiotic stewardship) and stopping the spread of micro-organisms (infection prevention). Livestock farms contribute to this through various efforts, including working with a limited number of established contacts, applying good farm hygiene and maintaining overall animal health. Although antibiotic resistance in the

Netherlands is stable — due in part to such measures — the number of bacteria with resistance to several (and, in some cases, all) groups of antibiotics continues to increase worldwide (National Institute for Public Health and the Environment [RIVM], 2023). This poses a serious threat to both human and veterinary healthcare.

The EMA has established a platform for EU countries to register the sale and use of antimicrobials (EMA, 2024). This platform is intended to streamline the submission of data for member states, in addition to strengthening the analysis and identification of European trends in the use of antimicrobials. Access to reliable data provides participating countries with valuable insight into the impact of their measures to promote the prudent use of antimicrobials in animals, and it can facilitate the identification of potential actions at the national and international levels to support an overall decrease in resistance.

Following the establishment of the Netherlands Veterinary Medicines Institute (SDa) in 2010 and a 2011 recommendation from the Health Council, professional guidelines on antibiotic use have been developed in the Netherlands, and structural monitoring and benchmarking of antibiotic usage have been established. As a result, the Netherlands was already prepared for the European Veterinary Medicinal Products Regulation. This has led to a significant reduction in antibiotic sales to the livestock farming sector, with a reduction of more than 76 percent compared to the baseline year 2009 (Netherlands Veterinary Medicines Institute [SDa], 2023). The extent of reduction nevertheless varies greatly by sector.

Limited availability for veterinary use

To prevent resistance, the government has made some groups of antibiotics unavailable for use in animals, or only under strict conditions. Newly developed antimicrobial drugs are often reserved for human use, making them unavailable for veterinary use. For this reason, not all existing antibiotics can be applied for veterinary purposes, making it difficult for veterinarians to treat animals appropriately in some cases. This can lead to distressing cases (*Source: personal communication F. Verstappen*). The Ministry of Agriculture, Fisheries, Food Security and Nature (LVVN) is currently considering compiling a list of essential antibiotics for the Netherlands.

Another challenge has to do with the effective use of the antibiotic arsenal that is available for veterinary treatments. Recent knowledge and insights are not always incorporated into the summary of product characteristics (SPC) for older antibiotics. Deviations from the SPC are not permitted, thus allowing veterinarians insufficient leeway to apply the latest scientific knowledge on dosage in their treatment choices. Veterinarians need professional guidelines (formularies) that are well embedded, supported and enforced.

The use of antibiotics is expected to decrease further in the future, through the application of new animal housing concepts and livestock farming systems. Other developments that are likely to decrease antibiotic usage include the use of alternatives, such as monoclonal antibodies or the addition of feed additives (e.g. probiotics, organic acids or chitin derived from insects) (Gasco et al., 2021; Van Huis and Gasco et al., 2023). Additional research on the possibilities of deploying such alternatives is therefore desirable.

5.3. Homeopathy, herbs and supplements

Some livestock farmers use homeopathic veterinary medicinal products, herbs (and herbal mixtures) or nutritional supplements. Although the quality and safety of homeopathic veterinary medicinal products are guaranteed by the Veterinary Medicinal Products Regulation, there is no scientific basis for their effectiveness. Although many herbs (and herbal mixtures) and dietary supplements are marketed with claims suggesting medicinal effects, their efficacy is usually unproven. In contrast to regular veterinary medicinal products or registered feed additives, the safety, quality and efficacy of these products are not guaranteed. Moreover, the quality of herbs (and herbal mixtures) depends on growing conditions (e.g. heat and humidity), and it is therefore not stable. (For that matter, purified herbs and herbal mixtures are used as animal feed additives. These products fall under the EU Feed Additives Regulation and must obtain authorisation, such that their efficacy and safety are indeed assessed.)

Homeopathic remedies, herbs (and herbal mixtures) and dietary supplements are often freely available, and they are sometimes used as substitutes for veterinary medicinal products, without the intervention of a veterinarian. We do not consider the use of these agents objectionable, as long as it has been scientifically demonstrated that they do not have a negative effect on animal and public health or food quality, and as long as a veterinarian is consulted in a timely manner if the agent does not produce the desired results.

6. Conclusions and recommendations

Ensuring good animal health is one of the six guiding principles for humane livestock farming. This means that the health of production animals should be explicitly included in the design of future livestock farming systems, as animal health is a crucial element of animal welfare. Even in current systems, adjustments can be made in the short term to improve the health of production animals. The Council advocates developing an animal health agenda for the future that is supported by both government and sectors.

