EXTERNAL SCIENTIFIC REPORT

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Expert knowledge elicitation on African Swine Fever and outdoor farming of pigs

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Abstract

An expert knowledge elicitation was conducted to address three tasks identified by EFSA's Animal Health and Welfare (AHAW) Panel: categorize outdoor farm types of pigs in EU MS according to the risk of African Swine Fever (ASF) introduction into these farms and the risk of ASF spread from these farms, rank biosecurity measures according to their potential to lower the risk of ASF introduction into these farms and the risk of ASF spread from these farms in ASF-affected countries, and propose improvements of biosecurity for outdoor pig farming categories and the control measures that should flank these in ASF-affected countries. The elicitation was conducted with four scientists with expertise in ASF epidemiology, biosecurity and outdoor farming practices and structures, including organic and backyard farming of pigs outdoors. The first task was addressed by eliciting estimates for the risk of new ASF outbreaks in the areas of interest in the coming year for two types of outdoor pig farms, specified by EFSA. As a worst-case scenario for assessment, the EKE considered areas of the EU where ASF is present in wild boar and in domestic pigs in indoor farms and, if outdoor farms were to be permitted in such areas, in domestic pigs in outdoor farms. The second task was addressed by developing a preliminary list of biosecurity measures, prioritising 7 measures in terms of expected effectiveness in reducing risk for each farm type, and then eliciting estimates of the effectiveness, feasibility and sustainability of each of the prioritised measures, considered separately. The third task was addressed by brainstorming of potential control measures to be considered in conjunction with improved biosecurity. The results are intended for consideration by the EFSA AHAW Panel when developing a Scientific Opinion on ASF and outdoor pig farming.

Key words:

African Swine Fever, outdoor pig farms, biosecurity measures, control measures, expert knowledge elicitation

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Summary

An Expert Knowledge Elicitation (EKE) was conducted to address three tasks identified by EFSA's Animal Health and Welfare Panel: categorize outdoor farm types of pigs in EU MS according to the risk of ASF introduction into these farms and the risk of ASF spread from these farms, rank biosecurity measures according to their potential to lower the risk of ASF introduction into these farms and the risk of ASF spread from these farms in ASF-affected countries, and propose improvements of biosecurity for outdoor pig farming categories and the control measures that should flank these in ASF-affected countries.

The first task was addressed by eliciting estimates for the risk of new ASF outbreaks in the areas of interest in the coming year for two types of outdoor pig farms, specified by EFSA. The second task was addressed by developing a preliminary list of biosecurity measures (BSMs), prioritising 7 measures in terms of expected effectiveness in reducing risk for each farm type, and then eliciting estimates of the effectiveness, feasibility and sustainability of each of the prioritised measures, considered separately. The third task was addressed by brainstorming of potential control measures to be considered in conjunction with improved biosecurity.

The EKE was conducted in two parts with four scientists with expertise in ASF epidemiology, biosecurity and outdoor farming practices and structures, including organic and backyard farming of pigs outdoors, in different regions of the EU. In the first part, the experts assessed the ASF risk in outdoor pig farms and identified and prioritised potential biosecurity measures (BSMs). In the second part, the experts assessed the effectiveness, feasibility and sustainability of the prioritised BSMs.

As a worst-case scenario for assessment, the EKE considered areas of the EU where ASF is present in wild boar and in domestic pigs in indoor farms and, if outdoor farms were to be permitted in such areas, in domestic pigs in outdoor farms. In farm type I, pigs have access to an outdoor area in forest, woodlands, on agricultural land or pastures, while in farm type II, pigs have access to an outdoor area on farm premises (adjacent to farm buildings).

ASF risk was assessed in terms of the number of new ASF outbreaks that would occur in the coming year. The experts' consensus distribution for the number of new outbreaks per 100 type I outdoor pig farms had a median of 87 and 95% probability interval of 53 - 99. The probability interval quantifies the scientific uncertainty of the experts' assessment: they judge that, with 95% probability, the true value would lie between 55 and 99. The experts agreed on two distributions to express their uncertainty about the number of new outbreaks per 100 type II outdoor pig farms. The medians for these distributions were 37 and 42, much lower than their median for type I outdoor pig farms and the uncertainty was greater, with 95% probability intervals of 4 – 90 and 8 – 90, overlapping the median estimate for type I farms.

The experts were asked to rank 12 potential BSMs in terms of their effectiveness for reducing ASF risk in each type of outdoor pig farms and then to prioritise which BSMs should be considered further in the second part of the EKE. They selected 4 BSMs for both farm types: *double fence*, *single solid fence*, *single fence* and *no access to stored feed*. A further 3 BSMs were selected only for farm type I (*removal of uneaten feed*, *no wild boar baiting* and *no access to water*) and 3 for farm type II (*daily inspection*, *cleaning/disinfection facilities* and *protective clothing*). Two potential BSMs were considered less effective for both farm types and not considered further (closed carcase storage and *absence of crops/trees*).

The effectiveness of each prioritised BSM was assessed in terms of how much they would reduce the number of new ASF outbreaks in the coming year in the respective farm type, if the BSM was implemented fully and properly in all farms of that type and without any of the other prioritised BSMs being implemented. The experts rated effectiveness highest for *double fence* and *single solid fence*, with most experts at least 90% certain this would reduce the number of new outbreaks by 40% or more in both farm types and median estimates of the reduction ranging from 55 to 90%.

To varying degrees, the experts rated *single fence* less effective (median estimates 10 – 60%) than double or solid fence but more effective than all the other BSMs on type I farms (*no wild boar baiting* and *no access to stored feed*, *uneaten feed and water*), which all experts were at least 90% certain would reduce outbreaks by less than 40%.

For farm type II, most experts were at least 90% certain that *daily inspection* and *no access to stored feed* would reduce outbreaks by less than 40%. The effectiveness of *protective clothing* and *cleaning/disinfection facilities* was rated higher than those BSMs and approaching the effectiveness of a *single fence* for farm type II, but with very wide uncertainty.

The experts also assessed the relative contribution of each BSM to reducing introduction and spread of ASF. Most experts considered it most likely that *double fence* and *single solid fence* would contribute more to reducing introduction than spread in both farm types. *Single fence* was considered most likely to have similar impacts on introduction and spread for farm type I, but similar or more impact on spread for farm type II.

For both farm types, *no access to stored feed* was judged most likely to have similar impacts on introduction and spread or more on introduction. The same result was obtained for *no access to water* in farm type I, while removing uneaten food was judged most likely to have similar impacts or more impact on spread. There was least agreement between experts for wild boar baiting for farm type I, which one expert considered to have similar impacts, two more impact on introduction and one more on spread. All four experts judged that *protective clothing* would have similar impacts on introduction and spread in farm type II, and three experts made the same judgement for *cleaning/disinfection facilities*. The experts were evenly split on whether *daily inspection* on farm type II would have more impact on introduction or spread.

Feasibility of each BSM was assessed in terms of what proportion of farms would implement it, if it was included in the Strategic Approach to the management of ASF in the EU. Overall, implementation of BSMs was expected to be higher on type II farms than type I. Most experts judged that *double fence* and *single solid fence* were most likely to have medium to high feasibility for farm type II (implemented by 40 – 80% of farms), but very low to low feasibility for farm type I (0 - 40%). *Single fence* was judged most likely to have medium to high feasibility (40 – 80% implementation) on farm type I and medium to very high (40 – 100%) on farm type II.

Most experts judged that *no access to stored feed* was most likely to have medium to high feasibility (40 – 80% implementation) for both farm types, with similar results for wild boar baiting on farm type I and *daily inspection* on farm type II. For farm type I, *removal of uneaten feed* was judged most likely to be of low to medium feasibility (20-60% of farms) while *no access to water* was assessed as very low to low feasibility (0 – 40%). For farm type II, most experts considered *cleaning/disinfection facilities* and *protective clothing* most likely to be between low and high feasibility (40 – 80%).

Sustainability of each BSM was assessed in terms of what proportion of farms that implement it would continue to do so for at least 2 years. In general, the experts tended to judge that sustainability would be higher than feasibility, i.e., the proportion of farms sustaining a BSM after implementing it would be greater than the proportion that initially implement it. All experts judged that *double fence* and *single solid fence* were most likely to have high to very high sustainability for both farm types (sustained by 60 – 100% of farms). Most experts judged that sustainability of *single fence* would be similar to double and solid fence for farm type II (most likely high to very high, 60 – 100% of farms) but medium to high (40 – 80% of farms) for farm type I.

Most experts judged that access to stored feed was most likely to have medium to high feasibility (40 – 80% implementation) for both farm types. These first four BSMs all involve creating or improving structures, whereas the remaining BSMs all rely on behaviour change and tended to be judged less sustainable, with more uncertainty and more variation between experts. For farm type I, *removal of uneaten feed* and *no access to water* were judged most likely to be of very low to medium sustainability (0-60% of farms), while *no wild boar baiting* was rated from low to very high (20 – 100% of farms). For farm type II, the experts' judgements ranged from very low to high (0 – 80% of farms) for *daily inspection* and *cleaning/disinfection facilities* and very low to very high (0 – 100% of farms) for *protective clothing*.

The EKE concluded with a brainstorming session on potential control measures, which were defined as risk management measures undertaken by the competent authorities of EU Member States to further reduce the risk of disease introduction and spread for ASF in addition to improved biosecurity of outdoor farms. The experts developed a list of 14 potential control measures, which is included in the report, and commented on a similar list developed independently by EFSA's Working Group on ASF and outdoor pig farming.

The results of the EKE are being made available for consideration by the EFSA AHAW Panel when developing its Opinion on ASF and outdoor pig farming.

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1. Introduction

1.1. Background and Terms of Reference as provided by the requestor

This contract/grant was awarded by EFSA to:

Contractor/Beneficiary: University of Strathclyde

Contract/Grant title: Support Services for Expert Knowledge Elicitation

Contract/Grant number: OC/EFSA/AMU/2017/01, Specific Contract No 4

1.1.1. Background of the mandate provided to EFSA by the European Commission

African swine fever (ASF) is an infectious, lethal disease affecting domestic pigs and wild boar. It can be transmitted via direct animal contact or via dissemination of contaminated food/feed or equipment. There is no vaccine nor cure.

Since 2014, ASF Genotype II has been notified in Belgium, Bulgaria, the Czech Republic, Estonia, Greece, Hungary, Latvia, Lithuania, Poland, Romania and Slovakia, and Genotype I has been present in Italy (Sardinia only) since 1978. The disease has also been reported in Belarus, Moldova, Serbia, Russia and Ukraine, which creates a constant risk for all the Member States that share a border with these third countries.

Commission Implementing Decision 2014/709/EU sets up a regionalization of ASF-affected countries according to the epidemiology of the disease, defining 4 different areas: free areas (Part I) with no cases, nor outbreaks of ASF where higher surveillance (passive) is applied adjacent to a Part II, III or IV; areas with occurrence of ASF in wild boar only (Part II), areas with occurrence of ASF in both domestic pigs and wild boar (or in domestic pigs AND lack of surveillance data to justify the absence of ASF infection in wild boar) where the epidemiological situation is dynamic (Part III), areas with occurrence of ASF in both domestic pigs and wild boar where the epidemiological situation is endemic (Part IV).

Currently, the European Commission (EC) Strategic approach provides for a general recommendation for a prohibition of outdoor keeping of pigs at least in the areas covered by Decision 2014/709/EU (=affected by ASF). However, in some Member States outdoor farming is an important socio-economic factor in certain rural areas, and often special breeds of pigs (e.g. Mangalitza pigs, Iberian pigs) are reared in outdoor farms.

Some Member States have proposed to derogate from the ban and to set biosecurity criteria to allow for certain derogations.

The EC needs an EFSA Scientific Opinion on the infection risks associated with keeping of pigs outdoors in ASF-affected areas, on the characterization and categorization of keeping of pigs outdoors in the Member States, and the application of efficient biosecurity measures that might allow to minimize African swine fever virus (ASFV) introduction into and ASFV spread from pigs kept outdoors.

1.1.2. AHAW Panel translation of the mandate into tasks

The working group (WG) experts and the AHAW Panel translated the terms of reference received by the EC into six tasks. Tasks 1-3 are carried out by the WG experts. Tasks 4-6 will be achieved by carrying out an Expert Knowledge Elicitation (EKE). The results of tasks 1-3 will be used to inform the EKE.

Task 1) Characterise outdoor pig farming types in EU MS.

Task 2) Describe biosecurity measures presently applied in outdoor pig farms in EU MS.

Task 3) Describe potential risk factors for ASF introduction into farms and ASF spread from outdoor farms in the EU MS (based on evidence from current and past ASF outbreaks in the EU, by type of outdoor pig farm).

Task 4) Categorize outdoor farm types of pigs in EU MS according to the risk of ASF introduction into these farms and the risk of ASF spread from these farms.

Task 5) Rank biosecurity measures according to their potential to lower the risk of ASF introduction into these farms and the risk of ASF spread from these farms in ASF-affected countries.

Task 6) Propose improvements of biosecurity for outdoor pig farming categories and the control measures that should flank these in ASF-affected countries.

1.2. Interpretation of the Terms of Reference

The purpose of the present contract is to carry out Tasks 4-6 in the Terms of Reference from EFSA to the contractors, listed in the preceding section.

The contractors' proposals for addressing these tasks, including the framing of EKE questions and the choice of EKE methods to address them, was prepared as a PowerPoint file and discussed with EFSA in a web meeting on 17 December 2020. The key outcomes of the meeting were as follows:

- It was agreed that Task 4 would be addressed by two EKE questions assessing **the risk of new ASF outbreaks in the coming year for two types of outdoor pig farms** (Types I and II), specified by EFSA, recognising that the number of new outbreaks reflects the combined effects of the risks of introduction of ASF into farms and spread from farms.
- It was agreed that Task 5 would be addressed by developing a **preliminary list of biosecurity measures** in consultation, **prioritising 5-8 measures** in terms of expected effectiveness in reducing risk for each farm type, and then eliciting **estimates of the effectiveness, feasibility and sustainability of the prioritised measures**. It was agreed to assess effectiveness in terms of the reduction of new ASF outbreaks and also to elicit judgements about whether each measure would have similar impacts on introduction and spread of ASF, or more impact on one or the other.
- It was agreed that Task 6 would be addressed by brainstorming to develop a list of **potential control measures**.

The methods used to address each of the elements identified above are described in section 2 and the results in section 3.

Decisions made in the meeting were incorporated by the contractors into a draft protocol document, which was provided to EFSA for review. The protocol was subsequently updated to document in detail the methods used in the EKE as they were implemented in practice. The final version of the protocol is archived in EFSA's Document Management System.

1.3. Role of this project in EFSA's assessment on ASF and outdoor pig farming

This project was commissioned to elicit the judgements of external experts on Tasks 4-6 (listed above), as a contribution to the evidence to be considered by the Working Group preparing EFSA's Opinion on ASF and outdoor pig farming. The members of the Working Group participated in the EKE process as observers, to facilitate their subsequent work when interpreting the EKE results and developing the Working Group's assessment for the Opinion.

2. Data and Methodologies

2.1. Data

The evidence made available to participants during the EKE comprised the following:

- An evidence dossier prepared by the EFSA Working Group. This comprised selected sections from the current draft of the EFSA Opinion on ASF and outdoor pig farming, plus an additional section summarising literature on the ecology and behaviour of wild boar. The section on wild boar will not be included in the EFSA Opinion, so is reproduced in Appendix F of this report. Readers are referred to the EFSA Opinion (when published) for the final version of other parts of the evidence dossier.
- A selection of papers and reports referenced by the experts during the course of the EKE and provided by them to the other experts. A list of these documents is provided in Appendix G.

An overview of the evidence dossier was presented by EFSA during the preparatory meeting with the experts and observers on 13 January 2021.

2.2. Participants and their roles in the project

2.2.1. Participants

The participants in the project are listed below.

Experts (selected by EFSA):

- Georgi Chobanov, Director of Animal Health and Welfare and Feed Control, Bulgarian Food Safety Authority
- Federica Loi, Istituto Zooprofilattico Sperimentale della Sardegna
- Merel Postma, Ghent University, Faculty of Veterinary Medicine
- Saúl Jiménez Ruiz, SaBio-IREC, University of Castilla-La Mancha & Animal Health Department, University of Cordoba

The experts were selected based on EFSA's assessment of the expertise areas required for the EKE: ASF epidemiology, biosecurity and outdoor farming practices and structures, including organic and backyard farming of pigs outdoors. Experts were identified by screening relevant scientific publications with the aim to select experts having at least expertise in biosecurity and one farming type, as well as ASF epidemiology, and covering most, if not all areas of the EU. The number of EKE experts was limited to 4 to make the EKE more manageable via web meetings due to ongoing travel restrictions during the Covid19 pandemic.

Facilitators (members of the contractor team for this project):

- Andy Hart, A & A Hart Ltd, UK
- Gene Rowe, GRE, Norwich, UK
- Fergus Bolger, Minerva Consulting, UK

Rapporteurs:

- Andrea Gervelmeyer, EFSA
- Sotiria-Eleni Antoniou, EFSA

Observers (members of EFSA's Working Group on ASF and outdoor pig farming):

- Christian Gortazar Schmidt, University of Castilla-La Mancha, Sanidad y Biotecnología (SaBio) (Working Group Chair)
- Sandra Blome, Friedrich Loeffler Institut FLI

- Simon More, School of Veterinary Medicine, University College Dublin

Project Leader:

- Abby Colson, Strathclyde University Business School, Glasgow, UK (lead contractor)

2.2.2. Roles in the EKE

The **experts'** role in the EKE was to provide judgements and reasoning on the EKE questions, participate in discussion of their collected judgements and reasoning in EKE Meetings 1-4, and review and (optionally) revise their judgements and reasoning when requested.

The **observers'** also provided judgements and reasoning on the EKE questions, but these were not shared with the experts at any time during the project. The observers were present in EKE Meetings 1-4 and were invited to review and (optionally) revise their own judgements and reasoning after observing the experts' discussion but did not participate in those discussions except when asked by the experts to provide additional information. They were also able to raise points of order via the rapporteurs if the need arose.

The **facilitators** drafted the EKE protocols and revised them after review by the rapporteurs and observers, developed tools and materials for use in the EKE and facilitated EKE Meetings 1-4.

The **rapporteurs** were present in EKE Meetings 1-4 and made a written record of the discussions. They asked for clarification of discussion points where needed, responded to questions raised by the experts and/or facilitators and alerted the facilitator if they or the observers identified a need to clarify the interpretation of the EKE questions or of the definitions established for the EKE.

2.2.3. Anonymity of judgements and discussions

It was agreed that throughout this report and the project records, the judgements, reasoning and discussions of the experts and observers would be anonymised, in accordance with the EFSA Guidance on EKE (EFSA 2014). This was done by referring to the experts by the letters A-D and the observers by the letters E-F. These letters were assigned to the individuals in an arbitrary order.

2.3. Methodologies

2.3.1. Preparatory meeting

A preparatory meeting was held on 13 January 2021 and attended by the experts, observers, rapporteurs and facilitators. The main aims of the meeting were to introduce all the participants for the approaches to be used, review and clarify the first set of EKE questions and supporting definitions, train the experts and observers in making probability judgements of the type required for the first set of EKE questions, and agree an initial list of potential biosecurity measures (BSMs) for consideration in the first set of questions. The meeting agenda comprised the following topics:

- Tour de table
- Introduction and EFSA context and objectives
- Expertise assembled for this EKE
- Introduction to EKE process
- Overview of project tasks and meetings
- Presentation of EKE questions and definitions on ASF risk
- Overview of evidence provided
- Questions and clarifications on the evidence
- Training in making probability judgements
- Presentation of Excel tool for risk questions
- Informal elicitation of plausible limits for baseline risk, without specific BSMs
- Presentation of the list of specific BSMs including input provided by the experts
- Presentation of the EKE question on ranking BSMs

- Demonstration of tool for ranking questions
- Briefing for questionnaire and timetable for future tasks and meetings
- Use of EKE results in Opinion
- Use of the Teams system for meetings, communications and document sharing
- Meeting review and feedback

During the preparatory meeting it was explained to the experts that the EKE results would form one part of the evidence to be considered by the Working Group preparing EFSA's Opinion on ASF and outdoor pig farming for review and adoption by EFSA's Panel on Animal Health and Welfare.

2.3.2. Risk of ASF outbreaks in two categories of outdoor pig farms

As explained in section 1.2, Task 4 in the Terms of Reference was addressed by an EKE question assessing the risk of new ASF outbreaks in the coming year for two types of outdoor pig farms (Types I and II), specified by EFSA, recognising that the number of new outbreaks reflects the combined effects of the risks of introduction of ASF into farms and spread from farms.

The specific question to be addressed by the experts was as follows: **What proportion (expressed as the *number per 100*) of currently uninfected [*Type I or II*] outdoor pig farms located in the areas of interest, not applying outdoor-specific biosecurity measures against ASF introduction, will have an ASF outbreak in the coming year?**

This question was addressed twice: once for Farm Type I and once for Farm Type II, which were defined as follows:

I	Pigs have access to an outdoor area in forest, woodlands, on agricultural land or pastures	 
II	Pigs have access to an outdoor area on farm premises (adjacent to farm buildings)	 

(Image I left: © CSIC (source: http://cultureandhistory.revistas.csic.es/index.php/cultureandhistory/article/download/90/312?inline=1); Image I right: © Jason Thomas (source: https://www.agric.wa.gov.au/livestock-biosecurity/keep-pigs-healthy-follow-biosecurity-checklist); Image II left: © Christian Wucherpfennig (source: https://www.oekolandbau.nrw.de/fachinfo/tierhaltung/schweine/2018/langjaehrig-erfolgreich-mit-bio-mastschweinen); Image II right: © BAT e.V. (source: https://www.oekolandbau.de/landwirtschaft/tier/spezielle-tierhaltung/schweine/mastschweinehaltung/haltung/umbau-eines-herkoemmlichen-mastschweinestalls/))

It was clarified during the EKE that both farm types include premises that might not normally be considered as farms, but where pigs were kept for personal consumption or as pets.

