Confidential

Innovative Use of Emerging Technologies to Improve Pig Production Efficiency

KTIF/007/2015

FINAL REPORT

Funding is being made available through the SRDP Knowledge Transfer and Innovation Fund (KTIF), which is jointly funded by the Scottish Government and the European Union.

1. PROJECT TITLE & APPLICANT

1.1 Innovative Use of Emerging Technologies to Improve Pig Production Efficiency

1.2 Wholesome Pigs (Scotland) Ltd

Wholesome Pigs Scotland was formed in 2003 as a not-for-profit body to deliver an abattoir surveillance system for significant production diseases of pigs. Dr David Strachan from SAC designed the programme and funding was from a mixture of membership fees and contracts from QMS. Membership numbers have been maintained to this day, even whilst the closure of VION Halls at Broxburn significantly complicated the operational delivery. Notable falls in levels of enzootic pneumonia, mange and pleurisy in the Scottish pig herd have been observed. Health break-downs on individual units have been identified before clinical symptoms were visible on farm, enabling the economic impact to be minimised. QMS has recently announced that they will use WP(S) to administer the new Scottish Salmonella Control Scheme. WPS currently has 50 paying company members with 114 different units.

WPS is co-located with Scottish Pig Producers, the largest pig marketing cooperative in Scotland. Since its formation in 1979, SPP has grown steadily and has 75 active members in Scotland and Northern Ireland, marketing around 10,000 pigs every week with an annual turnover of around £60m.

2. EXECUTIVE SUMMARY

The “Innovative Use of Emerging Technologies to Improve Pig Production Efficiency” project was funded by the Scottish Government´s Knowledge Transfer and Innovation Fund and was led by Wholesome Pigs (Scotland) Ltd, running from 1st April 2016 to 30th March 2019. It was a collaboration between Wholesome Pigs (Scotland), Scottish Pig Producers, Quality Meat Scotland, British Veterinary Association, Scotland and Scotland’s Rural College’s (SRUC’s) Epidemiology Research Unit.
The project aimed to create an evolving knowledge base to provide sustained impetus for an improved Scottish product by using existing data from different sources, integrating these data and providing useful outputs.

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At the onset of the project several targets relating to important diseases of pigs were established and resources were allocated to develop a relational database that would allow us to accommodate and relate different data streams.
Two of the new tools developed were the Salmonella reports and an interactive mapping tool. The Salmonella report is currently being used by producers and their vets to improve unit health status for Salmonella, whilst the mapping tool is used to provide situation awareness for the industry current to health status of several diseases.
Despite several challenges encountered during the project (for example, the fire at Brechin abattoir) all bar one of these targets (that for pleurisy) were achieved. The constant monitoring undertaken shows that the Scottish pig industry demonstrably has the highest overall health status of any part of the UK and would be amongst the best performers across global pig industries.
Overall satisfaction from producers and vets with this project was high and all consulted highlighted that the information provided by the project helped to bring the industry together to coordinate health improvements, such as demonstrated by the PRRS control and elimination programme.

3. PROJECT DESCRIPTION

3.1 OUTLINE

The “Innovative Use of Emerging Technologies to Improve Pig Production Efficiency” project was funded by the Scottish Government´s Knowledge Transfer and Innovation Fund and was led by Wholesome Pigs (Scotland) Ltd, from 1st April 2016 to 30th March 2019. The Project Director was Gordon McKen from Wholesome Pigs (Scotland) (WPS).

In this project, an operational group was established to use emerging technology to build a new system to improve the efficiency of Scottish pig production. The operational group consisted of Andy McGowan and Gordon McKen (WPS and Scottish Pig Producers - SPP), Allan Ward (Quality Meat Scotland - QMS), Grace Webster (British Veterinary Association - BVA Scotland) and the Epidemiology Research Unit (ERU-SRUC). Twice a year the operational group discussed the main matters relating to the project. SRUC was the research partner in this project and was responsible for the integration of datasets, mapping of national health status, design and generation of reports, provision of specialist advice, and managing the monitoring and evaluation framework. The SRUC team was comprised of Carla Gomes, Roger Humphry, Aaron Reeves, Jo Baughan, Catherine McCann, Katherine Adam, Madeleine Henry, Andrew Duncan and George Gunn.

The project aimed to create an evolving knowledge base to provide sustained impetus for an improved Scottish product by:

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- utilising raw data from a number of pre-existing and emerging but untapped, unconnected sources;

- implementing methodologies developed in the RESAS Strategic Research Programme 2011-16 to integrate datasets;

- applying analytical methods to that data using skilled staff, computer technology and developing tools;

- communicating results to pig farmers and their vets to drive change;

- using results to inform industry and Government environmental, health & welfare policies and so improve the competitiveness of Scottish pig meat.

3.2 MATERIALS AND METHODS

a. Data sources

Data available from a number of different data sources was used:

- Agrosoft farm management software (known as WinPig©) data. WinPig is a software product available to producers to record and summarise production parameters and financial performance data. For this project we used farm performance data for breeding herds since April 2016.
- QMS Pig Health Scheme data, also known as Wholesome Pigs Scotland (WPS). This coordinated industry-wide lesion scoring of pigs at slaughter has been implemented in Scotland since 2003. It reports the presence of 13 different macroscopic conditions proxy for endemic disease in slaughtered pigs.
- Salmonella scheme data. In 2016 the Scottish pig industry started a new scheme for Salmonella that involved testing 15 meat juice samples per slapmark (i.e. farm) for *Salmonella spp*. using an ELISA test.
- Quarterly veterinary reports (QVRs) are a requirement of QMS farm assurance scheme. These are veterinary on-farm observations related to disease syndromes and known pathogens, such as PRRS. In this project we included data from 2016 onwards.
- To assess the status of the Scottish pig industry for Porcine Reproductive and Respiratory Syndrome (PRRS) a survey was conducted in 2017/2018, which collected blood samples at slaughter from finishers and culled sows and bloods or oral fluids from weaners/grower pigs.
- Carcase performance information from Scottish Pig Producers (weights and grades).
- Collection and Communication of Inspection Results from Food Standards Scotland (meat inspection data) from Brechin and Woodheads abattoirs.

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b. Focus groups meetings

At the onset of the project, meetings were organised and held with producers and vets to explain what the project was about and to give them the chance to comment and suggest what type of outputs they would like the project team to develop. Based on their feedback the project team revised the project plan.

The project team used existing pig industry meetings to collect informal feedback on the project activities during the project lifetime.

In March 2019 formal feedback from vets and producers was elicited.

c. Database construction

A relational database was developed by the SRUC, ERU team that was able to host all the data mentioned in point a (data sources) above. The upload of data to the database is done through a password protected website and it allows the automatic checking of mistakes before data is incorporated into the main database. Data are then pulled down from the database for the analyses.

d. Exploratory analyses.

i. Graphs and maps

Graphs per quarter and per year were drawn based on data available from WPS, Agrosoft and Salmonella scheme. A Shiny© app was developed for mapping disease in Scotland. It comprises three different maps: one that maps the results from QVRs for five specific diseases (PRRS, Sarcoptic Mange, Enzootic Pneumonia, Swine Dysentery and *Streptococcus suis*), the second maps the results of the QMS Pig health scheme and a third map that shows the results of the PRRS survey.

ii. Analyses

Trend for the QMS Pig Health scheme data was investigated using STL, a nonparametric filtering procedure for decomposing time series into additive components of variation (trend, season and residual) by application of locally-weighted regression smoothing modelling. The STL decomposition method has been recommended over other methods due to its good visualisation capabilities and good performance for data fitting. The trends in this report, generated using STL, are indicative of underlying changes in occurrence but do not imply any level of statistical significance as no formal inferential tests of trends are made by STL.

All the other analyses were done using summary statistics, such as mean and median.

iii. Program.

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All the above mentioned analyses were performed with R version 3.5.3 from the R Foundation for Statistical Computing. http://www.r-project.org.

Quarterly reports were sent to producers and their vets . These reports consisted of a summary of assessments carried out at the abattoir and the benchmarking of the results per producer against the national average. The reports also included data from past assessments so each producer could monitor their evolution over time.
An anonymised example is provided (Figure 1 -3).

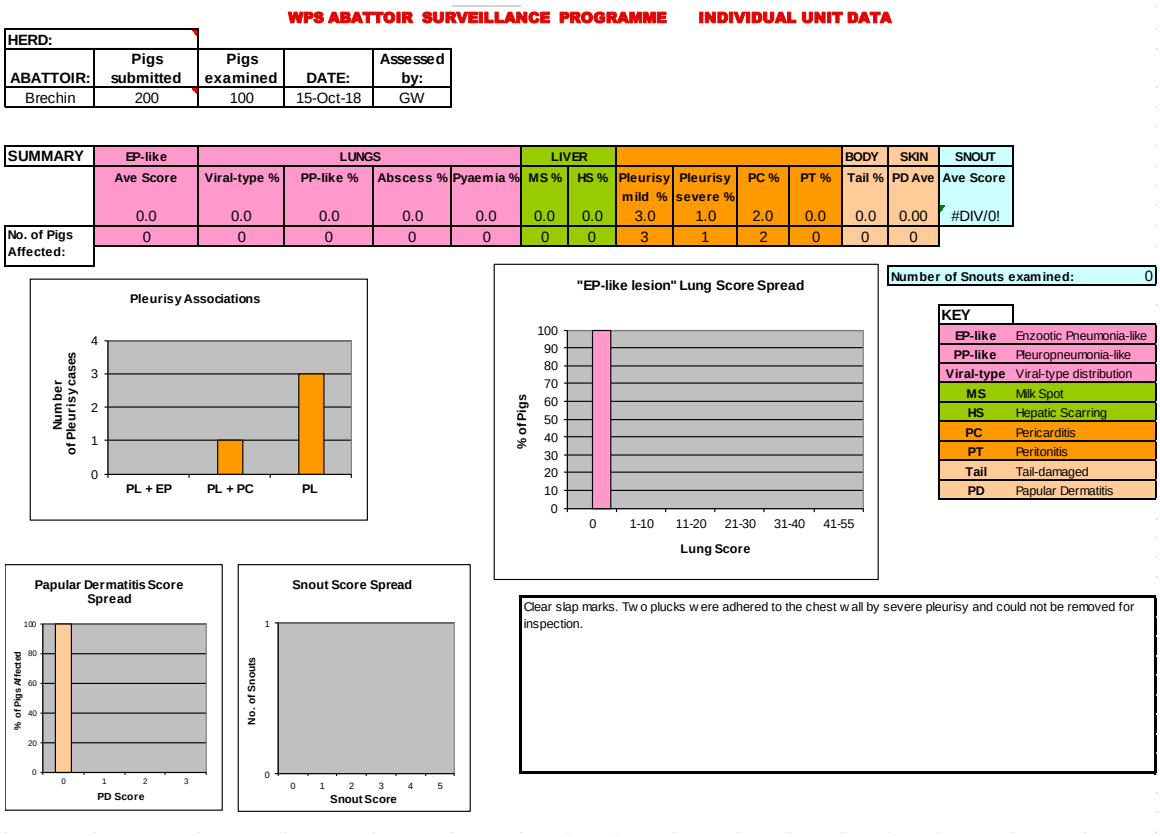

Figure 1 – Summary of the assessment results

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		WP(S) LTD				INTER-UNIT COMPARISON DATA								
Date	15-Oct-18													
UNIT ID	EP-like	LUNGS				LIVER						BODY	SKIN	SNOUT
	Ave Score	Viral %	PP-like%	Abscess %	Pyaemia %	M/S%	H/S %	Pleurisy mild%	Pleurisy severe%	P/C%	P/T%	Tail %	PD Ave	Ave Score
	EP-like	Viral Pna	PP-like	Abscess	Pyaemia	Milk spot	H/S	Pleurisy Mild	Pleurisy severe	Pericarditis	Peritonitis	Tail-damage	PD	Snout
	0.31	0	0	0.4	0	1.1	0.7	6.3	0.4	2.6	0	0.4	0	
Bottom 25%	0.64	0	0	1.1	0	1.4	1.9	11.1	6.9	3.1	0	0.5	0	2.2
Top 25%	0	0	0	0	0	0	0	0.6	0	0	0	0	0	2.2
AVERAGE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.7	2.4	2.0	0.0	0.0	0.00	2.2

