



DigiVet: Digitalisation of livestock data to improve veterinary public health.

UK workshop report.

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Executive summary

A workshop was held with 24 key stakeholders from the UK, Sweden, Denmark and Estonia sharing their experience on the use of pig movement data to manage the risk of African Swine Fever (ASF) and providing feedback on the data digitalisation tool “movenet” developed in the DigiVet project. Shared challenges included: ensuring holding registrations match with actual business operations on the ground and recording and integrating movements of vehicles and people between premises. The UK faces additional challenges integrating data from four devolved countries who may record data differently.

Participants perceived the movenet tool as having potential benefits for certain actors including academics and policy makers by making data sharing easier and quicker. It was noted that the tool is primarily for people with a certain amount of expertise in data management or analysis rather than non-expert users. Suggestions were made for improving the tool, including separating data analysis and anonymisation functions to cater for different user needs. A discussion of the wider risks and benefits of data digitalisation highlighted the potential to improve outbreak preparedness by enabling data analysis out-with a disease outbreak. Greater sharing of data, of the right type and for the right purpose across more people and organisations, can have differing societal impacts depending on its use. Next steps in the project are to incorporate the feedback from this workshop into the design of the movenet tool.

Overview of the DigiVet Project

https://www.dcs.gla.ac.uk/~jenright/digivet_website/index.html

Successful management of livestock disease ensures a consistent supply of safe food for everyone in society. The use of data by industry, public services, and the wider public is a key part of this veterinary public health mission. However, managing these data comes with many challenges: how should data collection be standardised, and who should have access to different aspects of this data? To what risks are farmers exposed by making their data publicly available? What data and processes need to be maintained to be able to effectively control threats to our supply of safe food within our increasingly international society?

The DigiVet project is studying how livestock data is currently used across the partner nations (Denmark, Sweden and UK) and how technology, training, and regulatory frameworks might provide societal benefit by improving the public-interest uses of these data. The study includes workshops with stakeholders to map existing practices, and document the gaps, roadblocks, and opportunities for improvement.

Three case studies cover (I) foodborne disease, (II) antimicrobial usage, and (III) contagious diseases of livestock. Foodborne illnesses such as Salmonella are a serious public health issue, antimicrobial usage in livestock may be contributing to the developing antimicrobial resistance problem in human pathogens. Exotic and highly contagious livestock diseases such as African swine fever have the potential to devastate our national agricultural sectors. Each of these challenges has wide-reaching implications for society.

Meeting these challenges requires different, individualised approaches, but all are united by their dependence on similar sources of data to enable authorities to continually monitor the threat of a disease incursion and respond quickly when required. Within the study we explore the data models and analytical approaches that are used in each partner nation, investigating what approaches will work under which circumstances, and what needs to change to facilitate more effective use of the data.

DigiVet will also investigate the risks associated with missing, sparse, or coarsely aggregated data, and evaluate the potential societal benefits of making better quality data more widely available.

The project is funded by Nordforsk: a body which funds Nordic research and cooperation.

<https://www.nordforsk.org/>

UK workshop

Introduction

This event was the first of three international workshops to be held during the project. It concentrated on the impacts of digitalising pig movement data in the context of preparedness for African swine fever (ASF) outbreaks. The workshop was attended by twenty-four stakeholders from Estonia, Denmark, Sweden and UK (Appendix 1) and was facilitated by researchers at the James Hutton Institute and University of Edinburgh in conjunction with partners at University of Glasgow and University of Copenhagen.

The workshop took place at the University of Edinburgh and was designed, using four exercises, to encourage discussion and co-learning among the stakeholders present. All participants were asked to read an information sheet and sign a consent form prior to the start of the workshop.

The aims of the workshop were to:

- Receive feedback on movenet, a data digitalisation tool developed in the DigiVet project, for exploring and anonymising livestock movement networks.
- Discuss the ethical and governance issues around the use of the tool and livestock movement data more widely.
- Share experiences about managing the risk of ASF and the use of data between stakeholders from Estonia, Denmark, Sweden, and UK

Strengths and weaknesses around the use of pig data within each country

Participants were randomly assigned to three groups and asked to discuss the strengths and weaknesses of pig data in their country. Comments were captured by facilitators.

Strengths:

It is a legal requirement that all countries represented at the workshop collect pig movement and holding data which they have in electronic format. In Denmark and Estonia this data is publicly available, which is seen as a strength because it is accessible to different actors and the data is accurate and of high quality. In Sweden, the location of animal holding, and the species kept is publicly available while data on animal movements is available on request. In the UK, data is not publicly available, and requires data sharing agreements. This is seen both as a strength by farmers because data is not publicly available, but a weakness by researchers and other interested bodies as data is not easily accessible. In addition to provision of real-time data on pig numbers and movements, data is predominantly used to inform disease simulation models that can be used to estimate the transmission of disease during an incursion.

