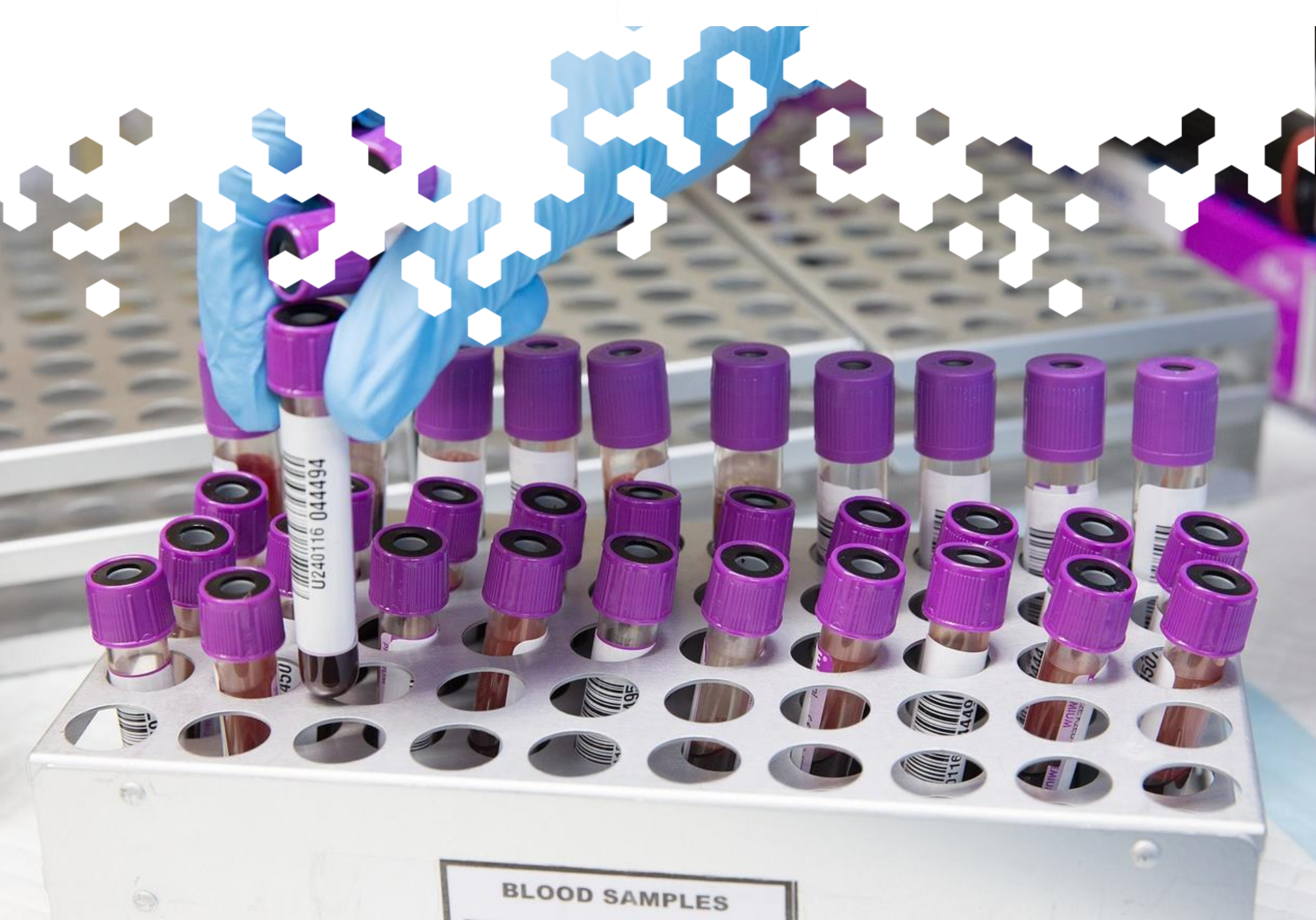
STAR IDAZ | International Research Consortium on Animal Health

Gaps and Opportunities in Animal Health Diagnostics: A STAR IDAZ Survey Report

12 September, 2025



STAR IDAZ IRC is the ‘Global Strategic Alliances for the Coordination of Research on the Major Infectious Diseases of Animals and Zoonoses - International Research Consortium’. It is a global consortium that brings together funders and programme owners for research on animal health to maximise funding for coordinated animal health research. To achieve its aim, STAR IDAZ facilitates networking among funders, researchers, industry experts, policymakers and other stakeholders to collaborate on research and innovation in the field of infectious animal diseases. This document was produced by SIRCAH, the Scientific Secretariat of the STAR IDAZ IRC.