Further definitions that were agreed for use by the experts and observers when answering the questions are listed in section 2.6.

The plausible range for answers to the EKE question was set to 0-100, based on an informal elicitation with the experts during the preparatory meeting on 13 January.

The elicitation of this question was conducted using the Sheffield method as described in the EFSA Guidance on EKE (2014), but eliciting 10th, 90th and 50th percentiles rather than quartiles. This was preferred to eliciting median and quartiles in this project because experience in EFSA has shown that

experts find it harder to understand the process for making judgements on quartiles and this difficulty is exacerbated when experts are working remotely from the facilitator.

The facilitator constructed a questionnaire worksheet in MS Excel, containing the EKE questions and definitions, boxes for experts to enter their judgements and reasoning, and instructions on how to do this. This was sent to both the experts and observers on 15 January and they were asked to complete and return it by the end of 20 January, which they all did. The facilitator compiled separate reports for the experts and observers containing the individual judgements and reasoning and their respective best-fit distributions. The report for experts was sent to all participants via Teams and email on 22 January, while the report for observers was sent only to the rapporteurs and observers. To ensure independence of the experts' judgements, the observers' judgements were not disclosed to or discussed with the experts at any time in the project.

Distributions were fitted to the individual judgements using the SHELF Shiny app for multiple experts[1]. The distributions identified by the app as 'best-fitting' were shown in the reports provided to participants.

Consensus judgements on the question for each farm type were elicited in EKE Meeting 1 on 27 January 2021. The facilitator displayed the judgements and distributions in the meeting and asked each expert in turn to summarise the reasons for their judgements. Participants were able to refer to the individual judgements report to see the detailed reasoning provided by experts before the meeting.

The consensus judgements were elicited using the 'probability method', rather than eliciting the 10th, 50th and 90th quantiles as in the individual judgements. This is intended to counter the tendency of experts to anchor on their individual judgements and to encourage them to reach consensus by reasoned discussion rather than by a process of compromise between their individual judgements[2]. In the probability method, the facilitator elicits consensus probabilities for the true value being below or above 3 selected values, which the facilitator chooses to explore areas where the individual distributions differ markedly.

The facilitator explained the RIO concept of consensus that is used in EKE following the Sheffield method (EFSA, 2014). The facilitator then proposed two values for which consensus probabilities would be elicited. Before eliciting those probabilities, the facilitator invited the experts to suggest reasons that would make it more likely that the true value is below the lower of these values, and then reasons that would make it more likely that the true value is above the upper value. At this point, the observers were asked to review and (optionally) revise their judgements and reasoning on the question in the light of the discussions so far, before the facilitator elicited consensus probabilities from the experts. The facilitator then proposed a third value, for which a third consensus probability was then elicited from the experts.

The facilitator entered the judgements in the SHELF Shiny app for single distributions[3] live on screen and displayed alternative fitted distributions and selected fitted quantiles. The facilitator invited the experts to comment on the fitted distributions and indicate preferences for which one(s) better represent the consensus judgement of the group. Where appropriate, the facilitator elicited adjustments to the judgements from the experts, or suggested adjustments for the experts to review, in order to arrive at a distribution that the experts would accept as representing their consensus judgement. Finally, the facilitator asked the experts to confirm that they were all content that the final consensus distributions would be reported as the result of the EKE for this question.

2.3.3. Identification and prioritisation of biosecurity measures

[1] https://jeremy-oakley.shinyapps.io/SHELF-multiple/

[2] For further information see the document on 'SHELF methods' at Oakley J. E. and O'Hagan, A. (2019). SHELF: the Sheffield Elicitation Framework (version 4). School of Mathematics and Statistics, University of Sheffield, UK. (http://tonyohagan.co.uk/shelf).

[3] https://jeremy-oakley.shinyapps.io/SHELF-single/

As explained in section 1.2, Task 5 in the Terms of Reference was addressed by developing a preliminary list of biosecurity measures in consultation, prioritising 5-8 measures in terms of expected effectiveness in reducing risk for each farm type, and then eliciting estimates of the effectiveness, feasibility and sustainability of the prioritised measures.

2.3.3.1. Initial list of potential biosecurity measures

Prior to the preparatory meeting on 13 January, the experts were asked to submit lists of biosecurity measures which they proposed for consideration for use in outdoor pig farms to reduce ASF risks.

EFSA scientists (the rapporteurs for the EKE) compared the lists submitted by the experts with a similar list drafted by EFSA's Working Group on ASF and outdoor farming of pigs (who were also the observers for the EKE). They integrated the two lists, removing duplicate entries, removing suggestions that are not strictly outdoor-specific BSMs or that are control measures and rewording for clarity where needed. The rapporteurs also proposed a draft definition for each potential BSM. Each potential BSM and its draft definition was discussed with the experts and observers in the preparatory meeting, with the aim of reaching consensus on the initial list of potential biosecurity measures to be considered in Questionnaire 1 (see next section).

2.3.3.2. Ranking of potential biosecurity measures

The EKE question for ranking the potential BSMs was framed as follows: **Please rank the list of biosecurity measures (BSMs) on the right in terms of how effective each one would be in reducing the number of ASF outbreaks in the coming year in currently uninfected TYPE I/II OUTDOOR PIG FARMS located in the areas of interest, if it was fully implemented and sustained by all Type I/II outdoor pig farms and no other outdoor-specific BSMs against ASF introduction were applied.**

This question was addressed twice: once for Farm Type I and once for Farm Type II, defined as for the question on risk. Further definitions that were agreed for use by the experts and observers when answering the questions are listed in section 2.6.

The facilitator constructed two questionnaire worksheets in MS Excel, one for each farm type. Each worksheet contained the EKE questions and accompanying definitions, the initial list of potential BSMs in an arbitrary order, spaces for the experts to rank the BSMs and record their reasoning, and instructions on how to do this. These two worksheets were presented in the same Excel file as the worksheet for the risk questions (section 2.3.2), which was referred to as Questionnaire 1. This file was sent to both the experts and observers on 15 January and they were asked to complete and return it by the end of 20 January, which they all did. The facilitator compiled separate reports on the ranking questions for the experts and observers containing the individual judgements and reasoning. The report for experts was sent to all participants via Teams and email on 22 January, while the report for observers was sent only to the rapporteurs and observers. To ensure independence of the experts' judgements, the observers' judgements were not disclosed to or discussed with the experts at any time in the project.

2.3.3.3. Prioritisation of potential biosecurity measures

The experts' rankings for each farm type were discussed at EKE meeting 1. Using an online whiteboard, the facilitator presented the rankings of the four experts as four columns with the individual BSMs written onto 'post-its' (coloured, size-adjustable shapes), with the most highly ranked BSM at the top and the least highly ranked at the bottom. The BSMs ranked top of the list were coloured green – not only at the top of the lists but wherever these appear in the lists of experts who did not rank these BSMs highest – to indicate that these have a special character. In contrast, BSMs at the bottom of the four lists were coloured red, with these similarly coloured wherever they might appear in other experts' lists – to further highlight their 'negative' character. All other BSMs were presented on yellow post-its.

The facilitator first addressed one of the 'green' measures. He asked one expert to explain why they ranked the first green measure as they did, in order to elicit a rationale, which was recorded by the

rapporteurs. The other experts were then asked to comment on this, support or contest the ranking, and provide further rationales. A post-it for this particular BSM was then selected from a fifth set of post-its at the bottom of the whiteboard space, holding the names of all of the BSMs, and temporarily moved to a space below one of three other post-its, titled Consensus Accept (in green), Uncertain (in yellow) and Consensus Reject (in red) – in this case, likely beneath the Consensus Accept label. Next, in order to identify a 'low' benchmark (versus the previous 'high' benchmark), the facilitator addressed the first 'red' measure, eliciting an explanation for its choice, and initiating a discussion amongst experts. The post-it was then placed under the relevant heading. This process continued, switching from the green to the red measures and back again, until all of these were considered, before going on to the yellow measures, that had not been ranked highest or lowest by any of the experts and about which there may be expected to be greater uncertainty.

This process continued until all of the measures were assigned beneath a label. Importantly, the fluid nature of discussion, and the constant comparisons between the BSMs, resulted in measures being moved between headings in the light of fresh arguments. The aim was to identify a limited set of BSMs – between five to eight (a range deemed tractable for the remaining aspects of the EKE) - that were designated either Consensus Accept or Uncertain. BSMs above this number, left under the Consensus Reject heading, were deemed of lower importance and omitted from further consideration in the later stages of the project.

Importantly, because ranking only provides ordinal data, not interval, and says nothing of magnitude of difference between options, the facilitator concluded with a discussion into the degree of difference between the Uncertain items and the Consensus Reject ones, to enable the rapporteurs to record opinions on how great the difference between the selected and non-selected measure is, to inform EFSA's future thinking on whether more attention ought to be paid to the rejected measures or not.

This process was completed twice, once for Farm Type I and then for Farm Type II, producing two different lists of measures for assessment in the subsequent stages of the project.

2.3.4. Effectiveness, feasibility and sustainability of prioritised biosecurity measures

As explained in section 1.2, Task 5 in the Terms of Reference was addressed by developing a preliminary list of biosecurity measures in consultation and prioritising 5-8 measures in terms of expected effectiveness in reducing risk for each farm type, as described in the preceding sections, and then eliciting estimates of the effectiveness, feasibility and sustainability of the prioritised measures. It was agreed to assess effectiveness in terms of the reduction of new ASF outbreaks and also to elicit judgements about whether each measure would have similar impacts on introduction and spread of ASF, or more impact on one or the other.

The facilitators constructed a set of 14 questionnaire worksheets in MS Excel, one for each combination of BSM and farm type that had been identified by the prioritisation exercise described in the preceding section. Each worksheet contained the 4 EKE questions for assessing effectiveness, feasibility and sustainability, plus all the definitions needed by the experts and observers when answering the questions, and instructions on how to do this. The 14 worksheets were presented in a single Excel file (referred to as Questionnaire 2). The file also included an extra worksheet, displaying the judgements for all the combinations of BSM and farm type together, so that the expert or observer could compare them and decide whether to make adjustments. This file was sent to both the experts and observers on 29 January 2021 and they were asked to complete and return it by the end of 3 February.

A facilitator copied the experts' responses into a further Excel file for processing and display. This file showed the judgements and reasoning of all 4 experts together on one worksheet for each combination of BSM, farm type and Question, to facilitate comparison and discussion in EKE Meetings 2-4. The judgements for the quantitative question on effectiveness were displayed in a bar chart showing the median and 80% probability interval for each expert. The experts' individual ratings of the other 3 questions was collated and displayed in a histogram format, showing which experts selected each

category of response. The file also produced 4 overview worksheets, one for each question, where the responses to the same question were displayed graphically for comparison between BSMs and farm types. The same procedure was followed for the observers' responses, but in a separate Excel file that was shared with the observers and rapporteurs but not with the experts.

The results file for experts was sent to all participants via Teams and email on 5 February, while the results file for observers was sent only to the rapporteurs and observers.

2.3.4.1. Effectiveness in reducing the number of new ASF outbreaks

The EKE question for assessing effectiveness of the potential BSMs was framed as follows: **Consider those currently uninfected TYPE I/II outdoor pig farms located in the areas of interest, not applying outdoor-specific biosecurity measures against ASF introduction, that *will have an ASF outbreak in the coming year*. *What proportion of these farms* (expressed as the *number per 100*) would not have an ASF outbreak in the coming year if all TYPE I/II outdoor pig farms implemented [specific biosecurity measure] and maintained it throughout the coming year?**

The possible range for the question was between 0 and 100. Values above 100 were excluded by defining 'implementing' as 'implementing the outdoor-specific BSM fully and properly, without doing anything that would increase ASF risk'. Further definitions that were agreed for use by the experts and observers when answering the questions are listed in section 2.6.

Experts were asked to summarise the main reasons for their answers to the question in two parts: the main reasons or factors that might lead to the true value being near their lower estimate, and the same for their upper estimate.

Given the amount of time available for each combination of BSM and farm type in EKE meetings 2-4, it was not feasible to elicit consensus judgements for the above question by the Sheffield method that was used in EKE meeting 1. Instead, the facilitator led a structured discussion of the individual judgements and then invited the experts and observers to reconsider and, if they wished, adjust their individual judgements in the light of the discussion.

For each combination, the facilitator started by displaying graphs showing the judgements of the 4 experts for the questions on effectiveness and relative impact on introduction and spread, together with the reasoning provided by the experts for their judgements. Responses to these two questions were discussed together because the latter contributes to the reasoning for the former.

The facilitator invited each expert in turn to summarise, in 1-2 minutes each, the key points of the reasoning for their judgements. The observers' judgements were not displayed or discussed at any point in the meeting. The facilitator then initiated a 10-15-minute discussion to clarify where necessary the experts' reasoning, identify aspects of reasoning shared by different experts, discuss major differences between the judgements and reasoning of different experts, and explore additional considerations arising from the discussion.

Experts and observers were then invited to make revised judgements in their respective copies of the Excel file for Questionnaire 2 and submit these to the facilitator at the end of each day.

After the meeting, the facilitator copied the revised judgements of the experts into the Excel file that was used to process their initial judgements and produce 56 updated worksheets displaying the revised judgements and reasoning of all experts together for each combination of BSM, farm type and question (the contents of these worksheets showing the experts' results are reproduced in Appendix D). This process also produced revised overview graphs for both experts and observers, which are presented in section 3.1.3 below. Finally, for each combination of BSM and farm type, the facilitator fitted a beta distribution to each expert's judgements for effectiveness and calculated the linear pool (unweighted average) of those distributions using the SHELF Shiny app for multiple experts[4]. These distributions are

[4] https://jeremy-oakley.shinyapps.io/SHELF-multiple/

also included in Appendix D, in case they may be helpful for EFSA's Working Group when interpreting the results of the EKE.

2.3.4.2. Relative impact on introduction and spread of ASF

This was framed as a multiple-choice question with three options, as follows: **Select which of the following is most likely to be true for this BSM and farm type:**

- **This BSM will tend to reduce both introduction and spread to similar extents**
- **This BSM will tend to reduce introduction more than spread**
- **This BSM will tend to reduce spread more than introduction**

Where:

- *Introduction* was defined as initial transmission/spread of ASF virus resulting in an ASF outbreak into an outdoor farm, (i.e., that farm was uninfected prior to this event)
- *Spread* was defined as transmission of ASF infection out of a farm to other domestic pigs or to wild boar

Further definitions that were agreed for use by the experts and observers when answering the questions are listed in section 2.6.

Experts and observers were asked to select the answer which they judge is most likely. They were also asked to summarise the reasoning for their choice.

This question was discussed and revised in EKE Meetings 2-4 in conjunction with the question on effectiveness, as described in the preceding section.

2.3.4.3. Feasibility

The question on feasibility was framed as follows: **Feasibility (tick most likely answer/s):**

- **Very low (implemented by 0-20% of farms)**
- **Low (implemented by 20-40% of farms)**
- **Medium (implemented by 40-60% of farms)**
- **High (implemented by 60-80% of farms)**
- **Very high (implemented by 80-100% of farms)**

Where '*feasibility*' was defined as the proportion of this Type of outdoor pig farms that would start implementing this BSM if it was included as a requirement for this type of outdoor farm in the EU Strategic Approach. Further definitions that were agreed for use by the experts and observers when answering the questions are listed in section 2.6.

Experts and observers were asked to select the range which they judge is most likely to contain the true value of this proportion and told that they could select more than one range if this better reflected their judgement. They were also asked to summarise the reasoning for their judgements.

During EKE Meetings 2-4, an attempt was made to assess the responses to these questions and help experts come towards a degree of consensus in their ratings. This task was conducted sequentially for each combination of BSM and farm type, following and interspersed with the discussions of the responses on effectiveness.

Prior to the meeting, one slide was prepared for each BSM for feasibility and sustainability (i.e. two for each BSM x farm type combination). Each slide contained a histogram that summarised the experts' ratings (in the same format as shown in Appendix D), and some text summarising the rationales the experts gave for their ratings.

The text summaries were based on expert rationales, but 'cleansed' (to deal with typographic and spelling errors, etc.) and combined (where experts make essentially similar points), and then annotated with letters A-D to show which experts made a particular point, with a further directional symbol (+ or – or =) to indicate whether the identified factor might be seen to have high, low or neutral implications for the rating. During the discussion, the facilitator first described the pattern in the histogram, and then considered the rationales, asking the experts to explain their points and then inviting commentary and rebuttal by the other experts. After this discussion, the facilitator also, where appropriate, invited the experts to consider whether there might be other relevant factors not discussed – such as legal, ethical, social and economic ones. Finally, the facilitator returned to the histogram to ask the experts what impact the discussion had on their opinion of the rating of the feasibility or sustainability of the BSM.

After this discussion, the experts (and observers) were asked to re-consider their open Questionnaire 2 spreadsheets and amend their ratings if they thought this was appropriate.

Higher consensus might be expected to emerge from this process, but consensus was not forced, although the elicited reasons for expert opinion were recorded to provide extra information for EFSA's considerations.

After the meeting, the facilitator copied the revised judgements of the experts into the Excel file that was used to process their initial judgements and produce 56 updated worksheets displaying the revised judgements and reasoning of all experts together for each combination of BSM, farm type and question (the contents of these worksheets showing the experts' results are reproduced in Appendix D). This process also produced revised overview graphs for both experts, which are presented in section 3.1.3 below.

2.3.4.4. Sustainability

The question on sustainability was framed as follows: **Sustainability (tick most likely answer/s):**

- **Very low (sustained by 0-20% of farms)**
- **Low (sustained by 20-40% of farms)**
- **Medium (sustained by 40-60% of farms)**
- **High (sustained by 60-80% of farms)**
- **Very high (sustained by 80-100% of farms)**

Where '*sustainability*' was defined as the proportion of this type of outdoor pig farms implementing this BSM that would continue implementing it for at least 2 years. Further definitions that were agreed for use by the experts and observers when answering the questions are listed in section 2.6.

Experts and observers were asked to select the range which they judge is most likely to contain the true value of this proportion and told that they could select more than one range if this better reflected their judgement. They were also asked to summarise the reasoning for their judgements.

During EKE Meetings 2-4, an attempt was made to assess the responses to these questions and help experts come towards a degree of consensus in their ratings. This task was conducted sequentially for each combination of BSM and farm type, following and interspersed with the discussions of the responses on effectiveness and feasibility. The discussion of the judgements on sustainability was conducted in the same manner as for the judgements on feasibility, as described in the preceding section.

2.3.5. Identification of potential control measures

As explained in section 1.2, Task 6 in the Terms of Reference was addressed by brainstorming to develop a list of potential control measures. This brainstorming session was conducted during the final half day of EKE meeting 4.

The session began with an introduction by the facilitator on what '**control measures**' are, with a clear definition provided: **Risk management measures undertaken by the competent authorities of EU Member States to reduce the risk of disease introduction and spread, e.g. registration of outdoor farms, regular farm visits by official veterinarians.**

The experts were then asked to take 5-10 minutes to individually produce a list of generic possible control measures that may be applied across all farm types and with reference to all biosecurity measures. These measures were elicited before consideration of a list that was compiled by EFSA's Working Group, in order not to bias/frame/dominate experts' thoughts on the topic. On reconvening, experts were asked in turn to nominate one measure from their list (starting with the most important), which was written on a PowerPoint slide for display to all, and these were discussed within the group to elaborate rationales. Once the list was complete, the list from the WG was presented on additional slides. Similarities and differences to the experts' generated list were noted, and the experts were invited to provide commentary on the scope and potential deficiencies of each of the new items.

Finally, the facilitator asked whether any of the control measures might need to differ according to farm type or biosecurity measure. A record of the discussions was made by the rapporteurs.

2.3.6. Definitions used in this assessment

This section lists the final versions of all the definitions used in this project. Initial drafts of the definitions required for Questionnaire 1 were introduced, discussed and refined in the preparatory meeting. Further revisions were made during EKE Meeting 1, when the definitions for Questionnaire 2 were also introduced. Further revisions and clarifications were made during EKE Meetings 2-4, resulting in the final versions shown here.

