

Innovation in animal health

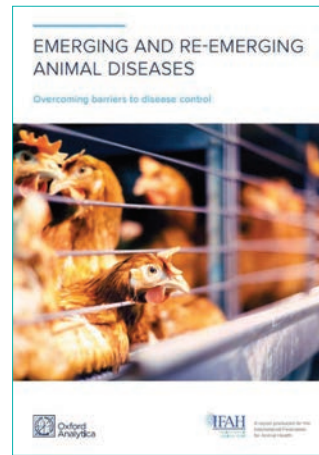
Historic success,
current challenges
& future opportunities





2012 The Costs of Animal Disease

The whitepaper compared the international social and economic impacts of three well-documented animal health diseases: FMD, salmonella and rabies. Aimed to not only inspire greater conversation amongst international stakeholders on what future efforts would be required to establish effective disease control and preventative activities based on their technical merits, but also to consider their socio-economic impact on the systems on which they are being imposed.



2013 Emerging and Re-emerging Animal Diseases – Overcoming Barriers to Disease Control

A group of independent experts in animal health examined three dominant barriers to effective disease control with a view to encourage wider collaborative discussions with international stakeholders on what future efforts would be required to overcome barriers that limit our ability to control emerging and re-emerging diseases.



2014 The growing threat of vector-borne disease in humans and animals

Created with the support of the Bill and Melinda Gates Foundation, 2014's whitepaper report collated the opinions of a wide range of key opinion leaders with varied and relevant expertise and presented a snapshot of the situation today, complete with the key challenges faced and what is required to develop effective solutions in tackling vector-borne diseases globally.



2015 Innovation in animal health

A panel of global industry experts were brought together to review previous example of innovation in the animal health sector, discuss the current areas where innovation is driving for change and look to what might be achieved in the future.





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Introduction

This report is the fourth annual collaboration between HealthforAnimals and Oxford Analytica. We have published 'The cost of animal disease' in 2012; 'Emerging and re-emerging diseases' in 2013; and 'The growing threat of vector-borne diseases in humans and animals' in 2014. With the publication of this new report, HealthforAnimals and Oxford Analytica are aiming to generate exposure around the topic of innovation in the animal health sector, among policymakers, industry, the NGO sector and the media. Innovation within the sector is vital for progress.

Earlier this year HealthforAnimals, in partnership with the World Veterinary Association and Animal Pharm, conducted a global industry survey of 156 people who work in animal health in some capacity. Nearly half of the respondents work in the pharmaceutical industry¹. The insights gained in the survey have been used to structure the current report, by identifying the following four sets of key questions:

1. Food safety and sustainability

- How is innovation in animal health helping to feed the growing population of the world safely, adequately, economically, and in a responsible and ecologically sound way?
- What are the main barriers to further progress here?

2. Zoonotic (including vector-borne) disease

- What innovations need to occur to help the animal and human health sectors collaborate better in protecting both against zoonotic diseases?

3. Innovation in pet health

- What recent innovations are helping to keep pets healthy?
- What can other areas of animal health and even human health learn from this?

¹ In this report, we refer to this survey as the '2015 HealthforAnimals Industry Survey'.

4. Barriers to modern vaccine use

- What are the barriers to modern vaccine use generally - regulatory, financial, perception/societal acceptance etc.?

We refer to the results of the survey throughout this report. In addition, we draw on the valuable insights provided by expert participants from industry, academia, government and multilateral organisations at a roundtable hosted by HealthforAnimals on September 22, 2015. We refer to some of these participants and their organisations in this report.

Our analysis covers both food production animals and pets, highlighting areas of overlap between the two. Where especially relevant, linkages between animal and human health, and the impact of innovation on those linkages, are highlighted.

Innovation in this report is interpreted in a broad sense. It includes not only technological innovation (i.e., inventions), but also innovation in services, management and policy, and innovative changes in society. The report does not cover the area of antimicrobials and antibiotics. Innovation in this area is of huge significance and merits a study of its own.



Executive Summary

1. Food safety and sustainability

Increasing the productivity of livestock is critical to feeding the growing global population. The animal health sector can support this by providing treatments for disease prevention and control, and by innovating to improve the nutritional quality of the finished product. A major area for product innovation will be animal feed.

- Policymakers can encourage the intensification of food production by providing farmers with innovative, targeted incentives. Such innovation must be appropriate to the needs of small-scale, resource-poor farmers as well as their larger-scale counterparts. Long-term sustainability will only be attained by combining productivity and health improvements with greater attention to animal welfare.
- Food safety is a global public good that is dependent on the resources allocated to animal health. Therefore, governments need to increase their support for animal health as part of broader human health policy.
- Globally, progress is required in streamlining national regulatory processes, and in harmonising different sets of regulation in different countries. This is one of the biggest barriers to a more efficient contribution of the animal health sector to health outcomes.
- In many developing countries, weak transport links, and a lack of refrigeration or networks of laboratories can prevent animal health care reaching animals that need it. Meeting these challenges requires point-of-care equipment that is lightweight, cheap and can be used to conduct basic tests, or provide vaccines or treatment.
- The informality of animal markets in many developing countries negatively affects how animals are kept and traded, and whether diseases are identified, monitored and treated. Significant further progress is required in formalisation of animal trade and in combating the rising use of counterfeit medicines for animal health.

2. Zoonotic (including vector-borne) disease

- The 2015 HealthforAnimals Industry Survey confirms that animal health professionals strongly believe that the animal health sector has a bigger role to play in the control of diseases in the human population. One Health initiatives involving networks of stakeholders can provide a strong boost to collaboration between animal and human health.

- Local governments, farmers and health workers need to be involved in putting in place strategies to manage interactions between human, animal and environmental health issues. Communities need to be shown examples of success stories.
- The impacts of animal health issues on human health need to be quantified, in terms of both the health (i.e., fatalities and illness) and economic burdens. Such statistics then need to be clearly communicated to all relevant stakeholders.

3. Innovation in pet health

- There are diverse opportunities for the veterinary health sector to adopt new technologies. For example, data generated in veterinary clinics can be uploaded to the Internet, for sharing with other clinics and researchers. This can permit real-time analysis of changes in prevalence of diseases. Also, real-time communication between vets and owners about pet health issues using mobile online technology is an important growth area. For example, vets can send reminders to owners about the dates for vaccines or medication refills, or provide instructions for pets' diets.
- There is high potential for increased transfer of knowledge both ways between the human and animal health sectors. Sometimes, this can still be impeded by slow regulatory processes or by a lack of communication. In fostering deeper collaboration, the animal health sector needs to explain and emphasise the channels through which animal health affects human health.
- In some areas, research is more advanced on pet health issues than in the food production animals sector. Some of these technologies can be transferred.

4. Barriers to modern vaccine use

- Regulatory streamlining is also required for vaccine technology. This barrier can be linked to broader inefficiency and a lack of transparency in government procurement of vaccines. However, regulatory barriers can often be overcome rapidly in times of emergency.
- There is potential for co-competition in the area of vaccine technology. Risks and costs, as well as data, can be shared by working together with each other, and with research institutes and the public sector. This would permit quicker development of vaccines and better use of overall available funding. However, co-competition needs to be structured in such a way that companies can make a return on their investment.
- Vaccine banks are hugely important and merit a greater allocation of funding. Vaccine banks can hold ready-to-use, formulated vaccines, and/or antigen components, to be formulated into vaccines as needed. The World Organisation for Animal Health (OIE) has developed a new concept that creates virtual rolling stocks: suppliers produce the vaccines only when needed, or they remain with the suppliers at their own risk and are renewed on a rolling basis under terms and conditions contractually defined with the OIE.

Food safety and sustainability



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Food safety and sustainability

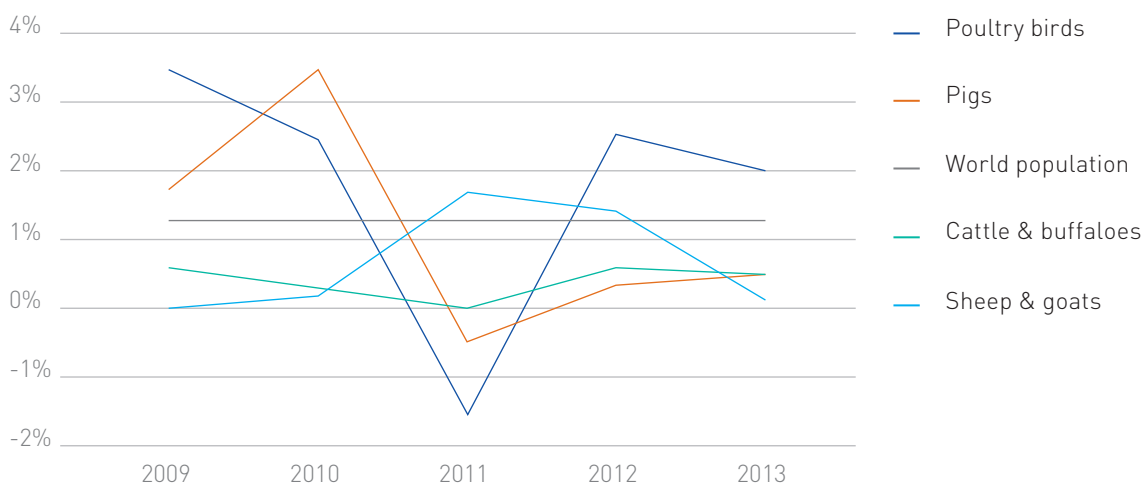
1.1. Innovation to feed the world

1.1.1. PRODUCTIVITY OF FOOD PRODUCTION ANIMALS

The global population is currently about 7.3 billion people; it is likely to reach about 9.7 billion by 2050.² Some 795 million people are currently undernourished.³ Given these statistics, it is perhaps no surprise that the 2015 HealthforAnimals Industry Survey suggests that 'the global food supply' will be the third-biggest challenge facing the animal health sector over the next five years, after antibiotic resistance and infectious diseases.

Especially in emerging markets, where animal products typically account for approximately one third of human protein consumption, increasing the productivity of livestock is critical to feeding the growing population, as is increasing the number of livestock overall. If the quantity of food produced can be increased sufficiently, food prices will fall, enabling a larger share of the population to afford an adequate amount of food. However, in recent years, the rate of growth of the livestock population has struggled to keep up with the rate of human population growth (see Figure 1).

Figure 1. World (human) population growth versus world growth in the stocks of food production animals



Source: FAOSTAT

² UN Department of Economic and Social Affairs, 'World Population Prospects: The 2015 Revision'.

³ International Fund for Agricultural Development (IFAD), World Food Programme (WFP) and Food and Agriculture Organization (FAO), 'The State of Food Insecurity in the World 2015'.