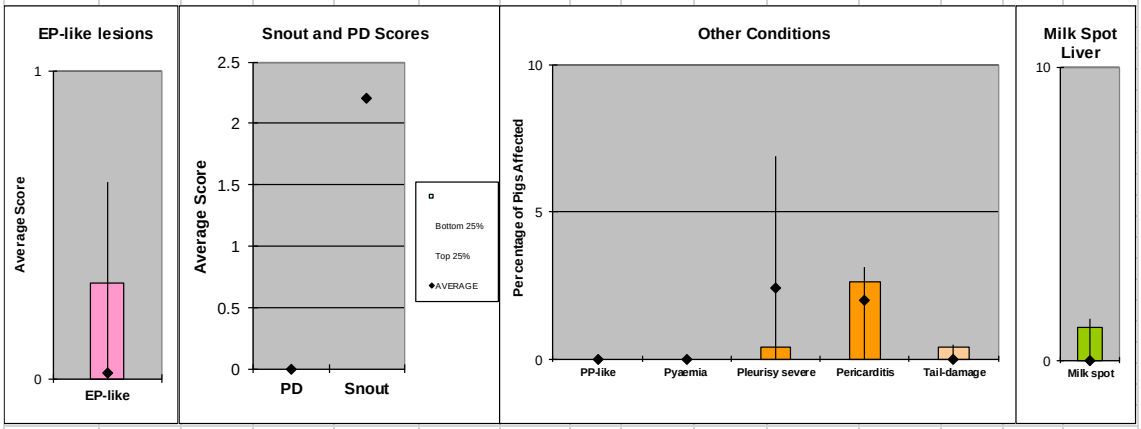

Figure 2 – Benchmarking of the unit results with national results

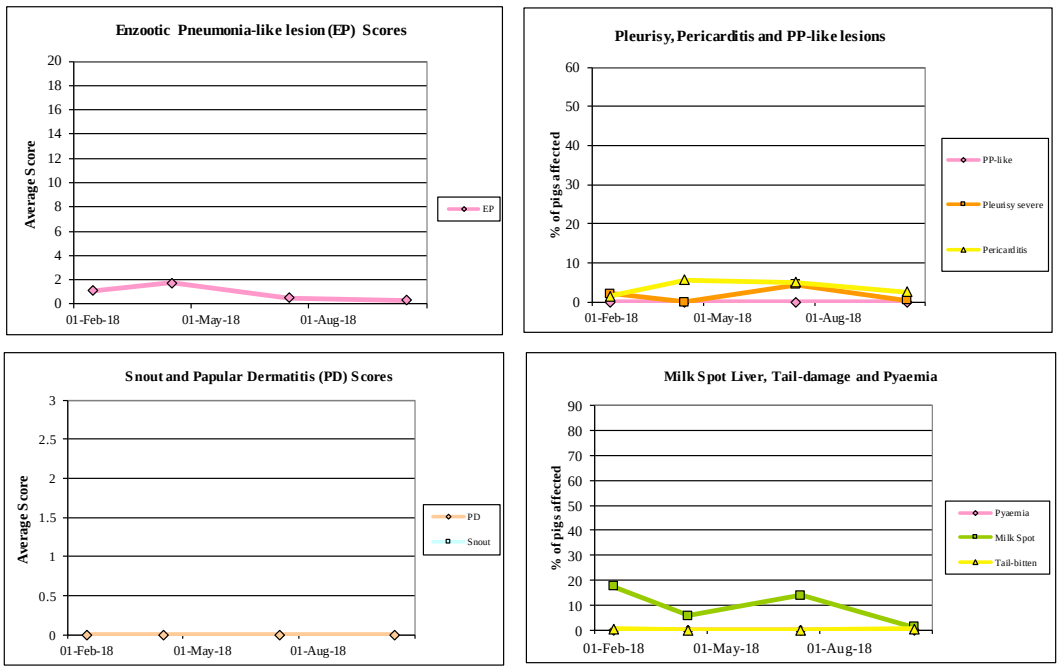

Figure 3 – Comparison over time of the unit results

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At national level the results were aggregated and a trend analysis was carried out to see evolution over time for several conditions and to provide guidance to the industry for improving health. . The results were also presented in several industry meetings and the highlights were selected to be part of the national health status summaries for producers and vets.
Figures 4 to 20 show the national results of the scheme from the beginning of 2009 until the end of 2018.
Since to the closure of Broxburn abattoir in 2012 a significant number of pigs have been moved south of the border to slaughter which accounts for the decrease in the number of batches and pigs being assessed shown in Figure 4 and 5.
In terms of health status the number of pigs with no lesion at abattoir has increased since 2015 and in the last year has achieved its highest level (Figure 6).

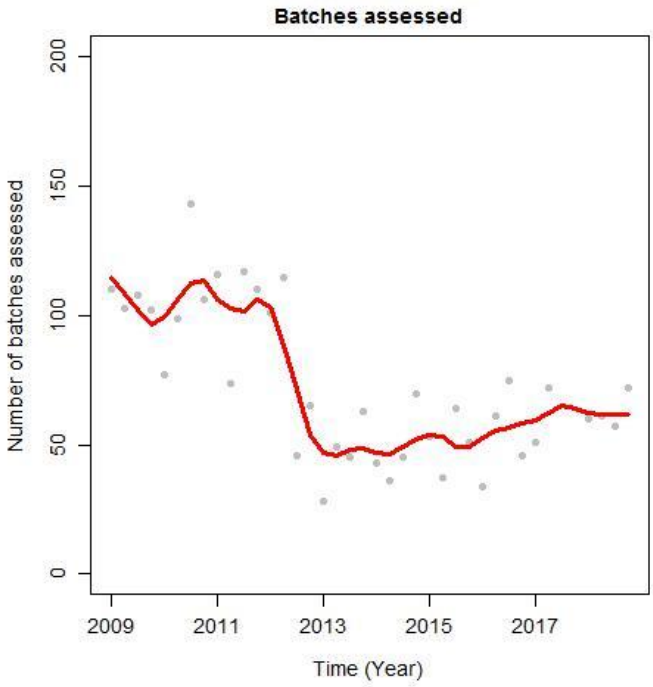

Figure 4 - Number of batches assessed, by calendar quarter, with fitted trend line.

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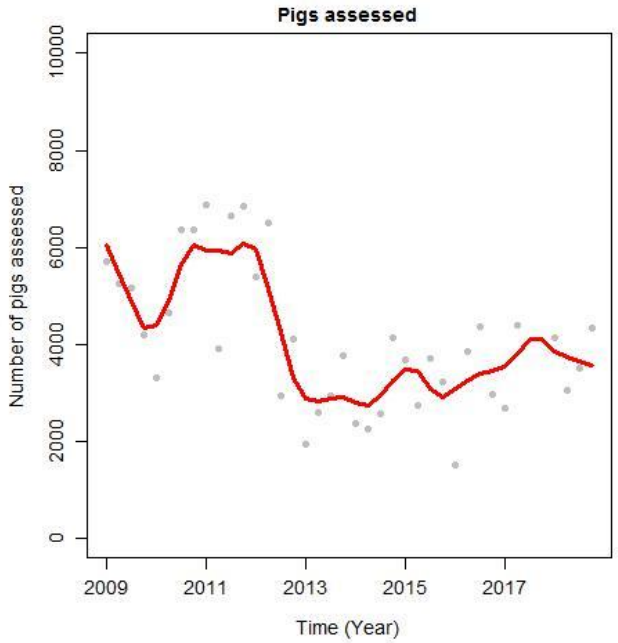

Figure 5 - Number of pigs assessed, by calendar quarter, with fitted trend line.

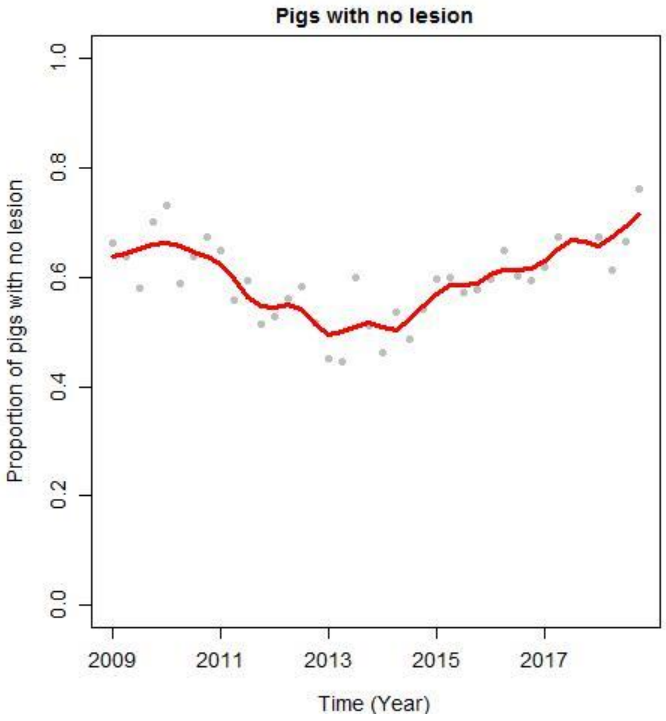

Figure 6 - Proportion of pigs with no lesions, by calendar quarter, with fitted trend line

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Epizootic Pneumonia-Like Lesions: Total

Enzootic pneumonia is an infectious pulmonary disease of pigs caused by *Mycoplasma hyopneumoniae.* It is characterised by coughing, ill-thrift and, although associated with very low mortality, is a cause of economic loss. Spread of *M. hyopneumoniae* infection within a unit depends upon the husbandry system. Infection is transmitted most rapidly within common airspaces and continuous stocking systems with open pen divisions, and least slowly in all-in-all-out systems and outdoor systems. Swine influenza, PRRS, *Haemophilus parasuis* (Glasser's disease) and other *Mycoplasma* infections can also cause enzootic pneumonia-like lesions.

The proportion of slapmarks that had no pigs with any EP-like lesions at the time of slaughter is shown in Figure 7. Following a decrease in the proportion of slapmarks with no pigs exhibiting EP-like lesions from 2008 to 2014, the proportion has trended upwards and has fluctuated in the range of 0.35 to 0.5 in the last year.

The proportion of pigs with any EP-like lesions at the time of slaughter is shown in Figure 8. Following a rise in the proportion of pigs with EP-like lesions from 2010 to the peak proportion registered in the first quarter of 2014, the proportion has trended downwards. The trend line suggests that the proportion of pigs with EP-Like lesions has been going down in the last six months and in Quarter 4 2018 reached the lowest level of the last 10 years.

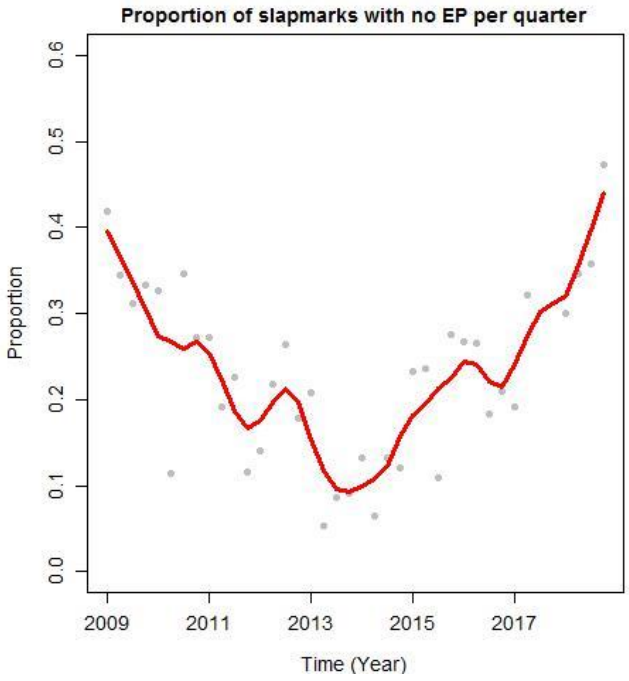

Figure 7 - Proportion of slapmarks with no pigs with any EP-like lesions, by calendar quarter, with fitted trend line.