Weaknesses:

In the UK there are different data systems for recording pig movements across devolved countries and there are difficulties integrating these. Data may be recorded differently, including different ways of defining premises, the level of error involved with data entry is uncertain and changes in one database are not always updated in other databases. Work is underway to better coordinate databases but is facing challenges due to the complexity of working across devolved systems. Swedish stakeholders mentioned that movement data are being collected, but not used systematically. In general usage depends on research projects requesting the data.

Relying purely on holding registrations was seen as a weakness in Denmark, Sweden and the UK. There may be different kinds of discrepancies between holding registrations and the operations of businesses in practice, including for instance a business which has several premises which are not registered separately. These anomalies may result in missing links in the network.

Farmers not de-registering their holdings, or the de-registration information not being passed through the system in the UK, along with the length of time allowed to notify movements in Sweden and Denmark were also seen as weaknesses.

The movements of transport vehicles, or actors such as veterinarians and feed merchants, between premises are either not recorded or not linked with other databases, creating a gap in knowledge about movements between farms.

Stakeholders highlighted a lack of quality control and active electronic data curation. There was concern around the absence of a long-term plan for storage and archiving data when a system becomes obsolete.

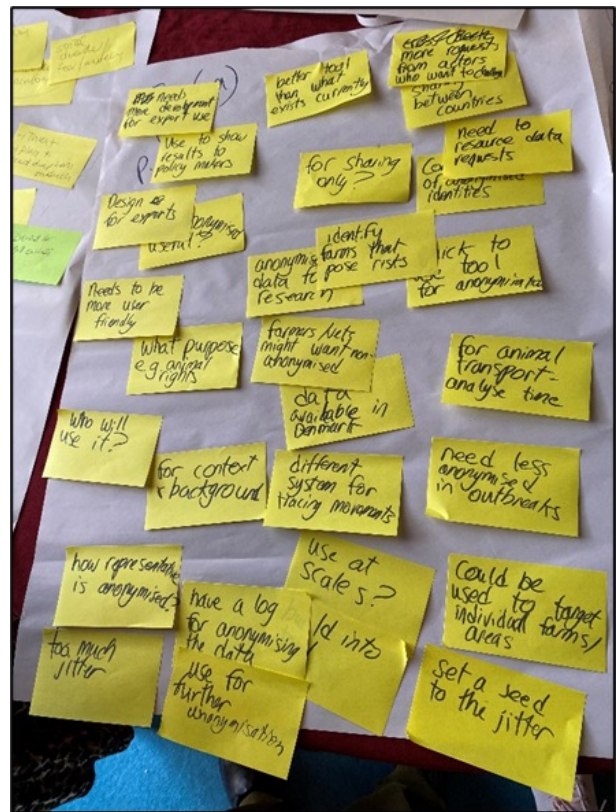


Figure 1 Comments recorded on sticky notes.

Presentation of the movenet toolkit

Following the initial exercise, Carlijn Bogaardt gave a presentation of the movenet toolkit, its attributes and how to use it.

Movenet is an R package, with an accompanying interactive app, that facilitates the effective use of livestock movement data in veterinary public health. It does so in two ways:

1. To address commercial sensitivity concerns and improve the potential for collaborative data sharing, movenet provides data owners and data managers with a variety of options to make livestock movement data less identifiable: holding identifiers can be substituted (pseudonymised), and movement dates and weights can be modified by addition of random noise or by rounding. A geographical jittering function for holding coordinates is in development. Modified datasets can be viewed and downloaded in various formats. The movenet developers encourage users to consider that data modifications may impact the results of any analyses, and to seek an appropriate balance between identifiability of data and accuracy of results. To this end, movenet provides users with the opportunity to compare the effects of various data modifications on network measures (implemented for maximum reachability at the time of the workshop).
2. To facilitate the effective use of (real or modified) movement networks in risk assessment, movenet provides researchers and decision-makers with a quick entry into social network analysis of livestock movement data. movenet produces an overview of various metrics relevant to disease spread, displayed in a range of tables and figures. This includes basic network properties like the number of active holdings and edges (overall and over time), static network analysis of (monthly) snapshots, temporal analysis including ingoing and outgoing contact chains (reachability), and component analysis. An equivalent quick entry into transmission modelling using livestock movement data is in development.