6.1. Conclusions

We conclude that healthcare for production animals in the Netherlands has developed and improved significantly in recent decades, particularly with regard to regulated infectious diseases. For such infectious diseases, there is a well-functioning system of monitoring, surveillance and knowledge development, and responsibilities are well established at the national and European levels. For unregulated infectious diseases, there is currently no possibility for mandating collective measures. This makes it difficult to control such infectious diseases, as the risk of livestock contamination depends not only on the preventive measures taken by individual livestock farmers, but also on the measures taken by other farms.

In recent decades, the sectors have made substantial investments in addressing production diseases. Although concrete results have been achieved, production diseases are still common in practice. This is largely because the often-complex combination of causes, which may be strongly associated with the livestock farming system, makes a targeted approach difficult. A successful solution requires a multidisciplinary approach involving long-term attention from a variety of actors, including livestock farmers, veterinarians and farm advisers. In addition, benchmarking and preventive measures are difficult to apply, due to the lack of representative data on the incidence of these diseases, as such data do not exist or are largely not shared. In addition, research to date has been limited to practical research within current livestock farming systems, and little fundamental research has been conducted on production diseases and animal health within the context of humane livestock farming. As a result, few animal health experts are being trained to have sufficient knowledge of animal health management within the capabilities of future livestock farming systems.

Another point of concern has to do with curative care for production animals. The availability of veterinary medicinal products is strained, especially for rare diseases and less commonly kept species. Availability may decrease even further (including in larger sectors) if the prevalence of animal diseases is further decreased through effective monitoring, benchmarking and prevention, accompanied by a decrease in the production

of veterinary medicinal products (the prevention paradox). This will have negative implications for the care of individual animals.

This is having greater or lesser effects on the welfare of animals with infectious or production diseases. Given society's increasing focus on animal welfare and the government's commitment to humane livestock farming, it is necessary to find ways to reduce the prevalence of production diseases and unregulated infectious diseases. We conclude that there is a need to develop a strategy to improve and maintain animal healthcare for production animals in the future. This calls for a programme-based, public-private and cross-farm approach to reducing and, where possible, preventing animal welfare problems due to production diseases and unregulated infectious diseases.

In addition to the explicit inclusion of animal health aspects in the design (or re-design) of animal housing systems, we recommend working towards a future-oriented national agenda for animal health for production animals centring on animal health. This agenda should focus specifically on unregulated infectious diseases and production diseases. It should be supported by both the government and the sectors. In addition, societal challenges that may affect animal health in the future should be included in this agenda. Examples include climate change and the shifting demands that accompany it. On the one hand, the agenda could focus on measures that could be implemented in the short term, based on current knowledge. On the other hand, it could focus on adapting livestock farming systems in the longer term, with the aim of optimising animal health.

6.2. Recommendations

1. Establish a future-oriented national agenda for animal health

The government should cooperate with the livestock farming sector, the scientific community and NGOs to capture the shared ambition for reducing the incidence and prevalence of production diseases and unregulated infectious diseases in an agenda for animal health for the future. In doing so, it is important to consider the potential concerns of stakeholders with regard to feasibility. The approach that led to the reduction of antibiotic usage in the livestock farming sector could serve as an example for the formulation of the ambition. Where possible, join the process surrounding the Covenant on Humane Livestock Farming, or organise independent round table meetings to define shared ambitions.

2. Promote the development and sharing of knowledge

- *Develop a benchmarking system for production diseases.* In a public-private partnership, objectively determine which production diseases require attention (those with the highest burden of disease), and assign a priority to each disease. Develop a benchmarking system for each production disease, with the aim of reducing the prevalence of these diseases, starting with the highest-priority disease.
- *Develop a collaborative structure for research and knowledge development.* The government should promote collaboration between the government,

industries and knowledge institutions to enable fundamental research on production diseases, infectious diseases and animal health within the context of humane livestock farming.

- *Encourage training opportunities.* The government should ensure that public and/or private funding is made available to train specialists in the field of production animal health. It should also encourage the establishment of a recognised degree programme in animal health at the level of universities of applied sciences.

3. Maintain animal healthcare in relation to regulated infectious diseases

Continue prevention and control measures against regulated infectious diseases at current levels. In addition to their importance to the economy, food security and public health, these issues are also important to animal welfare.

4. Establish requirements for the prevention and control of unregulated infectious diseases

From a public-private partnership, provide opportunities to regulate measures to prevent or control unregulated infectious diseases at the sector level. In these efforts, take full advantage of the new opportunities that the Dutch Animal Health Fund (DGF) will offer from 1 January 2025.

5. Ensure the adequate availability of veterinary medicinal products

The government should consider compiling a list of essential veterinary medicinal products for production animals within the Dutch context, in order to ensure the availability of these products.