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More information on STAR IDAZ IRC can be found at www.star-idaz.net

Introduction

Infectious diseases of livestock cost the global economy uncounted billions of dollars every year and, in some cases, threaten human health directly. These diseases impact food security for everyone and damage the livelihoods of livestock keepers, especially among poorer subsistence and semi-commercial farmers. Infectious diseases also affect companion animals and these animals are an often-overlooked source of zoonotic transmission [1]. Because of the extremely large social and economic disruptions caused by an increasing range of established and emerging infectious diseases (EID), there is a need to ensure that economies are well-positioned to deal with future emergencies while reducing the impact of endemic diseases.

STAR IDAZ International Research Consortium (IRC) is a global network concerned with coordinating animal disease research at the international level to contribute to new and improved animal health strategies for at least 30 priority diseases, infections and issues.

The 21st century has seen a drastic increase in the emergence and re-emergence of infectious (zoonotic) diseases, most of which originated in wildlife [2,3]. Some of these have had the potential to spread rapidly and cause major epizootics, such as avian influenza, African swine fever, or, in the case of COVID-19, a pandemic. There is thus an urgent need to identify new technologies and approaches that can be used to deal with outbreaks of new and emerging infectious diseases in a timely and effective manner.

The development of detection and diagnostic technologies plays a crucial role in addressing global health challenges such as zoonotic diseases, antimicrobial resistance (AMR), and cross-species pathogen transmission. These technologies enable early detection, accurate diagnosis, and effective management of infectious diseases, thereby mitigating their impact on public health.

It has been proposed that a new paradigm is being developed in the 21st century based on combining Nanotechnology, Biotechnology, Information technology, and Cognitive science (NBIC). These converging technologies could radically change society, economy and culture in the next 20 years [4]. It is important to establish the potential role of these and other technological developments for detecting and diagnosing animal disease, in particular, how they can be used to address the current needs for improved disease control at the farm level, and for integrated detection systems to give early warning of emerging issues.

This report examines gaps and opportunities in diagnostic technology across wildlife, farmed terrestrial mammals, poultry, fish and companion animals to accelerate disease detection solutions.

Methodology

An online survey was sent to a selected group of 60 international experts, recommended by the STAR IDAZ Scientific Committee. These experts represent the following fields:

- Animal health diagnostics (including aquatic animal health)
- Human health diagnostics
- Wildlife monitoring/surveillance
- Biochemistry - biomarkers
- Molecular biology/sequencing technologies
- Artificial intelligence
- Data analysis
- Engineering (gadgets, sensors, robots)
- Policy/regulations

The survey included 28 questions grouped in eight sections designed to anonymously gather input on technological requirements and opportunities across various species, including wildlife, farmed terrestrial mammals, poultry, fish, and companion animals. It was launched in February 2023 and closed on 15 May. The survey had two stages for responding. The first stage covered new technologies and had a deadline to respond on 21 March. The second stage covered specific research needs with the deadline on 15 May. Experts had the possibility to respond to questions previously not responded or skip previously responded questions and the option to specify their name if willing for invitation in further activities.

A word frequency analysis was conducted to count the occurrences of each word across all responses. The analysis was organised by overall responses, animal species (wildlife, farmed terrestrial mammals, poultry, fish and companion animals) and individual questions. The top five most frequently used words were identified in each context. To ensure comparability across questions and categories, frequencies were normalised: each word count was divided by the total word count for that question or category, yielding a relative frequency expressed as a percentage.

Summary of Survey Responses

Response rate

Responses were received from 16 participants, representing an overall response rate of 27%. The response rates per section are shown in Figure 1. The question regarding the approaches that could be adopted to detect or warn of emerging problems received the most responses (24%). Additional aspects, issues, or considerations received the least amount of feedback (1%).

