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## [O50] THE DECIDE PROJECT: FROM SURVEILLANCE DATA TO DECISION SUPPORT FOR FARMERS AND VETERINARIANS

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### Summary

Farmers, veterinarians and other animal health managers in the livestock sector are currently missing information on prevalence and burden of non-EU-regulated contagious animal diseases. They are in need of adequate tools for risk assessment and for prioritisation of control measures for these diseases. The DECIDE project will develop data-driven decision support tools, which present (i) robust and early signals of disease emergence and options for diagnostic confirmation; and (ii) options for controlling the disease along with their implications in terms of disease spread, economic burden and animal welfare. DECIDE will focus on respiratory and gastro-intestinal syndromes in the three most important terrestrial livestock species (pigs, poultry, cattle) and on reduced growth and mortality in salmonids, important aquaculture species. For each of these, we will (i) identify the stakeholder needs; (ii) determine the burden of disease and costs of control measures; (iii) develop data sharing frameworks based on federated data access and meta-information sharing; (iv) build multivariate and multi-level models for creating an early warning system. Together, all of this will form the decision support tools to be integrated in existing farm management systems wherever possible and to be evaluated in several pilot implementations in farms across Europe.

The results of DECIDE will lead to improved use of surveillance data and evidence-based decisions on disease control to increase animal health and welfare and protect human health and the food chain in Europe and beyond.

### Introduction

Farmers, veterinarians and other animal health managers in the livestock and aquaculture sectors are currently missing information on the prevalence and burden of contagious animal diseases that are not regulated by the European Union.

The diseases, such as porcine reproductive and respiratory syndrome virus, avian infectious bronchitis, cardiomyopathy syndrome in salmonids or bovine corona virus infection — are estimated to cause 10-15% reduction in performance efficiency of livestock farming, resulting in large financial losses and lower sustainability as well as affect animal welfare. Professionals in the livestock and aquaculture sectors are therefore in considerable need of adequate tools to assess the risks for contagion and associated losses, and to help prioritise the appropriate control measures for these diseases. The DECIDE project will develop data-driven decision support tools that offer:

1. Robust and early signals of disease emergence and options for diagnostic confirmation.
2. Options for controlling the disease along with their implications in terms of disease spread, economic burden and animal welfare.

Together, all of this will form the decision support tools to be integrated in existing farm management systems wherever possible and to be evaluated in several pilot implementations in pig, poultry, cattle and salmon farms across Europe.

The aim of this paper is to discuss the rationale behind the project and how the project will tackle the challenges to eventually improve decisions to increase animal health and welfare.

### The concept of the DECIDE project

The main aim of DECIDE is to develop and evaluate data-driven decision support tools that will allow stakeholders in animal health and welfare management to take improved decisions on controlling animal diseases. DECIDE will focus on respiratory and gastro-intestinal syndromes in the three most important terrestrial livestock species (pigs, poultry, cattle) and on growth reduction and mortality in salmonids, the most important aquaculture species.

The key 'ingredients' for such decision support tools are the following (Figure 1): (i) a clear view on the stakeholder needs, barriers and drivers; (ii) availability of and access to relevant data; (iii) early warning systems that can detect signals of potential disease emergence or spread; (iv) a set of potential control

measures, along with associated costs; (v) an understanding of the disease burden in terms of economic and welfare impact. The decision support tool based on the situation gives various options (e.g. ranks the possible control measures, including treatments and preventive measures for reduction of spread, economic costs and benefits and welfare implications) and based on embedded simulated models in the tool stakeholders can see 'what-if' scenario for a decision.

The data useful for DECIDE will be existing data that can be used to monitor deviations of the normal production process indicative for infectious disease spread. We will also investigate the usefulness of innovative data, e.g. sensor data or (video) imaging that is currently already available in specific farms and species. For salmon, imaging is already used quite extensively, while in terrestrial species it is still in an early adoption phase. Salmon can thus serve as an example for the other species. Data availability is crucial for the DECIDE project, but access of data is restricted by laws, regulations, privacy concerns, and market pressures, as individual actors operate in a competitive environment. To overcome these challenges and assure availability of and access to relevant data, procedures to ensure access to data from the different species will be developed and documented. In addition, innovative approaches for supporting data access will be investigated (e.g., federated access and federated learning) by combining knowledge on production systems, epidemiology of diseases and data science.