6. Integrate animal health into the animal-centred design (or re-design) of livestock farming systems

Integrate the prevention of infectious diseases and production diseases, as well as the promotion of animal health, into the design of new livestock farming systems. The government should encourage the animal-centred design (or re-design) of these systems, focusing on the six guiding principles of humane livestock farming.

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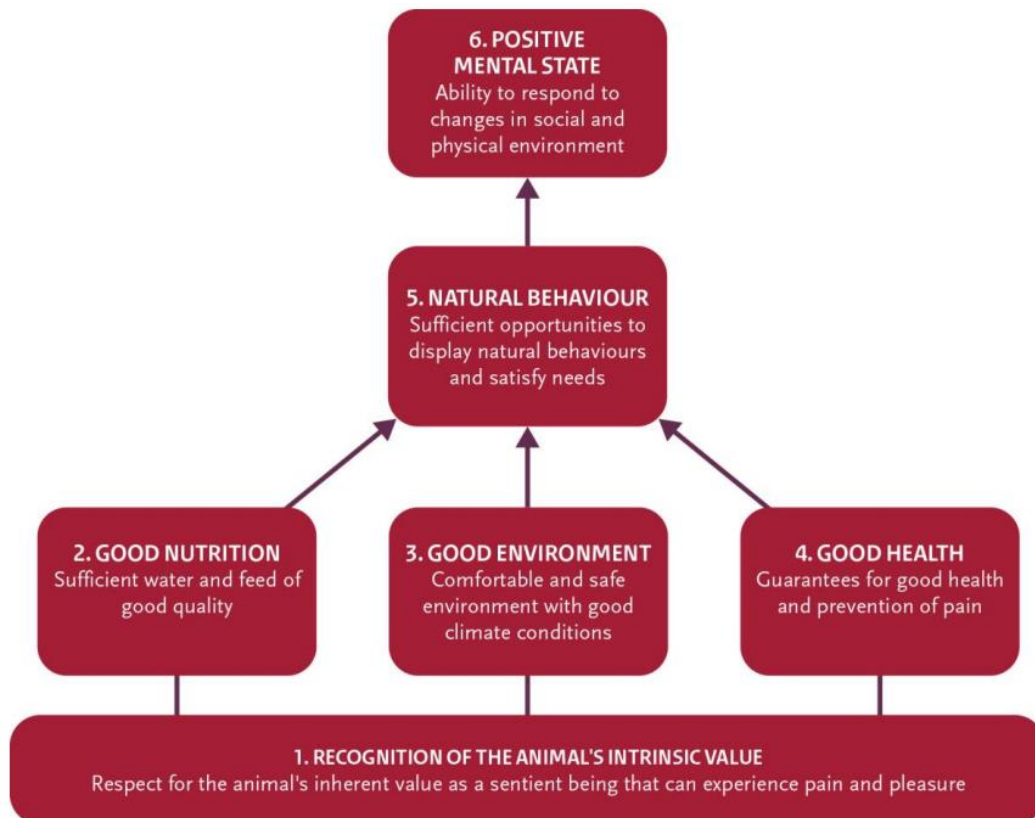
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Appendix 1. Animal health and livestock farming systems

In the Council's advisory report *Humane Livestock Farming*, we concluded that humane livestock farming is a system of livestock farming in which the intrinsic value and integrity of animals are recognised and respected, and in which production animals experience a positive state of well-being (Dutch Council on Animal Affairs [RDA], 2021). This system must comply with six guiding principles:



If a livestock farming system does not comply with these six guiding principles, animal health problems may arise, including the following.

- An environment in which animals cannot adequately meet their species-specific behavioural needs (Principle 5) may encourage behaviours such as feather plucking or tail biting. This can result in inflammation of the skin, tail, navel or joints.
- An environment that is insufficiently comfortable or safe (Principle 3) can contribute to a variety of health problems. A poor barn climate due to an open floor, insufficient ventilation or other risk factors can contribute to the development of lung diseases, and slippery floors can cause diseases of the legs and feet. In addition, stress and high infection pressure can occur due to the large-scale mixing of younger and older animals, or animals from different farms or departments, which can contribute to the development of pneumonia,

gastrointestinal diseases or other conditions. Other risk factors include the separation of flocks and the frequency and mode of livestock transport.

- Young animals that receive insufficient colostrum (nutrition, Principle 2) can become sick (e.g. lung problems and gastrointestinal diseases).

The incidence of unregulated infectious and production diseases could be expected to decrease in humane livestock systems. A future-oriented national agenda for animal health could help to ensure good health for individual animals within a system of humane livestock farming.

Appendix 2. Care for young animals

In 2021, the Council published an advisory report on care for young animals (Dutch Council on Animal Affairs [RDA], 2021b). This care can be further improved for all animal species. This requires attention from livestock farmers, who nevertheless also face system-related factors, including breeding lines with health or care problems, housing systems that do not optimally meet the health needs of the animals, and buyers who do not wish to pay too much for animals and animal products. Other stakeholders (e.g. breeding organisations and retailers) are partly responsible for these factors. They should therefore be involved in developing solutions.