Farm types:

I	Pigs have access to an outdoor area in forest, woodlands, on agricultural land or pastures	
II	Pigs have access to an outdoor area on farm premises (adjacent to farm buildings)	

(Image I left: © CSIC (source: http://cultureandhistory.revistas.csic.es/index.php/cultureandhistory/article/download/90/312?inline=1); Image I right: © Jason Thomas (source: https://www.agric.wa.gov.au/livestock-biosecurity/keep-pigs-healthy-follow-biosecurity-checklist); Image II left: © Christian Wucherpfennig (source: https://www.oekolandbau.nrw.de/fachinfo/tierhaltung/schweine/2018/langjaehrig-erfolgreich-mit-bio-mastschweinen); Image II right: © BAT e.V. (source: https://www.oekolandbau.de/landwirtschaft/tier/spezielle-tierhaltung/schweine/mastschweinehaltung/haltung/umbau-eines-herkoemmlichen-mastschweinestalls/))

- Both farm types may include 'hobby' pigs (kept for personal consumption or as pets)
- '*outdoor area*' refers to the outdoor area used by the farmed pigs (not the wider landscape)
- '*the areas of interest*': those areas of the EU where ASF infection is present in domestic pigs in indoor farms ***and*** domestic pigs in outdoor farms ***and*** in wild boar

- `*currently uninfected*': not having an ASF outbreak at the present time
- `*an ASF outbreak*': ASF infection **which would, if tested**, be diagnosed as an outbreak according to the EU legal definitions (see below):
    - A **primary outbreak** of ASF can be confirmed if clinical signs or lesions of disease have been detected in the pigs in question and at least two distinct antigen, genome or antibody detection tests have given a positive result on samples taken from the same suspected pig
    - A **secondary outbreak** of ASF can be confirmed if, in addition to the epidemiological link to a confirmed outbreak or case, clinical signs or lesions of disease have been detected in the pigs in question and an antigen, genome or antibody detection test has given a positive result
    - A **primary case of ASF in wild boar** can be confirmed by virus isolation or when at least two antigen, genome or antibody detection tests have given a positive result. **Further cases of ASF in feral pigs** for which an epidemiological link with previously confirmed cases has been found can be confirmed if an antigen, genome or antibody detection test has given a positive result
- `*the coming year*': one year starting from now
- `*not applying outdoor-specific biosecurity measures*': not applying any of the outdoor-specific BSMs against ASF introduction* and assuming that no changes will be made to the outdoor access, outdoor-related practices nor outdoor-related infrastructure, but taking account of the extent to which other BSMs are used in the area**

*i.e. those considered in the ranking exercise

****EFSA's introductory presentation includes the list of 'minimum' BSMs outlined in the EU Strategic Approach (see below), which may be applied in the baseline scenario**. The experts were asked to take account of the extent to which they believe these

Strategic approach to the management of ASF for the EU

EUROPEAN COMMISSION
DIRECTORATE-GENERAL FOR HEALTH AND FOOD SAFETY
Directorate G - Crisis management in food, animals and plants
Unit G3 – Official controls and eradication of diseases in animals

ASF measures to be applied for domestic pigs at least in the areas covered by Decision 2014/709/EU

Minimum biosecurity requirements

II - Biosecurity criteria for commercial farms:

a) Same criteria as for NCF with, in addition, the following criteria:
b) Stock-proof fencing of at least the stable and premises where feed and bedding are kept.
c) Biosecurity plan approved/recommended by veterinary services according to the profile of farm and national legislation. This biosecurity plan should include, but is not limited to:
    - Establish the clean/dirty areas for personnel appropriate to the farm typology (e.g. changing rooms, shower, eating room).
    - Review, when applicable, the logistical arrangements for entry of new animals into the farm.
    - Detailed procedures for the disinfection of vehicles, fomites and personnel hygiene rules should be established and applied.
    - Set rules on food for workers on site and ban the keeping of pigs at workers' homes if applicable.
    - Dedicated recurrent awareness programme for all workers on the farm.
    - Review logistical arrangements in order to ensure proper separation between production units. Avoid pigs being in contact (directly or indirectly) with animal by-products and other production units.
    - Internal basic audit or self-evaluation for enforcing the biosecurity measures.

III - Biosecurity criteria for outdoor farms:

Outdoor keeping of pigs is banned.

I - Biosecurity criteria for non-commercial farms (NCF):

a) No swill feeding and removal of animal by-products in accordance with Regulation (EC) No 1069/2009.
b) No contact between the pig(s) of the NCF, pigs from other holdings and feral pigs or wild boar. Pigs should be kept in a way that ensures that there is no direct, neither indirect, contact with pigs coming from other holdings or with pigs outside the premises nor with wild boar.
c) No contact to any part of the carcass of feral pigs/wild boar (including hunted or dead wild boar/meat/by-products).
d) The owner (or the person in charge of the pigs) should take appropriate biohygienic measures such as change clothes and boots on entering the stable and leaving the stable. Disinfection should be performed at the entrance of the holding and the stable.
e) No contact with pigs within 48h after hunting activity.
f) No unauthorized persons/transport are allowed to enter the pig holding (stable) and records are kept of people and vehicles accessing the area where the pigs are kept.
g) Home slaughtering is allowed only under veterinary supervision.
h) No sows and/or boar used for reproduction are allowed on the holding (this does not apply to commercial farms).
i) Commercially traded crops, vegetables, hay and straw have a very low ability to contain and maintain infectious ASFV. If the use of locally harvested grass and straw is considered to represent a risk under local prevailing conditions, the following should apply:
    - Ban of feeding fresh grass or grains[5] to pigs unless treated to inactivate ASF virus or stored (out of reach of wild boar) for at least 30 days before feeding.
    - Ban on using straw[6] for bedding of pigs unless treated to inactivate ASF virus or stored (out of reach of wild boar) for at least 90 days before use.
j) Farms buildings should:
    - be built in such a way that no feral pigs or other animals (e.g. dogs) can enter the stable.
    - Allow for disinfection facilities (or changing) for footwear and clothesat the entrance into the stable.

are applied in the area specified in the question and of their impact on risk, given the conditions on each farm.

- **All risk pathways** should be considered
- '*implementing*': implementing the outdoor-specific BSM **fully and properly, without doing anything that would increase ASF risk**
- It should be assumed that *things that are not specified* by the question and accompanying definitions will *continue as normal* for the *areas of interest* in the *coming year*: e.g., current practices for surveillance and control of detected outbreaks.
- In Questionnaire 2, it should be assumed **no other outdoor-specific BSM is implemented**, apart from the one specified in the question on effectiveness
- '*Introduction*' = entry of ASF infection into a farm
- '*Spread*' = transmission of ASF infection out of a farm to other domestic pigs or to wild boar
- '*Feasibility*': the proportion of this type of outdoor pig farms in the areas of interest that would start implementing this BSM if it was included as a requirement for this type of outdoor farm in the EU Strategic Approach
- '*Sustainability*': the proportion of this type of outdoor pig farms implementing this BSM in the areas of interest that would continue implementing it for at least 2 years
- '*Outdoor farms*': holdings in which pigs are kept temporarily or permanently outdoors.
- '*Outdoor pig*': a pig (including farmed wild boar) that is kept temporarily or permanently outdoors, not necessarily with means that constrain its movements, and with clearly defined ownership.
- '*Control measures*': Risk management measures undertaken by the competent authorities of MS to reduce the risk of disease introduction and spread, e.g. registration of outdoor farms, regular farm visits by official veterinarian.

3. Results

The following sections report the judgements and reasoning of the experts for each of the EKE questions that were addressed. The judgements and reasoning of observers are archived separately in EFSA's internal document management system, for use by EFSA's Working Group on ASF and outdoor pig farming and were not shown to the experts at any point during the EKE.

3.1.1. Risk of ASF outbreaks in two categories of outdoor pig farms

The Question for this elicitation was: **What proportion (expressed as the number per 100) of currently uninfected [Type I or Type II] outdoor pig farms located in the areas of interest, not applying outdoor-specific biosecurity measures against ASF introduction, will have an ASF outbreak in the coming year?**

This question was addressed twice, once for each farm type. Definitions applicable to these judgements are shown in section 2.2.5.

The experts individual and consensus judgements are shown in Figures 1 and 2. The numerical judgements and reasoning provided by each expert and distributions fitted to their judgements (which were displayed and discussed in the EKE) are documented in Appendix A. The rapporteurs' record of the EKE process and discussion is documented in Appendix C.

Figure 1: Experts' individual judgements for the risk of new outbreaks on Type I outdoor pig farms in the coming year (circle = median; bar = 80% probability interval).

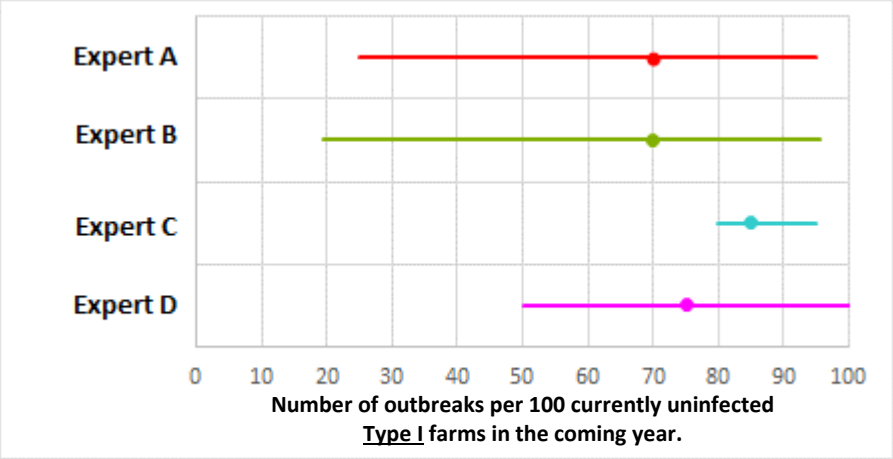
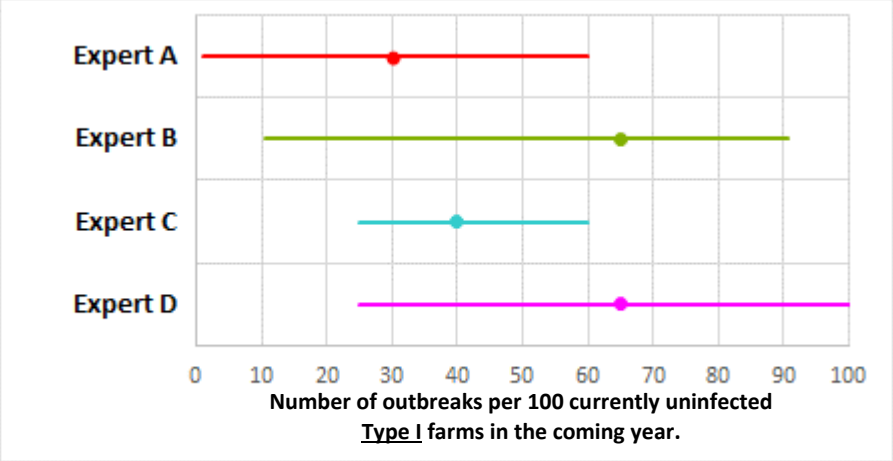


Figure 2: Experts' individual judgements for the risk of new outbreaks on Type II outdoor pig farms in the coming year (circle = median; bar = 80% probability interval).



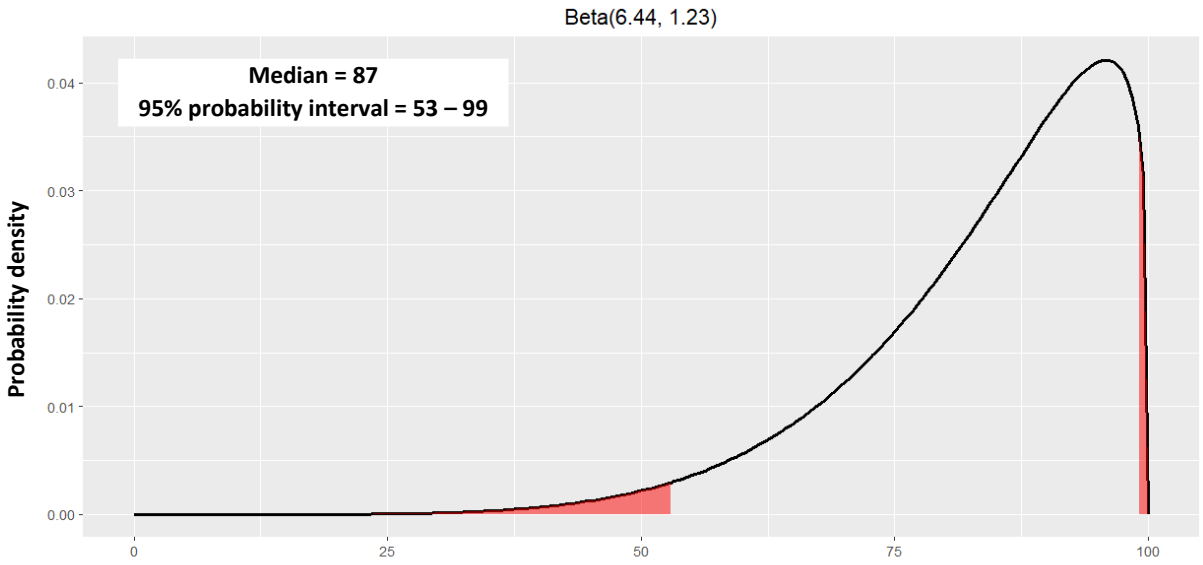
EXPERTS' CONSENSUS JUDGEMENTS FOR FARM TYPE I

The experts' initial consensus judgements were as follows:

- Probability that the true value is below 60: 12.5%
- Probability that the true value is above 90: 60%
- Probability that the true value is above 95: 25%

During the discussion, adjustments were made to these judgements to obtain a distribution that better reflected the experts' consensus opinion. This resulted in the final distribution shown in Figure 3, which all the experts agreed as representing the consensus judgement of the group. The areas outside the 95% probability interval are shaded red.

Figure 3: Experts' consensus distribution for the risk of new outbreaks on Type I outdoor pig farms in the coming year. The distribution parameters are shown above the graph and the red shading shows the 2.5% tail at each end.



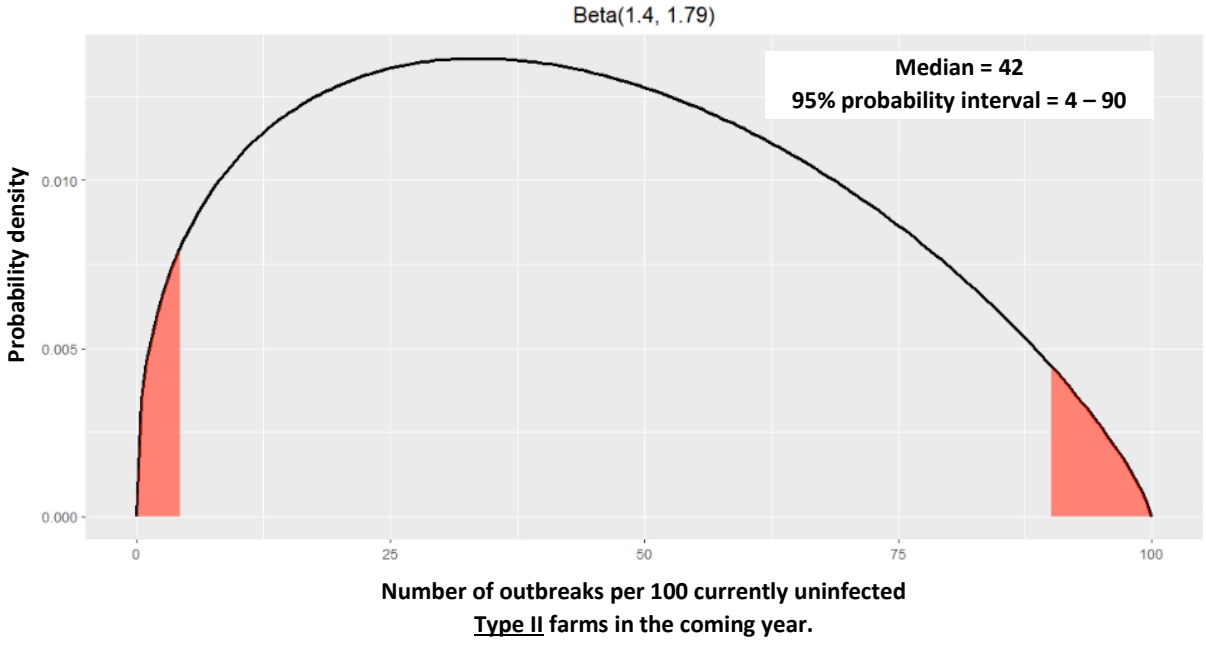
EXPERTS' CONSENSUS JUDGEMENTS FOR FARM TYPE II

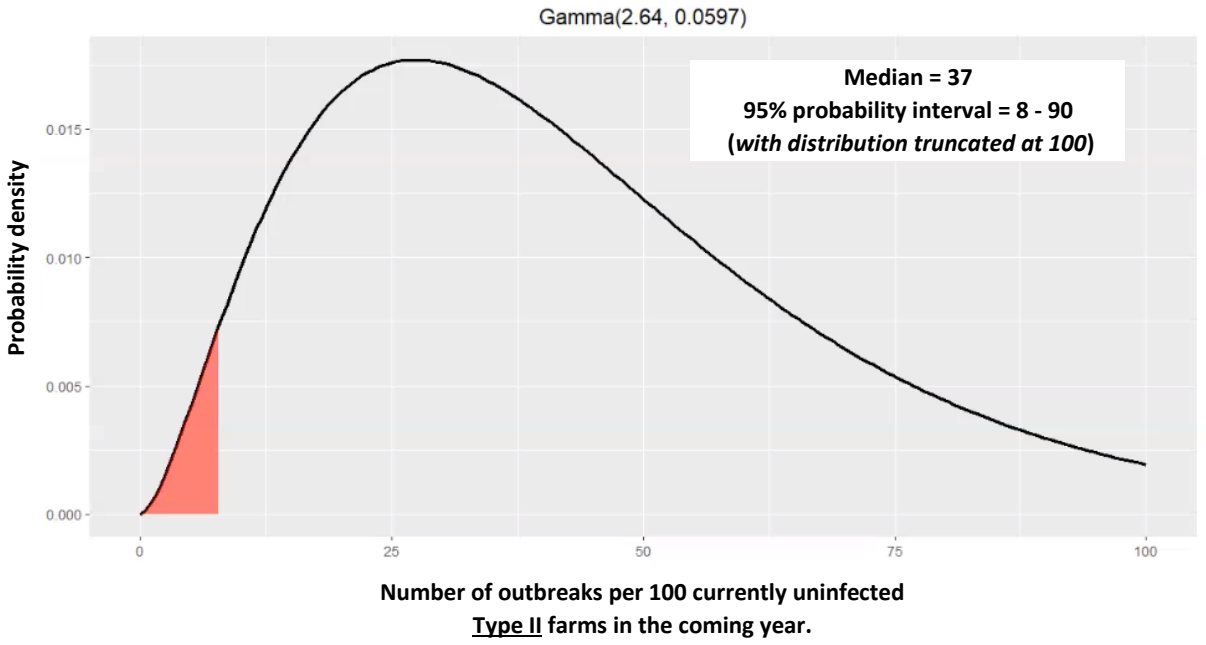
The experts' initial consensus judgements were as follows:

- Probability that the true value is below 30: 40%
- Probability that the true value is above 80: 30%
- Probability that the true value is below 10: 10%

During the discussion, adjustments were made to these judgements to obtain a distribution that better reflected the experts' consensus opinion. This resulted in the two alternative distributions shown in Figure 4. The experts agreed that both distributions should be retained to represent their consensus opinion, subject to the Gamma being truncated at 100 with median and probability interval recalculated accordingly (calculated after the meeting and shown in the graph). Areas outside the untruncated 95% probability interval are shaded red.

Figure 4: Experts' consensus distributions for the risk of new outbreaks on Type II outdoor pig farms in the coming year: in this case, the experts agreed on two alternative distributions to reflect their uncertainty. The distribution parameters are shown above each graph and the red shading shows the 2.5% tail at each end.





3.1.2. Identification and prioritisation of biosecurity measures

3.1.2.1. Initial list of potential biosecurity measures

Prior to the preparatory meeting on 13 January, the experts were asked to submit lists of biosecurity measures which they proposed for consideration for use in outdoor pig farms to reduce ASF risks.

EFSA scientists (the rapporteurs for the EKE) compared the lists submitted by the experts with a similar list drafted by EFSA's Working Group on ASF and outdoor farming of pigs (who were also the observers for the EKE). They integrated the two lists, removing duplicate entries, removing suggestions that are not strictly outdoor-specific BSMs or that are control measures and rewording for clarity where needed. This resulted in the following draft list of potential BSMs:

- Double fence
- Double fence with measures preventing rooting
- Double fence with electric line
- Single wall
- Single fence with measures preventing rooting
- Single fence with electric line
- Absence of crops/trees that are attractive to wild boar
- No wild boar baiting near outdoor farms
- Removal of uneaten feed
- No access of wild boar to water/ponds/rivers on the farm
- Daily inspection of outdoor area
- Cleaning/disinfection facilities near outdoor area
- Protective clothing in outdoor area
- Closed carcass storage
- No access to stored feed
- Prohibit double use of pig pastures

The rapporteurs also proposed a draft definition for each potential BSM. Each potential BSM and its draft definition was discussed with the experts and observers in the preparatory meeting. It was agreed to delete or merge some items in the list and changes were agreed to the wording of some definitions. It was agreed that the rapporteurs would make proposals for reducing the number of BSMs referring to fencing, and this was completed and agreed by correspondence after the meeting. This resulted in the agreed list of potential BSMs and definitions shown in Table 1 below.

Table 1: Initial list of potential BSMs and definitions resulting from the preparatory meeting, shown in the order they were subsequently presented to the experts and observers in Questionnaire 1. For ease of reference, the titles of these BSMs are shown in italics throughout this report.