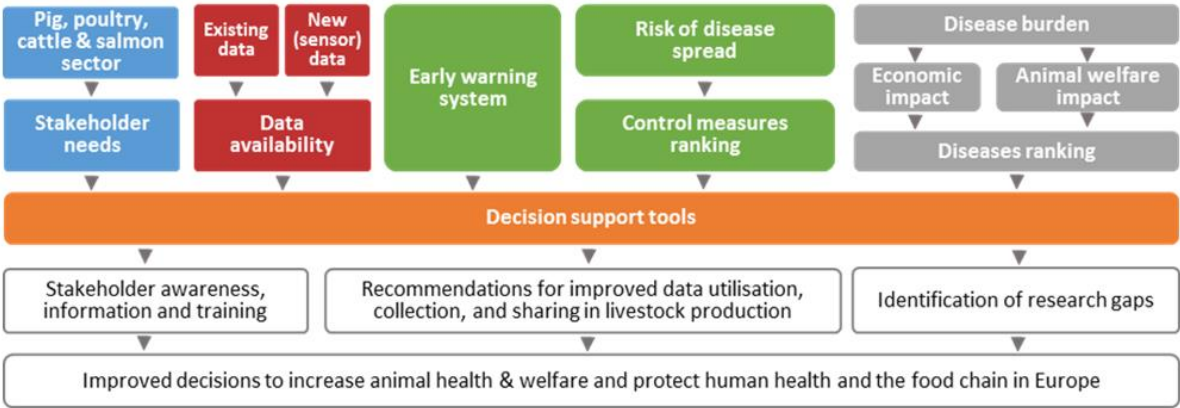


Figure 1. The concept of the DECIDE project.

The early warning system will consist of data analysis that can detect aberration from the normal variation in the monitoring data. „Early“ should be interpreted in the sense that it detects signals indicative for disease timely enough for the stakeholders to be useful for decision making on disease-mitigating actions. Frequently updated visualisation of data helps the users to understand and be aware of trends, including an immediate shift or deviation. The data information also confirms what the user already suspects and can be used to support general control strategies. The risk of disease spread is a key determinant for disease mitigating actions of the stakeholders. The effectiveness of control measures greatly depends on the ability to reduce further spread. Therefore, in DECIDE mechanistic disease models will be developed that simulate the spread of contagious diseases in the production systems of the four species. The input parameters of the models can easily be adapted to simulate spread of different pathogens, for different species and herd-types.

Stakeholders often have a choice of control measures including doing nothing at all. To effectively support stakeholders in their choice, a ranking of control measures for effectiveness, costs and benefits, welfare implications, medicine use, etc. is needed.

Obviously, whether to control a disease or not also depends on the impact of that disease on animal health and welfare, the disease burden. DECIDE will develop a multidimensional burden of disease metric that contains the economic impact as well as the impact on animal welfare and possibly on antimicrobial use. Thus, diseases can be ranked for their expected burden to prioritise the limited resources of the stakeholders for disease control.

The before mentioned key ingredients will be combined in decision support tools for the stakeholders. The adoption of tools also need in-depth understanding of stakeholder needs and beliefs. Incorporating social science methods, the tools will be developed in close collaboration with the stakeholder end-users and provide a warning when aberrations in the data indicate disease and suggest control options that are ranked for the expected burden of disease.

The decision support tools will be incorporated in already existing platforms to facilitate uptake of the tools. We will develop prototypes for each species that will be tested in several partner countries in pilot implementations. The pilot implementations will be the 'playground' in which our innovative framework

and tools can be tested and adapted again, learning from experiences with stakeholders and users across species. Through the pilot implementations, we will ensure that the generic methods and framework can be easily adapted and implemented for existing platforms. The long-term sustainability of the developed tools will be ensured by an open science approach.

## Discussion

Endemic contagious diseases are the main worry in day-to-day animal health management for farmers and their veterinarians. The so-called production diseases are often caused by multiple pathogens and pose the largest threat to animal health and welfare and thus to productivity of both terrestrial and aquatic species. For DECIDE we will focus on the three most important meat-producing terrestrial species (pigs, poultry and cattle) and the most important aquatic species, salmon. For young, growing animals, gastrointestinal and respiratory tract infections are the most prevalent syndromes that cause much growth reduction, mortality and use of medicine. In salmonids, respiration is impaired by gill diseases and diseases causing circulatory failure and inflammation of gastrointestinal organs causes growth reduction and mortality. The four species will have different levels of integration of farming and thus of available data and also differ in the level of data (animal, herd, unit, cage). However, the concept that a contagious disease will spread in an epidemiological unit and cause disease is the same. When syndromes are noted, farmers, veterinarians or other animal health managers (the stakeholders) need to decide on actions to prevent further spread, diagnose, treat, vaccinate, or take preventive actions for the next round of production. These decisions and choices are not necessarily rational and often not based on a sound quantitative basis. Why, how and when stakeholders decide to take action (the drivers) and why they do not (barriers) will be one of the key-elements of the DECIDE project as depicted in the box "Stakeholder needs" in Figure 1. The social scientists in DECIDE will ensure that in co-creation with the stakeholders the project will deliver suitable tools.

The DECIDE project will lead to use of existing data for disease monitoring, to rank and prioritise disease control and decision support for the stakeholders. DECIDE will increase stakeholder awareness about infectious endemic disease control and identify gaps for further training. The methods and framework developed in DECIDE are specific enough to support stakeholders for the focus species and syndromes in DECIDE but can also be easily generalised across species, countries or diseases. Research gaps will be identified and shared. The use of the co-created decision support tools will lead to improved decisions regarding disease control and thus result in improved sustainability, animal health and welfare. More efficient use of resources and less use of medicines will also positively impact human health.

## References

1. [www.decideproject.eu](http://www.decideproject.eu)

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