In many countries, raising productivity will involve a shift from extensive to more intensive food production animal management, with different animal feed and higher stocking densities. In turn, higher stocking densities can increase the risk of the spread of animal diseases. The animal health sector can support this trend towards greater productivity not only by providing treatments for disease prevention and control, but also by innovating to improve the nutritional quality of the finished product, and improving animal metabolisms.

The feed conversion efficiency of livestock production, particularly cattle, is typically relatively low compared to crop production; they contribute to greenhouse gas emissions and are resource-intensive in terms of water and land (both for living space and forage growth). In many areas of the world, the livestock sector is already seriously challenged by competition for agricultural land; for example, in South Asia as land per capita decreases, exacerbated by an increasing human population and potentially aggravated by climate change. The increased use of biofuels will also increase competition for land available for livestock and crop production and therefore increase food insecurity, partly by raising the prices of crop and fodder resources.

Policymakers can encourage the intensification of food production by providing farmers with innovative, targeted incentives, e.g., conditional cash transfers that must be used for applying good practices in animal management or for purchasing animal health products. If governments can create the right incentive framework for farmers, making the business case for intensifying production clear, then many farmers are likely to move in that direction. However, this step towards intensification can be problematic where the initial costs outweigh benefits. In resource-poor regions, productivity is often limited by forage availability and the high cost of disease prevention. Bank or government loan schemes, where available, can sometimes leave farmers vulnerable to short-term market and productivity fluctuations.

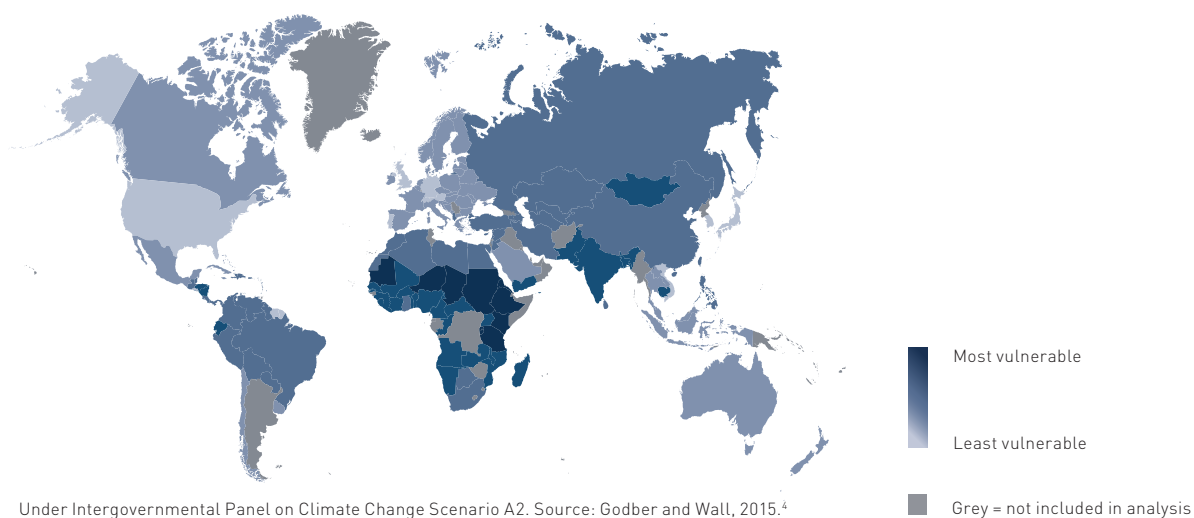
**795 million people
are currently
undernourished**

The need for policy support depends partly on the sensitivity of livestock production to population growth and future climate change. Livestock production in Sub-Saharan Africa, particularly in the Sahel region, and in some Asian countries is likely to be the most vulnerable to future population growth and climate-related impacts (see Figure 2). Livestock-based food security is already compromised in many of these areas and suffers constraints from current climate conditions, in addition to a lack of economic and technical support allowing mitigation of predicted impacts. Governance and political stability are also highly influential factors, as are trade networks. Paradoxically, current self-sufficiency may increase future potential vulnerability because trade networks are poorly developed. The potential benefits of investment in intensification should be seen within the broader context of all these factors.



Figure 2. Vulnerability to the impacts of population growth and climate change on grazing livestock and food security.

1. Food safety and sustainability



1.1.2. SUSTAINABLE DISEASE AND ANIMAL MANAGEMENT

The report 'The growing threat of vector-borne disease in humans and animals'⁵ highlighted that sustainable disease management involves accepting that the aim of eliminating pathogens is likely to be unrealistic and that a more sophisticated, multi-pronged approach is needed. For this, more research is required into the qualities of healthy animals, physiological and behavioural, and the implementation of management systems that foster the health of animals. Especially in emerging markets, improvement of basic husbandry practices can mean a significant contribution in this field. There should be a change in the emphasis on disease management, from pathogen-eradication to management for the development of long-term, sustainable health. This should include animal breeding for disease resilience, which has the potential to improve animal health, welfare and productivity.

Long-term sustainability will only be attained by combining productivity and health improvements with greater attention to animal welfare.

The 2015 HealthforAnimals Industry Survey suggests that innovation to improve welfare in food-producing animals is a popularly supported aim for the animal health sector, alongside its role in ensuring animals are healthy enough to increase productivity.

1.1.3. LOW-COST, POINT OF CARE SERVICES

In emerging markets, animal medicines may be completely locally unavailable; those that are available may be beyond the resources of local producers or may only be available in pack sizes that are inappropriate for small-scale producers that do not have the facilities to store opened packages appropriately. The lack of infrastructure may also make it difficult to transport medicines and vaccines to where they are needed because of poor transport links or lack of refrigeration, and networks of laboratories for conducting health tests often do not exist. Some countries, e.g., India, have made rapid progress in recent years in increasing refrigeration capacity (see Figures 3a and 3b). However, most emerging markets are further behind in adding additional capacity.

⁴ Godber, O.F. & Wall R. (2014) Livestock husbandry and food security: their vulnerability to population growth and climate change. *Global Change Biology* 20, 3092-3102.

⁵ HealthforAnimals in collaboration with Oxford Analytica and the Gates Foundation, 2014.

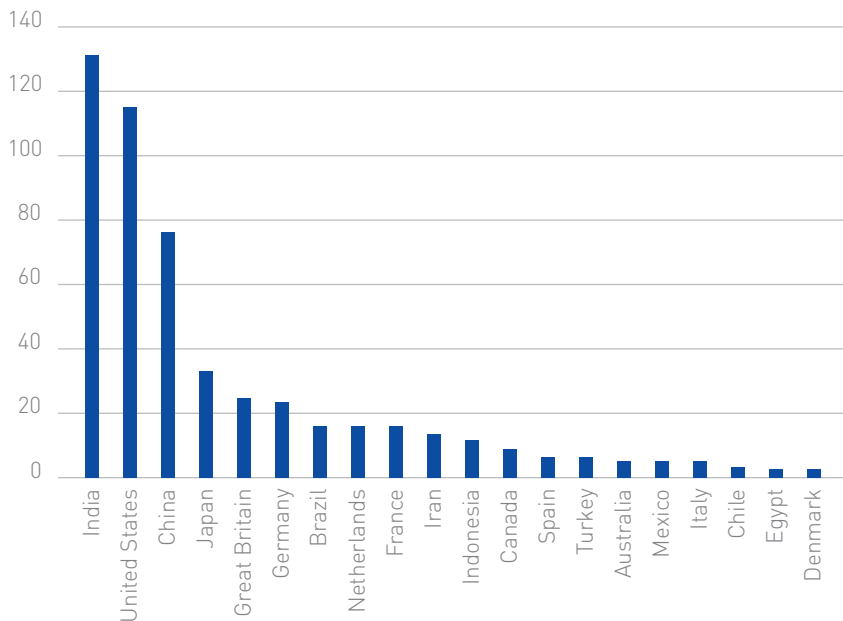
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Increasing the productivity of livestock is critical to feeding the growing population

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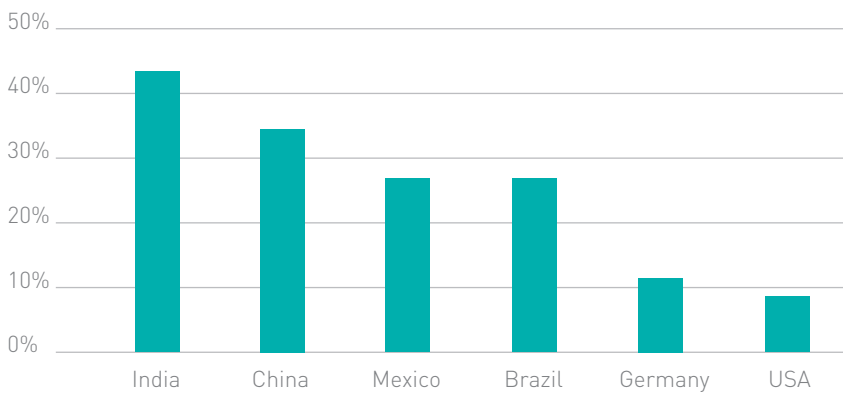


Figure 3a. Capacity of refrigerated warehouses for 20 largest country markets (million cubic meters), 2012 and 2014 is available



Source: Global Cold Storage Capacity Report, 2014

Figure 3b. Compound annual growth rate in volume of refrigerated warehouses in selected countries, 2008-2014

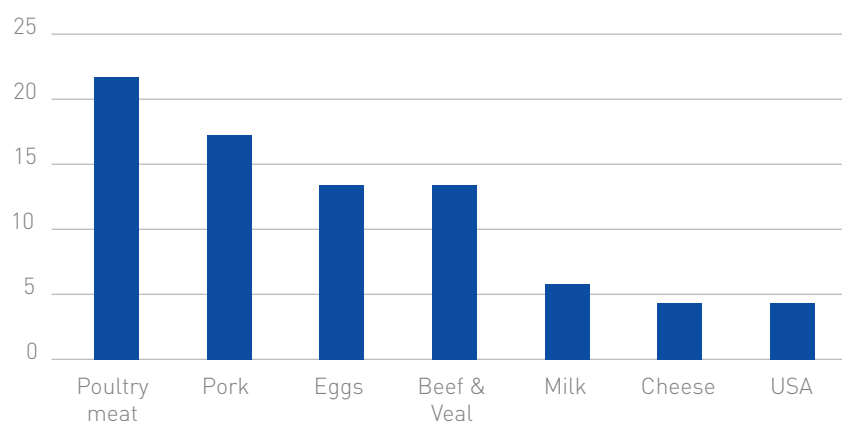


Source: Global Cold Storage Capacity Report, 2014.

Moreover, often what is needed is small-scale, mobile refrigeration capacity. Testing also often needs to be conducted outside laboratories, in remote locations. Meeting these challenges requires point-of-care equipment that is lightweight (e.g., so it can be transported by motorbike), cheap and can be used to conduct basic tests or provide vaccines or treatment.