Title	Definition
No wild boar baiting	No baiting or similar activities that might attract wild boar should be done within 500 m of the outdoor area
Double fence	Double row of fencing made from metal net or wire or electric wires around the perimeter of the outdoor area of a minimum height of 1.5 m and with a minimum distance of 1.5 m between fence rows, and weekly inspections of the fence by the farm personnel, to identify rooting and fence damages, especially after strong wind, rainfall or snowfall
Removal of uneaten feed	No uneaten feed should be left in the outdoor area after feeding
Daily inspection	*Daily inspection* of the outdoor area by the farm personnel, to identify carcasses or parts of carcasses, especially after strong rainfall, including checks in all areas close to the boundary
No access to water	Access of wild boar and other animals to water including ponds and streams on the farm should be prevented
No access to stored feed	*No access to stored feed* in the outdoor area for wild boar and other mammals and birds
Cleaning/disinfection facilities	Facilities for cleaning and disinfection of footwear, protective equipment and vehicle wheels (easily accessible and ready for use at any time) must be used upon entering and leaving the outdoor area
Closed carcass storage	*Closed carcass storage* in/next to the outdoor area to avoid attraction of scavenging birds and small mammals
Single solid fence	Single row solid fence made from metal, masonry or other solid material around the perimeter of the outdoor area of a minimum height of 1.5 m, with measures to prevent rooting, e.g. mesh skirt buried underground or cement underground
Protective clothing	Requirement to enter outdoor area either with *protective clothing* belonging to the farm or with disposable clothing, which must be removed before leaving the outdoor area
Absence of crops/trees	No trees or cultivated plants attractive as food for wild boar should be present on and around the farm (at least up to a distance of 500 m)
Single fence	Single row of fencing made from metal net or wire or electric wires around the perimeter of the outdoor area of a minimum height of 1.5 m without measures to prevent rooting

3.1.2.2. Ranking of potential biosecurity measures

The Question addressed when eliciting rankings of the BSMs was as follows: **Please rank the list of biosecurity measures (BSMs) on the right in terms of how effective each one would be in reducing the number of ASF outbreaks in the coming year in currently uninfected TYPE I/II OUTDOOR PIG FARMS located in the areas of interest, if it was fully implemented and sustained by all Type I outdoor pig farms and no other outdoor-specific BSMs against ASF introduction were applied.** This question was addressed separately by each expert for each farm type.

Tables 2 and 3 below show the experts' rankings of the 12 BSMs, from 1 (most effective) to 12 (least effective). The reasoning provided by the experts is shown in Appendix B.

Table 2: Experts' individual rankings of BSMs for Farm Type I.

Rank	A	B	C	D
1	*Double fence*	*Double fence*	*Single solid fence*	*Single solid fence*
2	*Single solid fence*	*Single solid fence*	*Double fence*	*Double fence*
3	*Cleaning/disinfection facilities*	*Daily inspection*	*Single fence*	*Daily inspection*
4	*No access to water*	*Cleaning/disinfection facilities*	*No wild boar baiting*	*Closed carcass storage*
5	*Protective clothing*	*Protective clothing*	*No access to stored feed*	*No wild boar baiting*
6	*Closed carcass storage*	*No access to stored feed*	*Removal of uneaten feed*	*Removal of uneaten feed*
7	*No access to stored feed*	*No access to water*	*No access to water*	*No access to stored feed*
8	*Absence of crops/trees*	*Removal of uneaten feed*	*Absence of crops/trees*	*No access to water*
9	*Removal of uneaten feed*	*Closed carcass storage*	*Daily inspection*	*Protective clothing*
10	*No wild boar baiting*	*Single fence*	*Cleaning/disinfection facilities*	*Absence of crops/trees*
11	*Daily inspection*	*No wild boar baiting*	*Protective clothing*	*Cleaning/disinfection facilities*
12	*Single fence*	(*Absence of crops/trees*)*	*Closed carcass storage*	*Single fence*

* Expert B declared this BSM not an 'applicable measure'

Table 3: Experts' individual rankings of BSMs for Farm Type II.

Rank	A	B	C	D
1	*Double fence*	*Double fence*	*Single solid fence*	*Double fence*
2	*Single solid fence*	*Single solid fence*	*Double fence*	*Single solid fence*
3	*Cleaning/disinfection facilities*	*Daily inspection*	*Single fence*	*Closed carcass storage*
4	*Protective clothing*	*Cleaning/disinfection facilities*	*Cleaning/disinfection facilities*	*Protective clothing*
5	*No access to stored feed*	*Protective clothing*	*Protective clothing*	*Daily inspection*
6	*Closed carcass storage*	*No access to stored feed*	*No wild boar baiting*	*Cleaning/disinfection facilities*
7	*Daily inspection*	*No access to water*	*Absence of crops/trees*	*Removal of uneaten feed*
8	*No access to water*	*Removal of uneaten feed*	*Daily inspection*	*No wild boar baiting*
9	*Absence of crops/trees*	*Closed carcass storage*	*No access to water*	*Absence of crops/trees*
10	*Removal of uneaten feed*	*Single fence*	*No access to stored feed*	*No access to stored feed*
11	*No wild boar baiting*	*No wild boar baiting*	*Removal of uneaten feed*	*No access to water*
12	*Single fence*	*Absence of crops/trees*	*Closed carcass storage*	*Single fence*

Tables 4 and 5 below collate the expert judgements to provide a mean ranking of the BSMs, from highest to lowest. Note that there are other methods for ordering ranks that involve conducting pairwise comparisons, such as the Schulze Method (which ensures that if there is an item preferred by a majority over every other item in pairwise comparisons, then this will be the accorded a higher or highest rank), which might suggest a different order of preference. Mean rankings were used in this case because they are simpler and were considered sufficient for the purpose of informing the experts' choices on which BSMs to prioritise for further assessment.

Table 4: Analysis of experts' individual rankings of BSMs for Farm Type I.

Rank based on average score	Expert A	B	C	D	Average
Double fence	1	1	2	2	1.5
Single solid fence	2	2	1	1	1.5
No access to stored feed	7	6	5	7	6.25
No access to water	4	7	7	8	6.5
Daily inspection	11	3	9	3	6.5
Cleaning/disinfection facilities	3	4	10	11	7
Removal of uneaten feed	9	8	6	6	7.25
No wild boar baiting	10	11	4	5	7.5
Protective clothing	5	5	11	9	7.5
Closed carcass storage	6	9	12	4	7.75
Absence of crops/trees	8	X	8	10	8.7
Single fence	12	10	3	12	9.25
Absence of crops/trees*	8	12	8	10	9.34

***coding n/a as 12**

Table 5: Analysis of experts' individual rankings of BSMs for Farm Type II.

Rank based on average score	Expert A	B	C	D	Average
Double fence	1	1	2	1	1.25
Single solid fence	2	2	1	2	1.75
Cleaning/disinfection facilities	3	4	4	6	4.25
Protective clothing	4	5	5	4	4.5
Daily inspection	7	3	8	5	5.75
Closed carcass storage	6	9	12	3	7.5
No access to stored feed	5	6	10	10	7.75
No access to water	8	7	9	11	8.75
No wild boar baiting	11	11	6	8	9
Removal of uneaten feed	10	8	11	7	9
Absence of crops/trees	9	12	7	9	9.25
Single fence	12	10	3	12	9.25

3.1.2.3. Prioritisation of potential biosecurity measures

At the EKE meeting on 27th January, the experts were asked to consider their judgements and reasoning for ranking the BSMs and – through facilitated discussion – decide on a smaller list of 'most effective' BSMs to take forward for further consideration in the remainder of this exercise. A target was set of reducing the list of BSMs to '5-8'. The discussion divided the BSMs into 3 categories for each farm type: 'accept' (for carrying forward to later stages of the project), 'reject' and 'uncertain'. At the end of the discussion the experts agreed by consensus to take forward the BSMs categorised as 'accept' and 'uncertain' but not those categorised as 'reject'. The results of this process are shown in Tables 6 and 7. The rapporteurs' record of the discussion leading to these conclusions is included in Appendix C.

Table 6: Experts' consensus prioritisation of BSMs for Farm Type I.

Accept (or 'uncertain')	*Double fence* *Single solid fence* *Single fence* *No wild boar baiting* *No access to stored feed* *Removal of uneaten feed* *No access to water*
Reject	*Closed carcass storage* *Daily inspection* *Protective clothing* *Cleaning/disinfection facilities* *Absence of crops/trees*

Table 7: Experts' consensus prioritisation of BSMs for Farm Type II.

Accept (or 'uncertain')	*Double fence* *Single solid fence* *Single fence* *Daily inspection* *Cleaning/disinfection facilities* *Protective clothing* *No access to stored feed*
Reject	*Closed carcass storage* *Absence of crops/trees* *No wild boar baiting* *No access to water* *Removal of uneaten feed*

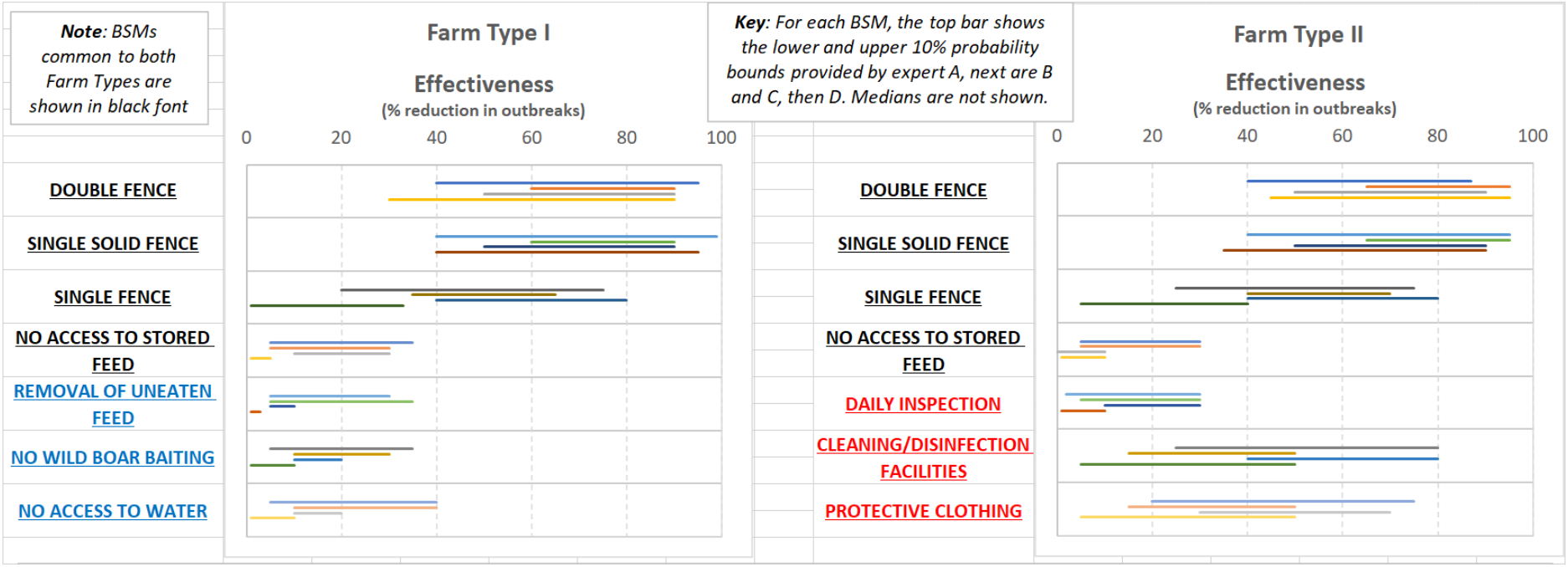
3.1.3. Effectiveness, feasibility and sustainability of prioritised biosecurity measures

The following four subsections present overview graphs showing the judgements of experts for all BSM/farm type combinations for each question. These are presented in landscape format to facilitate comparisons between BSMs and farm types.

3.1.3.1. Effectiveness in reducing the number of new ASF outbreaks

Figure 5 shows the 80% probability interval (lower and upper 10% probability bounds) provided by each expert for each combination of farm type and BSM, including revisions made by them during EKE Meetings 2-4. The full set of judgements including the medians is shown separately for each BSM/farm type combination in Appendix D, together with the reasonings provided by each expert. The rapporteurs' record of the discussions of these judgements in EKE Meetings 2-4 are in Appendix E.

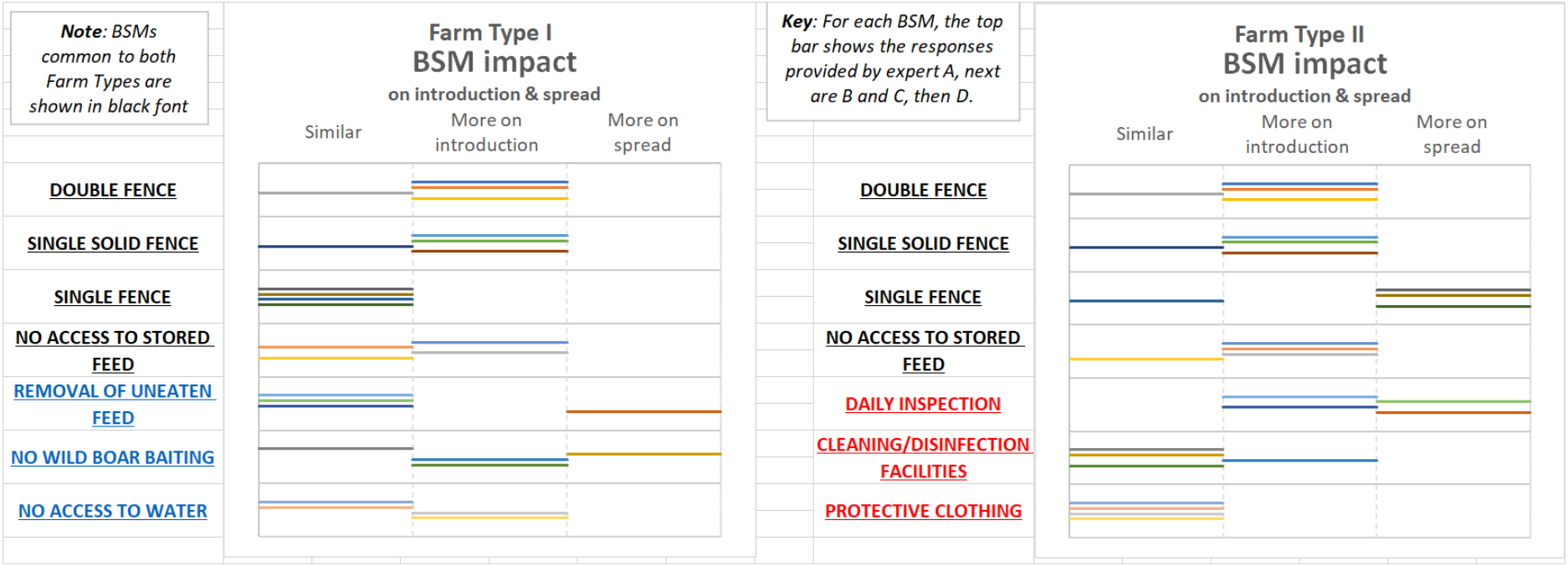
Figure 5: Effectiveness of BSMs for reducing the number of new ASF outbreaks in the coming year. The graphs show the 80% probability interval (lower and upper 10% probability bounds) provided by each expert for each combination of farm type and BSM. The colouring of the bars is arbitrary and serves only to distinguish bars within each section of the graph.



3.1.3.2. Relative impact on introduction and spread of ASF

Figure 6 shows the responses provided by each expert for each combination of farm type and BSM, including revisions made by them during EKE Meetings 2-4. The judgements are shown separately for each BSM/farm type combination in Appendix D, together with the reasonings provided by each expert. The rapporteurs' record of the discussions of these judgements in EKE Meetings 2-4 are in Appendix E.

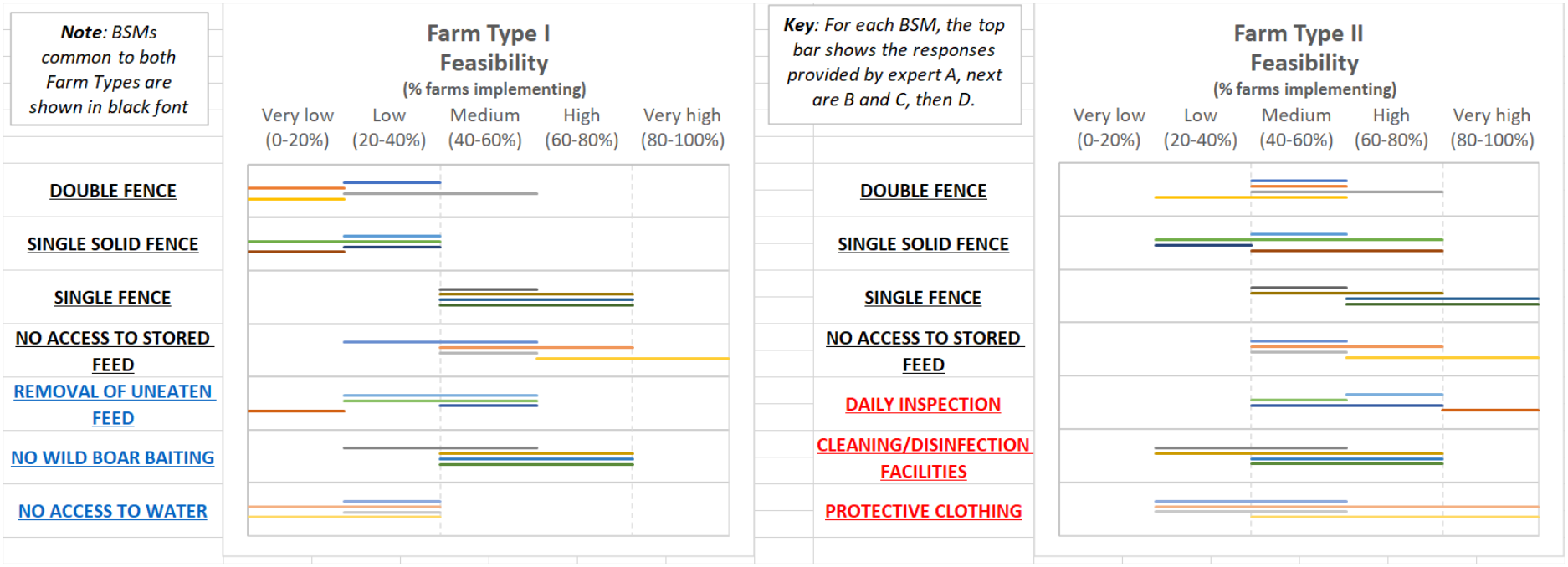
Figure 6: Relative impact of BSMs for on the introduction and spread of ASF. The graphs show the 80% probability interval (lower and upper 10% probability bounds) selected as most likely by each expert for each combination of farm type and BSM. The colouring of the bars is arbitrary and serves only to distinguish bars within each section of the graph.



3.1.3.3. Feasibility

For this question, experts were asked to select the category they considered most likely, or more than one category if they were uncertain about this. Figure 7 shows the responses provided by each expert for each combination of farm type and BSM, including revisions made by them during EKE Meetings 2-4. The judgements are shown separately for each BSM/farm type combination in Appendix D, together with the reasonings provided by each expert. The rapporteurs' record of the discussions of these judgements in EKE Meetings 2-4 are in Appendix E.

Figure 7: Feasibility of BSMs for ASF, in terms of the proportion of farms that would implement them if they were included in the Strategic approach for management of ASF in the EU. The graphs show the 80% probability interval (lower and upper 10% probability bounds) selected as most likely by each expert for each combination of farm type and BSM. The colouring of the bars is arbitrary and serves only to distinguish bars within each section of the graph.



3.1.3.4. Sustainability

For this question, experts were asked to select the category they considered most likely, or more than one category if they were uncertain about this. Figure 8 shows the responses provided by each expert for each combination of farm type and BSM, including revisions made by them during EKE Meetings 2-4. The judgements are shown separately for each BSM/farm type combination in Appendix D, together with the reasonings provided by each expert. The rapporteurs' record of the discussions of these judgements in EKE Meetings 2-4 are in Appendix E.

Figure 8: Sustainability of BSMs for ASF, in terms of the proportion of farms that implement them would continue to do so for at least 2 years. The graphs show the 80% probability interval (lower and upper 10% probability bounds) selected as most likely by each expert for each combination of farm type and BSM. The colouring of the bars is arbitrary and serves only to distinguish bars within each section of the graph.

3.1.4. Identification of potential control measures

This task took place at the end of 'meeting 4', on February 15th. In the initial brainstorming, the experts identified the measures listed below. They then considered the Working Group measures that had been generated prior to the event but not shown to the experts before the exercise so as to avoid priming. The experts then provided a number of comments on the WG measures – which are summarised beneath this second list of measures.

The rapporteurs' record of the discussions during this part of the EKE is included in Appendix E.

Control Measures identified by the experts

- Register and define/classify types of outdoor farms including categories for 'pet pigs' (companion animals), pigs kept for personal consumption and 'hybrid' farms; and including the numbers of animals in each farm – a measure necessary to establish the nature of farms to inform other measures (and allow for potentially applying measures differentially)
- Individual animal registration
- Movement control, requiring authorisation/ paperwork to move pigs between farms (with no movement in ASF-infected areas without relevant testing, including appropriate laboratory/clinical examinations and quarantine where/if necessary)
- Active surveillance through a regular (e.g. annual) schedule of laboratory (serological and virological) examinations of a sample of pigs from outdoor farms (different frequency and/or checks according to epidemiological context)
- Increased passive surveillance requiring notification of wild boar presence, wild boar carcasses, and dead pigs (i.e. factors related to potential ASF identification)
- A series of training/awareness campaigns to improve compliance with BSMs (e.g. on carcass detection, clothing, cleaning)
- Evaluation/quantification of biosecurity levels (with all farmers completing relevant pro forma on factors related to risk of ASF and implementation of BSMs, for assessment by relevant authority e.g. veterinarian)
- Ban on selling pigs in non-specialised (unregulated) markets (e.g. local markets)
- Control of online traded pigs
- Highly restricted on-farm/home slaughtering (with control through veterinarian supervision)
- Restrictions (light to severe) on movement/importation of wild boars (for hunting)
- Training on biosecurity issues for hunters with special attention to those that are also farmers
- Outdoor unfenced farming should be banned
- Specific outdoor pig farm risk analysis at the EU level with control measures based on this risk analysis

Control Measures identified by the EFSA Working Group

With comments of the EKE experts shown in italics in square brackets.