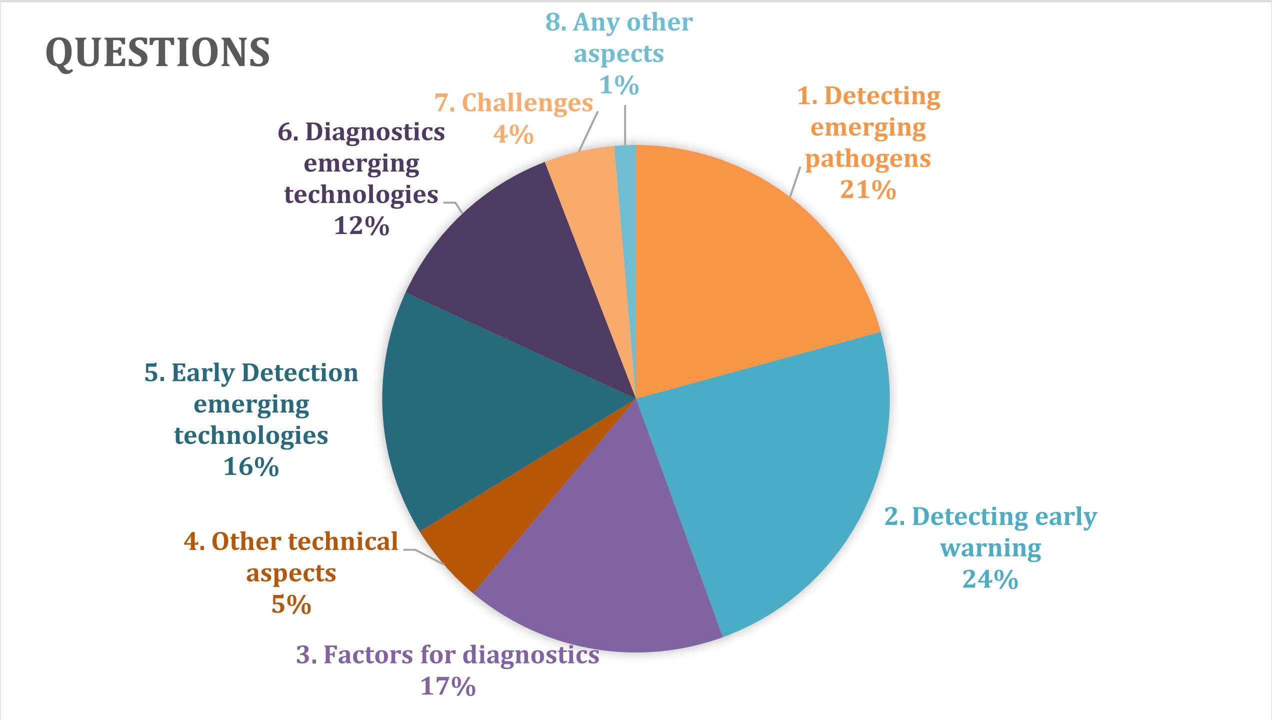

Figure 1. Pie chart with the percentage of responses for each survey section.

Wildlife and Farm received the most responses, while companion animals had the least (Figure 2).

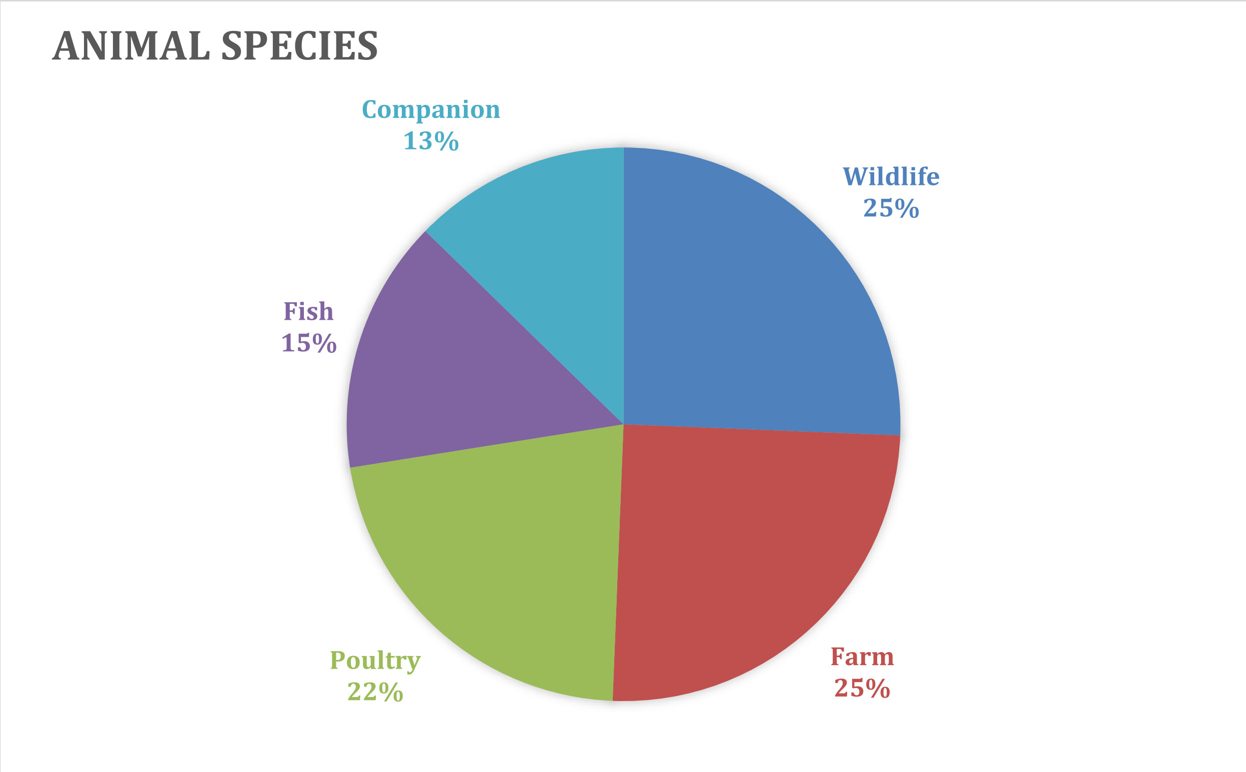

Figure 2. Pie chart with the percentages of responses on each animal species.