Figure 4. Soybean equivalent required to produce a UK citizen's annual intake of meat and dairy products (kg required per person)



Source: 'Soy consumption for feed and fuel in the European Union', Van Gelder et al, 2008

In order to feed growing populations, it will be critical for the animal health sector in emerging markets to make greater use of both new technologies and the latest science-based decision-making

1.1.5. CHANGING PERCEPTIONS THROUGH EDUCATION

In many emerging markets, not only do animals provide a direct source of food, but they are also used for work, and provide income through being traded. The animal health sector needs to be innovative in persuading policymakers at national and multilateral levels to acknowledge the importance of all these linkages between animal health, human health and poverty reduction, and then to increase support for animal health as part of broader human health policy and poverty reduction programmes.

According to the 2015 HealthforAnimals Industry Survey, 61% of respondents felt that ensuring food safety was the most important role the animal health sector has in the future of food production. This result should encourage the animal health sector to pursue a change in mindsets among policymakers, encouraging them to view food safety as a global public good and therefore to increase resources allocated to animal health.

1.1.6. STREAMLINING PRODUCT TESTING AND REGISTRATION

Worldwide, bureaucratic delays in public sector testing and registration of new animal health products - both for food production animals and for pets - are common. This is especially true in many emerging markets. The problem can be compounded by political interference in the testing and registration process. Streamlining these processes and ensuring their predictability are critical to increasing the supply of animal protein worldwide. Innovation has the potential to help: the European Medicines Agency, for example, uses an electronic submissions system.

A particularly critical barrier to innovation is that existing regulatory and registration processes are inflexible and are unable to accommodate novel technologies. For example, attempts to register biological control agents, such as entomopathogens for livestock parasite control, can suffer from administrative delays because the product does not fit any existing category (e.g., vaccines or veterinary medicines); attempting to bring such products to market can therefore be slow and expensive.



1. Food safety and sustainability

Even if progress can be made in streamlining the processes of national regulatory authorities, the animal health sector still faces the obstacle of different sets of regulation in different countries. This is one of the biggest barriers to a more efficient contribution of the animal health sector to health outcomes.

Innovation at the intergovernmental level is required to increase the degree of harmonisation and adoption of harmonised practices and procedures between national regulatory authorities. Progress has already been made under the International Cooperation on Harmonisation of Technical Requirements for Registration of Veterinary Medicinal Products (VICH) initiative, but expansion to additional countries is required (see Table 1).

According to Professor Peter Borriello of the UK Veterinary Medicines Directorate, governments should target going beyond harmonisation, to reform regulatory bodies, reduce their number and increase the level of mutual recognition of marketing authorisations. This would be enabled by external accreditation of regulatory bodies in order to provide acceptable assurance.

Table 1: Members of the International Cooperation on Harmonisation of Technical Requirements for Registration of Veterinary Medicinal Products (VICH) initiative

Member Regions	Principle Parties
European Union	European Commission and European Medicines Agency
	IFAH-Europe
United States	US Food & Drug Administration - Center for Veterinary Medicine
	US Department of Agriculture - Center for Veterinary Biologics
	US Animal Health Institute
Japan	Ministry of Agriculture, Forestry and Fisheries
	Japanese Veterinary Products Association

1.1.7. KNOWLEDGE AND TECHNOLOGY TRANSFER

In order to feed growing populations, it will be critical for the animal health sector in emerging markets to make greater use of both new technologies and the latest science-based decision making on animal health. To some degree, this is already happening, for example with the use of biotechnology in animal feed or hormones for livestock. However, often emerging markets lack access to animal health technologies and knowledge that are widely used in developed countries. Therefore, innovation is required in how to access these.

Frequently, transfer of knowledge is much less costly than transfer of innovation, but transfer of knowledge in isolation does not necessarily help to provide solutions where infrastructure, technology and finance are lacking.

Innovation must be appropriate to the needs of small-scale, resource-poor farmers. One key area where innovative developments may be within reach of such target groups is through mobile telephony, where inexpensive technology can be used more to provide farmers with knowledge and practical diagnostic assistance. Developments in mobile phone technology and software could be used, for example, to automate remote faecal egg counts or FAMACHA anaemia scores, leading to better targeted treatment.⁶ Mobile penetration rates are rising almost everywhere, and several large emerging markets (e.g., Brazil, Russia and South Africa) already have rates that are at least as high as in the OECD.

1.1.8. 'COOPETITION'

When companies across the animal health sector share a common objective, e.g., acknowledgement by policymakers, farmers and society of the benefits of synthetic biology, then it can make sense for those companies to work together pre-competitively, in a strategic way. Such 'coopetition' is taking place in many other sectors, e.g., the 'Soft Commodities Compact', an initiative that aligns the banking and the consumer goods sectors behind the goal of achieving zero net deforestation in consumer goods supply chains by 2020, and often is driven by potential cost savings and efficiency gains and/or consideration for larger societal or environmental benefits.

1.1.9. THE GLOBAL ECONOMIC MODEL

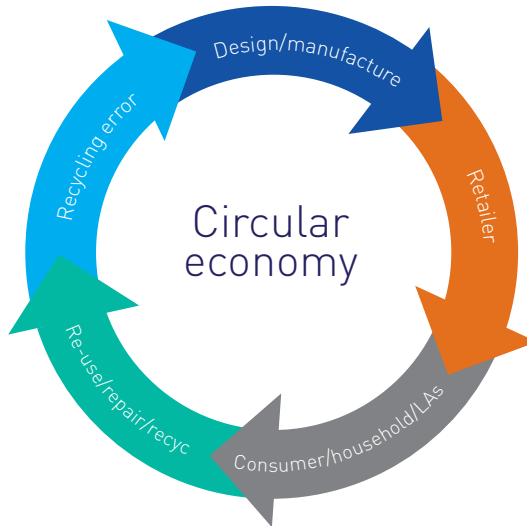
In the long-term, it is conceivable that the global economic model itself could shift to a 'circular' one (see Figure 5). In its optimal form, the circular economy involves 'cradle to cradle' production: the efficient and essentially waste-free development of a product whereby all inputs can be recycled in a non-toxic closed loop. This implies the recycling, upcycling or re-use (in all cases without any loss of quality), or composting or consumption of all material inputs and outputs⁷, requiring coordination across the entire supply and distribution chain. The food production animal sector would have a huge role to play in such an innovative new economic model.

⁶ FAMACHA is a treatment method according to which certain sheep or goats are selected for treatment against wireworm, based on the degree of anaemia in their mucous membranes.

⁷ www.sustainabilitydictionary.com/cradle-to-cradle



Figure 5. The circular economy



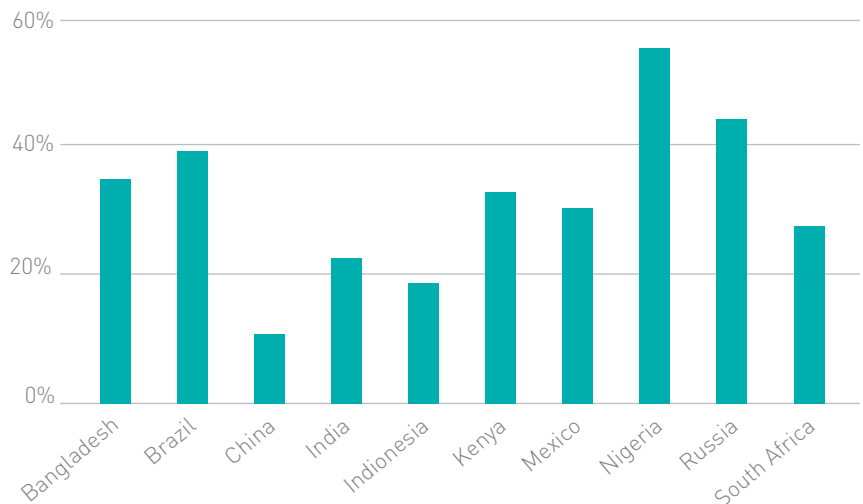
Source: www.waste-management-world.com. Note: LAs = local authorities. 1.2. Barriers to progress

1.2. Barriers to progress

1.2.1. INFORMAL MARKETS

In some emerging markets, large parts of the livestock and food sectors are informal. For example, in the Horn of Africa, millions of livelihoods depend on the informal livestock trade. This informality negatively affects how animals are kept and traded, and whether diseases are identified, monitored and treated. Often, informality reflects the size of the shadow economy in the overall economy. This is a problem of varying proportions across leading emerging markets (see Figure 6).

Figure 6. Average size of the shadow economy in selected emerging markets (% of national income), 1999-2007



Source: Bühn, Montenegro and Schneider (2010)

Therefore, top down policy innovation often may not work because of national and local governments' inability to enforce regulation. Instead, innovation at the local level is required to ensure that animal health becomes a key consideration even when markets are informal and regulations and standards do not exist or are not enforced.

Dr. Gregorio Torres of the World Organisation for Animal Health (OIE) notes that many standards in the area of animal health exist and have been adopted by all 180 countries⁸.

For example, in Malawi since 2009 the UK Royal Society for the Prevention of Cruelty to Animals, in partnership with the Lilongwe Society for the Protection and Care of Animals and the Malawi government's Department of Animal Health and Livestock Development, has run a programme of training for livestock coordinators in disease protection and chicken welfare, and delivering workshops to communities in Lilongwe. The programme adopts the OIE's standard on Newcastle disease, a lethal chicken disease common in Malawi. Therefore, countries should align their trade requirements with the recommendations in the relevant standards of the OIE.

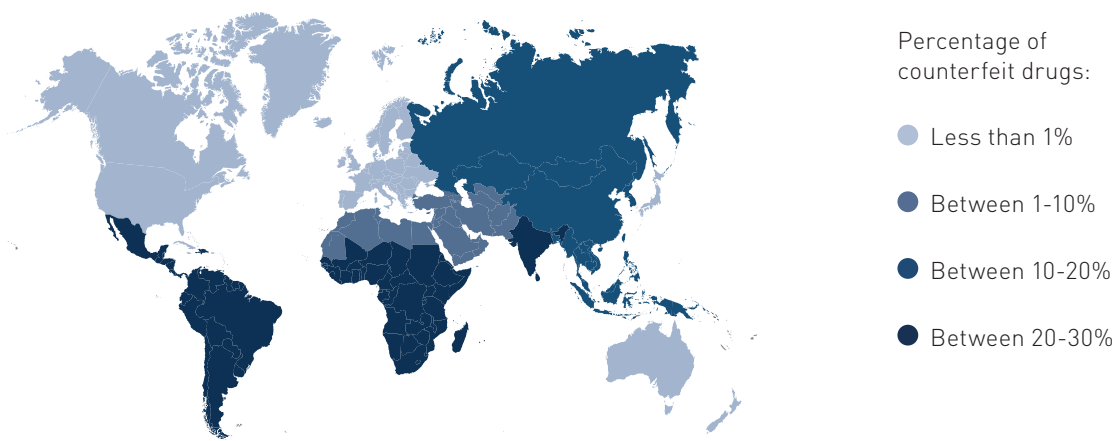
1.2.2. COUNTERFEIT MEDICINES

Globally, there is a trend towards the use of counterfeit medicines for animal (and human) health, which are usually cheap, low quality and produced without adequate testing. In some countries, the counterfeit market for animal health medicines is booming: for example, surveys focused on certain African Trypanosomiasis medicines in Benin, Cameroon, Chad, Mali, Mauritania, Senegal and Togo found that 43-93% were counterfeit or of substandard quality⁹. HealthforAnimals' own estimates put the value of the black market for African Trypanosomiasis at 400 million dollars annually¹⁰.