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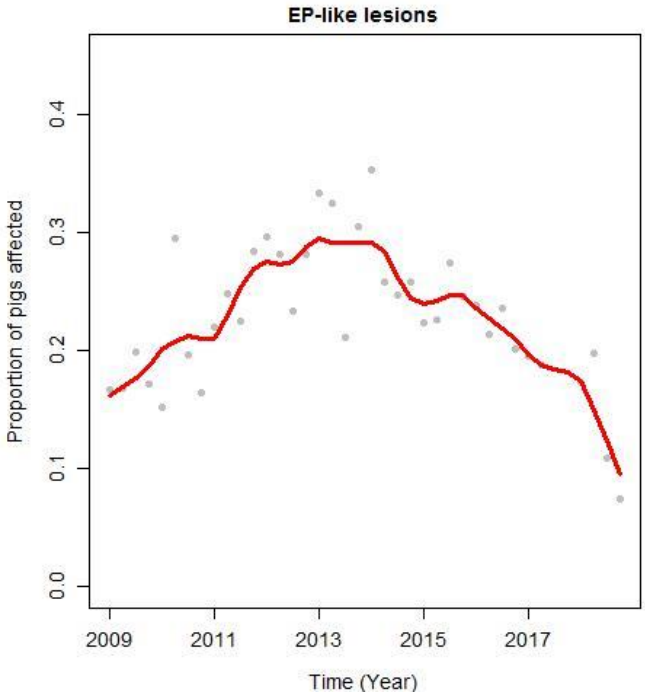

Figure 8 - Proportion of pigs with any EP-like lesions, by calendar quarter, with fitted trend line.

Epizootic Pneumonia-Like Lesions: Severe

EP lesions scored ≥9 are regarded as severe and cause economic loss by reducing growth of pigs.

The proportion of pigs with severe EP-like lesions at the time of slaughter is shown in Figure 9. Following an increase in the proportion of pigs with severe EP-like lesions from 2009 to 2013, the proportion has trended downwards reaching the lowest level of the last 10 years. The trend for severe lesions is similar to the one observed in Figure 8 – i.e. declining.

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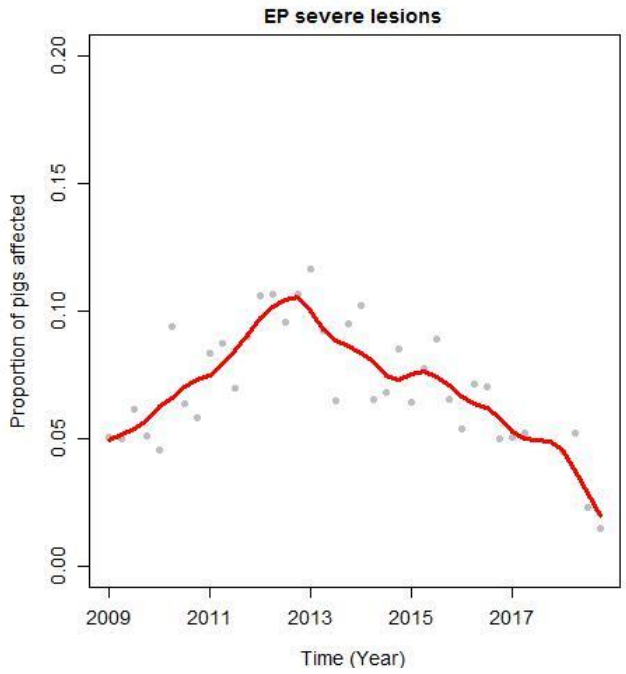

Figure 9 - Proportion of pigs with severe EP-like lesions, by calendar quarter, with fitted trend line.

Pleuropneumonia

An important cause of pleuropneumonia in pigs is *Actinobacillus pleuropneumoniae*. Spread of *A. pleuropneumoniae* between farms is believed to be mainly by movement of infected pigs and transmission on fomites.

The proportion of pigs with pleuropneumonia at the time of slaughter is shown in Figure 10 and has fluctuated over the last ten years. An increase in the proportion of pigs affected in 2013 – 2015, was followed by a decrease in prevalence in 2016. The proportion of pigs affected now seems to have stabilised at around 0.005 or less.

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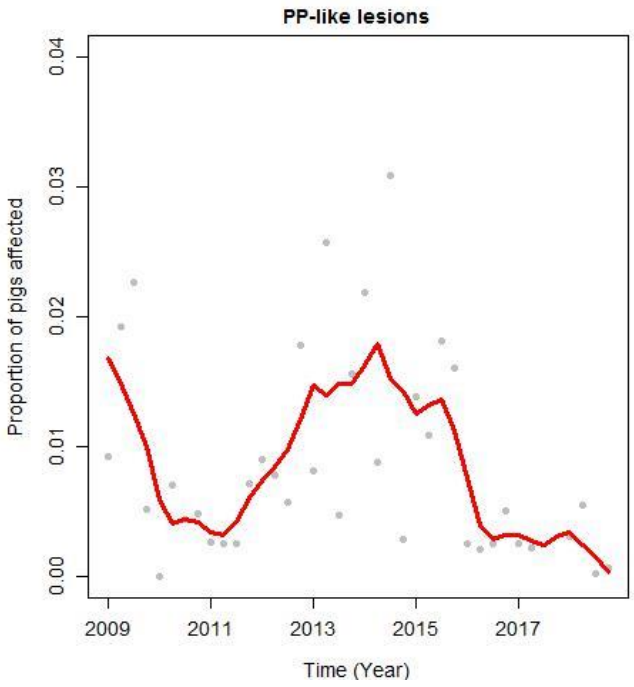

Figure 10 - Proportion of pigs with pleuropneumonia, by calendar quarter, with fitted trend line.

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Viral Pneumonia

Viral-like pneumonia lesions are characterised by a particular distribution and appearance of lung consolidation. Viruses associated with pneumonia in pigs include: porcine reproductive and respiratory syndrome virus (PRRS), swine influenza virus among others.

The proportion of pigs with viral-like pneumonia at slaughter is shown in Figure 11. There was a steep increase in the proportion of pigs with viral-like pneumonia from 2008 to 2015 followed by a rapid decrease. Since the first quarter of 2016, the proportion has decreased to the very low level observed in 2009.

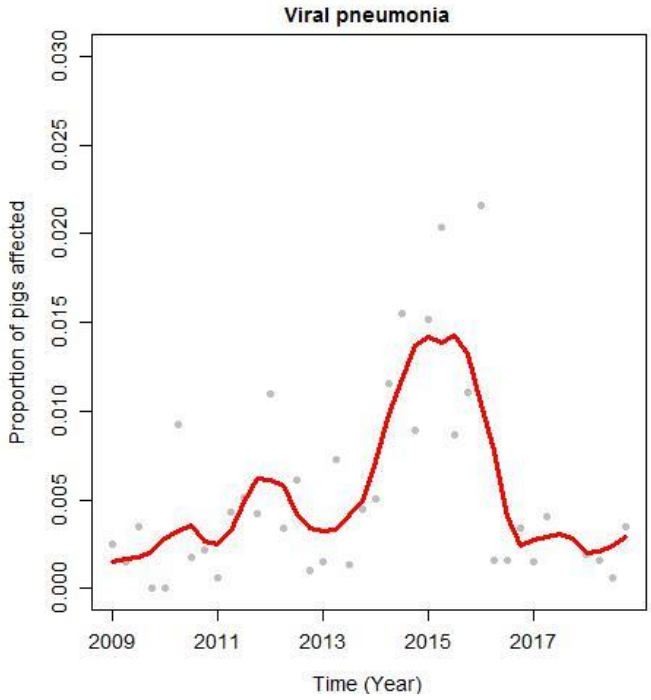

Figure 11 - Proportion of pigs with viral pneumonia, by calendar quarter, with fitted trend line.

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Pleurisy

Pleurisy is a condition in which the pleura—the tissue membrane lining the inner side of the chest cavity and lungs—becomes inflamed. Pleurisy may results in adhesions between lung lobes or between the lungs and the thoracic wall.

Pleurisy with pericarditis is common in pigs and accounts for considerable loss from condemnation at slaughter. Viruses such as influenza, PRRS, swine fever, and bacteria such as *Actinobacillus pleuropneumoniae* (APP), *Haemophilus parasuis* (HS) and *Pasteurella multocida* may cause pleurisy.

The proportion of pigs with pleurisy at slaughter is shown in Figure 12. From 2011 to 2013, there was a pronounced increase in the proportion of pigs with pleurisy at slaughter, followed by a decrease from the second quarter of 2013. The prevalence has fluctuated since 2016.

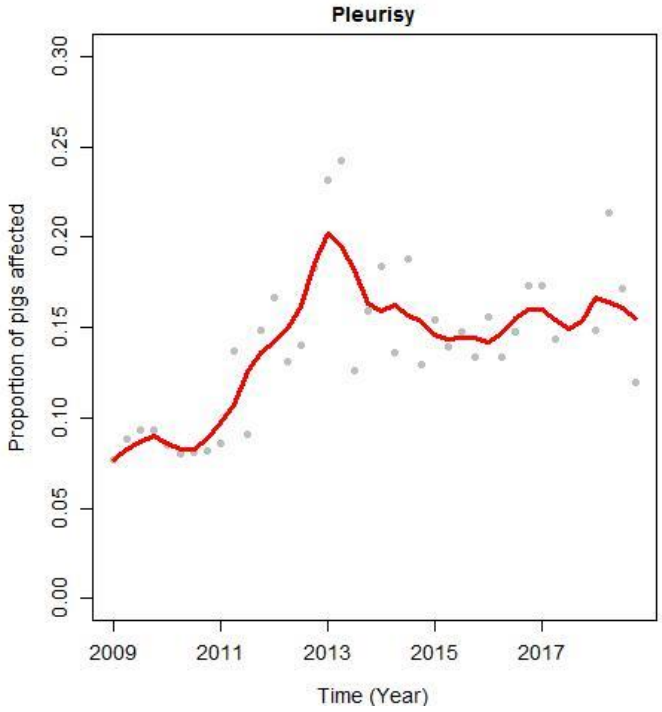

Figure 12 - Proportion of pigs with pleurisy, by calendar quarter, with fitted trend line.

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Lung Abscess

The proportion of pigs with lung abscesses at slaughter is shown in Figure 13. The proportion of pigs with lung abscesses increased from 2010 to 2014 followed by a decrease. In Quarter 4 2018 the prevalence increased compared to previous quarters.

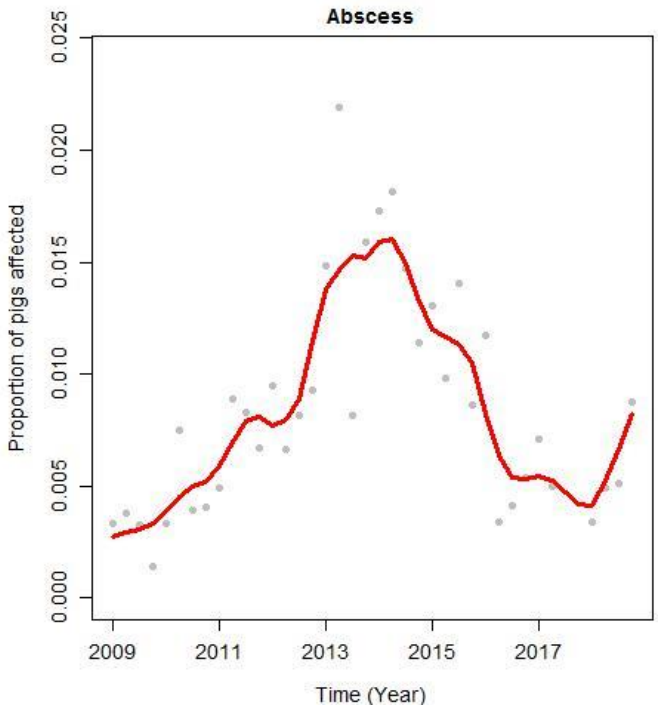

Figure 13 - Proportion of pigs with lung abscesses, by calendar quarter, with fitted trend line.

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Liver

Milk Spot

Milk spots occur in the liver and are evidence of recent migration by *Ascaris suum* roundworm (nematode) larvae. Presence of milk spot results in the condemnation of livers. *Ascaris suum* roundworms also affect the growth rate and food conversion efficiency of pigs.

The proportion of pigs with milk spot at slaughter is shown in Figure 14. There has been a gradual decrease in the proportion of pigs with this condition since 2008. Since 2013 the variation in the prevalence per quarter has increased considerably although there has been no big change in the prevalence over the last year.