The interface demonstrated to workshop participants was the movenet interactive app. This app was developed to make movenet functions accessible to users who are not confident in R, or who prefer graphical user interfaces. Where the app focuses on some standardised workflows, the movenet package provides more flexibility to users who are familiar with the R command line interface. Both the app (<https://github.com/digivet-consortium/movenetapp>) and the R package (<https://github.com/digivet-consortium/movenet>) are freely downloadable, open-source software.

Following the presentation participants were given time to explore the tool and give feedback on its use.

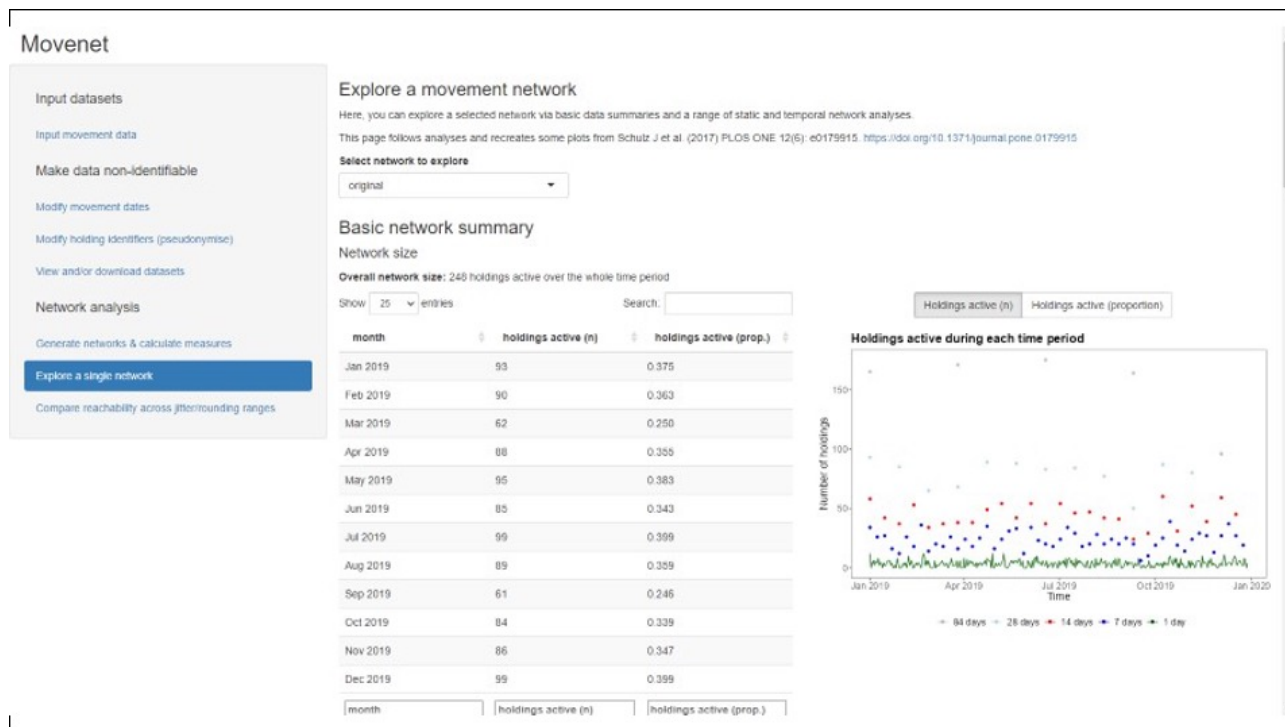


Figure 2 Screen shot of part of the movenet tool.

Discussion and feedback on using movenet.

Several interesting and useful comments and critiques were raised. One of the main questions that was highlighted was ‘what is it for?’ and ‘how practical would it be for vets/farmers/agencies to use?’. Because data is managed differently in the partner countries, the tool could have a different purpose in these contexts. There was concern that the software package R may be a barrier as it’s not a commonly used software in some sectors. In addition, there is a distinction between non-experts and specialists in the way outputs can be interpreted. As anonymisation of data is not an issue in Denmark and Estonia, there was a suggestion that the tool be ‘repackaged’ depending on the requirement for anonymisation or that a tick box could be used to include or exclude the anonymisation component as required. A standardised protocol could be proposed to make the application of anonymisation options transparent.

Positive aspects about the tool included its potential for enabling data sharing with modellers as it would be faster, standardised, and easier to retain confidentiality. It is potentially scalable and sharable and has a user-friendly drop-down menu making it easy to train people in its use. It can provide added value for those users without data sharing agreements, and participants liked the ease and utility of interrogating data networks. It is particularly useful for building preparedness for disease incursions in ‘peacetime’ as data anonymisation is most relevant then, and ‘what if’ scenarios can be worked on using data that is not real time, thus allowing rapid

informed decision making. The addition of geo references and disease attributes would make it a good fast tool to explore data.