The overall market for counterfeit medicines was estimated at 20-30% of the total market in Latin America, Sub-Saharan Africa and India by the European Commission (see Figure 7). However, these estimates date from 2008 and the problem is likely to have worsened since then. The OIE, the World Customs Organisation and HealthforAnimals are working on initiatives that aim to combat counterfeit products, but the challenge is huge.

1. Food safety and sustainability

Figure 7. Estimates of prevalence of counterfeit medicines



Source: European Commission, 2008

⁸ The OIE International Standards sets out standards for the improvement of animal health and welfare and veterinary public health worldwide, and for safe international trade in animals and their products. The health measures in the international Standards are to be used by the Veterinary Authorities of importing and exporting countries for early detection, reporting and control of agents pathogenic to terrestrial animals and, in the case of zoonoses, for humans, and to prevent their transfer via international trade of animal and their products, while avoiding unjustified sanitary barriers to trade. The OIE international Standards are a key part of the World Trade Organization (WTO) legal framework for international trade, recognising the role of the OIE as the international standard setting organisation for animal health and zoonotic diseases.

⁹ For references to these surveys see 'Animal trypanosomosis: making quality control of trypanocidal drugs possible' by O.B. Sutcliffe et al, Review of Science and Technology 2014. The surveys covered ivermectin, diminazene, oxytetracycline and albendazole formulations.

¹⁰ See 'IFAH and FAO drive veterinary medicine standards to safeguard animals and farmers from counterfeit products', Brussels, March 1, 2012.

1.2.3. INSUFFICIENT SECTORAL EDUCATION FOR WOMEN

In several countries in South Asia and Sub-Saharan Africa, women play a leading role in livestock and agriculture, e.g., in India, where they represent 69% of the sectoral workforce. Greater involvement of women in livestock and agriculture can provide a route out of poverty; however, as with men, often their education about sectoral good practices lags behind the scale of their involvement. In countries such as India, innovative efforts in animal health education should be targeted disproportionately at poor women, as part of broader efforts to increase their prosperity. However, at present the exclusion of women from education about animal health still presents a significant barrier to progress. Overcoming this barrier requires long-term behavioural 'innovation', and in some cases a questioning of traditional and/or religious roles of women.

A good example is provided by Anthra, an NGO working with rural communities in India on strengthening livelihoods by improving livestock health and productivity. Its programme ensured that at least 75% of all new animal health workers were women, and that the women Animal Health Workers (AHWs) participate in key health-related meetings. According to the NGO, women AHWs have begun to take on leadership roles within the village women's groups and the community as a result of their deepened role in the livestock sector.¹¹

1.2.4. INCOMPATIBLE ANIMAL HEALTH INFORMATION MANAGEMENT SYSTEMS

The incompatibility of data management systems often complicates the exchange of knowledge between the scientific community, policymakers, the animal food production sector and vets. As a result, data collected by policymakers and the sector often lags behind what is most relevant according to industry best practices and the latest scientific research. Such data can then be of limited use for, e.g., syndromic surveillance. The best way to overcome this barrier would be for regulation to impose compatible data management systems for all stakeholders, but this would require substantial financial and training support for those stakeholders that are required to switch systems.

Greater involvement of women in livestock and agriculture can provide a route out of poverty...

It can also be helpful to make the sharing of data anonymous. For example, in Switzerland cattle breeding organisations pass their data on production and animal health anonymously to the authorities, which are currently evaluating how useful the data is for syndromic surveillance.

1.2.5. THE RISE OF A SCEPTICAL POPULAR CULTURE

Sections of the general public are relatively cautious in the face of the drive towards innovation, even when presented with evidence of the solutions that these innovations provide, e.g., pesticides are frequently perceived in a negative light despite their huge positive impact on the food supply. In fields such as biotechnology and increasingly also newer fields such as synthetic biology and nanotechnology, there is resistance among parts of the general public to their use in areas that are perceived to have an impact on human health, even where scientific evidence for adverse effects is not available. The adoption of a 'precautionary principle' is to be anticipated in economies where there is already a high degree of food security. Resistance from the general public needs to be taken into account when technological innovations are introduced in the animal health sector - alongside (or even before) introduction of an innovation itself. The onus is on the user of the technology to provide the evidence required to demonstrate long-term benefits along with health and environmental safety. The user of the technology also needs to undertake a process of cultural, behavioural and political innovation, led by the marketing and public affairs departments of animal health companies with support from the academic research community. Key to the success of such up-front engagement is likely to be clear and innovative communication.

¹¹ www.anthra.org

Zoonotic (including vector-borne) disease



2 Zoonotic (including vector-borne) disease

Local governments, farmers and health workers need to be involved in putting in place strategies to manage interactions between human, animal and environmental health issues.

2.1. Emergency preparedness

Many zoonotic and vector-borne diseases are likely to increase in prevalence in the near future as a result of changing social habits, habitat modification, exotic vector introductions and climate change. Furthermore, the rapid movement of people and transportation of goods have resulted in the introduction and establishment of several novel vector species not previously present in some areas, for example *Aedes albopictus* (the mosquito that is a vector for chikungunya and dengue, among other viruses) in Europe.

In emergency disease outbreaks, barriers to collaboration can sometimes be overcome more quickly than during 'business as usual', particularly if the emergency affects developed country citizens' health or developed country finances. An example of such an emergency was when screwworm (*Cochliomyia hominivorax*), an obligate parasite causing wound myiasis, became established in Libya in 1988. To avert a major disaster for the livestock industry and wildlife of Africa and Southern Europe, the Libyan Government and the FAO launched an intensive screwworm eradication programme, despite the difficult political relationships between Libya and key participating nations, such as the United States. This programme was quickly able to eradicate the outbreak.

Stressing the importance of impacts on public health or economies beyond the area of immediate concern can also be used to accelerate future collaboration between the animal and human health sectors in preparing for emergencies. A potential emergency could be used to highlight the importance of pre-emergency collaboration.

This should then be maintained after the acute phase of an emergency is over. Ideally, this can involve the institutionalisation of collaboration. For example, in the area of avian influenza, the OIE and the FAO have created a partnership called OFFLU. Its vision statement reads 'The animal health community will provide early recognition and characterisation of emerging influenza viral strains in animal populations, and effective management of known infections, thereby better managing the risk to human health and supporting global food security, animal health and welfare, and other community benefits derived from domestic animals and wildlife.'¹²

¹² www.offlu.net

2.2. Specific disease targets

Some 25 years ago, rabies was still common in Western Europe. It was then almost eradicated in the region thanks to an effort focused around giving a vaccine to foxes. In many other parts of the world where rabies is still common, e.g., India, the disease could in principle be tackled through mass dog vaccination and targeted collaborative approach. Such an effort needs to be led by governments and international organisations, and indeed the OIE is planning to head the coordination of that effort with a global conference focused on how to combat rabies successfully. Animal health companies will participate in the effort as long as they have some profit incentive. Pet owners and farmers will also have major roles to play.

Globally, only one animal disease (rinderpest) has ever been eradicated, which emphasises the extreme difficulty of achieving more than local eradication and global management, at best. With so many stakeholders involved in any major eradication effort, organising the effort is difficult and critical. That is why it makes sense to focus on one disease at a time, but intensively. The effort could be targeted even more specifically by focusing on one country at a time, or at least by choosing one country as a 'pilot' project.

2.3. Network-based One Health initiatives

Consideration of One Health principles has been common in veterinary health for decades. Among medical doctors, there is less understanding and appreciation for it. The 2015 HealthforAnimals Industry Survey confirms that animal health professionals strongly believe that the animal health sector has a bigger role to play in the control of diseases in the human population. One Health initiatives involving networks of stakeholders can provide a strong boost to collaboration between animal and human health, for example:

- The Innovative Medicines Initiative (IMI) is a public-private partnership that 'supports collaborative research projects and builds networks of industrial and academic experts in order to boost pharmaceutical innovation in Europe'.¹³
- The MediLabSecure project aims to establish a laboratory network on the emerging viruses that are pathogens for humans and/or animals in 19 countries in the Mediterranean and Black Sea Regions. As of September 2015, 57 labs were actively involved. Additionally, twelve public health institutes and eight ministries of health of the 19 countries are participating in the activities.¹⁴

2.4. Bottom-up approach to One Health

The OIE is highlighting the value of a bottom-up approach, starting at the level of villages. Local governments, farmers and health workers need to be involved in putting in place strategies to manage interactions between human, animal and environmental health issues. Communities need to be shown examples of success stories, and assisted in undertaking cost-benefit analysis of a collaborative One Health approach versus inadequate dialogue among the different health sector participants.

2. Zoonotic (including vector-borne) disease

Many zoonotic and vector-borne diseases are likely to increase in prevalence in the near future as a result of changing social habits, habitat modification, exotic vector introductions and climate change



¹³ <http://www.imi.europa.eu/>

¹⁴ <http://medilabsecure.com>

Such an approach has generated notable successes in other issue areas that have gained global importance, for example climate change: Years of failure to establish global agreement on clear targets for international reduction of carbon emissions left individual countries or groups of countries to create domestic and regional schemes of their own: as a result, hundreds of climate change regulations and policies now exist internationally and action is being taken at the city, provincial and regional levels.

2.5. The human angle

Historically, vector-borne diseases in veterinary medicine were considered to be important largely because of the losses they cause to livestock production and impacts on pet health. Increasingly, however, the zoonotic potential of these diseases and their impacts on public health, particularly in developing countries, are being recognised. Increased disease transmission may be exacerbated by rising numbers of pets, since they represent an easily available food source for arthropod vectors and reservoirs for pathogens.

In order for animal health issues to gain greater recognition within the human health sector, the impacts of animal health issues on human health need to be quantified, in terms of both the health (i.e., fatalities and illness) and economic burdens. Such statistics then need to be clearly communicated to all relevant stakeholders. In addition, there is a need to establish effective surveillance systems for most zoonotic and vector-borne diseases across different countries to allow a detailed risk analysis, including the evaluation of the potential spread to new areas.