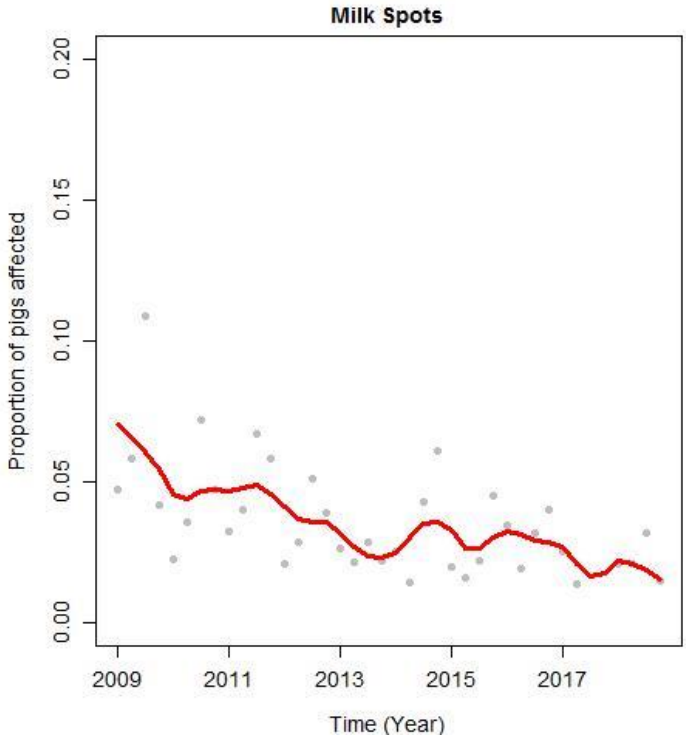

Figure 14 - Proportion of pigs with milk spot, by calendar quarter, with fitted trend line.

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Hepatic Scarring

Hepatic scarring is likely to represent mature, healed milk spot lesions.

The proportion of pigs with hepatic scarring at slaughter is shown in Figure 15. Following a downward trend in the proportion of pigs with hepatic scarring from 2008 to 2010, the proportion of pigs affected increased until the third quarter of 2014. Since then the proportion of pigs affected has decreased.

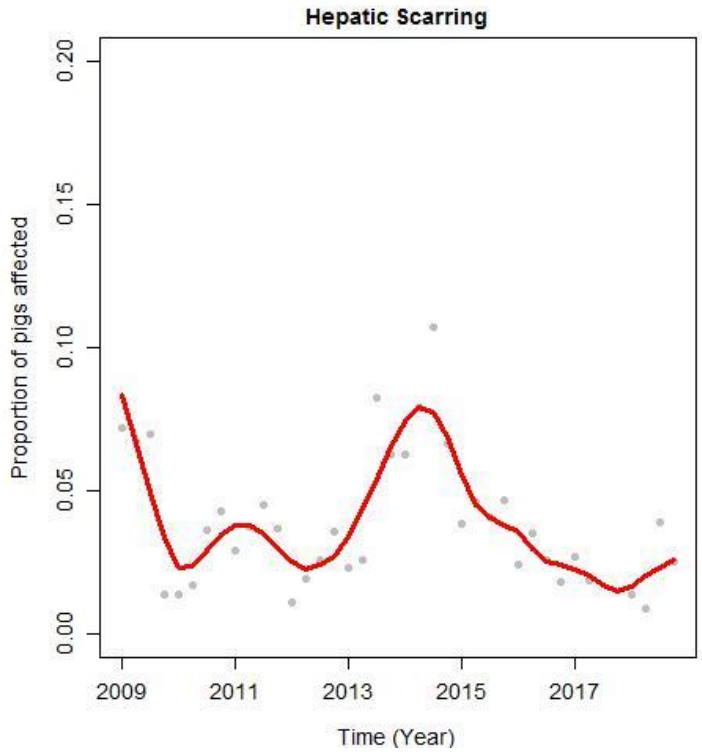

Figure 15 - Proportion of pigs with hepatic scarring, by calendar quarter, with fitted trend line.

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Skin

Papular Dermatitis

The most common cause of papular dermatitis is sarcoptic mange, i.e. infestation by *Sarcoptes scabei* var *suis*. Papular dermatitis is therefore a good marker for the probability of sarcoptic mange and associated financial losses.

The proportion of pigs with papular dermatitis at slaughter is shown in Figure 16. There has been a downward trend in the proportion of pigs with papular dermatitis since 2008. In the last year the proportion of pigs affected has been less than 0.001 i.e. less than one in 1000 pigs were affected.

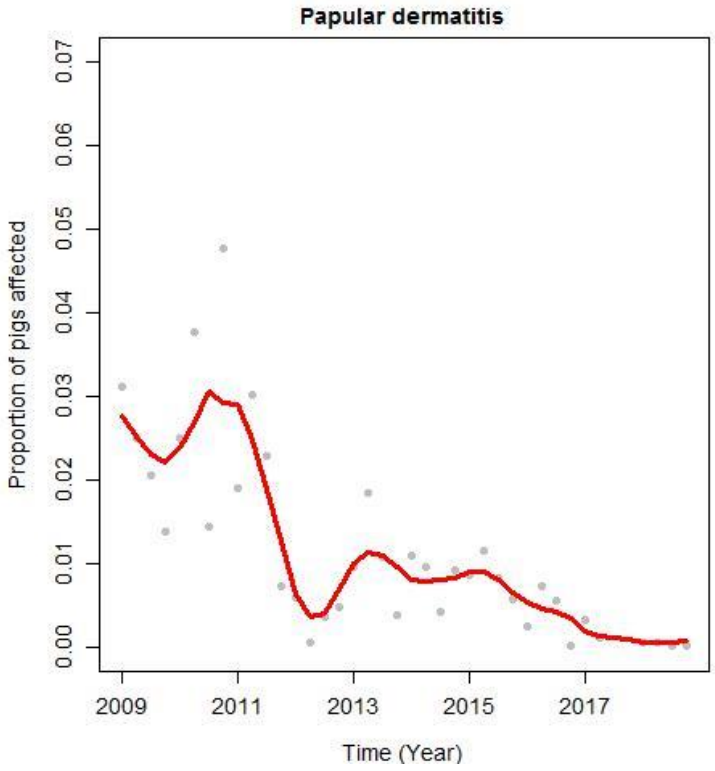

Figure 16 - Proportion of pigs with hepatic scarring, by calendar quarter, with fitted trend line.

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Other

Pyaemia

Pyaemia is a type of septicaemia, i.e. presence of bacteria in the blood, resulting in multiple, widely disseminated metastatic abscesses. It may follow tail-biting, endocarditis or abscessation somewhere in the body.

The proportion of pigs with pyaemia at slaughter is shown in Figure 17. Since 2008, the proportion of pigs with pyaemia has fluctuated, with an increase between 2012 and 2014 followed by a decrease. In this last year the prevalence of pyaemia fluctuated in the range of 0.06% to 0.3%.

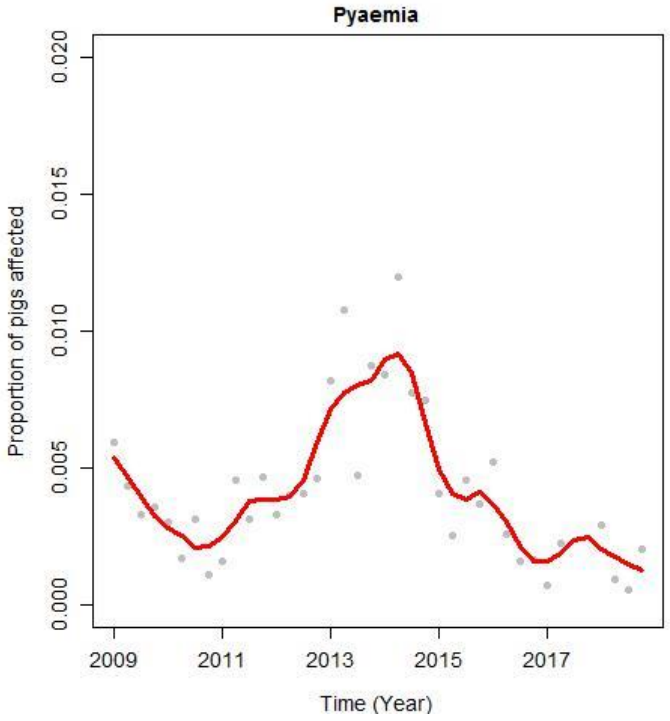

Figure 17 - Proportion of pigs with pyaemia, by calendar quarter, with fitted trend line.

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Tail Damage

Tail biting lesions indicate stress, adverse environmental conditions and possibly, underlying disease. Tail biting may result in blood-borne spread of bacteria from the wounds and cause pyaemia, resulting in total carcase condemnation.

The proportion of pigs with tail damage at slaughter is shown in Figure 18. From 2011 to 2018, the proportion of pigs with tail damage fluctuated within a band ranging from 0.005 to 0.016.

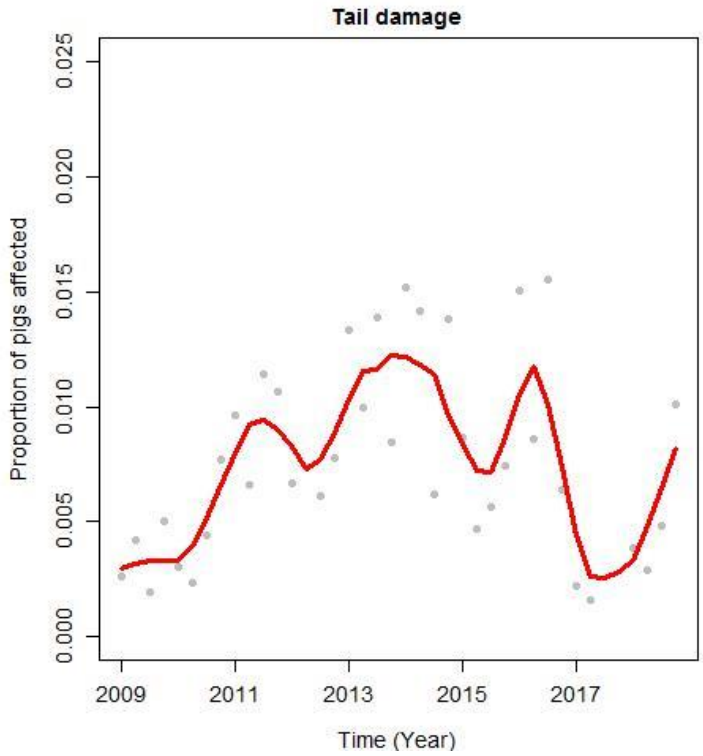

Figure 18 - Proportion of pigs with tail biting lesions, by calendar quarter, with fitted trend line.

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Pericarditis and Peritonitis

Pericarditis

Pericarditis is inflammation of tissue membranes lining the heart and the surrounding pericardial sac, and may result in adhesions between the heart and the pericardial sac. Such lesions result in losses from condemnation at slaughter.

The proportion of pigs with pericarditis at slaughter is shown in Figure 19. After a rise in the proportion of pigs with pericarditis from 2010 to 2013, the proportion of pigs with pericarditis has fluctuated with considerable variation between consecutive quarters.

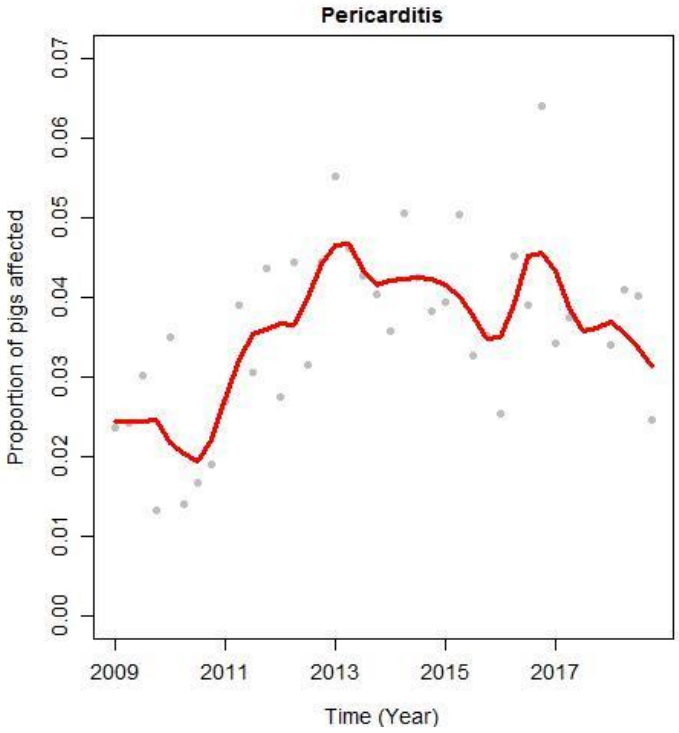

Figure 19 - Proportion of pigs with pericarditis, by calendar quarter, with fitted trend line.