Several measures are known to be important to keeping young animals healthy, but they are not always applied or cannot always be applied. For example, it is important to give young animals enough colostrum shortly after birth or to check whether they are taking in enough colostrum from their mothers. In addition, hygiene is essential in relation to the birth and housing of young animals. In the veal sector, the implementation of these measures has already been improved through the KalfOK programme, which provides livestock farmers with insight into the quality of their calf-rearing (ZuivelNL, 2023). The KalfOK system also allows comparison with other farms, thereby raising awareness amongst livestock farmers concerning the importance of proper care for young animals. Even in the veal sector, however, wide variations remain between farms with regard to the quality of care for young animals. This suggests that there is room for further improvement.

In 2021, we recommended encouraging livestock farmers to keep relevant records on care and mortality, and to make them available (while ensuring privacy) for mutual comparison (benchmarking). In return, they would receive information, guidance, education and training to improve targeted and planned care for young animals. This would also improve their overall business results. In response to a query from the dairy, pig and dairy goat sectors, the Netherlands Veterinary Medicines Institute (SDa) is currently investigating possibilities for a benchmarking system for young animals (Lesscher, 2022; SDa, 2024).

In addition to known factors (e.g. colostrum feeding, hygiene and prompt treatment of infectious diseases), there are still many causes and treatments of diseases in young animals about which too little is known. Additional knowledge on the epidemiology, pathobiology, treatment and prevention of infectious (and other) diseases in young animals is important to preventing morbidity and mortality. Sepsis, gastrointestinal problems and respiratory tract diseases are particularly likely to cause high levels of morbidity and mortality in young animals. More specific veterinary research on these diseases in young animals is important to the development of effective prevention and treatment programmes. The microbiome and virome of young animals contain many of the germs that can also be pathogenic. Understanding the dynamic factors leading to

dysbacteriosis or dominant viral infections is essential to the prevention and reduction of morbidity and mortality in the future.

Appendix 3. Diseases of the legs and feet

Diseases of the legs and feet have a significant impact on the health and welfare of production animals. Many species of production animals suffer from both infectious and non-infectious diseases leading to leg and foot problems. For example, *dermatitis digitalis* (an infectious disease) and laminitis (a non-infectious disease) are seen in cattle. Laminitis also occurs in sows and horses. Because diseases of the legs and feet are not zoonotic and are not used as models for human diseases, it is difficult to find funding for research on these diseases in the Netherlands. Innovations in this area are nevertheless important to improving the health of production animals. New insights into the physiology, pathophysiology and epidemiology of leg and foot diseases could be applied in a variety of production animal species. Examples could include the influence of metabolic changes, nutrition (e.g. phosphate), stress, housing and genetics on the development of diseases.

Diseases of the legs and feet are multifactorial problems that are associated with housing and farming operations. Slippery barn floors, high livestock density and other risk factors can contribute to the development of these diseases. Innovations (e.g. sensors, video sensing and artificial intelligence) could help to identify issues and address underlying factors. In this regard, it is important to examine and resolve obstacles to the implementation of knowledge. Examples of such obstacles include privacy concerns, lack of incentives and limited financial leeway amongst livestock farmers. The sectors could support the efforts of individual livestock farmers to make changes in their farms, thereby increasing the willingness to make improvements.

Sociological and psychological research is also needed in order to enhance understanding how to encourage and support the efforts of livestock farmers to address these issues at the farm level. In a 2013 questionnaire survey, Bruijnis and colleagues (Bruijnis et al., 2013) report that almost 70 percent of dairy livestock farmers expressed the intention to take action to improve the foot health of their dairy cows. They were eager to achieve better foot health with cost-effective measures. Possible barriers to taking action included labour efficiency and a long period between taking action and seeing an improvement in foot health. Feed consultants and hoof trimmers seemed to have the greatest influence on the intention to take action. More studies of this type are needed in order to ensure that the available knowledge is actually applied in practice. Some livestock farmers are also concerned about the confidentiality of monitoring data. It is therefore essential for the government to work with livestock farmers and their sector partners to ensure that the monitoring is designed appropriately.

Composition of the Council

The Council on Animal Affairs (*Raad voor Dierenaangelegenheden*, RDA) is an independent council of experts that provides the Minister for Agriculture with solicited and unsolicited advice on issues relating to animal welfare and animal health. The Council consists of scientific experts and professional practitioners, whose membership is in a personal capacity and not bound by any instructions or binding mandate.

The draft advisory report was submitted to the entire Council for assessment. As such, the advisory report is a product of the Council as a whole.

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