Globally, only one animal disease (rinderpest) has ever been eradicated

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In emergency disease outbreaks, barriers to collaboration can sometimes be overcome

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Innovation
in pet health

3 ■ Innovation in pet health

3.1. Recent innovations

3.1.1. HOLISTIC HEALTH CHECKS

The 2015 HealthforAnimals Industry Survey found that obesity was considered to be by far the most significant potentially lifestyle-related disease in pets. It was also the condition that respondents felt the animal health sector could play the biggest role in combating, ahead of osteoarthritis due to age-related changes.

Despite the gradual growth in awareness of the need to treat 'lifestyle' pet health problems such as obesity or ageing-related illnesses, the area of infectious diseases remains where the greatest gains in pet health can be made globally, and especially in emerging markets. The 2015 HealthforAnimals Industry Survey suggests that infectious diseases will be the second-biggest challenge facing the animal health sector over the next five years, after antibiotic resistance.

Ideally, pets should be screened in a regular and holistic way for both lifestyle-related and other diseases. However it should be noted that there are fundamental cultural differences in the concept of pet ownership between the developed world and most emerging markets, where the preventive veterinary medicine is largely unknown. In these regions, long-term pet health issues are usually left untreated.

Some programmes are contributing to improvements in animal health, through their primary interest in eliminating animal reservoirs of human disease. For example, the EU-funded Integrated Control of Neglected Zoonoses Africa programme (ICONZ Africa)¹⁵, a work package established a strategy to address rabies and other diseases affecting dogs in Morocco, involving giving dogs holistic health checks.

3.1.2. IMPROVEMENTS IN PET FOOD

The quality of pet food is continuing to improve. As with humans, better diets are leading to longer, healthier lives for pets, especially in developing pet markets, and this is in part because of better diets. Even in a developed pet market such as the United States, there has been some increase in lifespans (see Table 2). Higher quality pet foods are often more expensive, but this is not necessarily the primary obstacle to greater demand for them; often, owners simply are not aware of the health benefits of such pet food. This could be addressed by innovative communication and education campaigns targeted specifically at higher-income pet owners.

¹⁵ www.iconzafrica.org/

3.1.6. ADJUSTING VETERINARY STUDENT CURRICULA

Dr. Zeev Noga of the World Veterinary Association (WVA) points out that innovation in veterinary student curricula can contribute to improved animal health, and to enhancing dialogue between future members of the animal and human health professions. In particular, curricula should include a stronger focus on the linkages between animal and human health, as well as the importance of the role of animal owners, and of holistic, preventive healthcare for animals.

In particular, curricula should include a stronger focus on the linkages between animal and human health, as well as the importance of the role of pet owners, and of holistic, preventive healthcare for pets. In some countries, e.g., Brazil and China, where pet ownership is growing fast and veterinary student interest in pet health (as opposed to food production animal health) is rising in parallel, adjusting curricula is especially relevant.

3.2. Lessons for other areas of animal and human health

3.2.1. DEEPEN COLLABORATION BETWEEN HUMAN AND ANIMAL HEALTH PROFESSIONS

There have been good examples of medicines that have been used in animal health then being used for humans, and vice versa. For example, in West Africa river blindness in humans was combated using ivermectin, a medicine used for animals (following its initial development in horticulture), after the continued use of insecticide had proved largely ineffective. However, transferring knowledge both ways between the human and animal health sectors can be impeded by slow regulatory processes or by a lack of communication. For example, there is a lack of available treatments for epilepsy in animals, partly because it represents a small market with low margins. Regulation is holding up the re-use of human medical knowledge in this area; even though some animal studies have already been done (e.g., on relevant toxicology in dogs), regulations often require that these are repeated. Such delays could be lessened by the implementation of regulation permitting rare pet diseases to be given 'orphan' status, similar to orphan diseases in humans.¹⁶

According to the 2015 HealthforAnimals Industry Survey, 89% of respondents believe that the human health sector could learn from veterinary medicine. However, the perception remains that the human health sector has not yet fully acknowledged the potential gains to both human and animal health that could be derived from closer collaboration in the areas of diagnostics, treatment and innovation. For example, studies of the DNA of the papilloma virus in cattle and horses have led to the development of a vaccine to prevent cervical cancer in humans.

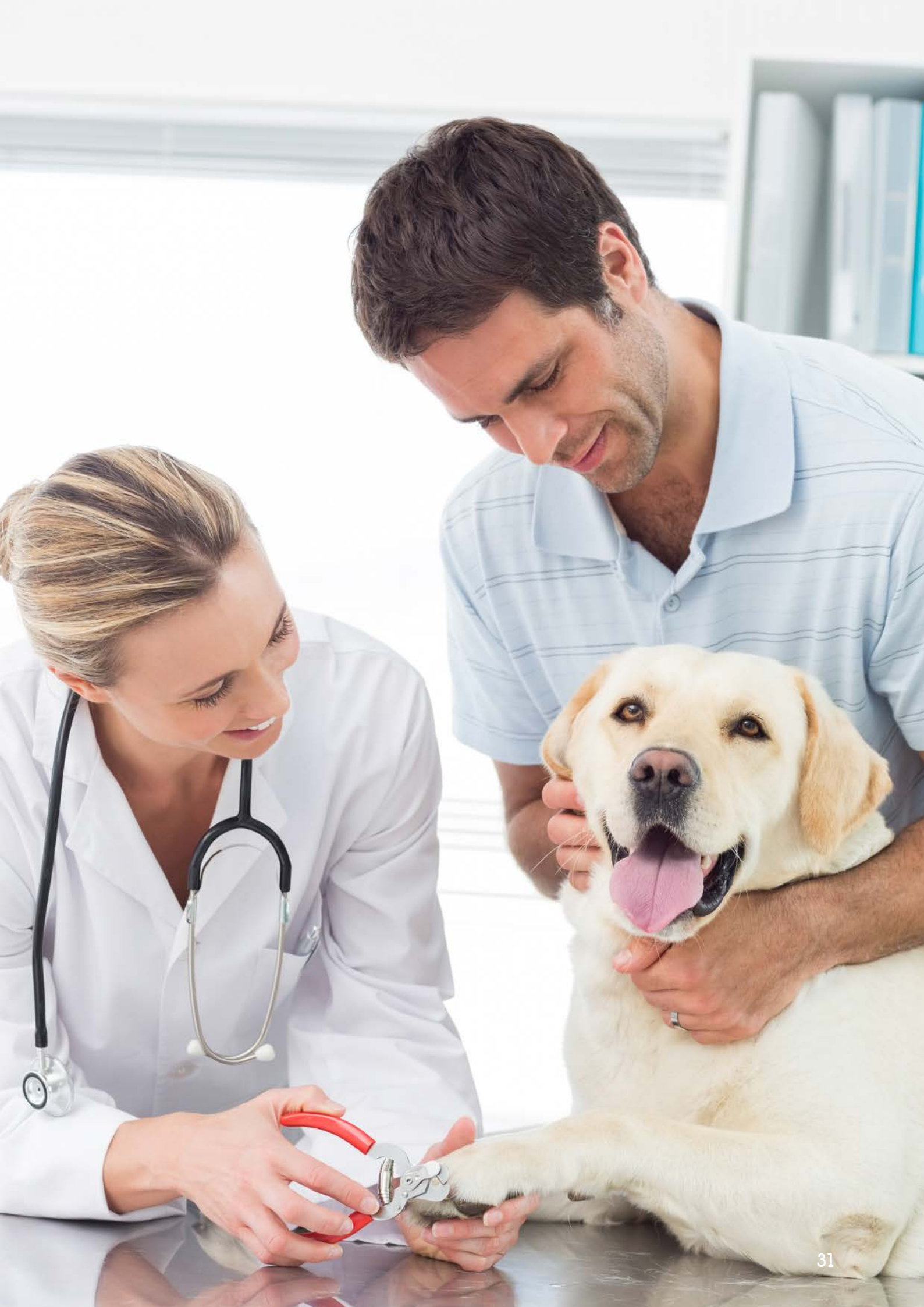
There is often solid collaboration within the animal health sector on research. This is exemplified, for example, by the EU-funded network STAR-IDAZ - Global Strategic Alliances for the Coordination of Research on the Major Infectious Diseases of Animals and Zoonoses. However, such coordination sometimes does not extend fully to human health. The inadequate dialogue and collaboration is partly because the size of the human health sector still dwarves the size of the animal health sector. However, this relative size can be misleading, given the potential for huge societal, economic and human health

¹⁶ In human medicine, orphan status is given to certain rare diseases. Orphan medicines can be approved through regulatory processes that are less onerous than for other medicines. This, together with other incentives, aims to encourage the development of medicines that may otherwise not be profitable for companies.

3. Innovation in pet health

According to the 'hygiene hypothesis', early childhood exposure to pets can significantly reduce subsequent risks of developing asthma or other allergies





impacts of animal health. In fostering deeper collaboration, the animal health sector needs to explain and emphasise the channels through which animal health affects human health.

Progress in deepening dialogue and collaboration is being made. The WVA has started working closely with the World Medical Association, e.g., conducting joint conferences. Dr. Zeev Noga of the WVA notes that trust between the two sets of professionals is increasing, and new initiatives for collaboration are now being put forward by both sides.

3.2.2. ENCOURAGE RESPONSIBLE PET OWNERSHIP TO BENEFIT HUMAN HEALTH

The 2015 HealthforAnimals Industry Survey found that 78% of respondents agreed that the animal health sector should be doing more to promote responsible ownership of pets. Society's awareness of the link between responsible pet ownership and human health is still maturing. There is a clear dichotomy between approaches to pet ownership in the developed and much of the developing world. In most of the developing world, where, with the exception of working dogs, most dogs and cats are free-roaming, the concept of small animal preventive veterinary medicine is not strongly developed. In the developed world, most pets are well cared for and live in environments where there is a demand for effective and pro-active approaches to health management. In contrast, in the developing world health management is much more driven by economics and concerns relating to zoonoses, with a large population of free-roaming dogs and cats acting as reservoirs of potentially meta-zoonotic diseases. In some emerging markets, however, the differences with the developed world are narrowing, and capitalising on this presents a major opportunity.

Responsible pet ownership, in particular ensuring that pets have sufficient exercise, has clear benefits for human health. Research by the International Federation of Ageing has shown that regular dog-walking can improve human cardiovascular health, lengthening the healthy lifespan of owners, and also that human-dog interaction can alleviate depression. In turn, in order for pets to exercise regularly, they need to be in good health, which depends partly on the health treatment that they receive, and partly on the owner's lifestyle both outside and inside the home (e.g., smoking in the home can cause cancer in pets). According to the 'hygiene hypothesis', early childhood exposure to pets can significantly reduce subsequent risks of developing asthma or other allergies.

Especially in emerging markets, a lot more could be done to increase awareness around responsible pet ownership. Policymakers so far have done little to reflect the health benefits of dog ownership in policies, e.g., communication campaigns to encourage dog-walking, or investment in dog-walking routes for the elderly. However, this is starting to change. For example, anecdotal evidence from China suggests that public health officials are increasingly focusing on policies that can help Chinese society 'leapfrog' towards responsible pet ownership, avoiding some of the lifestyle and nutritional mistakes made by pet owners in more mature markets such as Europe and the United States.