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Peritonitis

Peritonitis is inflammation of tissue membranes lining the abdominal organs, abdominal cavity and omentum, and may result in adhesions between these surfaces and organs. Such lesions account for considerable losses from condemnation at slaughter. It may be coincident with pleurisy and pericarditis. Peritonitis may result from a ruptured gastric ulcer, bowel perforation, penetration of the abdomen cavity at mating, external trauma to the abdomen a ruptured bowel or liver, bacterial infection, e.g. *Actinobacillus pleuropneumoniae*, migrating *Ascaris suum* larvae and systemic infection.

The proportion of pigs with peritonitis at slaughter is shown in Figure 20. Since the first quarter of 2015, there has been a downward trend in the proportion of pigs at slaughter with peritonitis—with a maximum of six pigs reported to have peritonitis in any one quarter.

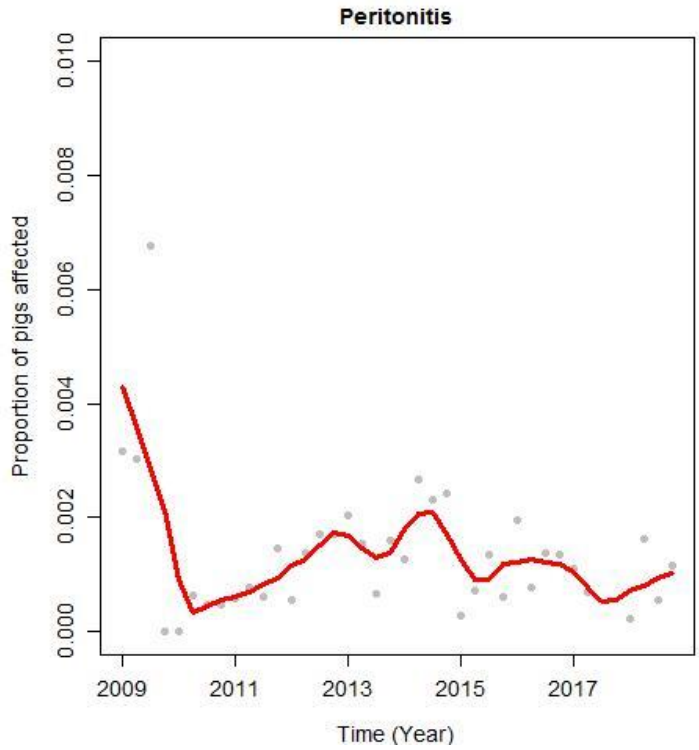

Figure 20 - Proportion of pigs with peritonitis, by calendar quarter, with fitted trend line.

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4.3 Salmonella scheme

The Scottish Salmonella scheme consists of collecting 15 meat juice samples per slapmark per quarter at the abattoir. These samples are analysed using the IDEXX ELISA test and each sample gets a percentage positivity value on a scale of 0 – 100%, annotated as SALP. The Average SALP value per slapmark is the average SALP for all the samples from that slapmark sampled in the last four assessments. The higher the average SALP value the higher the number of infected pigs which are probably shedding Salmonella at the time of slaughter. The industry average is the average SALP for all the pigs sampled in the last four assessments. This rolling average was set up due to the variability between assessments of the SALP values. Figure 21 is an example of the reports sent to producers and their vets and used by the industry to monitor the scheme over time.

Due to a fire in Brechin in August 2017 samples from Quarter 3 and 4 of 2017 were lost and the abattoir was not able to resume its normal operations in terms of collecting samples until Quarter 3 of 2018. Therefore there was a gap of one year in the scheme. Figure 22 shows the results over time; overall the median SALP over the quarters (tick line on the boxes) is below 20%. In the *Salmonella* 2014/2015 pilot study it was found that a SALP value of less than 20% was associated with less probability of animals shedding *Salmonella spp*. at the abattoir (Jill Thompson personal communication).

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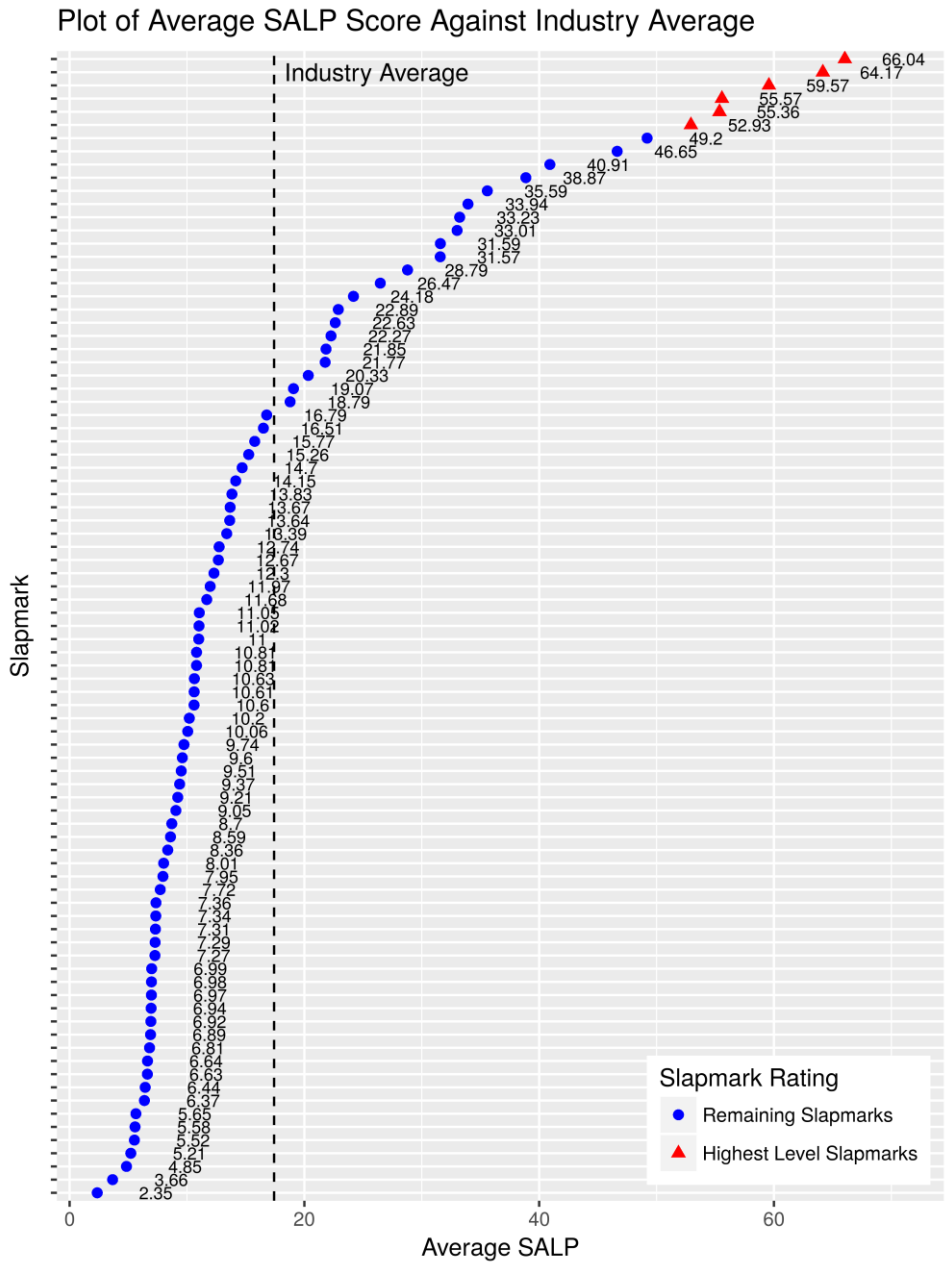

Figure 21: Example of Salmonella report sent to producers, to keep anonymity all slapmarks names have been deleted.

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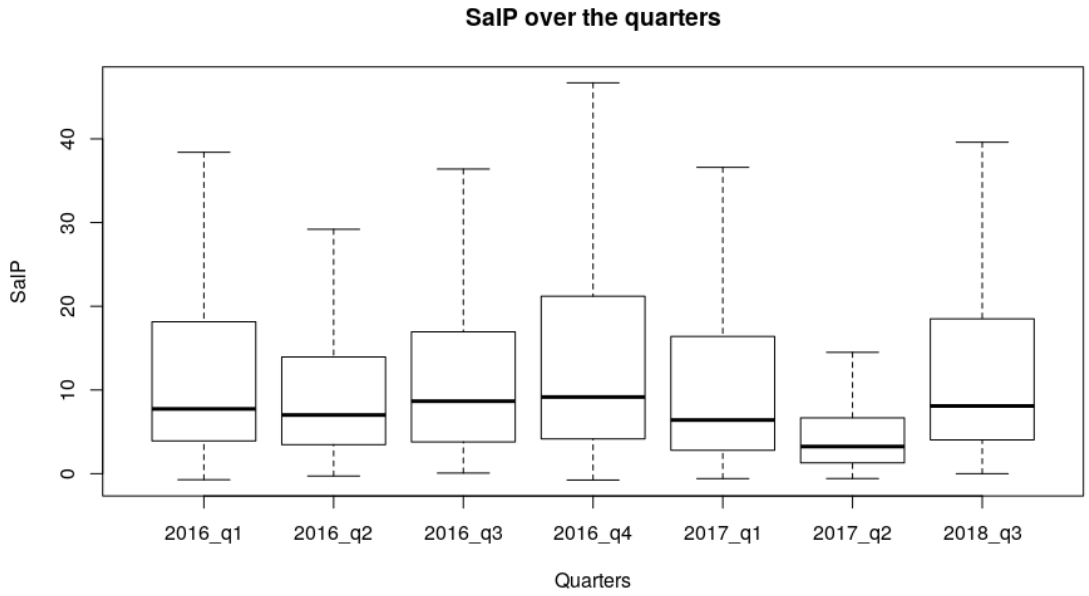

Figure 22: Boxplot with SalP variation over calendar quarters. Outliers have been removed from this graph.

Several interactive maps were developed during this project that show the prevalence for several diseases/conditions using QVRs data, WPS data and PRRS survey data. These maps have been used to drive for improvements in pig health at national level. As an example, Figure 23 shows the status of the units for Enzootic pneumonia (one of the most prevalent respiratory diseases caused by *M. hypopneumoniae*) according to the classification attributed by the farm veterinary assistant. A summary of the results of the QVRs is provided in Table 2.

Overall the health status of the Scottish units is good (Table 2). Most of the units in Scotland are negative for mange (85.4%) and A. pleuropneumoniae (84.2%). There is no positive unit for swine dysentery (B. hyodysenteriae) (Figure 24). For M. hyopneumoniae, S. suis and PRRS around 53%, 58% and 67% of the unit are also negative respectively.

For PRRS an aggregated map for was produced with the results of the PRRS survey (Figure 25) to raise awareness and help drive initiatives towards the control and elimination of this disease. This map was presented in several producer/vet meetings.