Overall and Animal-specific Responses

Considering all of the responses across all the questions in all the animal species, the highest-scoring responses emphasised (Figure 3):

- Cost-effectiveness (low and affordable)
- Data (production, handling, collection)
- Monitoring changes in behaviour, patterns, and activities
- Sampling from environmental factors such as water/waste/sewage
- Sensitivity and specificity of the methods used.

Figure 3. Bars show the percentage of normalised word frequency of top 5 words in responses overall.

Excluding the factors already mentioned in Figure 3, the emphasis for each animal species was as follows (Figure 4):

- Wildlife - Focus on evaluating a wide range of pathogens, including unknowns, with an emphasis on low cost, and low, poor quality and or quantity of samples. Suggested methods include lateral flow, CRISPR, Luminex along with sampling excreta and faeces and utilising non-invasive diagnostics.
- Farmed Terrestrial Mammals - Emphasis on monitoring behavioural approaches, such as reproduction rates, milk production, and pregnancy. A preference for rapid, real-time diagnostics was noted.
- Poultry - Fast, real-time monitoring, at a low cost was prioritised.
- Fish - Emphasis on water-resistant diagnostics, including imaging, camera technology, monitoring through Artificial Intelligence (AI), and fast diagnostic methods.
- Companion animals - Diagnostics that owners can use, connected to veterinarians and private clinics. Fast, real-time diagnostics, at a low cost were highlighted, along with the use of lateral flow, CRISPR, Luminex and NGS.

Figure 4. Bars show the percentage of normalised word frequency of top words in responses across animal categories.

Detection and diagnostic technology development

Factors to be considered in detecting new or emerging pathogens (Figure 5):

- A focus on cost-efficient, non-invasive, that do not require specialised personnel.
- The development of a universal detection method that can be adapted for multiple species, and cover various pathogens, even in poor-quality samples while maintaining good sensitivity.
- Tools must be field-deployable, user-friendly and portable to ensure practical usage in all the settings.

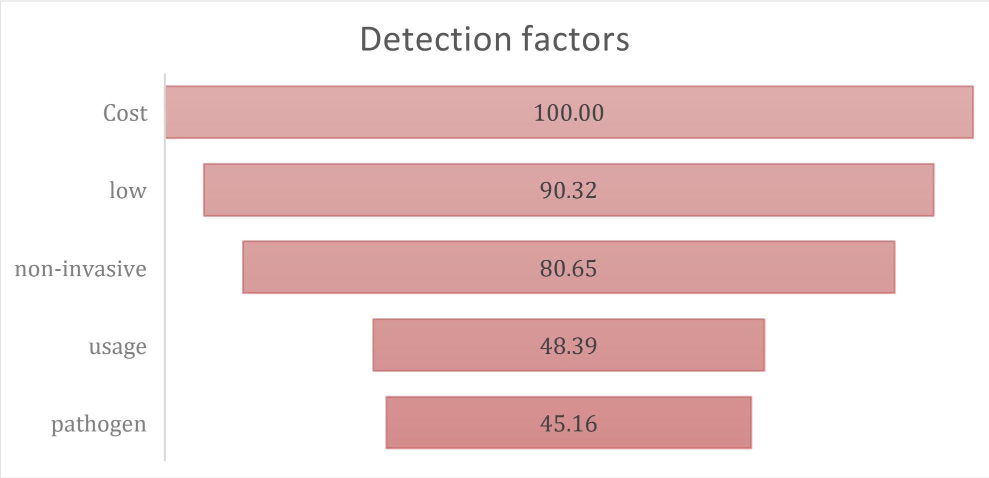

Figure 5. Bars show the percentage of normalised word frequency of the top words in responses for detection factors for new, emerging pathogens.

Approaches for detection or early warning of emerging problems (Figure 6):

- Monitoring behavioural changes and interactions among animals as well as evaluating temperature variations using infrared (IR cameras) is essential.
- Sampling from environmental factors such as air, water, wastewater, faeces, and elements related to feeding/drinking, nesting sites and dog parks is important.
- Collecting production data on bulk milk, assessing the quality and quantity of products are crucial.
- Sharing information and integrating databases is vital.