3. Innovation in pet health

...studies of the DNA of the papilloma virus in cattle and horses have led to the development of a vaccine to prevent cervical cancer in humans

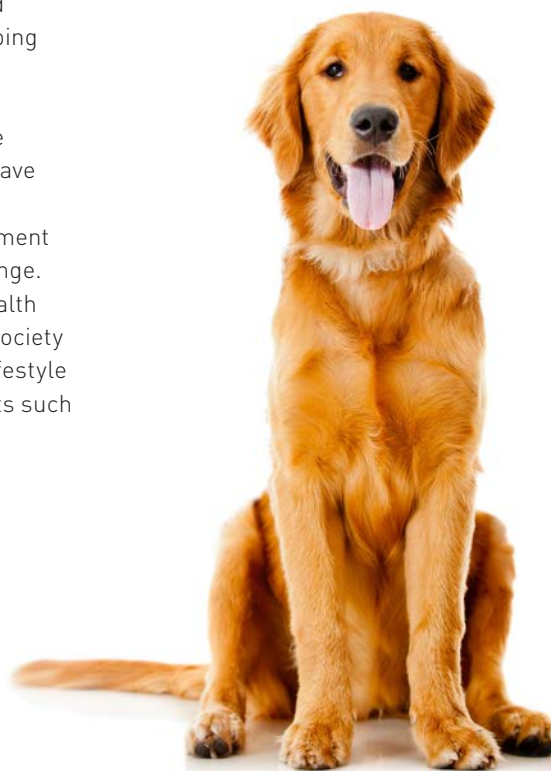


Table 2: Lifespans of cats and dogs in the United States

	Average lifespan (years)	Growth in lifespan 2002-13*
Cats	12.1	10%
Dogs	11.0	4%

Source: Banfield State of Pet Health Report 2013. *This is not an annual growth rate, i.e., the lifespan for dogs has risen by about half a year over the period 2002 to 2013.

3.1.3. 'BIOLOGICAL/NATURAL' TREATMENTS

As a general trend, pet owners are increasingly interested in sustainable 'biological/natural' methods as alternative to pharmaceuticals to treat their animals. Some natural oils from lemon eucalyptus, geranium, camomile and lavender have demonstrated high levels of toxicity against a range of arthropod parasites, although they have a short residual effect, usually being relatively volatile. However, the fact that these compounds can rarely be used to eradicate pests completely may limit their use in the domestic environment.

3.1.4. VETERINARY HEALTH INFORMATION SYSTEMS

In the United States, data generated in some veterinary clinics is uploaded to the Internet, for sharing with other clinics and researchers. This is permitting real-time analysis of changes in prevalence of diseases. In some respects, this use of health information systems is more advanced than in human medicine. However, this is the exception rather than the rule and further development in this area would be highly desirable.

3.1.5. VET-OWNER MOBILE TECHNOLOGY COMMUNICATION

There are examples of real-time communication about pet health issues using mobile online technology. For example, vets can send reminders to owners about the dates for vaccines or medication refills, provide instructions for pets' diets, or remind owners about appointments. As vets and owners become more accustomed to such communication, it is likely to increase sharply, given that the technology for it already exists. Such communication has clear benefits for vets as well as for pet owners and pets: clients are likely to become more loyal, increasing business for vets.

3.2.3. TRANSFER KNOWLEDGE FROM PETS SECTOR TO FOOD PRODUCTION ANIMALS SECTOR

In some areas, research is more advanced on pet health issues than in the food production animals sector. For example, symmetric dimethylarginine (SDMA)¹⁷, a form of amino acid excreted primarily from the kidneys, is now being used to diagnose chronic kidney disease (CKD) in cats and dogs. It has been found to permit identification of CKD on average nine months sooner in dogs and 17 months earlier in cats. Whether such technologies can transfer into the livestock sector will depend on the test cost relative to animal value.

17 www.idexx.com

3. Innovation in pet health

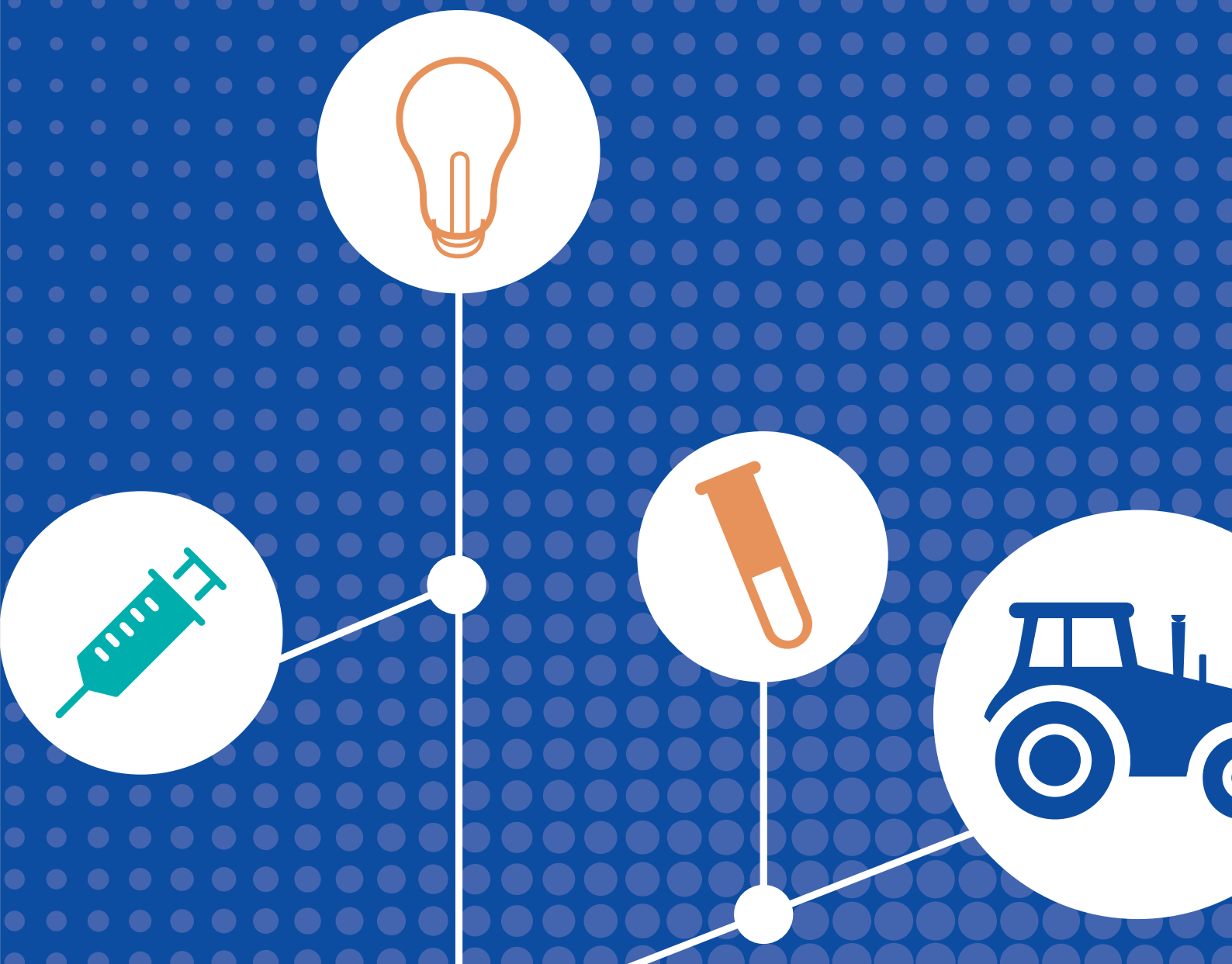


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According to the 2015 HealthforAnimals Industry Survey, 89% of respondents believe that the human health sector could learn from veterinary medicine

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Barriers towards modern vaccine use



4 Barriers to modern vaccine use

4.1. Regulation

The need for regulatory streamlining described in Section 1 above also applies to vaccine technology. Regulatory barriers can often be overcome rapidly in times of emergency. For example, during the 2014-15 Ebola outbreak centred in West Africa, many regulations were circumvented in the UK and some other countries, as emergency plans were implemented. Similarly, during the Bluetongue outbreak in the UK in 2007-08, vaccine development, registration and delivery was accelerated to help combat the spread of the outbreak. This demonstrates how dependent regulatory barriers can be on political will.

4.2. Funding

4.2.1. COOPETITION

There is potential for co-competition in the area of vaccine technology. For several significant livestock vector-borne pathogens, no vaccines are available. During the 2014 Schmallenberg virus outbreak, for example, many companies at first hesitated about investing, before several companies undertook similar investments in vaccine innovation in parallel. Risks and costs, as well as data, could have been shared by working together with each other, and with research institutes and the public sector. This would permit quicker development of vaccines and better use of overall available funding.

Sometimes research institutes argue that the scientific knowledge exists to quickly develop vaccines, but that there is a lack of understanding within the research community of how to turn inventions into products. In turn, George Tice of Elanco Animal Health points to the substantial costs of developing a manufacturing process for vaccines (which can require forward planning of up to 5 years), and the relative scarcity of high-quality manufacturing plants.

In future, for example, collaborative efforts could be started to develop a vaccine for a high-impact neglected disease, such as African trypanosomiasis¹⁸. However, co-competition needs to be structured in such a way that companies can make a return on their investment. Both animal and human health would benefit from targeted efforts at cooperation that also involve governments, multilateral organisations and NGOs. The European Commission is pressing ahead in this regard, with a new initiative, the International Research Consortium (IRC) on Animal Health, to advance the activities of the EU-funded STAR-IDAZ -- Global Strategic Alliances for the Coordination of Research on the Major Infectious Diseases of Animals and Zoonoses. The IRC aims to coordinate research funding activities in animal health.

¹⁸ The immunological control of African trypanosomiasis has not succeeded because of the antigenic variation of the trypanosome parasites.

However, it remains the case that vaccine development is usually slow and expensive. In many areas the margins derived from livestock production are low, so decisions by individual producers about whether to use animal medicines are informed strongly by cost. Likely market uptake drives the willingness of pharmaceutical companies to invest and innovate. Low profit margins therefore ultimately limit the rate of change in the livestock sector unless development and uptake are supported by government, multilateral organisations or NGO funding

4.2.2. UNFUNDED NEED FOR VACCINES

According to the 2015 HealthforAnimals Industry Survey, vaccination has been the top innovation or breakthrough within the animal health sector over the past 100 years. Many developing country governments and farmers would like to make greater use of vaccines for animals, but lack the financial resources to purchase them. Globally, there is ongoing competition for donor funding that can be channelled into vaccine procurement. The lack of sufficient funding for animal vaccines is partly because animal health problems that affect primarily poorer countries are not prioritised by developed country governments.