- Approval of an outdoor farm by veterinary authorities after inspection and assessment of biosecurity level using a standard protocol/tool (e.g. Biocheck UGent)

  [*This was deemed to be covered by and overlap several expert CMs*]

- Electronic registration of outdoor pig farms in national databases, capturing data on location, farm size (i.e. number of pigs), production type (e.g. breeding, grower, etc.) and farm type (e.g. intensive, extensive, organic etc.) that is regularly updated (annually or at least every second year)

[*It was felt that a better definition was needed here, that is, a more detailed specification of farm type and an extension to more types including hobby/pet pigs, with 'approval' needed alongside registration*]

- Regular farm visits by official veterinarian with clinical examination of the outdoor pigs; increase of frequency in case of ASF outbreaks/cases occurring in the vicinity of the outdoor farm

  [*It was questioned whether this CM actually went beyond the active surveillance expert CM. A related expert CM included different contexts. It was wondered whether there is a need here to define 'vicinity'.*]

- Regular sampling of pigs from outdoor farms for antibodies and/or virus (e.g. at slaughter); increase of frequency in case of ASF outbreaks/cases occurring in the vicinity of the outdoor farm

  [*Experts thought there was a need here to define 'vicinity'.*]

- Animal movements from outdoor farms to other farms are only allowed after i) keeping the animals to be dispatched indoors for at least the maximum incubation period of ASF before dispatch, ii) clinical examination of animals- testing of animals

  [*This was thought to be covered by an expert CM*]

- Animal movements from outdoor farms to slaughter ['for commercial purposes' added by WG/EFSA in meeting] are only allowed to the closest slaughterhouse

  [*There was some expert concern about this measure, which could exclude many farms. Hence it was thought that 'control' would be better than 'ban'. Also, some clarification of definitions was thought necessary, e.g., would this apply to on-farm slaughter (which perhaps could be allowed)? There might also be practical considerations e.g., capacity limitations forcing transport to slaughterhouses that might not be the closest, or differentially certified slaughterhouses (Dutch example) meaning that the closest might not be appropriate for a particular farm.*]

- Awareness campaigns on ASF and biosecurity for farmers, ideally tailor-made for specific farmer classes/risk groups (i.e. by age, sex, educational level, socio-economic context, type of outdoor farm (historically present, traditional, new introduction))

  [*It was noted that this appropriately considers on demographics, but overall, the CM needed to add consideration of content of awareness courses made in the expert CMs. Also include farmer/hunters as specific demographic as well as all people keeping pigs (not just farmers). It was suggested that psychology/ behavioural experts would be needed to design these.*]

- Awareness campaigns on ASF and biosecurity of outdoor pigs targeted at persons using outdoors for recreational purposes (e.g. mushroom picking, wildlife sighting)

  [*It was noted that this was another demographic-focused CM, which ought to consider other constituencies as well. It was thought that these campaigns should include awareness on avoiding baiting: see contents and comments on previous CM.*]

Additional considerations

It is worth noting that in the general discussion one expert in particular thought that there was a need to consider seasonality of activities as a factor that should have an impact on risk management (including things like festivals, the limited capacities of services, different behaviours, etc). There was also some discussion of the necessity of providing subsidies to support implementation of some of these control measures and of the BSMs assessed earlier.

The discussion of relevance of the identified CMs to different farm types was brief, with experts generally not thinking there was much need to differentiate the application of the control measures. However, one expert thought that inspections on Type I farms might take longer than on Type II farms, and another suggested that implementation of these measures on hobby pig farms might be difficult.

4. Conclusions

1. An expert knowledge elicitation (EKE) study was conducted to address the following objectives: categorize outdoor farm types of pigs in EU MS according to the risk of ASF introduction into these farms and the risk of ASF spread from these farms, rank biosecurity measures according to their potential to lower the risk of ASF introduction into these farms and the risk of ASF spread from these farms in ASF-affected countries, and propose improvements of biosecurity for outdoor pig farming categories and the control measures that should flank these in ASF-affected countries.
2. The EKE was conducted in two parts with four scientists with expertise in ASF epidemiology, biosecurity and outdoor farming practices and structures, including organic and backyard farming of pigs outdoors, in different regions of the EU. In the first part, the experts assessed the ASF risk in outdoor pig farms and identified and prioritised potential biosecurity measures (BSMs). In the second part, the experts assessed the effectiveness, feasibility and sustainability of the prioritised BSMs.
3. As a worst-case scenario for assessment, the EKE considered areas of the EU where ASF is present in wild boar and in domestic pigs in indoor farms and, if outdoor farms were to be permitted in such areas, in domestic pigs in outdoor farms. In farm type I, pigs have access to an outdoor area in forest, woodlands, on agricultural land or pastures, while in farm type II, pigs have access to an outdoor area on farm premises (adjacent to farm buildings).
4. ASF risk was assessed in terms of the number of new ASF outbreaks that would occur in the coming year. The experts' consensus distribution for the number of new outbreaks per 100 type I outdoor pig farms had a median of 87 and 95% probability interval of 53 - 99. The probability interval quantifies the scientific uncertainty of the experts' assessment: they judge that, with 95% probability, the true value would lie between 55 and 99. The experts agreed on two distributions to express their uncertainty about the number of new outbreaks per 100 type II outdoor pig farms. The medians for these distributions were 37 and 42, much lower than their median for type I outdoor pig farms and the uncertainty was greater, with 95% probability intervals of 4 – 90 and 8 – 90, overlapping the median estimate for type I farms.
5. The experts were asked to rank 12 potential BSMs in terms of their effectiveness for reducing ASF risk in each type of outdoor pig farms and then to prioritise which BSMs should be considered further in the second part of the EKE. They selected 4 BSMs for both farm types: *double fence*, *single solid fence*, *single fence* and *no access to stored feed*. A further 3 BSMs were selected only for farm type I (*removal of uneaten feed*, *no wild boar baiting* and *no access to water*) and 3 for farm type II (*daily inspection*, *cleaning/disinfection facilities* and *protective clothing*). Two potential BSMs were considered less effective for both farm types and not considered further (closed carcase storage and *absence of crops/trees*).
6. The effectiveness of each prioritised BSM was assessed in terms of how much they would reduce the number of new ASF outbreaks in the coming year in the respective farm type, if the BSM was implemented fully and properly in all farms of that type and without any of the other prioritised BSMs being implemented. The experts rated effectiveness highest for *double fence* and *single solid fence*, with most experts at least 90% certain this would reduce the number of new outbreaks by 40% or more in both farm types and median estimates of the reduction ranging from 55 to 90%.
7. To varying degrees, the experts rated *single fence* less effective (median estimates 10 – 60%) than double or solid fence but more effective than all the other BSMs on type I farms (*no wild boar baiting* and *no access to stored feed*, uneaten feed and water), which all experts were at least 90% certain would reduce outbreaks by less than 40%.
8. For farm type II, most experts were at least 90% certain that *daily inspection* and *no access to stored feed* would reduce outbreaks by less than 40%. The effectiveness of *protective clothing* and *cleaning/disinfection facilities* was rated higher than those BSMs and approaching the effectiveness of a *single fence* for farm type II, but with very wide uncertainty.

9. The experts also assessed the relative contribution of each BSM to reducing introduction and spread of ASF. Most experts considered it most likely that *double fence* and *single solid fence* would contribute more to reducing introduction than spread in both farm types. *Single fence* was considered most likely to have similar impacts on introduction and spread for farm type I, but similar or more impact on spread for farm type II.
10. For both farm types, *no access to stored feed* was judged most likely to have similar impacts on introduction and spread or more on introduction. The same result was obtained for *no access to water* in farm type I, while removing uneaten food was judged most likely to have similar impacts or more impact on spread. There was least agreement between experts for wild boar baiting for farm type I, which one expert considered to have similar impacts, two more impact on introduction and one more on spread. All four experts judged that *protective clothing* would have similar impacts on introduction and spread in farm type II, and three experts made the same judgement for *cleaning/disinfection facilities*. The experts were evenly split on whether *daily inspection* on farm type II would have more impact on introduction or spread.
11. Feasibility of each BSM was assessed in terms of what proportion of farms would implement it, if it was included in the Strategic Approach to the management of ASF in the EU. Overall, implementation of BSMs was expected to be higher on type II farms than type I. Most experts judged that *double fence* and *single solid fence* were most likely to have medium to high feasibility for farm type II (implemented by 40 – 80% of farms), but very low to low feasibility for farm type I (0 - 40%). *Single fence* was judged most likely to have medium to high feasibility (40 – 80% implementation) on farm type I and medium to very high (40 – 100%) on farm type II.
12. Most experts judged that *no access to stored feed* was most likely to have medium to high feasibility (40 – 80% implementation) for both farm types, with similar results for wild boar baiting on farm type I and *daily inspection* on farm type II. For farm type I, *removal of uneaten feed* was judged most likely to be of low to medium feasibility (20-60% of farms) while *no access to water* was assessed as very low to low feasibility (0 – 40%). For farm type II, most experts considered *cleaning/disinfection facilities* and *protective clothing* most likely to be between low and high feasibility (40 – 80%).
13. Sustainability of each BSM was assessed in terms of what proportion of farms that implement it would continue to do so for at least 2 years. In general, the experts tended to judge that sustainability would be higher than feasibility, i.e., the proportion of farms sustaining a BSM after implementing it would be greater than the proportion that initially implement it. All experts judged that *double fence* and *single solid fence* were most likely to have high to very high sustainability for both farm types (sustained by 60 – 100% of farms). Most experts judged that sustainability of *single fence* would be similar to double and solid fence for farm type II (most likely high to very high, 60 – 100% of farms) but medium to high (40 – 80% of farms) for farm type I.
14. Most experts judged that access to stored feed was most likely to have medium to high feasibility (40 – 80% implementation) for both farm types. These first four BSMs all involve creating or improving structures, whereas the remaining BSMs all rely on behaviour change and tended to be judged less sustainable, with more uncertainty and more variation between experts. For farm type I, *removal of uneaten feed* and *no access to water* were judged most likely to be of very low to medium sustainability (0-60% of farms), while *no wild boar baiting* was rated from low to very high (20 – 100% of farms). For farm type II, the experts' judgements ranged from very low to high (0 – 80% of farms) for *daily inspection* and *cleaning/disinfection facilities* and very low to very high (0 – 100% of farms) for *protective clothing*.
15. The EKE concluded with a brainstorming session on potential control measures, which were defined as risk management measures undertaken by the competent authorities of EU Member States to further reduce the risk of disease introduction and spread for ASF in addition to improved biosecurity of outdoor farms. The experts developed a list of 14 potential control measures, which is included in the report, and commented on a similar list developed independently by EFSA's Working Group on ASF and outdoor pig farming.

16. The results of the EKE are being made available for consideration by the EFSA AHAW Panel when developing its Opinion on ASF and outdoor pig farming.

References

EFSA (European Food Safety Authority), 2014. Guidance on Expert Knowledge Elicitation in Food and Feed Safety Risk Assessment. EFSA Journal 2014;12(6):3734. [278 pp.] doi:10.2903/j.efsa.2014.3734

Abbreviations

(Definitions of biosecurity measures and other terms and assumptions used in the EKE are listed in section 2.3.6 of this report)

AHAW	Animal Health and Welfare
ASF	African Swine Fever
BSM	Biosecurity measure
EKE	Expert Knowledge Elicitation
DP	Domestic pigs
MS	EU Member State(s)
SHELF	Sheffield Framework for elicitation
Wb	Wild boar
WG	Working Group

Appendix A – Detailed responses of experts for EKE on risk of ASF in Farm Types I and II

QUESTION (REPEATED FOR FARM TYPES I AND II): What proportion (expressed as the number per 100) of currently uninfected [Type I or Type II] outdoor pig farms located in the areas of interest, not applying outdoor-specific biosecurity measures against ASF introduction, will have an ASF outbreak in the coming year?

Definitions used by the experts when making their individual judgements were shown in the Excel template (Questionnaire 1). When preparing for the consensus meeting, the facilitator and rapporteurs made some revisions to clarify the definitions accompanying the question, which itself was not changed. The revised definitions and clarifications were displayed at the start of the meeting and accepted by the experts and recorded in the PowerPoint file used in the meeting.

Judgements for Type I outdoor pig farms

Expert	Lower 10% probability bound	Median	Upper 10% probability bound	Best-fitting distribution in SHELF
A	25	70	95	beta
B	19.5	70	95.5	beta
C	80	85	95	logt
D	50	75	100	normal

Judgements for Type II outdoor pig farms:

Expert	Lower 10% probability bound	Median	Upper 10% probability bound	Best-fitting distribution in SHELF
A	1	30	60	t
B	10.5	65	90.5	t
C	25	40	60	gamma
D	25	65	100	t

Experts' reasoning for their judgements for Type I outdoor pig farms

Exp	Estimate	Reasoning for true value being close to lower or upper estimate
A	**Lower (25)**	They are currently still uninfected although ASF is very present in the surroundings. ASF transmission is most effective through direct contact, which is possible in type I farms. For all types I did not take into account the possibility that for example the feed for the outdoor pigs, or the bedding material could be contaminated.
	Upper (95)	High risk/probability of contact between outdoor pigs and wild boar. Higher probability of contact between outdoor pigs and se- and excretes from wild boar. Higher probability of contact with other wild animals. Higher risk of contact with dead wild boar (remains), due to fact that it is a large and mainly uncontrolled area where the pigs are kept. Less control of visitors/passer-by's/hikers/hunters etc compared to type II. Control of vermin/rodents is almost impossible. Natural water source could potentially flow (possibly contaminated with ASFV) through the area where the outdoor pigs are kept. Potentially less control of access to the outdoor pig's feed by wild boar (and other

		wild animals). Storage of feed so that it could not be accessed by wild boar/animals is probably hard. Do we have data on the quality of the registration of the number/animal category of type I outdoor pigs versus type II?
B	**Lower (19.5)**	Considering an R0 value of ASF transmission between herd ranging between 1.5-3.0 (Barongo et al., 2015; Gulenkin et al., 2011; Franzoni et al., 2020), and given the exponential grow of the number of outbreaks, with an average period of three months before strong actions put in place by veterinary services, at least 20% of the farms will have an outbreaks before stopping the spread. Considering the uncertain, a 0.5 value has been subtracted.
	Upper (95.5)	Considering the surveillance activities by veterinary services the probability to observe more than 95% proportion of outdoor pig farms will have an outbreak in the mentioned context is lower than 10%. Given the uncertain by the different context (i.e., different surveillance by countries), a 0.5% has been added to exceed the threshold of 95% (more common confidence intervals).
C	**Lower (80)**	Farm pigs use infected territory and chance to eat ASFV is very high. It depends on density of ASFV and density of domestic pigs on this territory.
	Upper (95)	Experience shows that ASF never affect 100% of pigs, resp. farms. Is same situation in wild boar population - in infected area always have not infected animals. Also so far is not clear how long ASFV is infectious in environment (field, forest), but seems is not like was written in publications few 4 years. For this reason, my upper estimate is 95%.
D	**Lower (50)**	ASFV is not highly contagious if BSM are correctly implemented. Low local transmission speed in ASF affected wild boar populations.
	Upper (100)	Presence of as many risk factors and pathways for ASF introduction as possible. Current state of art of wild boar populations overlapping outdoor pig farm areas. Non-compliance of even basic BSM, which facilitate ASFV introduction and spread.

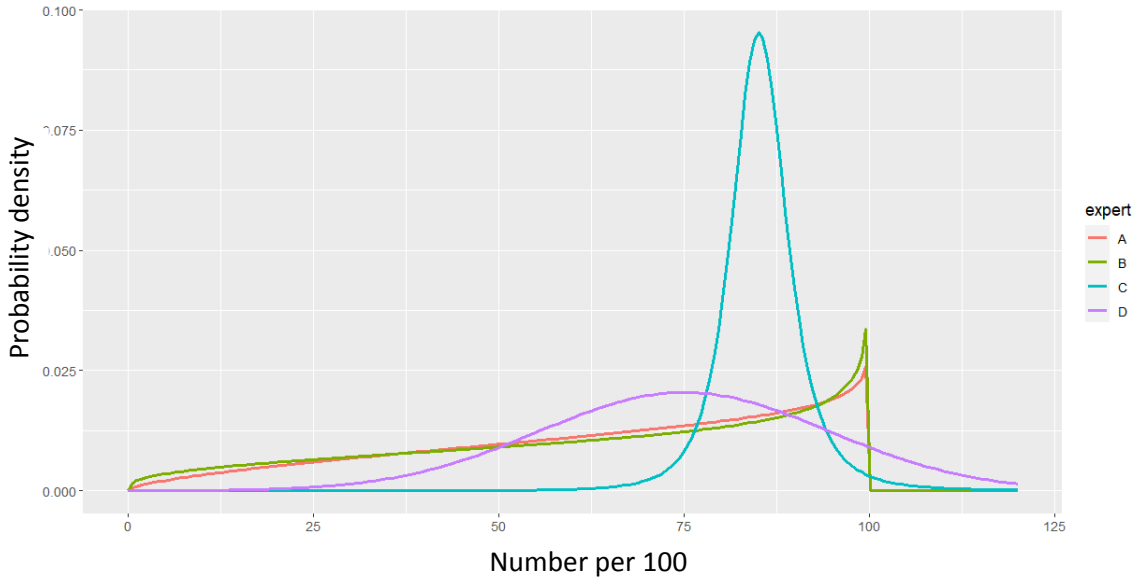
Experts' reasoning for their judgements for Type II outdoor pig farms

Exp	Estimate	Reasoning for true value being close to lower or upper estimate
A	Lower (1)	Compared to type I farms, type II farms can have better control over their animals and the surroundings. Rodent control is better possible. The animals are kept close to farm buildings, often with at least one fence around the premises, which reduces the risk of contact with wild boar/animals. Clinical observation of the pigs is easier since they are closer to farm buildings and most likely have less space to roam around compared to type I. Farm buildings are present providing an opportunity to keep the pigs indoors if needed Safe storage of feed is easier. ASF transmission most effective through direct contact. This is less likely in type II vs type I.
	Upper (60)	Compared to type I farms, type II farms have a lower risk of direct contact with wild boar, wild animals etc due to the fact that they are located close to buildings which probably makes them less interesting for these animals to come close, however they are still outdoors and without proper fencing direct contact is still possible. Contact with dead wild boar or their remains is less likely compared to type I. Feed in type II might be attractive to wild boar (and wild animals) as well, without a proper fence the risk is similar to type I farms. It is less likely that natural waters flow through the farm premises. Control of vermin/rodents can be done, taking into consideration that the premises are more delineated compared to type I farms. There is probably more contact between the outdoor pigs of type II and the farmer who could pose a risk of transmitting ASFV when not taking precautionary measures such as changing of clothes and personal hygiene. The level of "normal" BSM measures is also of importance to estimate the risk of an outbreak.
B	Lower (10.5)	Starting from the lower estimation in Type I, given that the animals bred in Type II are probably more under control by the farmer and veterinary services, the proportion of outdoor pig farms which have an ASF outbreaks could be lower. Otherwise, given the condition mentioned (i.e., no BSMs applied), even if it is possible that the spread of the disease could be stopped after the first, the second, or the ten percent of farms having outbreak, this probability is lower than 10%. Otherwise, given even more uncertain associated to the Type II context (would lead us to think more control respect to Type I, but this control is context specific and strictly related to the farmer's behaviour), the 0.5 has been add and the confidence intervals in Type II are larger than in Type I.
	Upper (90.5)	Starting from the upper estimation in Type I, given that the animals bred in Type II are probably more under control by the farmer and veterinary services, the proportion of outdoor pig farms which have an ASF outbreaks could be lower, as well as the probability to observe an outbreak in more than 90% of these farms. Otherwise, given even more uncertain associated to the Type II context, the 0.5 has been add and the confidence intervals in Type II are larger than in Type I.
C	Lower (25)	25% because in normal case, ASF introduction will be indirect and is connected with farm BSMs, so probability is low.
	Upper (60)	60% because farm BSMs in common case are not satisfactory. In same time, direct transmission of ASFV is not possible, because pigs are fenced.
D	Lower (25)	ASFV is not highly contagious if BSM are correctly implemented. Risk factors and pathways related to wild boar may be more limited in type II outdoor pig farms.