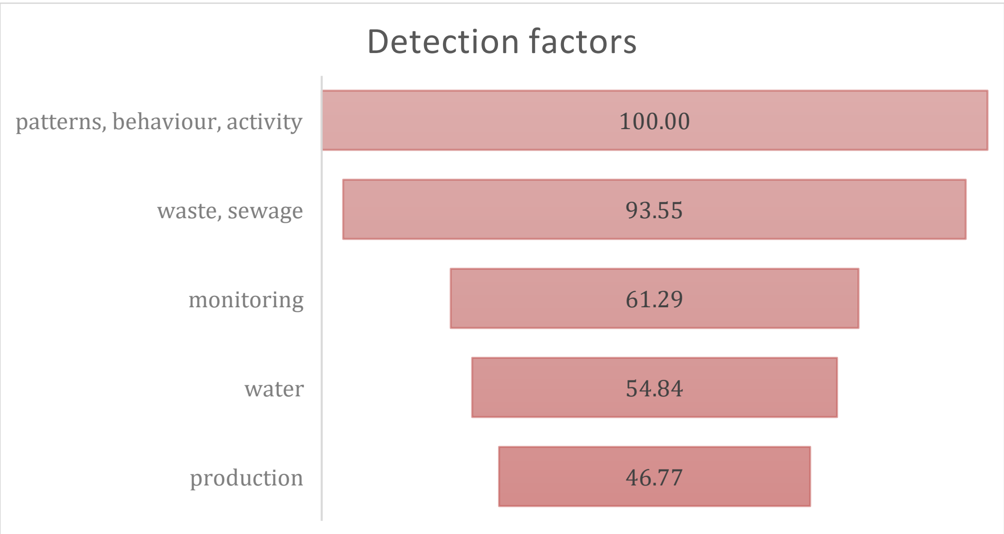

Figure 6. Bars show the percentage of normalised word frequency of the top words in responses for detection factors for early warning of emerging problems.

Factors and criteria of technologies for use in diagnostics (Figure 7):

- Diagnostic methods should demonstrate high sensitivity and high specificity. Rapid detection, preferably in real-time is ideal.
- These must be cost-efficient, portable, durable, capable of functioning in different environmental conditions (including water).
- The technology should perform well with low quantity/poor-quality samples and be validated for diverse species as well as a broad range of pathogens, including fish references.

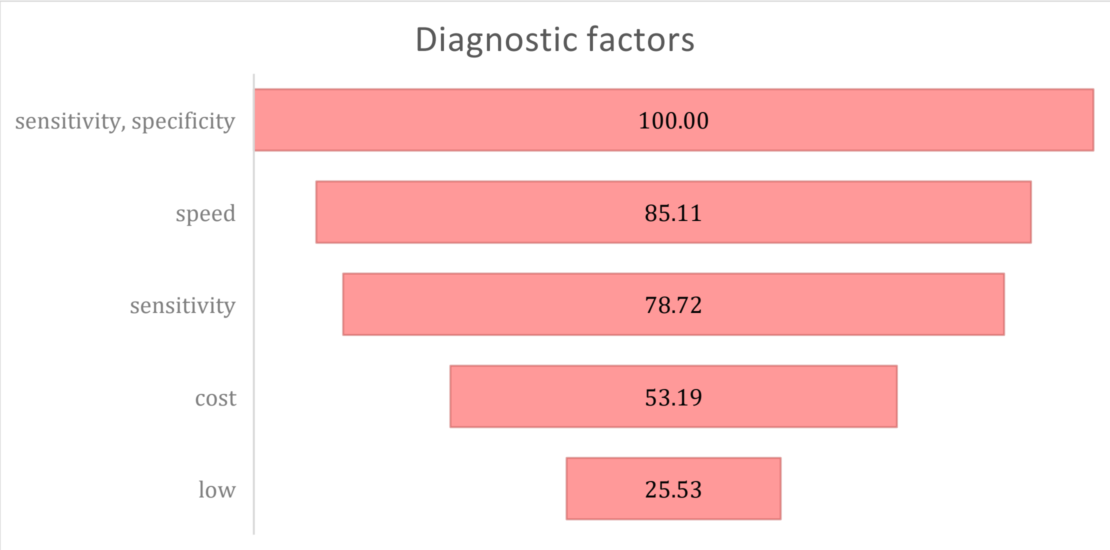

Figure 7. Bars show the percentage of normalised word frequency of the top words in responses for diagnostic factors.

Other technical aspects (Figure 8):

- An easy reporting system is necessary, along with reasonable standards for “normal” animal production and behaviour.
- New early detection technologies may include BioCV (hostpot observation), Allfelx, SmartBow.
- Tools must be field-deployable, operable with minimal training. Sustainability of the technology should be taken into account.