Over time, as awareness of the human impact of animal health issues grows, it is likely that some of the international organisations involved in technical, financing and supply aspects of human vaccines will also become more deeply involved in the area of animal health vaccines (see Table 3).

Table 3. Roles of major donors in the area of human vaccines

Category	Partner inputs
Technical	WHO, US Center for Disease Control and Prevention, ADIPs/HI/VISI/PATH vaccine projects, UNICEF, World Bank
Financing	WHO, Regional development banks, World Bank, GAVI, UNICEF, GAVI partners, ADIPs/HI/VISI/PATH vaccine projects, UNFIP, the Bill & Melinda Gates Foundation
Supply	WHO, GAVI, GAVI partners, World Bank, ADIPs/HI/VISI/PATH vaccine projects

Source: WHO

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The scientific barriers to the development of new vaccines should not be overlooked... researchers have for some 40 years been working on developing a vaccine for Trypanosomiasis

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4. Barriers to modern vaccine use

4.2.3. VACCINE BANKS

According to Dr. Gregorio Torres of the OIE, vaccine banks are hugely important and merit a greater allocation of funding. Vaccine banks can hold ready-to-use, formulated vaccines, and/or antigen components, to be formulated into vaccines as needed. In order to improve the management of vaccine banks, the OIE has developed a new concept that creates virtual rolling stocks: the suppliers (selected based on an international tender) produce the vaccines only when needed or they remain with the suppliers at their own risk and are renewed on a rolling basis under terms and conditions contractually defined with the OIE. According to the OIE, this revised concept enables the rapid supply of high quality vaccine according to international standards.¹⁹

4.3. Perception/social acceptance

Among the general public and sometimes farmers, dissemination of misleading information about certain vaccines or vaccine types is common. For example, in the UK there was widespread concern among producers about a supposed link between Bluetongue vaccine and abortion, even though no scientific evidence for this existed. Such sentiment can drive political stances, which in turn can delay regulatory approval for any vaccine technology that is perceived as 'controversial'.

However, within the animal health sector there is consensus (based on scientific evidence) that the increased use of such controversial vaccine technologies is essential to maintaining the health of increasingly large and more productive animal populations. Companies and researchers involved in developing vaccines can pre-empt scepticism through careful communication about progress in vaccine technology.

However, ultimately a wide-ranging public-private education initiative on the benefits of vaccination (both controversial and non-controversial types) is required. This should be led by the OIE and the Food and Agriculture Organization (FAO), with strong support from national authorities. The important advantages of vaccination, particularly over the use of insecticides and acaricides, should be emphasised, for example highlighting the lack of contamination in the environment, specificity, high levels of safety for humans, ease of administration and low production costs.

4.4. Infrastructure

In many parts of the developing world, inadequate physical infrastructure (including poor road networks and insufficient refrigeration capacity), coupled with long distances between locations where vaccines are needed, can preclude the use of some vaccines that are not stable at room temperature. Therefore, an important future area of innovation in vaccine technology is in the development of such vaccines and the means to transport those that are temperature-sensitive.

Vaxess technologies, a start-up founded by Harvard graduates, is developing an innovative way to address the storage problem. The company extracts fibroin from silk and combines it with a vaccine. The mixture is freeze dried in thin sheets to become a solidified form of the vaccine that does not require refrigeration, and can later be dissolved in water and injected. Such an initiative, although it has not yet reached the mainstream, is illustrative of efforts to overcome infrastructure barriers.²⁰

¹⁹ www.oie.int/support-to-oie-members/vaccine-bank/

²⁰ www.vaxess.com

4.5. Human capital

An additional barrier in many emerging markets and some parts of the developed world is that there is a lack of vets and a shortage of farm workers skilled enough to administer vaccines. In countries where interest in pets is growing, such as Brazil and China, the proportion of vets who specialise in pets is likely to grow as a proportion of the total number of vets, which could cause additional problems for veterinary care of food production animals.

Given these human capital constraints, it is often necessary to combine several vaccines into one, to minimise the amount of time spent gathering and handling animals in implementing vaccine programmes. Researchers from South Africa and Canada have developed a novel vaccine that protects livestock from five diseases in a single dose. The aim of this multi-funder initiative led by the Canadian International Food Security Research Fund (CIFSRF) is to bring this new technique to farmers in Sub-Saharan Africa by 2018. Not only is this single-dose vaccine heat stable, it may also be interchangeable - the goal of the research team is to produce vaccines that can be tailored to the needs of specific regions by adding or eliminating diseases to target exposure in each context.²¹

4.6. Science

The scientific barriers to the development of new vaccines should not be overlooked. While in the case of several diseases, the application of existing scientific knowledge to vaccine development and rollout is constrained by the other barriers discussed in this section, in other cases it has proved challenging to invent appropriate vaccines. For example, a programme to develop a vaccine for sheep scab (psoroptic mange) by Moredun²² in the UK has been running for over 15 years, with some, but limited, success and no near-market vaccine to date.

Dr. Vishvanath Nene of ILRI points out that researchers have for some 40 years been working on developing a vaccine for African Trypanosomiasis, but so far without success.

4.7. Surveillance and reporting

Even when vaccines for diseases are available, a lack of data can complicate decisions about where vaccines are needed. Surveillance and reporting systems are still very inadequate for many diseases and in many countries. This problem is related to funding, as farmers are often reluctant to pay for diagnostic tests, or undertake surveillance and reporting that may be costly in terms of time or money (e.g., if it requires investing in IT). EU funding in this area appears set to decline (see Figure 8).

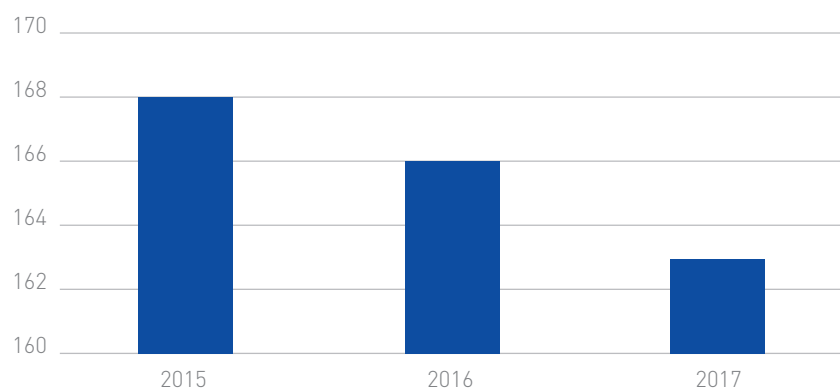
4. Barriers to modern vaccine use

...The important advantages of vaccination... should be emphasised, for example highlighting the lack of contamination in the environment, specificity, high levels of safety for humans, ease of administration and low production costs.

²¹ www.idrc.ca/EN/Documents/107848Single-dose-vaccines.pdf

²² www.moredun.org.uk

Figure 8. EU funding for eradication, control and surveillance of animal diseases and zoonoses programmes (million euros), 2015-2017



Source: Directorate General for Health and Food Safety, European Commission

A project developed by the European Space Agency is seeking to address the surveillance issue at the regional scale in Africa. VGTropics aims at establishing a service platform to support early detection of livestock diseases, identification of livestock populations and related disease outbreak risks, and planning of livestock surveys. At this stage of the project, user needs and requirements have been consolidated and the service platform has been developed and is at the product demonstration stage.²³

4.8. Politics

Disagreement among policymakers at national and multilateral levels (and among private sector donors) about how to determine the allocation of funding for different vaccines and vaccination programmes can delay the development of vaccines and the implementation of programmes. In an initiative that will contribute to tackling this issue, the OIE in April 2015 convened a meeting of an ad hoc 'Group on prioritisation of diseases for which vaccines could reduce antimicrobial use in animals', specifically in poultry, swine and fish farming. The subsequent report from the meeting provides guidance for future allocation of funding that helps to shift the focus from antimicrobial treatments to vaccines where applicable²⁴.

²³ <https://artes-apps.esa.int/projects/vgtropics>

²⁴ http://www.oie.int/fileadmin/Home/eng/International_Standard_Setting/docs/pdf/SCAD/A_SCAD_Sept2015.pdf

5 ■ Appendix

HealthforAnimals industry survey, summary of results

In which country are you based?

- Nearly half of respondents (74; 47.43%) based in North America and Canada
- Nearly a third of respondents (50; 32.05%) based in Europe
- 12 based in South and Central America
- 10 based in Asia
- 9 based in Australasia
- 1 based in Africa

In what area of the animal health sector do you work?

- Nearly half of the respondents work in the pharmaceutical industry (46.79%)
- Nearly a quarter of the respondents were veterinary professionals (23.08%)

Which of the following potentially lifestyle related issues in pets do you feel are most significant to the animal health sector?

(Osteoarthritis due to age-related changes, Diabetes, Obesity, Stress or anxiety, Dietary induced gastro-intestinal disease, Lack of exercise, Health risks associated with increasing urbanisation (and associated population density))

- Over a quarter of respondents feel antibiotic resistance will be the biggest challenge for the animal health sector over the next 5 years (26.92%)
- Nearly 1 in 5 of the respondents felt infectious disease outbreaks will be the biggest challenge faced by the animal health sector over the next 5 years (19.23%)
- 15.38% of respondents felt global food supply will be the biggest challenge for the animal health sector over the next 5 years
- 11.54% respondents felt zoonotic and vector borne disease will be the greatest challenge for the animal health sector over the next 5 years (7.05% and 4.49% respectively)

When asked to explain the above:

- Population increase putting increasing pressures on production
- Disease outbreaks having a knock on effect on food production
- Antibiotic resistance leading to increased zoonotic and infectious diseases leading to threats to global food supply
- Lack of funding into animal health drugs and increasing costs of registration and regulatory 'hurdles' of drugs limiting innovation
- 'Haphazard' antibiotic use in developing nations
- Climate change affecting distribution of disease vectors
- There needs to be global regulations on human and animal antimicrobial use
- Movement of people and animals more freely around world, along with global warming may increase disease transmission

What do you feel are the most important roles the animal health sector has to play in the future of food production?

- Nearly two thirds of respondents (60.90%) felt that ensuring food safety was the most important role the animal health sector has in the future of food production
- Nearly half (44.87%) thought improving animal welfare in food producing animals through health innovation was an important area the animal health sector should focus on in the future of food production
- Nearly half (44.23%) thought creating innovations to meet the growing demand for food was where the animal health sector could play an important role in future food production
- Over a third (41.67%) felt that generating strategies to reduce the environmental impact of food production was an important role the animal health sector has in the future of food production
- Over a third (40.38%) thought ensuring animals are healthy enough to achieve maximum productivity was an important role the animal health sector has in the future of food production

Should the animal health sector be doing more to promote responsible ownership of pets?