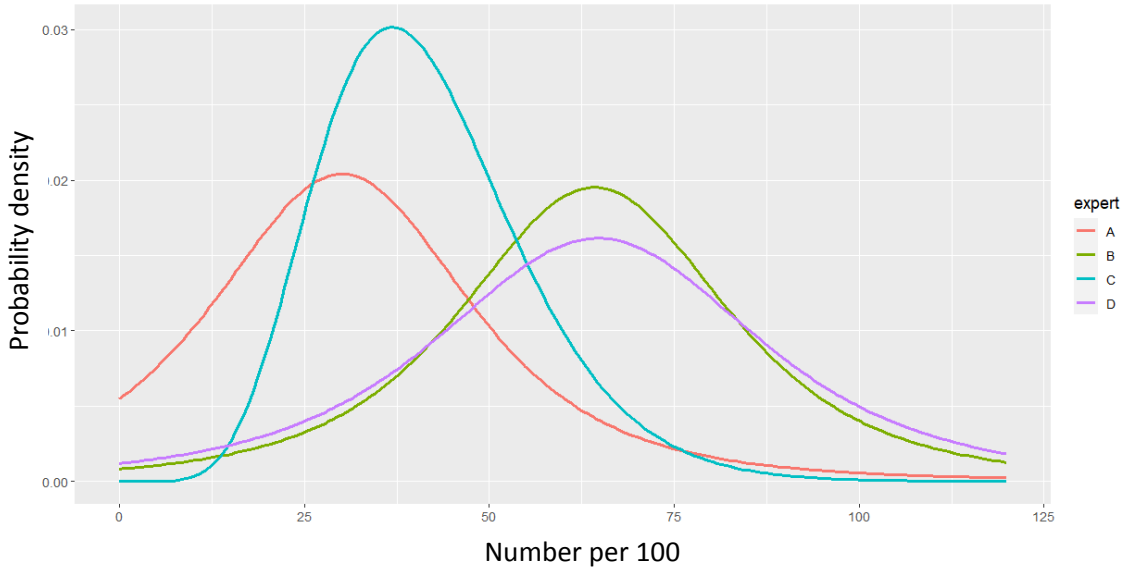
	Upper (100)	Human dominant (and unpredictable) component in ASFV epidemiology. Risk factors and pathways for ASF introduction related to wild boar may have a lesser important role. Non-compliance of basic BSM, which facilitates ASFV introduction and spread

The following graphs show the best-fitting distributions from the SHELF software for Farm Types I and II. Note that, for Farm Type I, the distributions for experts C and D extend beyond the physical maximum of 100 and therefore are not well-fitted to the judgements at the upper end. For Farm Type II, the distributions for experts A, B and D extend beyond the physical limits of 0 and 100 and therefore are not well-fitted to the judgements at each end of the scale. These limitations in fit are partly due to the limited range of distribution types available in the SHELF software and were discussed in EKE Meeting 1 on 27 January.

Best fit distributions for Q1 – Type I outdoor pig farms



Best fit distributions for Q2 – Type II outdoor pig farms



Appendix B – Reasoning provided by experts for their rankings of the biosecurity measures

The following table shows the reasoning provided by the EKE experts for their ranking of the initial list of biosecurity measures in Questionnaire 1.

Expert	Reasoning used in the ranking
A	Preventing direct contact should be priority. After that preventing indirect contact is of importance, starting with the riskiest situations; 1) contaminated materials, 2) attracting possibly sick wild boar. For type 1 farms I consider the chance that wild boar roam around in the same area as the outdoor pigs to be very high. Furthermore, rodent control is much harder compared to type II farms. And natural sources (e.g. water) are harder to control. Keeping control over the outdoor pigs/management (e.g. health, number of animals etc) might be harder as well due to the space the animals have and the natural surroundings they life in. A correct *double fence* will limit/prevent direct contact between wild boar and domestic pigs and will help as a visual indication that biosecurity is to be taken serious on the farm. A *single solid fence* (if well build) will also prevent direct contact between wild boar and outdoor pigs. A *double fence* might be a bit more effective in also making sure that people don't throw any food or so over the fence. Cleaning/Disinfection of materials/footwear/vehicle wheels that could have come into contact with contaminated material will reduce the risk of transmission onto the farmed pigs. Access to water could be, to my opinion, be a substantial risk if it's a e.g. river coming from further away and death wild boar (material) can drift/float to the place where the farmed pigs have access to the water. Considering the surroundings of the farmed pigs are contaminated with ASFV, wearing *protective clothing* might reduce the risk of introduction of ASF. A *closed carcass storage* will reduce the attractiveness of carcasses to wild boar/animals and from there reduce the risk that ASFV can get close to the farm (considering no fences present). Making sure the carcass storage is closed will also make the farmer more alert to take biosecurity measures seriously. Stored feed is attractable to wild boar/animals as well. Preventing access will reduce the risk of wild boar/animals close to the farmed pigs. Similar for interesting crops/trees and the *removal of uneaten feed*. Baiting of wild boar should be forbidden as well for the same reasons. *Daily inspection* is of course good, but direct contact between an infected wild boar carcass and the outdoor pig could already have taken place in the 24h period. A *single fence* will still allow very close (direct) contact between wild boar and outdoor pigs (through the fence). Excretions/droplets pass easily through the fence.
B	The first BSM is to ensure nose to nose contact and check that these fences are undamaged every day. Avoid virus introduction human mediated is first ensured by disinfection and single use clothing. If the fence are adequate and well-check daily, the risk of wild boar entrance is relatively lower, so to ensure *no access to stored feed* or water is a lower important BSM in my rank, as well as no baiting (the wild boar will arrive in any cases if they are attract), and the *single fence* is not enough. The absence of crop/threes is not an applicable measure in my opinion.
C	1. Most important is to separate pigs from wildlife; 2. Measures, making pig area not attractive for wild boar; 3. to avoid ASVF introduction with man
D	Measures to avoid potential direct ASFV transmission (segregation, scavenging) first. Measures to avoid potential indirect ASFV transmission (food, water) then. Human component, would require the implementation of all the other BSMs to be effective.

Appendix C – Rapporteurs' records of discussions in EKE Meeting 1

This appendix contains the rapporteurs' record of discussions in EKE Meeting 1, which was held on 27 January 2021. The record is in 4 parts:

- SHELF Part 1 form, providing general documentation on the Sheffield elicitation for the risk questions in EKE Meeting 1.
- Two SHELF Part 2 forms, providing specific documentation on the Sheffield elicitation the individual risk questions in EKE Meeting 1.
- A form documenting the discussions on the ranking and prioritisation of BSMs.

SHELF ELICITATION RECORD – Part 1

The Workshop Context

Elicitation title	African Swine Fever (ASF) and Outdoor Pig Farms
Workshop	EKE Meeting 1
Date	27 January 2021
Part 1 start time	0900 CET

Attendance and roles	Experts: • Federica Loi (Istituto Zooprofilattico Sperimentale della Sardegna) • Georgi Chobanov (Director of Animal Health and Welfare and Feed Control, Bulgarian Food Safety Authority) • Merel Postma (Ghent University, Faculty of Veterinary Medicine) • Saúl Jiménez Ruiz (SaBio-IREC, University of Castilla-La Mancha & Animal Health Department, University of Cordoba) Facilitators: Andy Hart, A & A Hart Ltd, UK (risk questions) and Gene Rowe, GRE, Norwich, UK (ranking questions) Rapporteurs: Andrea Gervelmeyer and Sotiria-Eleni Antoniou (EFSA) Observers: Sandra Blome (Friedrich Loeffler Institut FLI) Simon More (School of Veterinary Medicine, University College Dublin) and Christian Gortazar Schmidt (University of Castilla-La Mancha, Sanidad y Biotecnología (SaBio) – these are all members of EFSA's Working Group on ASF and outdoor pig farms.
Purpose of elicitation	To assess baseline risk of ASF introduction and spread and rank potential biosecurity measures for reducing the risk, for two types of outdoor pig farms
This record	Participants are aware that this elicitation will be conducted using the Sheffield Elicitation Framework, and that this document, including attachments, will form a record of the session.

<table>
<tr><td>Orientation and training</td><td colspan="8">Participants received orientation and training by means of a full-day training meeting on 13 January 2021.</td></tr>
<tr><td>Participants' expertise</td><td>Expert name</td><td>Expert type*</td><td>Region of expertise **</td><td>Biosecurity</td><td>Outdoor farming</td><td>Organic farming</td><td>Backyard farms</td><td>ASF epidemiology</td></tr>
<tr><td></td><td>Georgi Chobanov</td><td>G</td><td>SE</td><td>X</td><td>X</td><td></td><td>X</td><td>X</td></tr>
<tr><td></td><td>Federica Loi</td><td>R</td><td>SW</td><td>X</td><td>X</td><td></td><td>X</td><td>X</td></tr>
<tr><td></td><td>Merel Postma</td><td>R</td><td>NW</td><td>X</td><td>X</td><td>X</td><td></td><td>X</td></tr>
<tr><td></td><td>Saúl Jiménez Ruiz</td><td>R</td><td>SW</td><td>X</td><td>X</td><td></td><td></td><td>X</td></tr>
<tr><td></td><td colspan="8">*G=government, R=researcher
**NW=North-West EU, SW=South-West EU, SE=South-East EU</td></tr>
<tr><td>Declarations of interests</td><td colspan="8">In accordance with EFSA's Policy on Independence5 and the Decision of the Executive Director on Competing Interest Management, EFSA screened the Annual Declarations of Interest filled out by the Working Group members invited to the present meeting. No Conflicts of Interest related to the issues discussed in this meeting have been identified during the screening process and no interests were declared orally by the members at the beginning of this meeting (nor in the subsequent meetings in this project).</td></tr>
<tr><td>Strengths and weaknesses</td><td colspan="8">The expertise areas required for the EKE comprise biosecurity, outdoor farming practices and structures, including organic and backyard farming of pigs outdoors. Experts were identified screening relevant scientific publications with the aim to select experts having at least expertise in biosecurity and one farming type, as well as ASF epidemiology, and covering most, if not all areas of the EU. The number of EKE experts was limited to 4 to make the EKE more manageable via web meeting.</td></tr>
<tr><td>Evidence</td><td colspan="8">An evidence dossier was prepared by the EFSA Working Group on ASF and outdoor pig farms and sent to the experts on 5 January 2021. An overview of the evidence was presented by EFSA during the training meeting on 13 January.
The experts were invited to identify additional evidence they consider relevant, at any stage in the project, and to upload it in a Teams folder dedicated to this purpose.</td></tr>
<tr><td>Structuring</td><td colspan="8">The structuring of the questions and the rationale for this is reported in the protocol document for this EKE. The questions were introduced and explained to the experts during the training meeting on 13 January and included in the questionnaire templates provided to experts for making their judgements.</td></tr>
<tr><td>Definitions</td><td colspan="8">Definitions used in the EKE were reported in the first draft of the protocol document for this EKE. The definitions were introduced and explained to the experts during the training meeting on 13 January, where some clarifications and additions were made. The final wording of the definitions</td></tr>
</table>

[5] http://www.efsa.europa.eu/sites/default/files/corporate_publications/files/policy_independence.pdf

	is shown in the final version of the protocol document and included in the questionnaire templates provided to experts for making their judgements.

Part 1 end time	1800 CET
References	Final version of protocol document, archived in EFSA Document Management System. Evidence dossier as provided to experts before EKE meeting 1. List of additional evidence provided by the experts during the EKE process.

SHELF ELICITATION RECORD – Part 2

Question 1: Eliciting a Continuous Distribution for baseline ASF risk in Type I Outdoor Pig Farms

Elicitation title	African Swine Fever (ASF) and Outdoor Pig Farms
Workshop	EKE Meeting 1
Date	27 January 2021
Quantity	**Question 1. What proportion (expressed as the number per 100) of currently uninfected Type I outdoor pig farms located in the areas of interest, not applying specific biosecurity measures against ASF introduction, will have an ASF outbreak in the coming year?**
Anonymity	The EKE is conducted under Chatham House rule: recording who is present and what is said, but not who said what. Experts are identified by letters A-D, observers as E-G, rapporteurs as R1 and R2, and facilitators as F1 and F2. Statements that might reveal the identity of an expert are unattributed.
Start time	09:04 CET

Definition	Definitions used in the EKE were reported in the first draft of the protocol document for this EKE. The definitions were introduced and explained to the experts during the preparatory meeting on 13 January, where some clarifications and additions were made. The version of those definitions that was used by the experts when making their individual judgements is recorded in the Excel template for their responses (Questionnaire 1). When preparing for this meeting, the facilitator and rapporteurs made some further revisions to clarify the definitions. The revised definitions were

	displayed at the start of the meeting accepted by the experts to be used for their consensus judgements on both the risk and ranking questions. The final wording of the definitions is shown in the final version of the protocol document and included in the questionnaire templates provided to experts for making their judgements.
Evidence	An evidence dossier was prepared by the EFSA Working Group on ASF and outdoor pig farms and sent to the experts on 5 January 2021. An overview of the evidence was presented by EFSA during the preparatory meeting on 13 January. Several papers on socio-economic factors relevant to the control of ASF in Sardinia were provided by one of the experts, and a short paragraph summarising the main findings of these was shared with the experts on Teams.
Plausible range	The plausible range was set to 0-100, based on an informal elicitation with the experts during the preparatory meeting on 13 January.
Individual elicitation	**Method:** Sheffield method as described in the EFSA Guidance on EKE (2014), but eliciting 10th, 90th and 50th percentiles rather than quartiles. Justification of this and more details on the method are reported in the protocol document. **Judgements:** The facilitator constructed a questionnaire in MS Excel, containing the EKE questions and definitions, boxes for experts to enter their judgements and reasoning, and instructions on how to do this. This was sent to both the experts and observers on 15 January and they were asked to complete and return it by the end of 20 January, which they all did. The facilitator compiled separate reports for the experts and observers containing the individual judgements and reasoning and their respective best-fit distributions (see below). The report for experts was sent to all participants via Teams and email on 22 January, while the report for observers was sent only to the rapporteurs and observers. The individual judgements and reasoning are included in the project report (see References, below). *NOTE: The observers also made individual judgements on each question, for reasons explained in the protocol document. The observers' judgements were not displayed or discussed at any point in the meeting.*
Fitting	Distributions were fitted to the individual judgements using the SHELF Shiny app for multiple experts[6]. The distributions identified by the app as 'best-fitting' were shown in the reports provided to participants.
Group discussion	The facilitator displayed the judgements and distributions in the meeting and asked each expert in turn to summarise the reasons for their

[6] https://jeremy-oakley.shinyapps.io/SHELF-multiple/

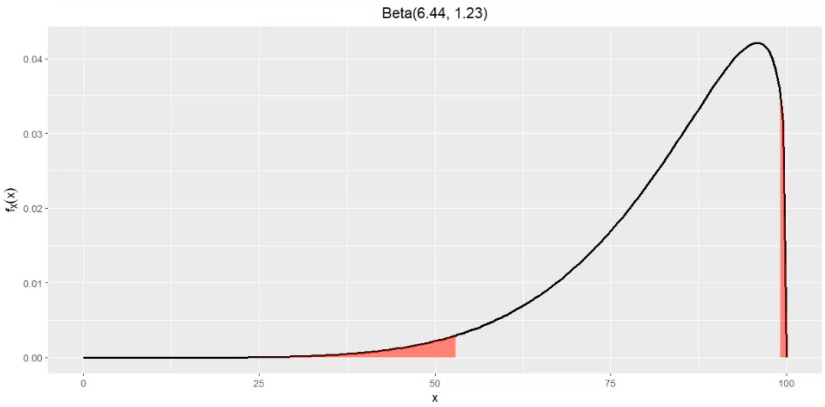
	judgements. Participants were able to refer to the individual judgements report to see the detailed reasoning provided by experts before the meeting. Summary of reasonings of individual judgements, with particular attention to points not included in the experts' written reasonings. The need to apply and/ or extrapolate knowledge and evidence originating from particular areas to the entire EU area, considering how much they are also applicable for these, was highlighted by F1. One expert has considered monitoring data on Type I farms in Spain that indicate a high probability of indirect interactions between wild boar and domestic pigs at water points in the outdoor area of Type I farms. A considered for the lower bound that direct contact with wild boar is more possible but still some outdoor type I farms remain uninfected, while for the upper bound, A considered that even if the infection has broadly spread, very few type I outdoor farms will remain uninfected. B considered that not all farms will get infected and selected a median of 70% but felt that the probability does not follow a normal distribution. C considered increasing the upper limit to 99% as C had not considered previously that no improvements of BSMs would be done during the year. B asked C which situation has been considered when estimating the lower and upper bound, which B considered to rather close to the median. C explained that a general Type I farm has been considered, which C does not consider to be very different from the situation in the region known to C, as in an affected area where animals are roaming freely, they will be in contact with the virus and will get infected, irrespective of the country.
Group plausible range	The plausible range of 0-100 was retained for the group elicitation.
Group elicitation	**Method:** The consensus judgements were elicited using the 'probability method', rather than eliciting the 10th, 50th and 90th quantiles as in the individual judgements. This is intended to counter the tendency of experts to anchor on their individual judgements and to encourage them to reach consensus by reasoned discussion rather than by a process of compromise between their individual judgements[7]. The facilitator elicits consensus probabilities for the true value being below or above 3 selected values, which the facilitator chooses to explore areas where the individual distributions differ markedly. **Judgements:** The facilitator explained the RIO concept of consensus that is used in EKE following the Sheffield method. The facilitator then proposed two values for which consensus probabilities would be elicited. Before eliciting those probabilities, the facilitator invited the experts to suggest reasons that would make it more likely that the true value is below the

[7] For further information see the document on 'SHELF methods' at Oakley J. E. and O'Hagan, A. (2019). SHELF: the Sheffield Elicitation Framework (version 4). School of Mathematics and Statistics, University of Sheffield, UK. (http://tonyohagan.co.uk/shelf)

	lower of these values, and then reasons that would make it more likely that the true value is above the upper value. The facilitator added summaries of the reasons provided by the experts to the PowerPoint file which was displayed on screen. F1 inquired which confidence level is usually used in EFSA's assessments. It was clarified that mostly the 95% level is used. Reasons that would make it more likely that the true value is below **60**: • A considered an area with low density of outdoor farms and wild boar where direct interaction between wild boar and domestic outdoor pigs is limited, e.g. by a highway, and that the ASF prevalence is low. • B considered low density of outdoor pig farms, high biosecurity in neighbouring domestic farms, rapid detection of the outbreak and swift action by veterinary authorities • C considered that the density of infected wild boar in the area is the most relevant factor to consider; further the influence of the weather/ pasture type are relevant: on empty pastures the virus is destroyed more rapidly in the environment by high sun radiation than on covered areas without sunshine; in addition the virus survives less in the environment in high temperatures; further, low temperatures/snow may impede contact between wild boar and domestic outdoor pigs • D considered the speed of local spread to be low (20-30 km spread/year), based on a review paper D shared with the group • B considered that a good awareness of farmers about ASF and BSMs could reduce the number of newly infected farms; D thinks that increasing the awareness will only have a long-term effect, rather than leading to effects within one year Reasons that would make it more likely that the true value is above **90**: • B considered poor awareness of farmers about ASF and BSMs • C considered the low level of BSMs of the farms and that it will not be improved during the year • B and C considered that this type of farm is difficult to regularly inspect, which would delay the detection of the outbreak • Longer survival and shedding of infected wild boar increase the probability to have higher values • There is a large overlap of wild boar habitats and Type I farm distribution; this use of the habitat by both infected wild boar and domestic outdoor pigs is important for high values • Presence of natural water sources, presence of non-farm-related person, difficult control of rodents are factors aggravating the risk for Type I farms *Before moving on to consensus probabilities from the experts, the facilitator asked the observers to disconnect from the meeting, review and if they wished revise their individual judgements in the light of the preceding discussions, email their updated submissions to the facilitator, and then re-*

	join the meeting when they were ready. The observers' judgements were not displayed or discussed at any stage in the meeting. The facilitator then elicited consensus probabilities from the experts. Probability that the true value is below 60: 12.5% (~one in eight) A and B considered that there is a probability of 20% that the true value is lower than 60%, C considered it impossible/not probable that less than 60% farms will be infected (0%); D considered that there is a very low probability (5%) that the true value is lower than 60%. The group agreed to a probability of 12.5% that the true value is lower than 60% of farms becoming infected. Reasons: in the situation considered (area is infected and free-roaming infected animals are present and biosecurity levels are not increasing throughout the period) a large proportion of farms is expected to become infected; however not all farms will become infected, especially in areas with low density of pigs. Probability that the true value is above 90: 60% A considered that the value is higher with a probability of 20%. B, C and D considered the probability that the true value is higher to be 60% or higher. Reasons: absence or low level of biosecurity in these farms will lead to a high proportion of them becoming infected. The facilitator then proposed a third value, for which a consensus probability was then elicited from the experts. Probability that the true value is above 95: 25% The experts considered this value to be 25%.
Fitting and feedback	The facilitator entered the judgements in the SHELF Shiny app for single distributions[8] live on screen and displayed alternative fitted distributions and selected fitted quantiles.
Chosen distribution	The facilitator invited the experts to comment on the fitted distributions and indicate preferences for which one(s) better represent the consensus judgement of the group. B expressed the preference for the beta-distribution as it presents the group's estimates better than the Student-t distribution. C initially considered the Student-T better as it indicates that it is possible to reach 100%, but not very likely, but then preferred a modified beta-distribution that had a flatter left tail (0.123, 0.52, 0.90). C proposed to change the confidence level to 90% and 99% to see what the differences to the CI would be (90%: CI 59-98; 99%: CI 41-99.8). A also agreed that this reflects the group estimates well, but felt that the tail should be extending a bit more to the left. All agreed that the peak should be slightly below 100%. B preferred the upper limit to be slighter lower than 99% (e.g. 97 or 98%), felt fine about the median and suggested that the left tail should be extending a bit more to the left.

[8] https://jeremy-oakley.shinyapps.io/SHELF-single/

	At the conclusion of the discussion the experts agreed to adopt the distribution shown below and were content with resulting median (87) and 95% probability interval (53-99): 
Discussion	The facilitator asked the experts to confirm that they were all content that the consensus distribution will be reported as the result of the EKE for this question. All experts accepted the distribution and the noted limitations that they had expressed.