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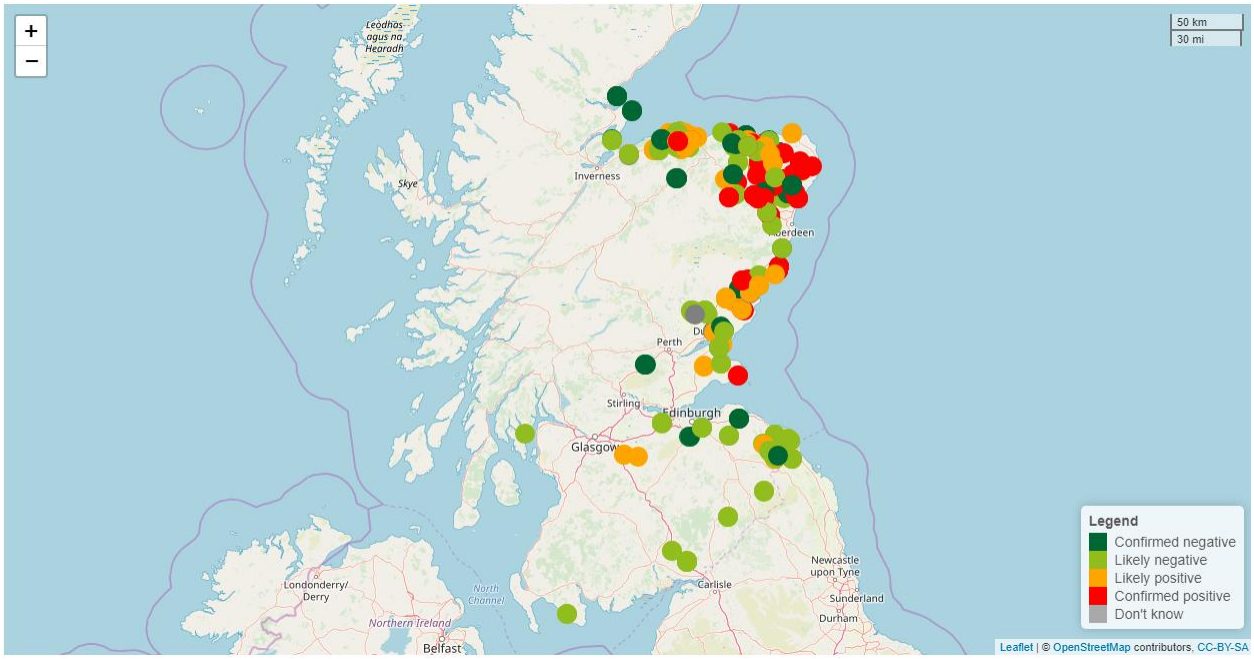

Figure 23 – Status of the units for Enzootic pneumonia according to the QVRs

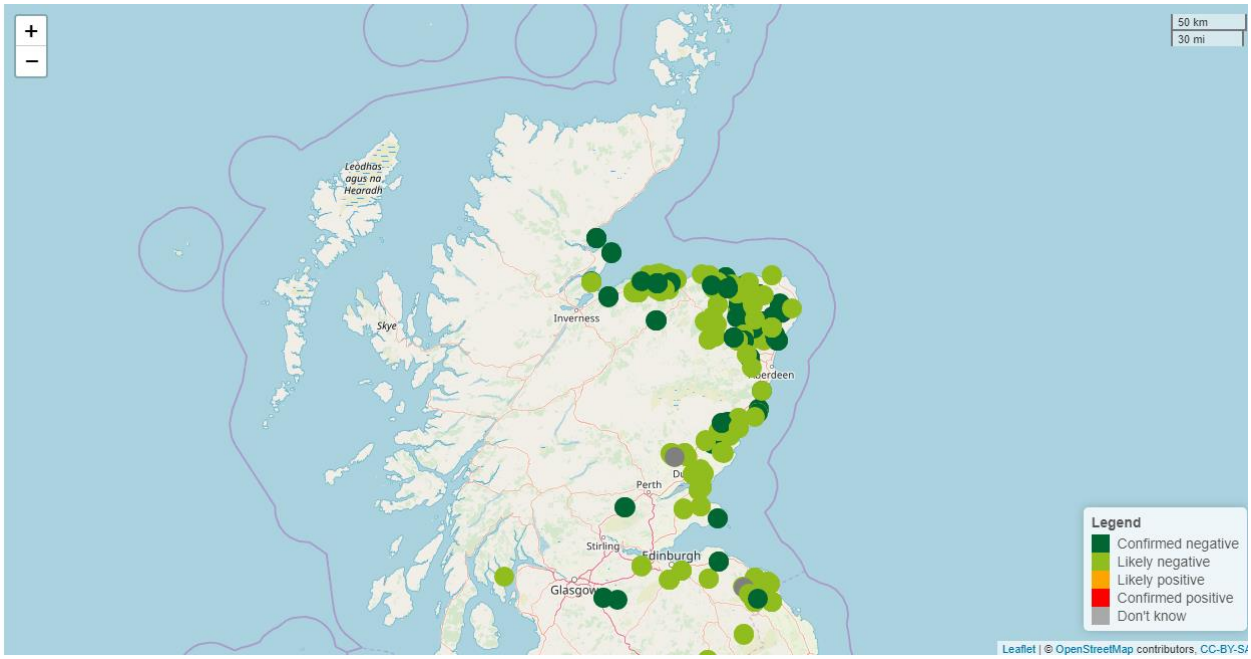

Figure 24 – Status of the units for swine dysentery according to the QVRs

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Table 2 – Summary of health status at national level for six diseases using QVR data

Disease	Per Cent Farms (Number)				
	Positive (+)		Negative (–)		Don't Know
	Confirmed	Likely	Confirmed	Likely	
PRRS	17.1 (28)	12.2 (20)	25.0 (41)	41.5 (68)	4.3 (7)
M. hyopneumoniae	23.2 (38)	22.6 (37)	15.9 (26)	36.6 (60)	1.8 (3)
A. pleuropneumoniae	1.8 (3)	11.0 (18)	23.2 (38)	61.0 (100)	3.0 (5)
Mange	1.8 (3)	9.1 (15)	28.7 (47)	56.7 (93)	3.7 (6)
B. hyodysenteriae	0.0 (0)	0.0 (0)	32.3 (53)	67.1 (110)	0.6 (1)
S. suis	6.7 (11)	28.0 (46)	4.9 (8)	53.0 (87)	7.3 (12)

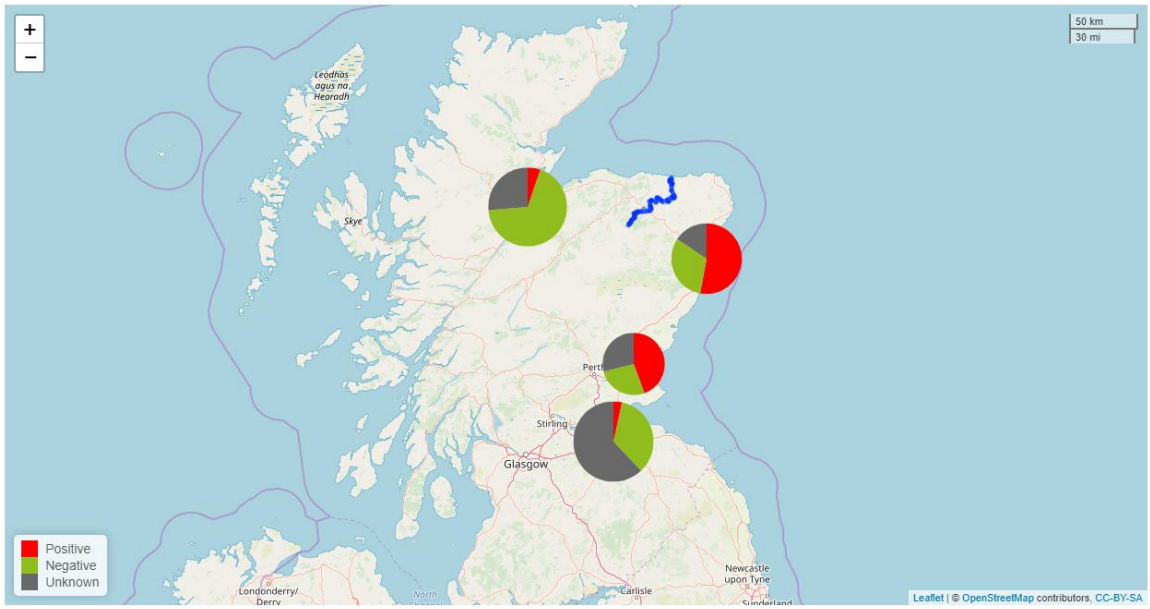

Figure 25: PRRS survey – national figures

Figure 25 shows that the Moray Coast area (the Deveron river – landmark in blue in Figure 25 was considered as a natural border to separate the Moray Coast area from the Aberdeen area)

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has few positive units albeit some are yet to be tested. The same applies for the South (which includes all the South of Scotland from Edinburgh), however this region has a significant number of units still to be tested. The Aberdeen area shows the highest proportion of positive units.

The results were further split by production type (Figure 26). Production type was split into three categories: units with breeding animals, units without breeding animals and units with unknown production type. The results show that most of the breeding units are negative for PRRS, while for units without breeding animals the split is almost 50:50.

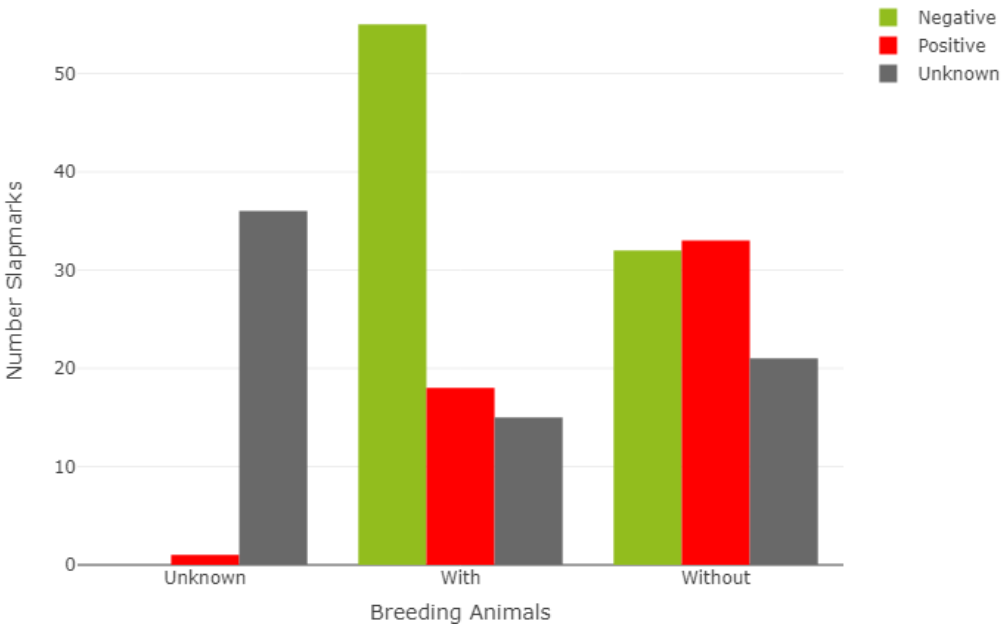

Figure 26 – PRRS survey national figures split by production type (units with breeding animals or without breeding animals or unknown units type) and by results for PRRS (negative, positive or unknown).

These two different data sources (PRRS survey and QVRs) allow comparison per unit of the results for PRRS (Table 3). There is a good correlation between the results of one compared to the other, which is not unexpected as assistant veterinarians use previous testing and knowledge about the unit itself (e.g. from where they source their pigs) to provide their assessment of the unit status. Even so it is good to confirm this correlation between the two datasets.

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Table 3 – Comparison of the results for PRRS based on the PRRS survey or the QVRs

QVR Report	PRRS Survey			
	Positive (+)	Negative (–)	No Result	Total
Confirmed positive (+)	23	**3**	1	27
Likely positive (+)	14	2	2	18
Likely negative (–)	2	30	34	66
Confirmed negative (–)	**2**	31	7	40
Don't know	1	4	2	7
No Result	10	17	30	57
Total	**52**	**87**	**76**	**215**

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4. FINANCE

4.1 **Sum Awarded:** £390,696

4.2 **Details of Expenditure**

COSTS	TOTAL BUDGET	TOTAL CLAIMED	TOTAL REMAINING
Direct Project Costs			
WPS Project Director	£75,920	£75,920	**£0**
SPP Project Officer	£39,000	£39,000	**£0**
SRUC specialists	£222,956	£222,956	**£0**
WPS staff travel and subsistence	£6,400	£5,065	**£1,335**
SRUC staff travel and subsistence	£3,000	£1,326	**£1,674**
Telephone	£1,260	£1,260	**£0**
Software	£1,650	£1,650	**£0**
Website	£1,500	£1,500	**£0**
Animation Costs			
Focus group meetings hire & catering	£1,750	£127	**£1,623**
External veterinary specialists	£8,400	£5,618	**£2,782**
Running Costs			
SPP Management, reporting & cooperation	£28,560	£28,560	**£0**
Op Gp meeting catering	£300	£149	**£151**
Sub Total (Eligible)	**£390,696**	£383,130	**£7,566**

4.3 **Underspends**

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Areas of significant underspend were:

- Travel & subsistence: fewer face to face meetings were required than originally thought and so there was less need for travel and accommodation.
- Focus group meetings hire & catering: rather than having stand-alone focus groups, it proved to be more effective undertaking focus groups as part of meetings being held for other reasons, i.e., Scottish Pig Producers Board meetings or Pig Monitor Farm meetings. This increased participation numbers but frequently meant that the costs for room hire and catering did not need to be paid by the project.
- External veterinary specialists: the need to pay for specific veterinary advice was slightly lower than originally thought as many veterinary practitioners were happy to share their expertise free of charge since the project was of benefit to their clients

A project change request was approved by Scottish Government in August 2019 to provide a total of five additional days to complete final reporting requirements.