Suggestions for improvement included improving accessibility for users who aren't data scientists by making it more visually appealing and intuitive, and by providing more explanatory wording and a dictionary of terms. Additionally, some suggestions were made to further improve data flows: allowing for data import directly from a database instead of via CSV file and enabling an option to download analyses as a report (including a section detailing any anonymisation options applied to the data). Regarding the network analysis, including a visual of connecting the dots and highlighting the strengths of links would assist users with less technical experience.

Brainstorming Ethical and Governance issues

The final exercise involved participants randomly assigned to three groups and asked to brainstorm the positive and negative the effects that the movenet tool may have in their country. The facilitators captured comments on post-it notes which were subsequently clustered into five similar subject areas and shared with all the participants in plenary.

Data storage:

Participants asked about the way data used in the movenet tool was stored and were told that it would be stored in the database of origin, and upon upload to the tool, in a temporary directory on an individual's device. Comments included concern about the integrity, longevity and use of data and that the use of the tool could have unintended consequences and / or drive unintended change.

Co-benefits:

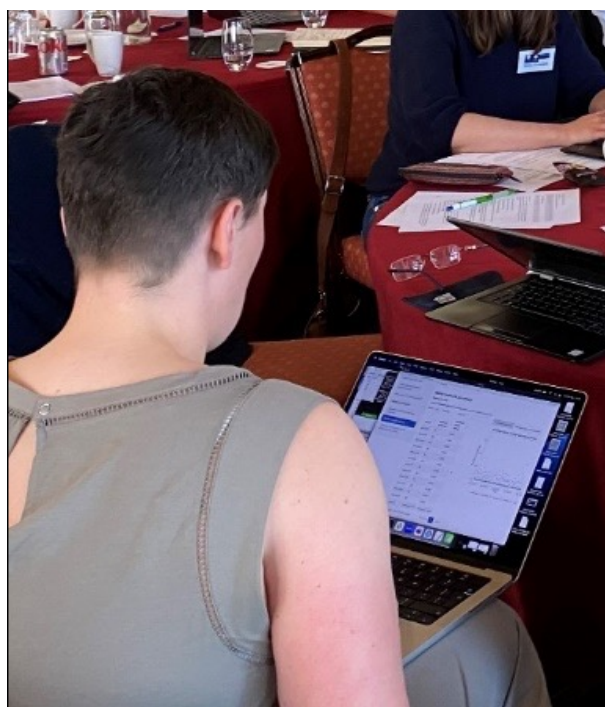
Movenet was perceived to be better than anything that currently exists. It allows a for accessible sharing of data, speed of access, is easy to use and could be invaluable for area-based evaluation and risk modelling of all diseases, not just ASF. The fact that participants had come together to discuss it in the first instance was also perceived to be a benefit.

Beneficiaries:

Beneficiaries could include policy makers and research involving building preparedness for disease incursions. The tool is presently designed for data experts and would need to be more user friendly to enable wider use. It was suggested that farmers and vets may want or need to examine non-anonymised data.

Utility of anonymisation:

Several comments focussed on anonymisation, how far to anonymise, and whether it was necessary. Denmark has free access to all data, for example hauliers can use it when looking for markets, so there would be no requirement for data anonymisation there.



Participants thought the networking aspect of the tool was interesting and useful.

Consequences of democratisation of data availability:

There was some concern around increasing the availability of data. Comments included the increased requirement to resource data requests, who will benefit and the vulnerability of shared data.

Incorrect analysis could lead to policy misinformation or malevolent misinformation leading to a public mistrust of the pig industry and the targeting of individual businesses.

Next Steps

Feedback from the workshop will be incorporated into the design of the movenet tool and a new version will be circulated to stakeholders before the end of the project. Two more international workshops, on digitalisation of data for managing the risk of foodborne pathogens in Denmark and antimicrobial use in Sweden, will be organised during the course of the project.



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APPENDIX 1- Participant affiliations:

Estonia: Two people participated from Estonia. One from the Estonian University of Life Sciences and the other from The Veterinary Authority – Agriculture and Food Board of Estonia.

Denmark: Seven people participated from Denmark. Three from the Danish Veterinary and Food Administration, two from SEGES Innovation and two from the University of Copenhagen.

Sweden: Four people participated from the Swedish National Veterinary Institute.

UK: 11 people participated from the UK. Two from AHDB, two from APHA, two from Scottish Government, one from the British Pig Association, one from Food Standards Scotland, one from ScotEID, one from Scottish Pig Producers and one from the Surveillance Management Board.