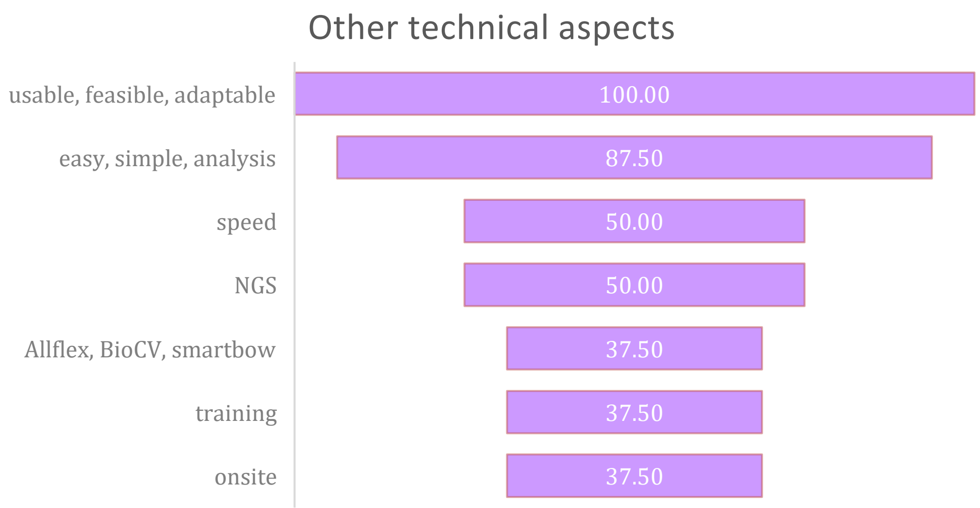

Figure 8. Bars show the percentage of normalised word frequency of the top words in responses for diagnostic factors.

Opportunities

Emerging Technologies for Early Detection (Figure 9):

- Rapid taxonomic identification, metagenomic technologies, and multiplex technologies can detect potentially present pathogens, utilising methods such as NGS, lateral flow, CRISPR, Luminex, microfluidics, and microarrays.
- Remote sensing and AI-based image analysis represent additional opportunities for detection.
- User-friendly data analysis platforms and emerging deep-learning approaches are essential for creating databases for existing pathogens and predictive models.

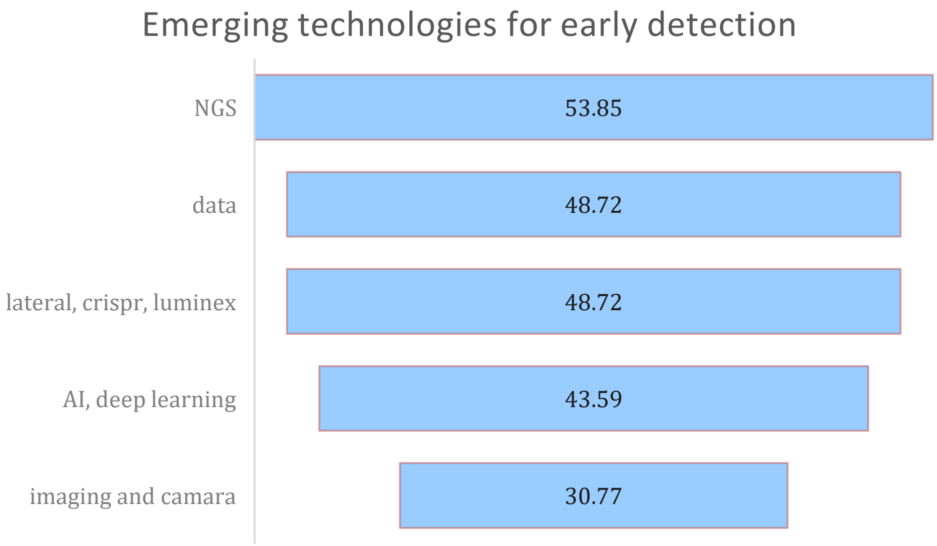

Figure 9. Bars show the percentage of normalised word frequency of the top words in responses for emerging technologies for early detection.

Emerging technologies for diagnosis (Figure 10):

- Advanced platforms such as NGS (next-generation sequencing), virus enrichment techniques, digital PCR, and serology/molecular surveillance are critical.
- Other methods include lateral flow devices, CRISPR diagnostics, Luminex and LAMP. All-in-one molecular tests and pen-side (on-site) tests are also crucial.
- Nanotechnology shows promise for developing rapid and simple diagnostic devices that can be applied on-site.
- Creating databases for wildlife pathogens, major infectious diseases (especially zoonotic agents) and newly emerging diseases is vital. General clinical parameters must be considered, along with data analysis platforms transferable to health authorities and policymakers.
- Remote sensing, AI, automated analysis, interoperability between systems, wearable devices, and participatory surveillance are significant focuses.