The final underspend for the whole project was £7,566.

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5. PROJECT AIMS/OBJECTIVES

AIM

To improve the efficiency and sustainability of the Scottish pig supply chain through control or elimination of production-limiting diseases by the innovative application of emerging technology to actively drive management changes on farm through a knowledge exchange network

OBJECTIVES

1. To establish a new Knowledge Transfer and Exchange (KTE) network for all Scottish commercial pig producers and their vets
2. To integrate existing datasets enabling tailored analysis for each herd to be disseminated through the KTE network
3. To establish a dynamic health mapping system that can inform strategic decision making for the pig industry

MILESTONES

M1.1: Focus groups for output design completed (June 16)
M1.2: KTE network design and operation finalised (Dec 16)
M1.3: Data transfer mechanisms between data owners and ERU operational (Dec 16)
M1.4: Review meetings with stakeholders to finalise outcomes completed (Dec 16)
M1.5: First individual reports generated (Dec 16)
M1.6: Dynamic health mapping system operational (Dec 16)
M2.1: Individual report generated for all units on a quarterly basis
M2.2: Review meetings with stakeholders completed (Dec 17)
M2.3: Automation of routine report generation completed (Jan 18)
M2.4: Preliminary evaluation of project outputs and delivery completed (Dec 17)
M2.5: Full evaluation of project delivery, outputs and outcomes completed (Oct 18)

TARGETS

PHASE 1
1. Successful integration of the datasets listed in Section 2.4 by Dec 16
2. Dynamic health status mapping operating by Dec 16
3. New KTE network for Scottish pig vets established by Dec 16

PHASE 2
1. Reports produced for every unit quarterly from start of Mar 17
2. Strategic health report produced quarterly from start of Mar 17

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Diseases/ conditions	Targets for April 2019	2015 levels	Dataset used to measure the objective
Sarcoptic Mange	Elimination of disease and maintenance of “free” status	0.8%	QMS Pig Health scheme (also known as Wholesome Pigs Scotland)
Enzootic Pneumonia	25% reduction of animal prevalence at slaughter	24.4%	QMS Pig Health scheme
Pleurisy	25% reduction of animal prevalence at slaughter	14.4%	QMS Pig Health scheme
PRRS	Determine regional levels and evaluate the possibility of progression to regional elimination	-	QMS Quarterly Veterinary Records (QVRs), Blood Surveys
Swine Dysentery	Maintenance of “free” status: no outbreaks during study period	No positive farm	QMS Quarterly Veterinary Records (QVRs)
Progressive Atrophic Rhinitis	Establish a baseline prevalence with the view to achieving a reduction during the study period	-	QMS Pig Health scheme
Salmonella	Establish and maintain a baseline prevalence at animal and herd level	-	Salmonella Scheme data

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6. PROJECT OUTCOMES

6.1 Progress Against Objectives

1. To establish a new Knowledge Transfer and Exchange (KTE) network for all Scottish commercial pig producers and their vets

This was achieved on schedule, although it proved significantly more difficult to enthuse private veterinarians to engage with the project than expected so changes were made to the mechanisms to target them more at farmers instead.

2. To integrate existing datasets enabling tailored analysis for each herd to be disseminated through the KTE network

This was partially achieved, two datasets belonging to AHDB have still not been received and so could not be integrated into the system yet.

3. To establish a dynamic health mapping system that can inform strategic decision making for the pig industry

This was achieved and is proving to be a major asset to the Scottish pig industry in planning for disease control and elimination.

6.2 Date Milestones Were Achieved (Original target vs actual)

M1.1: Focus groups for output design completed (June 16/Sept 16)
M1.2: KTE network design and operation finalised (Dec 16/Dec 16)
M1.3: Data transfer mechanisms between data owners and ERU operational (Dec 16/Feb17)
M1.4: Review meetings with stakeholders to finalise outcomes completed (Dec 16/Dec 16)
M1.5: First individual reports generated (Dec 16/Dec 16)
M1.6: Dynamic health mapping system operational (Dec 16/Dec 16)
M2.1: Individual report generated for all units on a quarterly basis (Sep 17/ Sep 17)
M2.2: Review meetings with stakeholders completed (Dec 17/Dec 17)
M2.3: Automation of routine report generation completed (Jan 18/Aug 18)
M2.4: Preliminary evaluation of project outputs and delivery completed (Dec 17/Dec 17)
M2.5: Full evaluation of project delivery, outputs and outcomes completed (Oct 18/Apr 19)

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7. LESSONS LEARNED

7.1 Issues & Challenges

The project faced three significant challenges that were unforeseen at the start.

Firstly, the main Scottish pig abattoir at Brechin had a major fire in August 2017 and did not reopen until November of the same year. This interrupted data collection for both abattoir monitoring and the salmonella scheme, as well as absorbing significant amounts of management time.

The second challenge has been the on-going refusal of Agriculture and Horticulture Development Board (AHDB) to share data on antibiotic use and pig welfare assessments with any Scottish organisations. This is despite the data actually belonging to Scottish farmers. This frustrating situation meant that these two datasets have not yet been integrated into the system yet.

Finally, there were several changes of personnel in the SRUC team that sometimes affected timescales for different workstreams.

7.2 Impacts

Diseases/ conditions	Targets for April 2019	2015 levels	2019 levels
Sarcoptic Mange	Elimination of disease and maintenance of "free" status	0.8%	0.1%
Enzootic Pneumonia	25% reduction of animal prevalence at slaughter	24.4%	7.6% (-31.1%)
Pleurisy	25% reduction of animal prevalence at slaughter	14.4%	14.6% (+1.4%)
PRRS	Determine regional levels and evaluate the possibility of progression to regional elimination	-	37.4% positive farms Region to target: Moray coast
Swine Dysentery	Maintenance of "free" status: no outbreaks during study period	No positive farm	No positive farm/ no outbreak

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Progressive Atrophic Rhinitis	Establish a baseline prevalence with the view to achieving a reduction during the study period	-	Prevalence too low to establish a numerical baseline.
Salmonella	Establish and maintain a baseline prevalence at animal and herd level	-	Average SALPscore =17.5

8. COMMUNICATION & ENGAGEMENT

8.1 Details Through Project Lifetime

Focus groups with producers and vets were held in August 2016. A general but common comment was that there was not great enthusiasm for amalgamating reports or generating new reports as producers and vets were already receiving a lot of information from different sources. Of greater importance was to receive information as quickly as possible that could then be acted upon. All agreed, however, that although adequate information relating to individual units was available it was data relating to the national status that was lacking. Therefore, the project team prioritised developing summarised information at national level to raise awareness of the national pig health status. Subsequently, every six months summarised reports were produced and sent to producers and vets (example – Appendix 1).

Results were presented by the team to a total of 28 meetings over the duration of the project. The majority of these were farmer groups, along with key stakeholders from government and public sector agencies, veterinary specialists, research groups and supply chain partners such as processors and retailers.

8.2 FAS Engagement

The project was a part of presentations on pigs given to two FAS New Entrant groups in 2018, one in Kelso and one in Larkhall. It also featured regularly in the SRUC Pig Newsletters circulated to all stakeholders.

8.3 EIP-AGRI Engagement

The project was uploaded to the EIP-AGRI website.

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9. KEY FINDINGS & RECOMMENDATIONS

Feedback was obtained through questionnaires (one for vets the other for producers). The questionnaires sought opinions of the general activities of the SPHN project, such as the mapping (using the PRRS maps as an example), the Salmonella reports, the WPS reports and then asked for an overall ranking of the usefulness of the project, and invited general comments about it.

Veterinarians: vets participating in the QMS Vet meeting March 2019; seven in number were asked to complete the questionnaire.

Producers: producers participating in the SPP Annual General Meeting March 2019: 14 in number were asked to complete the questionnaire.

With regard to the mapping tool developed, including the mapping of the PRRS current status, all considered the maps to be useful both for situation awareness (Figure 17) and to control PRRS (Figure 28).

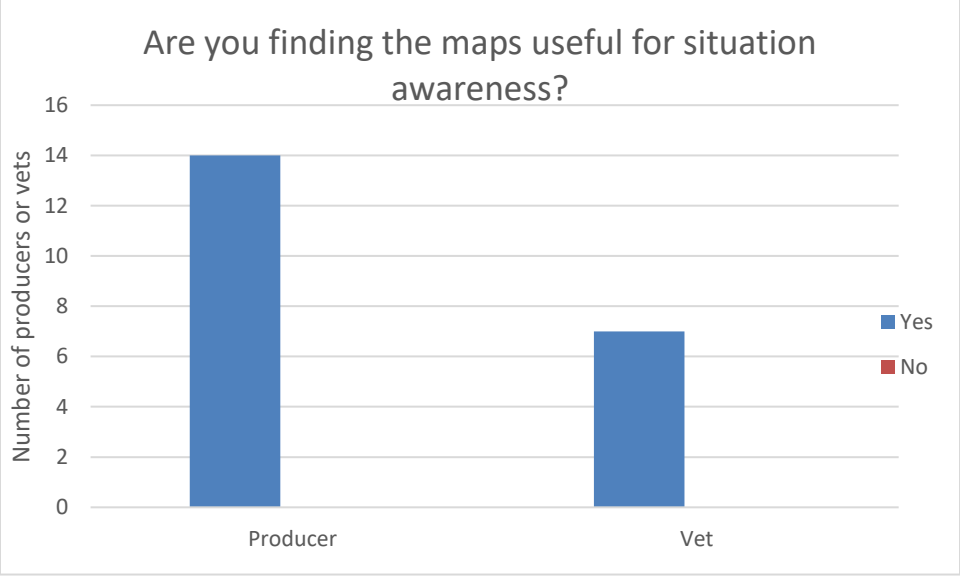

Figure 27 – Feedback received from veterinarians and producers regarding the usefulness of the maps for disease situation awareness.

General comments received included that “mapping is a vital part of the PRRS control programme”.

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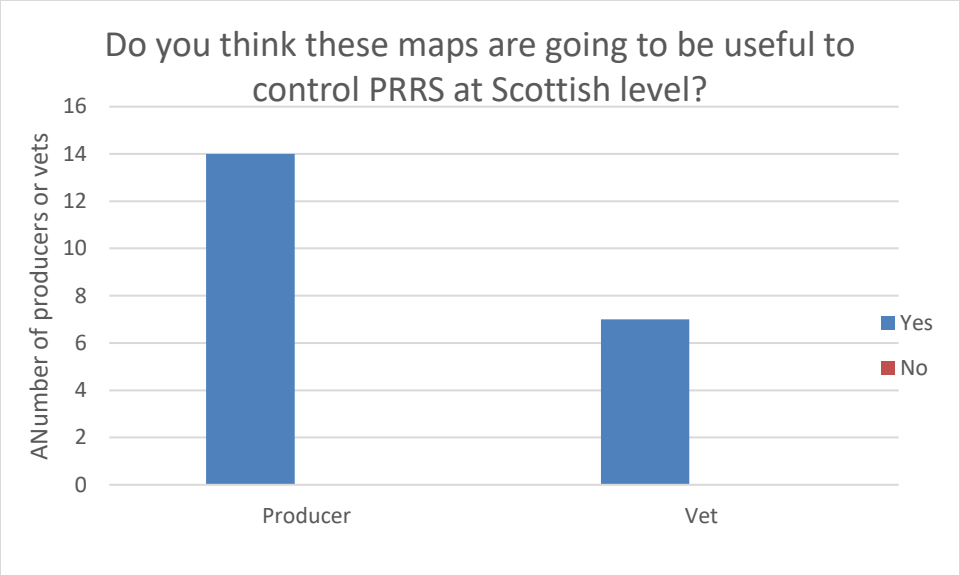

Figure 28 – Feedback received from veterinarians and producers regarding the usefulness of the maps for the control of PRRS at Scottish level.