- Over three quarters (77.56%) of respondents agreed with this statement (44.87% strongly agree, 32.69% agree)

Which of the following potentially lifestyle related issues in pets do you feel are most significant to the animal health sector:

- Nearly half of respondents (45.81%) chose obesity as their top answer
- Nearly three quarters (74.67%) chose obesity within their top 3 answers
- Overall osteoarthritis due to age related changes was the next answer (49.16%), most commonly chosen as the 3rd issue (19.48%)

Of the following conditions, which do you feel the animal health sector could play the biggest role in combating?

- Obesity (41.67%)
- Osteoarthritis due to age related changes (25.64%)

Do you think the animal health sector is currently doing enough to combat new and emerging zoonotic diseases and why?

- 30.77% agreed
- 39.10% neither agreed or disagreed
- 30.13% disagreed
 - Most commented on financial restriction and low investment in this field
 - More education to general public needed
 - More research required
 - Stricter biosecurity

Which animal disease area do you feel most urgently requires innovation in vaccine technology?

- 1 in 5 thought avian influenza requires vaccine development (20.35%)
- Vaccinations against parasitic and vector borne diseases (13.2%)
- Zoonotic diseases with a focus on wildlife and non-domesticated animals
- FMD
- Fish diseases

Does the animal health sector have a bigger role to play in the control of diseases amongst the human population?

- Over three quarters (75.84%) of respondents agreed with this (39.74% strongly and 39.10% agree)
 - One Health and a need to work together with medics and regulatory bodies
 - Many disease zoonotic

Do you think the human health sector could learn from the veterinary medicine sector?

- Yes 89.03%

In which areas do you think the human health sector could learn from the veterinary medicine sector?

- A greater focus on preventative healthcare (53.68%)
- Strategies for infectious disease control (47.79%)
- Public education and disease awareness (45.59%)
- Greater sharing of information (41.91%)
- More responsible use of antibiotics (38.97%)
- Only 10.29% innovation of products

Do you feel the animal health sector is adequately addressing the issue of antibiotic resistance?

- 42.38% no
- 32.45% Yes
- 25.17% not sure

What do you feel is the main barrier to the sector addressing the issue of antibiotic resistance?

- 32.35% low perception of risk
- 22.55% not commercially viable
- 22.55% other – Regulation, lack of compliance, financial interests

What do you feel are the main innovations helping the animal health sector to adequately address the issue of antibiotic resistance?

- Vaccines and prevention protocols
- Responsible use
- Surveillance and education

What do you feel have been the 3 most important innovations or breakthroughs within the animal health sector over the past 100 years and why?

- Number 1 response vaccinations followed by antibiotics
- Number 2 antibiotics, anti-parasitics and analgesia
- Number 3 animal welfare

What breakthrough or innovation would you most like to see in animal health and veterinary medicine in the future and why?

- Vaccination improvements
- Alternatives to antibiotics

Do you feel this is achievable within the next 5 years?

- 37.50% yes
- 32.50% no
- 30.00% don't know

As the global voice of the animal health industry, which topics would you like to see supported by HealthforAnimals over the next 5 years?

- 48.15% antibiotic resistance
- 39.26% zoonotic diseases
- 36.30% innovation and development
- 34.81% harmonization of regulations
- 28.89% welfare in production animals
- 27.41% global food supply issue
- 25.19% preventative healthcare
- 22.96% disease surveillance
- 19.26% vector-borne diseases
- 10.37% lifestyle-related conditions in pets

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Appendix

HealthforAnimals Round Table Meeting

22nd September 2015

Topic: Innovation In Animal Health

Attendees

Name	Short Biography
Dr Gregorio Torres OIE	Gregorio is veterinary epidemiologist currently working for the Scientific and Technical Department of the OIE. He is responsible for the Secretariat of the Scientific Commission for Animal Diseases which assists in identifying the most appropriate strategies and measures for disease prevention and control. Among other activities related to transboundary and emerging animal diseases, he serves as the OIE focal point for scientific aspects of rabies control of the OIE/WHO/FAO Tripartite Secretariat under the auspices of the One Health concept.
Dr Vishvanath Nene International Livestock Research Institute	Vish is the Director and Program Leader for Vaccine Biosciences and also Interim Deputy Director General-Biosciences (Health) at ILRI He has more than 20-years' experience in molecular parasitology and 8 years in genomics research.
Professor Norbert Mencke Bayer and Hannover University	Norbert is Director of Global Veterinary Services at Bayer Animal Health. He graduated DVM from Veterinary School Hannover, Germany in 1987. He has held various previous positions in research and development at Bayer, with research around the discovery of insecticidal/ acaricidal as well as anthelmintic compounds. He is also a guest parasitology lecturer at Hannover University.
Professor Jackie Hunter Biotechnology and Biological Sciences Research Council	Professor Jackie Hunter is BBSRC's Chief Executive and BBSRC is the major funder of animal health research in the UK. Jackie has over thirty years of experience in the bioscience research sector, working across academia and industry and playing a key role in innovative collaborations and partnerships. Jackie has also extensive experience of working in Europe and USA including a period as chair of the EFPIA Research Directors Group and an IMI Board Member.
Dr Zeev Noga World Veterinary Association	Since September 2012, Zeev has been working as a Veterinary Policy Officer for the World Veterinary Association (WVA) representing the global veterinary profession. He is dealing with different veterinary issues, focusing on international collaboration with a view to strengthen the veterinary profession around the world and to promote animal health, animal welfare and public health globally.

Name	Short Biography
<p>Dr Renée Hoynk World Small Animal Veterinary Association</p>	<p>Executive Board member of the WSAVA; owner of small animal veterinary clinic for 15 years; owner of small and large animal clinic for 10 years; Board Member of the Netherland Association of Companion Animals(NACAM); member of the ethical committee for the NACAM.</p>
<p>Dr Jeroen Kortekaas Central Veterinary Institute, part of Wageningen UR</p>	<p>The department of Virology of the Central Veterinary Institute, part of Wageningen University, develops control tools for emerging livestock and zoonotic viral diseases. Jeroen is a molecular virologist with a key expertise in vaccine development against zoonotic arboviruses.</p>
<p>Dr Thierry Pineau INRA, French National Institute for Agricultural Research</p>	<p>Thierry has been head of the Animal Health Division at INRA since January 2009. He got his Molecular pharmacology doctorate from the INSERM, and takes part in the “One World, One Health” initiative providing his expertise within national alliances hinging on the ecological, animal and public health perimeters</p>
<p>Jean-Pascal Marc VIRBAC S.A.</p>	<p>Jean-Pascal MARC is the current Corporate Product Innovation Director of VIRBAC. After over 30 years in Animal Health, in different marketing and general management positions, he is leading the departments R&D , Strategic Marketing, Market Survey and Patent Affairs for all business segments (species)</p>
<p>Dr Alicia Urniza Zoetis</p>	<p>Alicia received her DVM from University of Barcelona, Spain. She has 20 years’ experience in Research and Development of animal vaccines, increasing responsibilities through these years, contributing and leading different projects for animal vaccines development —from the discovery phase to registration. In her current role she supervises European R&D discovery and development activities for vaccine products to prevent diseases in both livestock and companion animals.</p>
<p>George Tice Elanco Animal Health</p>	<p>George is currently the Senior Director of Market Access Europe, Middle East and Africa (EMEA) of Elanco Animal Health George qualified as a Veterinary Surgeon in 1989 from Bristol University. He worked in food animal practice and then at Medical University of Southern Africa in South Africa, where he also received a Masters in Cattle Medicine.</p>
<p>Dr Serge Leterme IDEXX Laboratories</p>	<p>Serge is Senior Director Technical Operations at IDEXX Laboratories with responsibility for Livestock, Poultry and Dairy European Operations and Research & Development worldwide. He has over 20 years of experience in veterinary diagnostics. Prior to IDEXX, Serge has been working for Synbiotics (now Zoetis) and Merial. He spent 8 years of his professional career in US. Serge earned an engineering degree in Chemistry & Bio Industries, and a PhD in Biochemistry from the University of Louvain-La Neuve, Belgium.</p>
<p>Professor Peter Borriello Veterinary Medicines Directorate (UK)</p>	<p>Professor Borriello is Chief Executive of the Veterinary Medicines Directorate. He has vast experience in the research sector and has contributed to over 300 publications. Previous appointments include Director of the HPA Centre for Infections and Chief Executive of the Veterinary Laboratories Agency. He is currently chairman of a number of international and national learned societies and committees and on the editorial board of six scientific journals. He is a Visiting Professor at the London School of Hygiene and Tropical Medicine and the Royal Veterinary College London.</p>

Name	Short Biography
<p>Dr Alex Morrow Department for Environment Food & Rural Affairs</p>	<p>Dr Alex Morrow, BA, MVB, PhD, MRCVS is a veterinary surgeon with twenty years' experience in research, followed by four years in a research support capacity at Edinburgh University and twelve years in his current position in research programme management with Defra where he is currently International Evidence Lead for Animal Health and Welfare.</p>
<p>Dr Raffaele Mattioli FAO, Food and Agriculture Organization of the United Nations</p>	<p>Raffaele is a Veterinarian Senior Officer – Disease Ecology / Non-Infectious & Production Disease at the Food and Agriculture Organizations of the United Nations (FAO), Rome, Italy. He holds a PhD in Tropical Animal Production. He has more than 30 years of working experience with developing countries. Main activities range from livestock-agriculture policy development to integrate pest and animal health management. Raffaele has authored more than 100 scientific publications.</p>
<p>Jean-Charles Cavitte European Commission</p>	<p>Jean-Charles Cavitte holds a doctorate in Veterinary Medecine from Ecole Nationale des Services Vétérinaires, Maison-Alfort, France. He is a Senior Administrator at the European Commission, Directorate General (DG) for Agriculture and Rural Development. At DG 'Agriculture and Rural Development', Jean-Charles Cavitte works as a Planning and Programming Officer in the Unit dealing with Research and Innovation. He looks into the scientific and policy developments in the area of livestock.</p>
<p>Carel du Marchie Sarvaas HealthforAnimals</p>	<p>Carel is the current Executive Director of the HealthforAnimals, the global animal medicines association. Following his previous role as director of agricultural biotechnology at EuropaBio, the European Association for Bioindustries, he has many years of experience as a senior public affairs and communications advisor in Brussels, The Hague, and Washington DC.</p>
<p>Moderator Claire Davidson</p>	<p>Claire is a co-founder of Davidson Ryan Dore. Claire specialises in litigation communications, crisis and issues management and since then provides senior counsel to global corporations, shareholder groups, individuals and charities. Claire is frequently engaged in facilitating meetings addressing complex issues and works closely with advocacy groups in the EU, the US and internationally.</p>

On 22nd September 2015 HealthforAnimals hosted a global industry roundtable on the topic of 'Innovation in Animal health' The following expert participants from industry, academia, government and multilateral organisations were included in the meeting and have contributed to the creation of this report.