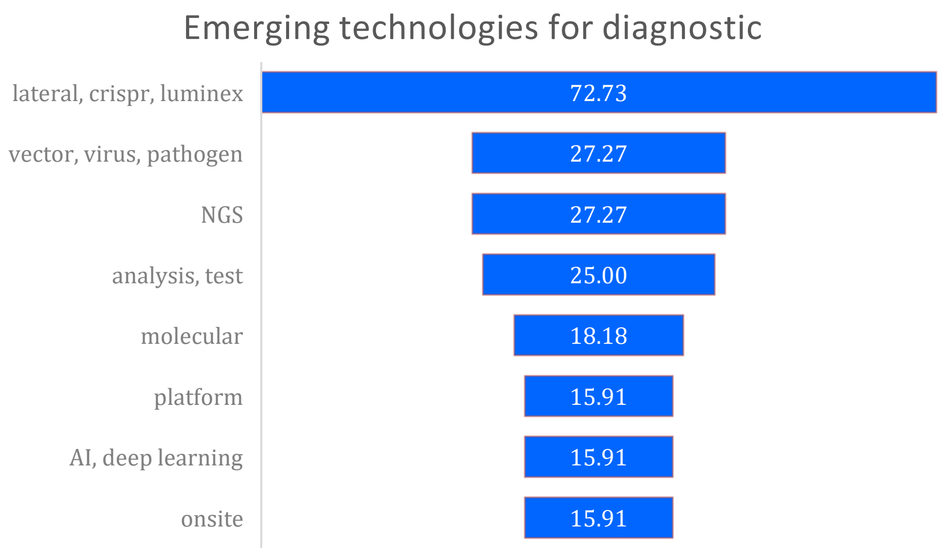

Figure 10. Bars show the percentage of normalised word frequency of the top words in responses for emerging technologies for diagnosis.

Challenges

Mentioned challenges are summarised in Figure 11. Key challenges included:

- Usability and added value for users — specifically, the implementation of technology among veterinarians and animal owners.
- A standardised database for pathogen searching or reference artificial sequences for pathogen identification through NGS data reference mapping is needed.
- Data management issues, such as integration, processing, transparency, confidentiality, sharing and ownership of data must be addressed alongside the interpretation of results.
- Determining the target pathogens and the range of pathogens to be included in a diagnostic test.

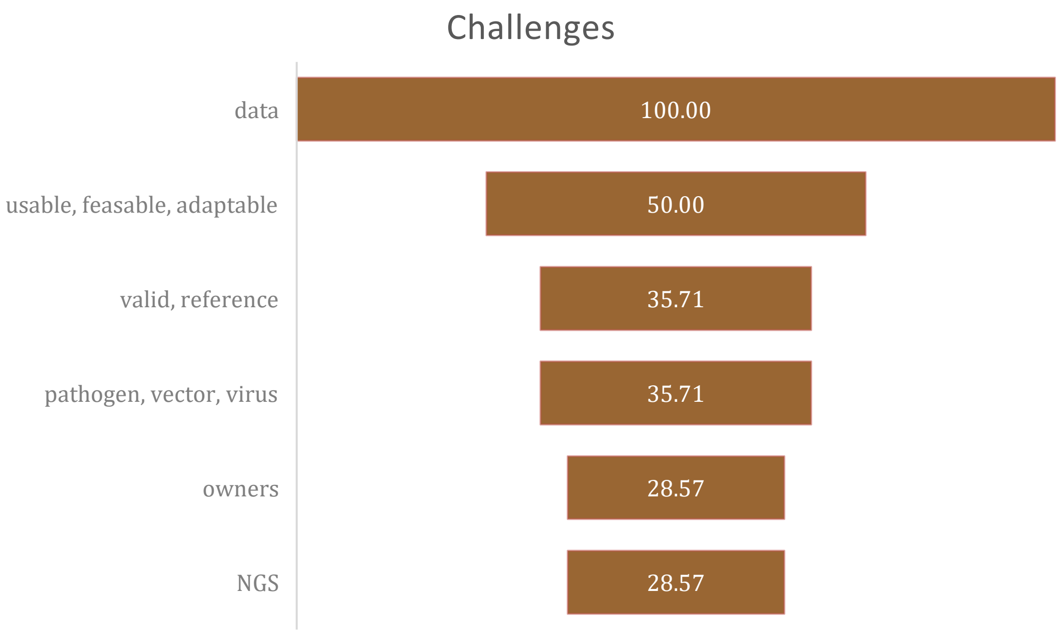

Figure 11. Bars show the percentage of normalised word frequency of the top words in responses for challenges.

Other aspects, issues or considerations

Other aspects and considerations are summarised in Figure 12. It is crucial to support diverse basic research and regulate the use of information among stakeholders. Additionally, information and technology should be accessible and affordable for Low-and Middle-Income Countries (LMIC), and facilitating collaboration among researchers across different regions should be prioritised.