End time	12:43 h
References	Final version of protocol document for the project (archived in EFSA's Document Management System). Individual judgements and reasoning provided by the experts, as sent to the participants before the meeting (reproduced in Appendices A and B of the project report).

Question 2: Eliciting a Continuous Distribution for baseline ASF risk in Type II Outdoor Pig Farms

Elicitation title	African Swine Fever (ASF) and Outdoor Pig Farms
Workshop	EKE Meeting 1
Date	27 January 2021
Quantity	**Question 2. What proportion (expressed as the number per 100) of currently uninfected Type II outdoor pig farms located in the areas of interest, not applying specific biosecurity measures against ASF introduction, will have an ASF outbreak in the coming year?**
Anonymity	The EKE is conducted under Chatham House rule: recording who is present and what is said, but not who said what. Experts are identified by letters A-D, observers as E-G, rapporteurs as R1 and R2, and facilitators as F1 and F2. Statements that might reveal the identity of an expert are unattributed.
Start time	12:45 CET

Definition	Definitions used in the EKE were reported in the first draft of the protocol document for this EKE. The definitions were introduced and explained to the experts during the preparatory meeting on 13 January, where some clarifications and additions were made. The version of those definitions that was used by the experts when making their individual judgements is recorded in the Excel template for their responses (Questionnaire 1). When preparing for this meeting, the facilitator and rapporteurs made some further revisions to clarify the definitions. The revised definitions were displayed at the start of the meeting accepted by the experts to be used for their consensus judgements on both the risk and ranking questions. The final wording of the definitions is shown in the final version of the protocol document and included in the questionnaire templates provided to experts for making their judgements.
Evidence	An evidence dossier was prepared by the EFSA Working Group on ASF and outdoor pig farms and sent to the experts on 5 January 2021. An overview of the evidence was presented by EFSA during the preparatory meeting on 13 January.
Plausible range	The plausible range was set to 0-100, based on an informal elicitation with the experts during the preparatory meeting on 13 January.
Individual elicitation	**Method:** Sheffield method as described in the EFSA Guidance on EKE (2014), but eliciting 10^{th}, 90^{th} and 50^{th} percentiles rather than quartiles.

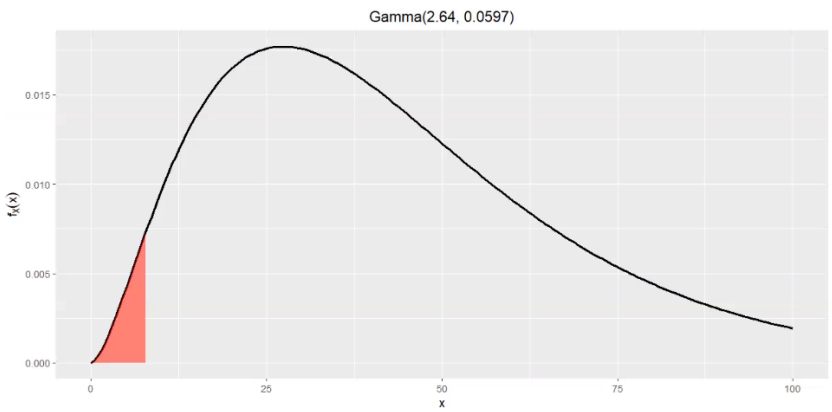
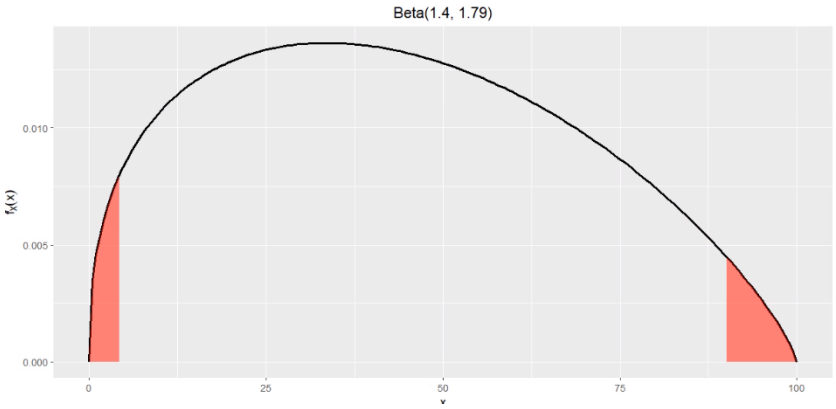
	Justification of this and more details on the method are reported in the protocol document. **Judgements:** The facilitator constructed a questionnaire in MS Excel, containing the EKE questions and definitions, boxes for experts to enter their judgements and reasoning, and instructions on how to do this. This was sent to both the experts and observers on 15 January and they were asked to complete and return it by the end of 20 January, which they all did. The facilitator compiled separate reports for the experts and observers containing the individual judgements and reasoning and their respective best-fit distributions (see below). The report for experts was sent to all participants via Teams and email on 22 January, while the report for observers was sent only to the rapporteurs and observers. The individual judgements and reasonings are included in the project report (see References, below). *NOTE: The observers also made individual judgements on each question, for reasons explained in the protocol document. The observers' judgements were not displayed or discussed at any point in the meeting.*
Fitting	Distributions were fitted to the individual judgements using the SHELF Shiny app for multiple experts[9]. The distributions identified by the app as 'best-fitting' were shown in the reports provided to participants.
Group discussion	The facilitator displayed the judgements and distributions in the meeting and asked each expert in turn to summarise the reasons for their judgements. Participants were able to refer to the individual judgements report to see the detailed reasoning provided by experts before the meeting. A indicated that their individual judgement was done without considering hobby farms, which comprise a large proportion of premises keeping outdoor pigs in at least some EU Member States. Taking those into consideration, A would increase all 3 estimates. **At this point in the discussion a break was taken for lunch, from 13:00 to 13:40 CET.** F1 asked the experts to consider, during their lunch break, the group discussion reasons for Q1 and reflect if these are also applicable for Q2 or what needed to be changed.
Group plausible range	The plausible range of 0-100 was retained for the group elicitation.
Group elicitation	**Method:** The consensus judgements were elicited using the 'probability method' as described in the report on Question 1 (above). **Judgements:** The facilitator reminded the experts of the RIO concept of consensus that is used in EKE following the Sheffield method. The facilitator then proposed two values for which consensus probabilities would be elicited. Before eliciting those probabilities, the facilitator asked the experts

[9] https://jeremy-oakley.shinyapps.io/SHELF-multiple/

	to consider reasons that would make it more likely that the true value is below the lower of these values, and then reasons that would make it more likely that the true value is above the upper value. As the meeting was running late, F1 copied the reasons that had been given for high and low values in when eliciting the same question for Farm Type I and displayed them on screen, then asked the experts to say how these should be revised for the values considered for Farm Type II. Reasons that would make it more likely that the true value for Farm Type II is below **30**: • A highlighted the better opportunity on type II farms of detecting clinical symptoms that could be added (this is linked to detection, not occurrence of outbreaks). • A and B considered that on type II farms there is less probability of contact with wild boar. • C considers it the main difference to type I farms is that no grazing of natural resources takes place which have a higher risk of being contaminated with ASFV and that no overlap of areas used by wild boar and by domestic pigs exists • D highlighted that the influence of weather is less important for type II farms; • A underlined that rodent control is easier on type II farms and could lead to lower values Reasons that would make it more likely that the true value is above **80**: • The experts considered that a high wild boar density in the area in which the type II farm is located could lead to higher values • B expressed the view that an important factor for higher values for type II farms is that there is a barrier to keep the domestic pigs in, but not necessarily prevents direct contact with infected wild boar or other animals • A highlighted that the closer contact of pigs with farm staff (and potentially with farm visitors) can also increase the introduction of virus into the animal area through these *Before moving on to elicit consensus probabilities from the experts, the facilitator asked the observers to disconnect from the meeting, review and if they wished revise their individual judgements in the light of the preceding discussions, email their updated submissions to the facilitator, and then rejoin the meeting when they were ready. The observers' judgements were not displayed or discussed at any stage in the meeting.* The facilitator then elicited consensus probabilities from the experts. Probability that the true value is below 30: **40%** A and B considered a probability of 25%, C considered 60 (-70)% and D considered 30%. Reasons: C considered that type II farms have a markedly decreased probability for direct contact between wild boar and domestic pigs, so very low values are possible. A highlighted that hobby pig farms of type II can

	have rather low biosecurity which limits the probability of lower values. G mentioned that hobby pigs are currently rather a niche but become more important and therefore should be mentioned in the scientific opinion. A group value of 40% was proposed by F1 and accepted by the experts as an initial estimate for use when starting the fitting. Probability that the true value is above 80: **30%** A considered a probability of 20-25%, B 30%, C 20% and D 50% to have higher values. The group value of 30% was proposed by F1 and accepted by the experts as an initial estimate for use when starting the fitting. No reasons were collected. The facilitator then proposed a third value, for which a consensus probability was then elicited from the experts. Probability that the true value is below 10: **10%** A considered this to be 7%, B 15%, C 5-10% and D 10%. The group value of 10% was proposed by F1 and accepted by the experts as an initial estimate for use when starting the fitting. No reasons were collected.
Fitting and feedback	The facilitator entered the judgements in the SHELF Shiny app for single distributions[10] live on screen and displayed alternative fitted distributions and selected fitted quantiles.
Chosen distribution	The facilitator invited the experts to comment on the fitted distributions and indicate preferences for which one(s) better represent the consensus judgement of the group. The experts expressed the opinion that the median value should be higher than 30. The curve using a gamma distribution was considered to reflect the estimates better than a beta distribution by B and A, yet A felt that the beta better reflects the hobby farms. Experts felt that most of the probability should be below 50%. C preferred the beta due to its confidence interval, B agreed with that. D preferred the beta distribution as it reflects better the high risk associated with backyard and hobby farms. A and B preferred the beta distribution. C and D felt both distributions were acceptable, but C said they might prefer the gamma distribution if it could be truncated at 100. At the conclusion of the discussion the experts agreed to adopt both the distributions shown below: Gamma distribution

[10] https://jeremy-oakley.shinyapps.io/SHELF-single/

	 Beta distribution 
Discussion	The facilitator asked the experts to confirm that they were all content that both the beta distribution and the gamma distribution (truncated at 100) will be reported as the result of the EKE for this question, to reflect the groups' uncertainty about which should be preferred. All agreed.

End time	15:10 h
References	Final version of protocol document for the project (archived in EFSA's Document Management System). Individual judgements and reasoning provided by the experts, as sent to the participants before the meeting (reproduced in Appendices A and B of the project report).

ELICITATION RECORD – Qualitative Rationales for BSM Rankings for Workshop 1

In this section, the rationales of the experts about the BSMs as to how effective they are (in themselves and with respect to, for example, the HI or LO benchmarks, or some other BSM) are recorded, together with any further reflections on the BSM made by experts, such as uncertainty about its nature/definition and of factors related to its conditionality or about the flow of the discussion process..

FARM TYPE I

FARM TYPE I – 1st BSM

Biosecurity measure	*Double fence*
Rationales for effectiveness of otherwise of the BSM (or other BSMs)	A considered that a *double fence* maintains the necessary distance between wild boar and domestic pigs to prevent direct contact; it also provides a clear signal to persons to not enter the farm premises and makes it more difficult to throw items into the outdoor area; B considered that a *double fence* effectively prevents the nose-to-nose contact (*single solid fence* is considered to have the same effectiveness) and that the *double fence* deters unauthorised persons from entering the outdoor area and makes it more difficult to throw items into the outdoor area
Other comments	ACCEPT

FARM TYPE I – 2nd BSM

Biosecurity measure	*Absence of crops/trees*
Rationales for effectiveness of otherwise of the BSM (or other BSMs)	B considered this BSM less relevant and very difficult to apply as many outdoor farms are actually located in areas with trees and crops to enable the pigs to feed on the natural resources (which are equally attractive to wild boar) and to protect animals from the sun C considered that any area with crops/trees that are attractive to pigs will be equally attractive to wild boar, therefore felt that this BSM is relevant A considered that it could be possible to limit the location of farm type I to areas in which no crops and trees are present, instead of removing trees/crops from the natural environment
Other comments	REJECTED

FARM TYPE I – 3rd BSM

Biosecurity measure	*Single fence*
Rationales for effectiveness of otherwise of the BSM (or other BSMs)	D, A, B expressed the view that a *single fence* is similar to no fence as wild boar (and domestic pigs) can cross it and as direct contact is not prevented C considers the *single fence* the least effective of the three fence options, but considers that at least a *single fence* should be there and that it prevents some contacts A highlighted that a fence should avoid the direct contact, the other measures are important to avoid indirect contact, therefore *single fence* was not considered to be effective Having a *single fence* is considered to be better than the other, non-fence BSMs by C B considers the *single fence* better than nothing
Other comments	ACCEPT

FARM TYPE I – 4th BSM

Biosecurity measure	*Closed carcass storage*
Rationales for effectiveness of otherwise of the BSM (or other BSMs)	C ranked it low as it is not ASF-specific if it concerns domestic pigs that died of other reasons D considers this BSM effective thinking about removal of wild boar carcasses but changes the view after clarification that the BSM concerns dead domestic pigs A considers that carcasses in the outdoor area attract wild boar, but that the BSM is not the most important
Other comments	REJECT

FARM TYPE I – 5th BSM

Biosecurity measure	*No wild boar baiting*
Rationales for effectiveness of otherwise of the BSM (or other BSMs)	A and B considered that baiting is not the most attractive item for wild boar compared to other things in the surroundings that could attract them C considered that feed for domestic pigs is equally attractive for wild boar as baiting and water access

	D considered the BSMs related to baiting, access to feed and water are equally relevant, but considered that it is slightly more important to not bait wild boar B considers that as a single measure, prohibition of baiting is less effective if the farm is located in a forest area
Other comments	UNCERTAIN

FARM TYPE I – 6th BSM

Biosecurity measure	*No access to water*
Rationales for effectiveness of otherwise of the BSM (or other BSMs)	C considered feed more important than water as wild boar usually have access to water outside the outdoor farm area D considered water access important as interactions between wild boar have been shown to take place around water places in warm/dry seasons/countries, but less important in less dry seasons/countries A considered water important considering it (in the form of rivers) as a means to transport contaminated material into the outdoor farm area B considered that the importance of this BSM varies between seasons/climate zones (higher in hot/dry periods/areas)
Other comments	UNCERTAIN Middle zone below feed

FARM TYPE I – 7th BSM

Biosecurity measure	*Daily inspection*
Rationales for effectiveness of otherwise of the BSM (or other BSMs)	D considered that this BSM is an effective way to detect entry of wild boar and of carcasses in the usually large grazing areas of this farm type B considered the BSM effective for early detection of sick animals/ of an outbreak which could reduce the risk of spread from the farm A considers a *daily inspection* not effective in preventing direct contact between wild boar and domestic pigs (more frequent inspections would be needed for this BSM to be effective) D agreed with A that this BSM does not prevent direct contact C considered that on its own this BSM is not effective in preventing the introduction of the virus nor in preventing the spread (if no improvements of

	biosecurity are made) and that it would be effective in combination with a fence, as it would allow to identify damaged parts
Other comments	REJECT

FARM TYPE I – 8th BSM

Biosecurity measure	*Protective clothing*
Rationales for effectiveness of otherwise of the BSM (or other BSMs)	C and D considered that it is not relevant in an already contaminated environment, especially not on its own A agreed with C B considered this BSM together with *cleaning/disinfection facilities* to be effective in preventing the introduction by humans
Other comments	REJECT

FARM TYPE I – 9th BSM

Biosecurity measure	*Cleaning/disinfection facilities*
Rationales for effectiveness of otherwise of the BSM (or other BSMs)	All experts considered that it is not relevant in an already contaminated environment, especially not on its own
Other comments	REJECT

FARM TYPE I – 10th BSM

Biosecurity measure	*Single solid fence*
Rationales for effectiveness of otherwise of the BSM (or other BSMs)	C noted that *single solid fence*s are more frequently used in C's country and highlighted that the most important aspect is the prevention of direct contact and entry/escape of pigs, which can best be achieved with a solid fence; in addition it also has lower maintenance and is not easily damaged D: in addition to the other reasons, *single solid fence* prevents the entry of wild boar under the fence, by rooting, into the outdoor area (better in this aspect than *double fence*)

	A considered that wild boar could climb up a *single solid fence*, which is considered not to be possible for *double fence*
Other comments	ACCEPT

Final categorisation of Farm Type I BSMs

Please record the final categorisation of the BSMs here.

Accept	*Double fence* *Single solid fence* *Single fence*
Uncertain	*No wild boar baiting* *No access to stored feed* *Removal of uneaten feed* *No access to water*
Reject	*Closed carcass storage* *Daily inspection* *Protective clothing* *Cleaning/disinfection facilities* *Absence of crops/trees*

Farm Type I - ADDITIONAL COMMENTS ON CONSENSUS DISCUSSION

Provide notes on discussion of the magnitude of difference in effectiveness between the Accept and Reject categories	No remarks on the magnitude of the differences were made by the experts.

******BREAK IN DISCUSSION**********

FARM TYPE II

FARM TYPE II – 1st BSM

Biosecurity measure	*Double fence|Single solid fence*
Rationales for effectiveness of otherwise of the BSM (or other BSMs)	The experts considered these BSM relevant for the same reasons as for type I farms
Other comments	ACCEPT

FARM TYPE II – 2nd BSM

Biosecurity measure	*Closed carcass storage*
Rationales for effectiveness of otherwise of the BSM (or other BSMs)	D agrees with the other experts that this BSM does not prevent infection if implemented on its own
Other comments	REJECT

FARM TYPE II – 3rd BSM

Biosecurity measure	Absence of crops and trees
Rationales for effectiveness of otherwise of the BSM (or other BSMs)	C considers that this BSM is not relevant for type II farms because in these types of farms there is a fence/barrier that restricts the animals
Other comments	REJECT

FARM TYPE II – 4th BSM

Biosecurity measure	*Protective clothing*

Rationales for effectiveness of otherwise of the BSM (or other BSMs)	A and C considered *daily inspection*, *protective clothing* and *cleaning/disinfection facilities* to be more important than baiting, feed and water access on type II farms
Other comments	UNCERTAIN

FARM TYPE II – 5th BSM

Biosecurity measure	*No wild boar baiting*
Rationales for effectiveness of otherwise of the BSM (or other BSMs)	A considered that a perimeter exists around the premises of type II farms and therefore felt that this BSM is less relevant for these D considered that wild boar rarely visit the premises and the surroundings of type II farms
Other comments	REJECT

FARM TYPE II – 6th BSM

Biosecurity measure	*No access to water*
Rationales for effectiveness of otherwise of the BSM (or other BSMs)	C and A considered that this BSM is less important as type II farms have separated areas for feeding and watering not accessible from the outside B pointed out that the barriers around water (and feed) on type II farms can/will be overcome by wild boar and considered this BSM important in warm/dry seasons/areas
Other comments	REJECT

FARM TYPE II – 7th BSM

Biosecurity measure	*No access to stored feed*
Rationales for effectiveness of otherwise of the BSM (or other BSMs)	A considered that prevention of wild boar access to stored feed (which is often outside the farm premises in the dirty area) could facilitate preventing that the farmer (who needs to access the feed storage) contaminates the farm premises/the outdoor area D agreed that this BSM could be included in the uncertain or accepted BSM group

Other comments	UNCERTAIN

FARM TYPE II – 8th BSM

Biosecurity measure	*Removal of uneaten feed*
Rationales for effectiveness of otherwise of the BSM (or other BSMs)	Less important on type II farms as the feeding area is surrounded by a barrier and considered less relevant than access to stored feed
Other comments	REJECT

FARM TYPE II – 9th BSM

Biosecurity measure	*Daily inspection*
Rationales for effectiveness of otherwise of the BSM (or other BSMs)	A, B and C considered this is relevant for type II farms because it allows verification of the intactness of barriers separating wild boar and domestic pigs A and C considered *daily inspection*, *protective clothing* and *cleaning/disinfection facilities* to be more important than baiting, feed and water access on type II farms
Other comments	UNCERTAIN

FARM TYPE II – 10th BSM

Biosecurity measure	*Cleaning/disinfection facilities*
Rationales for effectiveness of otherwise of the BSM (or other BSMs)	A and C considered *daily inspection*, *protective clothing* and *cleaning/disinfection facilities* to be more important than baiting, feed and water access on type II farms
Other comments	UNCERTAIN

FARM TYPE II – 11th BSM

Biosecurity measure	*Protective clothing*
Rationales for effectiveness of otherwise of the BSM (or other BSMs)	A and C considered *daily inspection*, *protective clothing* and *cleaning/disinfection facilities* to be more important than baiting, feed and water access on type II farms
Other comments	UNCERTAIN

Final categorisation of Farm Type II BSMs

Accept	*Double fence* *Single solid fence*
Uncertain	*Single fence* *Daily inspection* *Cleaning/disinfection facilities* *Protective clothing* *No access to stored feed*
Reject	*Closed carcass storage* *Absence of crops/trees* *No wild boar baiting* *No access to water* *Removal of uneaten feed*