With regard to the Salmonella reports (Figure 29-30), all were happy with the structure and presentation of the report and generally think that they can be useful to drive improvements. The one vet and one producer who said otherwise further explained that they had not seen those reports (vet) or because their Salmonella level was low (producer) - not requiring any intervention.

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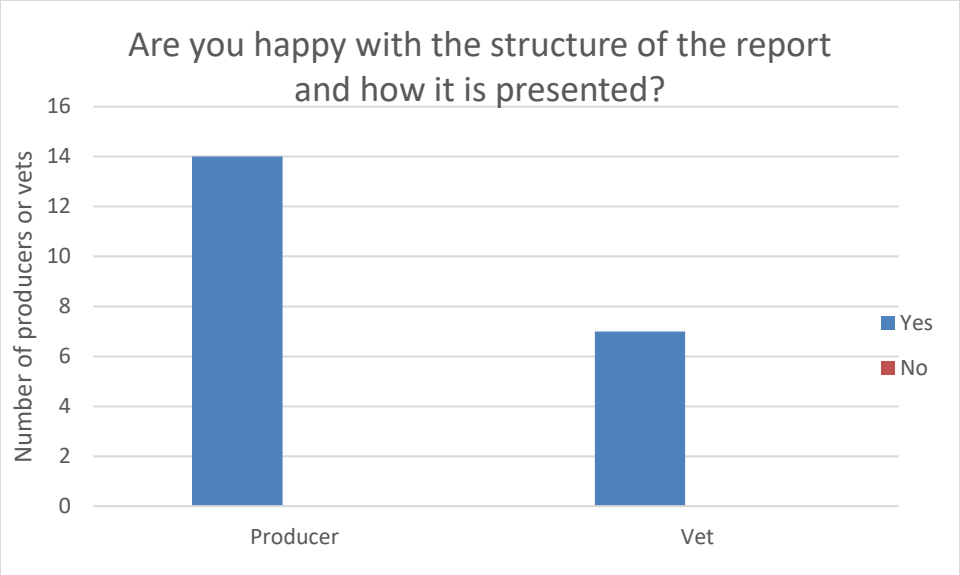

Figure 29 – Feedback received from veterinarians and producers regarding the structure and presentation of the Salmonella reports.

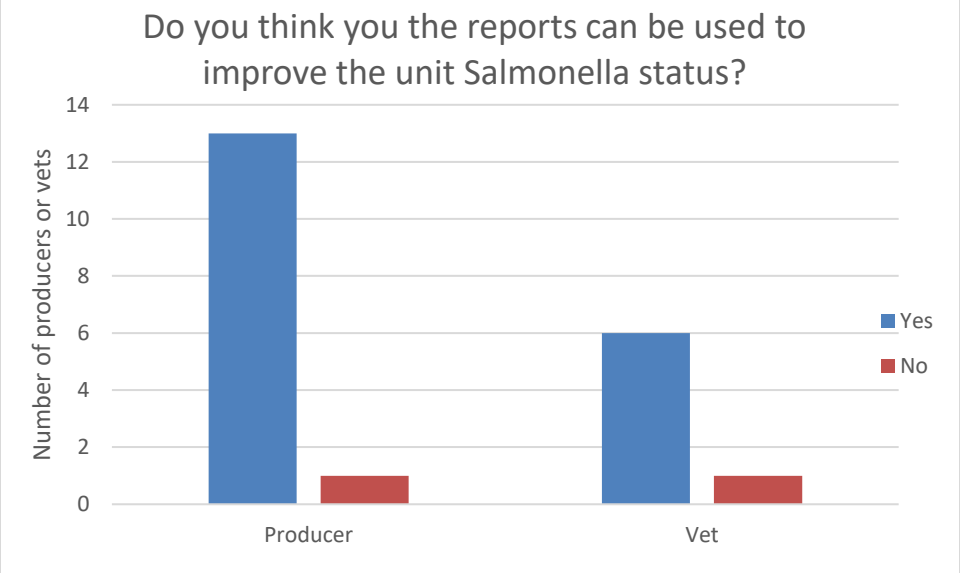

Figure 30 – Feedback received from veterinarians and producers determining if they can improve the clients/own Salmonella status with the help of the Samonella reports.

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With regard to making changes at farm level due to the Salmonella reports, most of the vets reported their clients had no issues so far but it was good to benchmark against others; while some of the producers mentioned acidification of feed. Almost 30% of the producers reported not making any change as their levels are were low.

As regards WPS reports (Figures 31-32), all consulted considered that the existing conditions monitored by WPS are still of value and the majority felt that there was no need to add additional conditions although erysipelas, enteric disease (including gastric ulcers) and arthritis were suggested.

The main changes that were reported having been made in response to the WPS reports included vaccination followed by disease elimination (partial or full depopulation). There were no comments regarding how these reports could be improved, suggesting that vets and producers were generally content with their format.

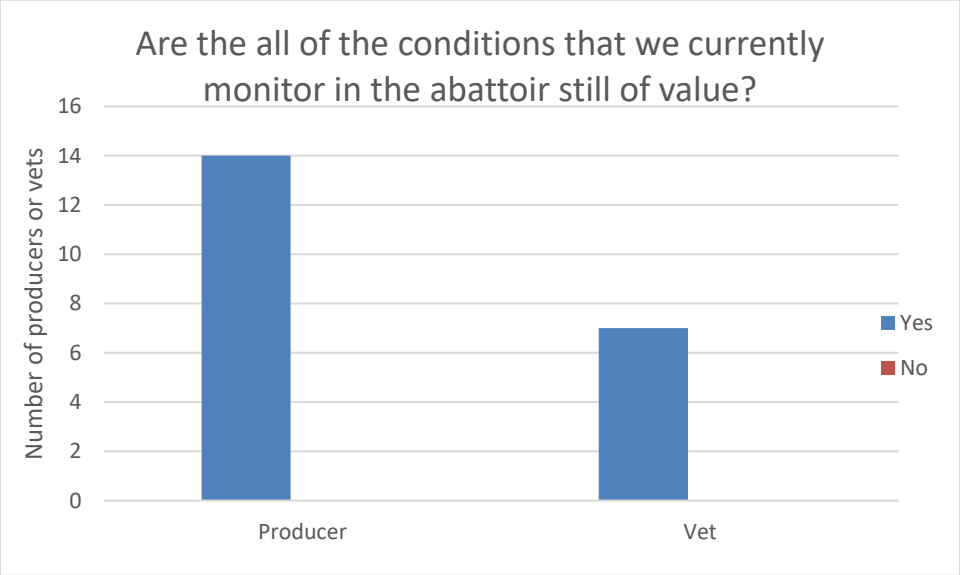

Figure 31 – Feedback received from veterinarians and producers asking if all the conditions monitored through WPS were still of value.

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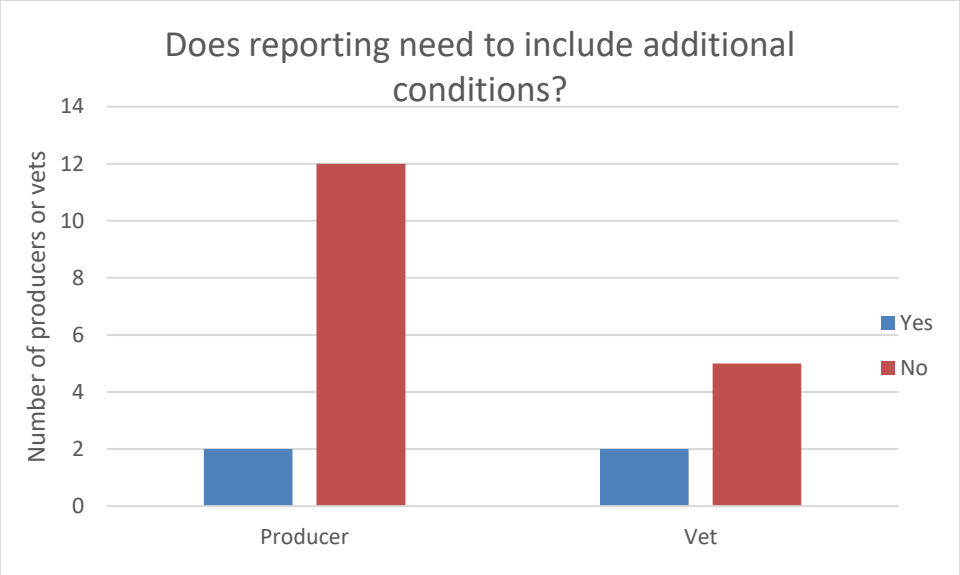

Figure 32 – Feedback received from veterinarians and producers asking if additional conditions should be monitored by the WPS scheme.

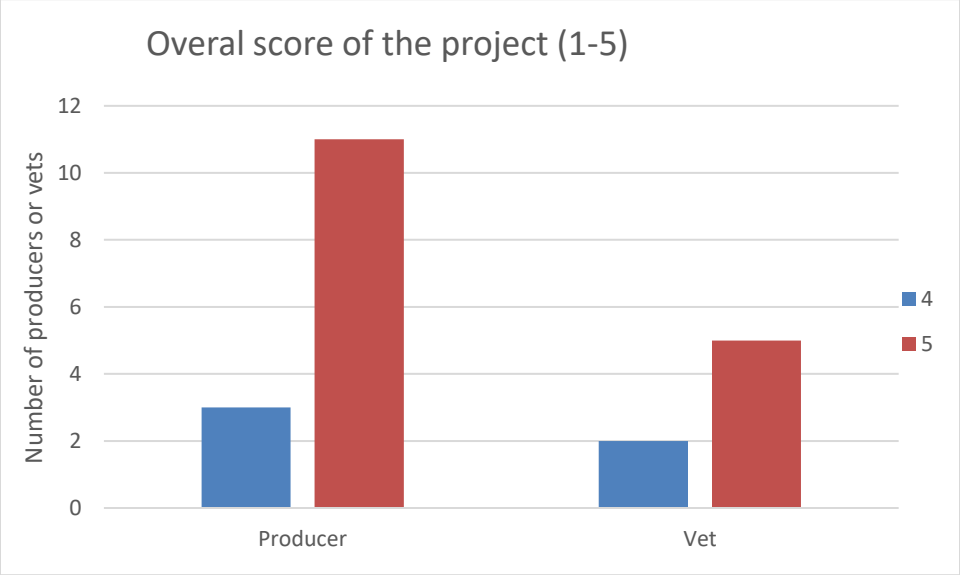

Figure 33 – Overall score given to the SPHN project on a scale of 1 (poor) to 5 (high)

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Overall score given to the project was high (Figure 33) indicating that the industry is pleased with the project outputs and outcomes. In general the comments were very positive.

One vet mentioned that “This is very valuable information that has helped to bring the industry together to coordinate health improvements. This has led to good industry cooperation for projects like mange elimination and PRRS elimination.” While a producer commented, “This is a valuable service to farmers which is now being copied in England”.

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10. CONCLUSION

The project aimed to create an evolving knowledge base to provide sustained impetus for improved Scottish product by using untapped data sources and providing information in a more “digestible” format, while at the same time improving the flow of existing data through a more up-to-date system. For this, very ambitious targets were set-up. Overall we have achieved those targets and the project has been the catalyst to accelerate the pace of herd health improvement in Scotland, as showed by the graph of health improvements.
There were some challenges - such as the Brechin fire and difficulty to access specific data sources - but the project has contributed to an improved line of communication between vets and the industry bodies (such as QMS), which already allowed for a plan for a control and elimination programme for PRRS to be drafted and presented to the industry. Overall satisfaction from producers and vets was high and all of them highlighted that the information provided by the project helped to bring the industry together to coordinate health improvements.

The tools developed in this project, i.e. Salmonella reports and the mapping tool, will continue to be of use for producers, vets and industry.

The Scottish pig industry demonstrably has the highest overall health status of any part of the UK and would be amongst the best performers across global pig industries.

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