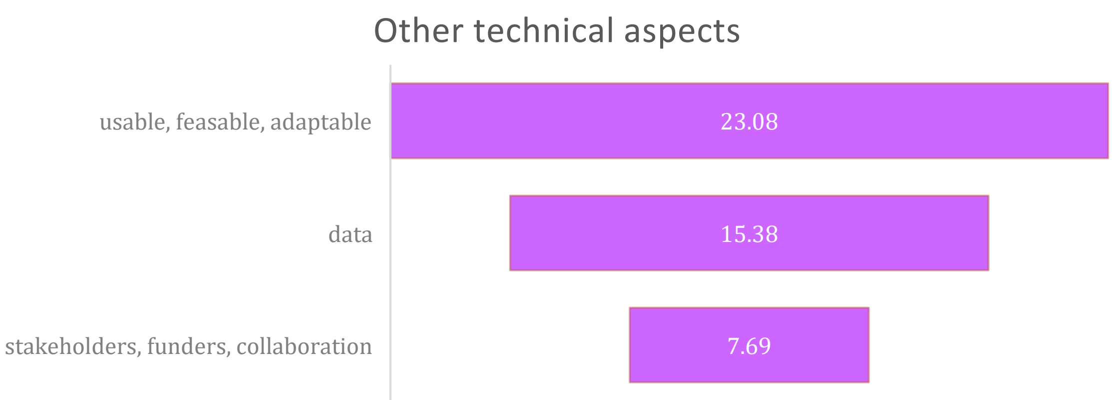

Figure 12. Bars show the percentage of normalised word frequency of the top words in responses for other technical aspects.

Conclusions

Detection and Diagnostic technology development is essential in tackling global health challenges, enabling early detection, accurate diagnosis, and effective disease management. Collaborative efforts through STAR IDAZ can enhance global research initiatives focused on high-priority animal diseases and accelerate the development of effective diagnostic tools. By addressing this report's scientific and technological considerations and integrating the One Health framework, we can improve disease control and give early warning of emerging issues. This will contribute to better preparedness for potential zoonotic outbreaks, ultimately safeguarding animal and human health worldwide.

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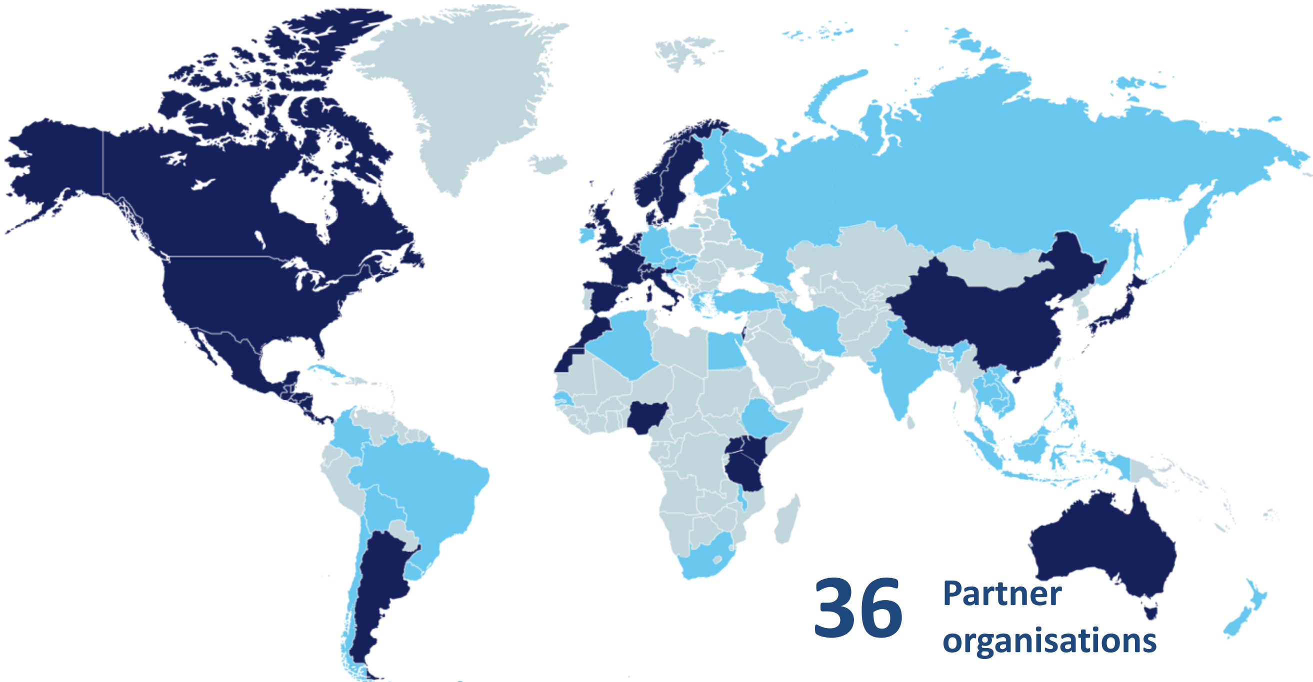

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