Farm Type II - ADDITIONAL COMMENTS ON CONSENSUS DISCUSSION

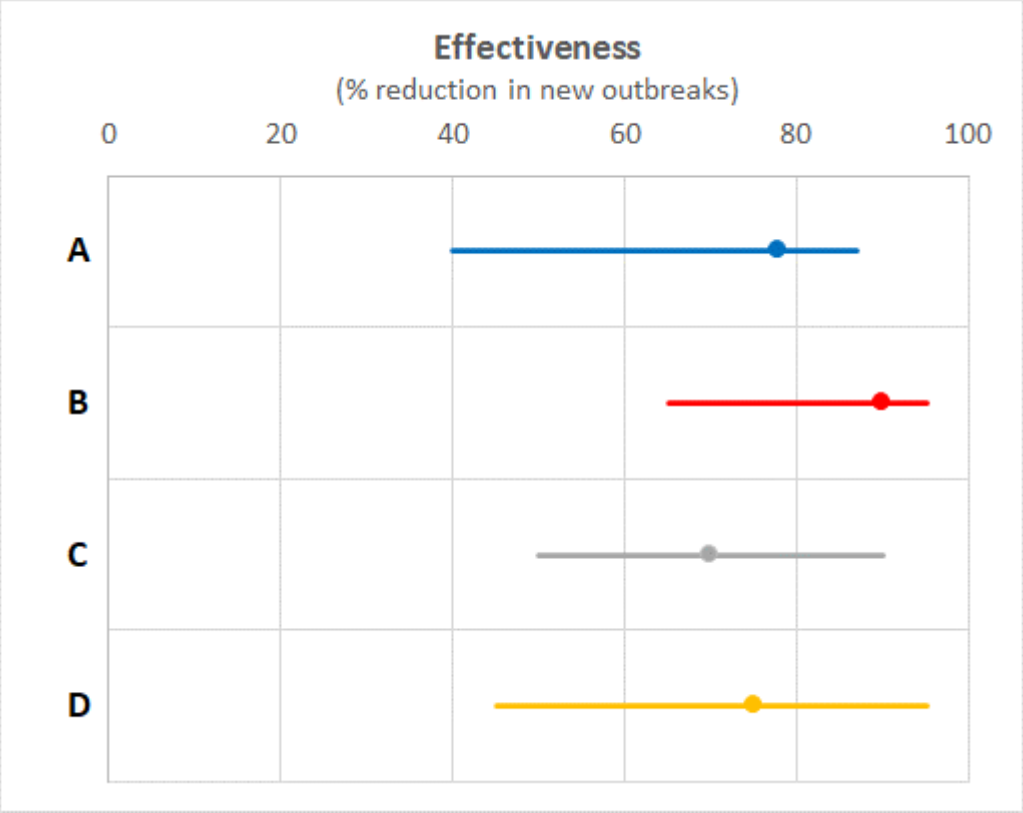
Provide notes on discussion of the magnitude of difference in effectiveness between the Accept and Reject categories	The experts considered that there is a significant difference in effectiveness between the rejected and the uncertain/accepted BSMs

Appendix D – Experts' revised responses on effectiveness, feasibility and sustainability of prioritised biosecurity measures

This appendix contains results for each combination of BSM, farm type and question, in the order they were discussed by the experts in EKE Meetings 2-4. Graphs and tables show the final judgements and reasoning of each expert, including revisions they made during the meetings. An additional graph is included for each question on effectiveness, showing fitted beta distributions for each expert and the linear pool (unweighted average) of those distributions, together with the median and 95% probability interval (PI) for the linear pool distribution. These distributions were fitted after EKE Meeting 4, using the SHELF Shiny app for multiple experts[11], so were not seen by the experts when discussing their judgements.

BSM: DOUBLE FENCE **FARM TYPE I**

Definition: Double row of fencing made from metal net or wire or electric wires around the perimeter of the outdoor area of a minimum height of 1.5 m and with a minimum distance of 1.5 m between fence rows, and weekly inspections of the fence by the farm personnel, to identify rooting and fence damages, especially after strong wind, rainfall or snowfall



Expert	Reasoning
A - low	General BSM not well implemented; e.g. via e.g. contaminated boots, introduction of diseased animals, rodents transmitting ASFV. Rooting is not prevented so in a rare occasion a wild boar could go under both fences.

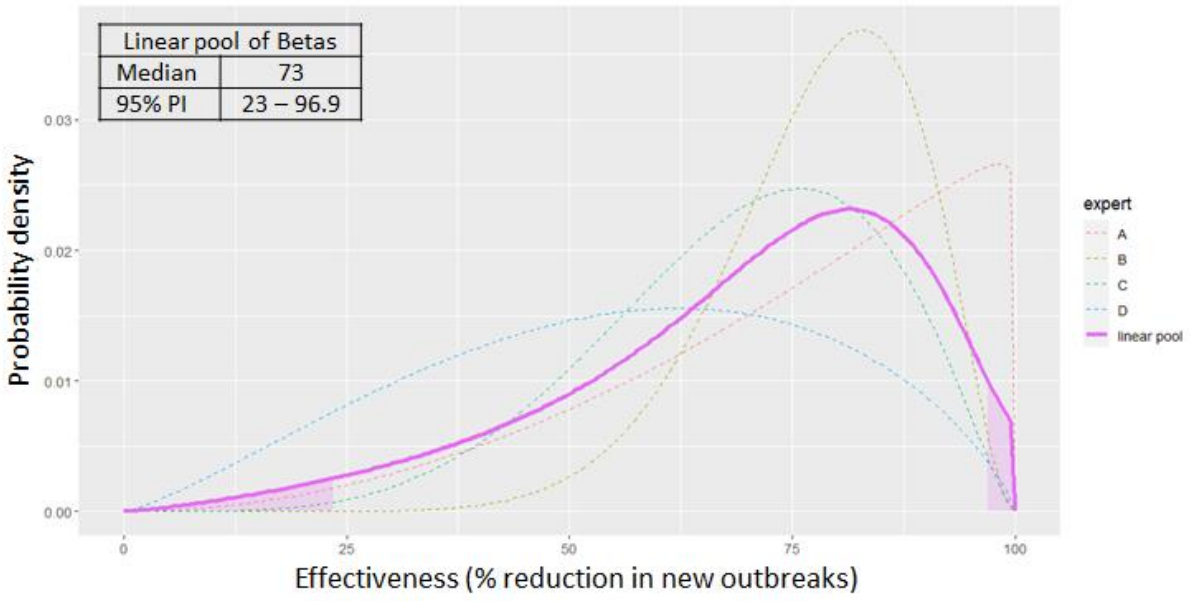
[11] https://jeremy-oakley.shinyapps.io/SHELF-multiple/

	Rare occasion that infected wild boar would still manage to jump over the *double fence* or just over the first fence after which they will be trapped between the 2 fences and closer contact through one fence can be possible. *Double fence* will not prevent a natural water flow if present (or heavy rainfall) to spread ASFV into the fenced area. *Double fence* without solid part/small maze near ground/prevention of rooting will not prevent smaller wild animals or rodents from entering the pasture/domestic pig area. What about the passages in the fences? Applies to all fencing option. Maybe a cattle grid would be needed?
A - high	*Double fence* will reduce direct contact risk to nearly zero. *Double fence* will provide visible barrier for people (which also makes it easier to make general BSM obliged). Type 1 farms currently have no form of fence, a *double fence* will make a huge difference. Since all type I farms will implement a *double fence* the overall risk of spread will reduce as well. Following discussion (10/2) slightly lower upper and median (99-->95 and 85-->80). The effect on the FT1 is larger from the baseline situation where it is more likely that wild boar roam around the outdoor area.

B - low	the *double fence* is in my opinion the most effective measure against introduction and spread of ASF, the application and maintain ace of this BSM during the coming year will safe at least 70% of the farms against introduction, taking for granted all the not specified things (i.e., activities of veterinary services, high attention of the farmer, etc...)
B - high	not the 100% of outbreaks will be prevented because the human factors and the not application of other BSM could affect the 100% farms biosecurity

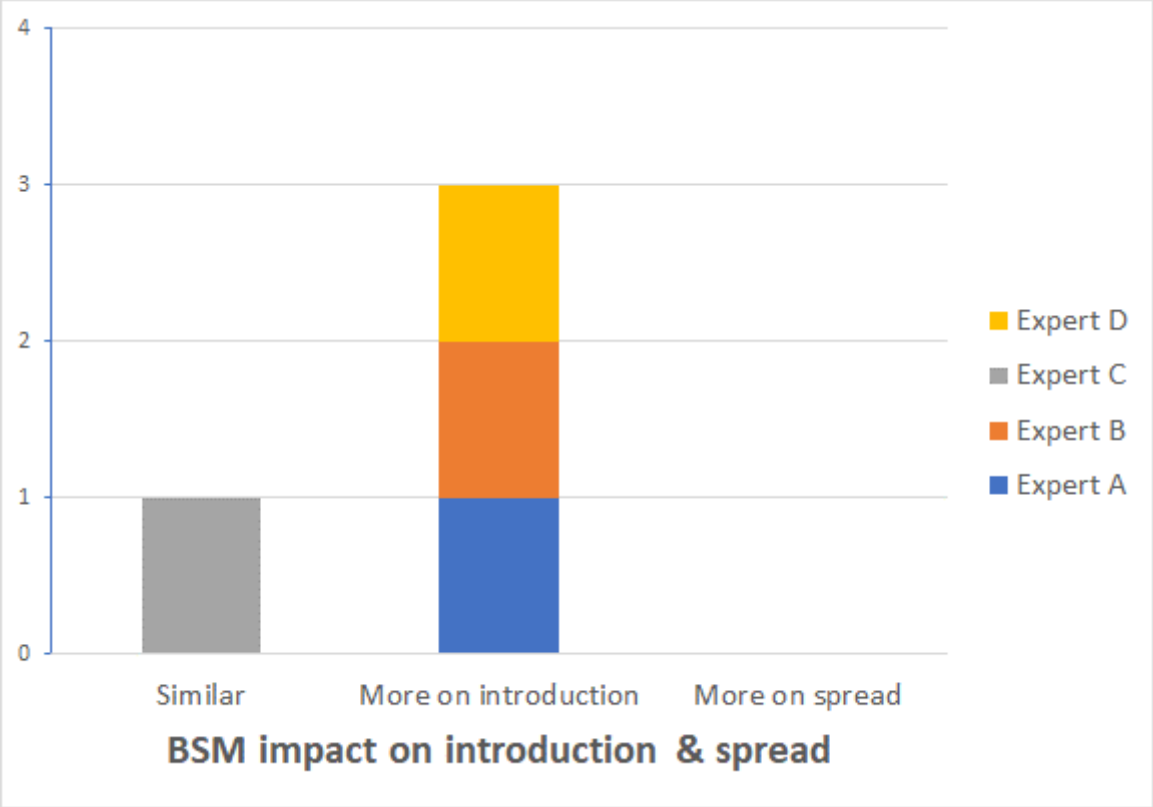
C - low	*double fence* divides the territory between wild and domestic pigs. This way domestic pigs can be infected with ASFV only by anthropogenic factors.
C - high	Domestic pigs can be infected with ASFV by anthropogenic factors.

D - low	Presence of wild boar populations inside the farm area (larger ones) implies a risk; Potential movement of wild boar (inside/outside the farm area going under the fences/gates) between weekly checks; Human movements (mostly of farm personnel) in/out of the farm area poses a risk Indirect pathways of ASF introduction related to sympatric species other than wild boar;
D - high	Direct contact with animals (live or carcasses) is prevented Sporadic human (external to the farm: walkers, hunters, etc.) access is minimised Large FT1 (size/hectares) may not be as frequent (number/density) in the current areas of interest However, wild boar can still pass under the fences or gates, and no specific measures are being applied for the farm personnel



BSM: DOUBLE FENCE **FARM TYPE I**

Definition: Double row of fencing made from metal net or wire or electric wires around the perimeter of the outdoor area of a minimum height of 1.5 m and with a minimum distance of 1.5 m between fence rows, and weekly inspections of the fence by the farm personnel, to identify rooting and fence damages, especially after strong wind, rainfall or snowfall

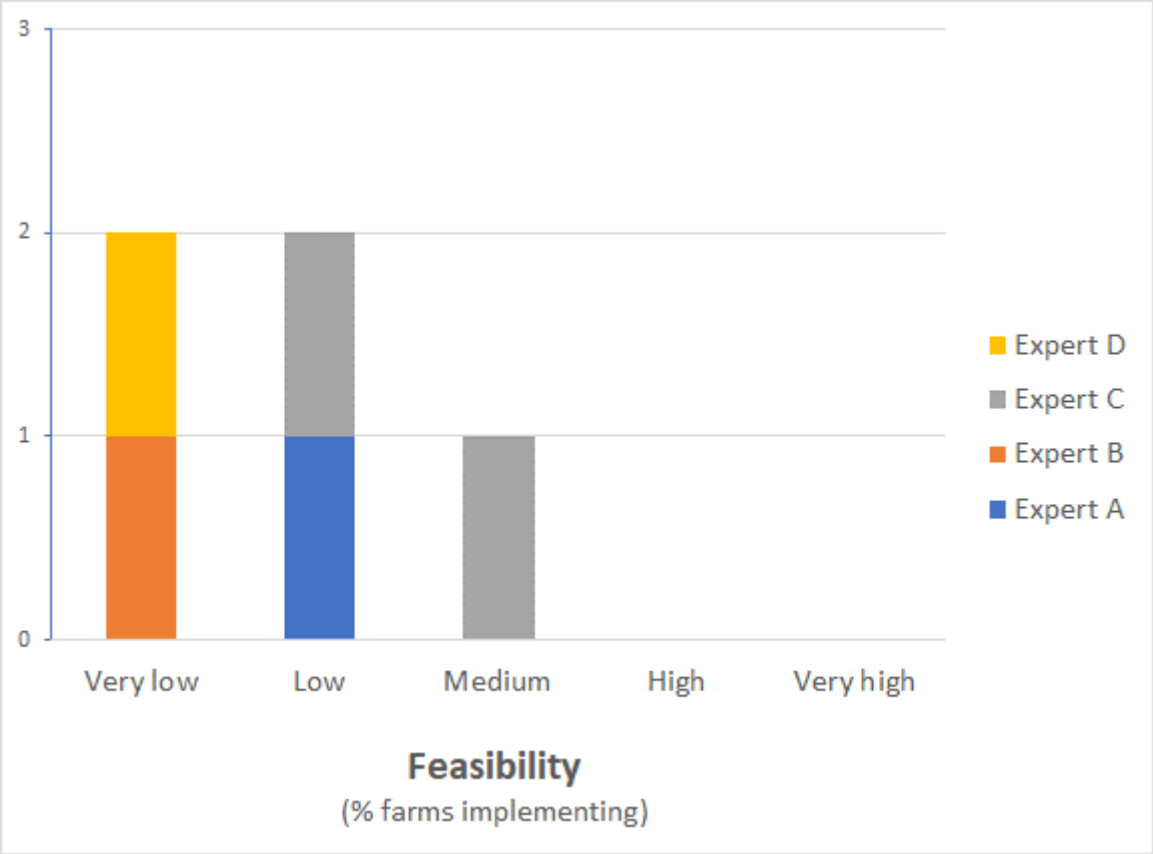


Expert	Reasoning
A	Type I farms had no fence before. Fencing them with an effective *double fence* will mainly reduce the risk of introduction. Spread might also be reduced; diseased animals cannot leave the farm premises easily. The *double fence* will however not prevent human actions that might spread ASFV. Small (wild) animals can still go under the *double fence* and introduce or spread the virus. For type I farms the impact on introduction is however much larger when comparing the situation before vs after implementation.
B	the *double fence* is a very efficient BSM to avoid the nose to nose contact between wild boar and domestic pigs, able to prevent the introduction of the disease. The main pathways prevented are between pigs and wild boar but this BSM does not prevent the spread between indoor and outdoor farms

C	separation of wild and domestic population is the most important measure.
D	Circulation of animals is limited in both directions in/out of the farm, The barrier may minimise more the number of wild board accesses than the domestic pig "escapes" out of the barrier (Expert A's explanation), while human movements remain invariable with its implementation.

BSM: DOUBLE FENCE **FARM TYPE I**

Definition: Double row of fencing made from metal net or wire or electric wires around the perimeter of the outdoor area of a minimum height of 1.5 m and with a minimum distance of 1.5 m between fence rows, and weekly inspections of the fence by the farm personnel, to identify rooting and fence damages, especially after strong wind, rainfall or snowfall

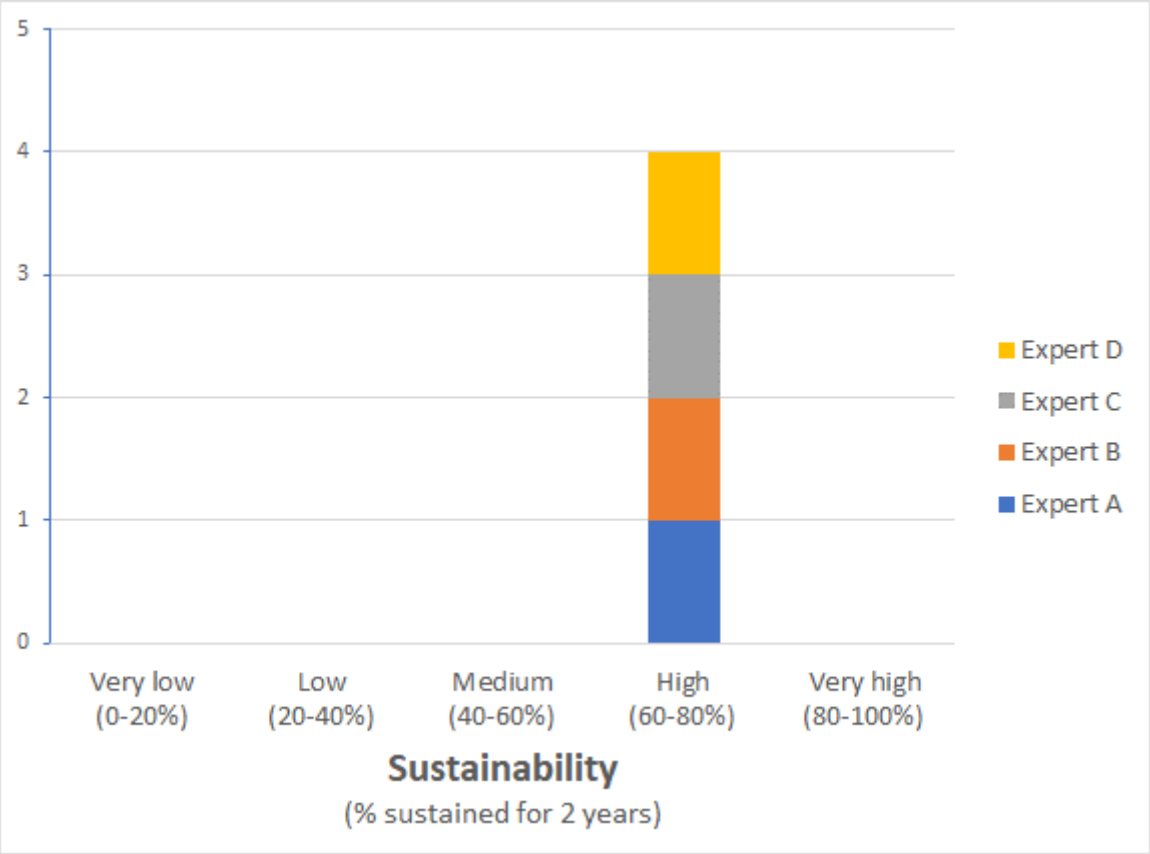


Expert	Reasoning
A	I think most farmers can see the importance of this measure. However, the farming system in type I farms is not very suited to build a double fence around (large acreage, natural surroundings) and/or it might affect the assumptions/conditions under which these type I pigs are kept (e.g. premium price, similar situation as with keeping free range/outdoor poultry inside during AI outbreak/risks; can these eggs still be sold as outdoor?). Costs are very high. E.g. two years ago we've build the outer layer of our double fence in one of our farms (1.5 m high, metal net + 50 cm into the ground). The inner layer (thorn bush, metal net, electric wire) already existed. The costs for 1 km of this outer layer fence was +/- 30.000 euro! Related to all measures: Some kind of sanctions for not implementing the proposed/required measures would be needed in my opinion. Futhermore, we are now considering worst case as "affected areas". However, the outdoor BSM will also be very helpful if there is only a threat in the region. Making sure outdoor pig farms are obliged to have at least a minimum set of BSM would be essential to limit introduction and spread. This should also be sanctioned from e.g. national veterinary authorities. From my experience mainly the holders of pet pigs and some outdoor pig farmers (with

	limited numbers of pigs) are not interested in taking preventive measures and do not see the importance of prevention for the whole sector!
B	Put in place double fence in so large land as the Type I farms is expensive and the outdoor pig farms are not very wealthy, so it will be really difficult to apply. The feasibility strictly depends on farmer education and sensibilization. Furthermore, this BSM will modify the type of breeding which will be no more completely outdoor, and this could be an impediment. To apply this in 1 year could be difficult
C	answer is tricky - we need fence, and this is possible in 80-100% of farms. But is 80-100% for all 3 types of fence, so I don't know what is the correct answer only for double fence!
D	The huge economic investment The impediment of the use of the land between the two fences along the entire perimeter will not be well received The farmers' perception about its effectiveness, as wild boar could pass under the fence

BSM: DOUBLE FENCE **FARM TYPE I**

Definition: Double row of fencing made from metal net or wire or electric wires around the perimeter of the outdoor area of a minimum height of 1.5 m and with a minimum distance of 1.5 m between fence rows, and weekly inspections of the fence by the farm personnel, to identify rooting and fence damages, especially after strong wind, rainfall or snowfall

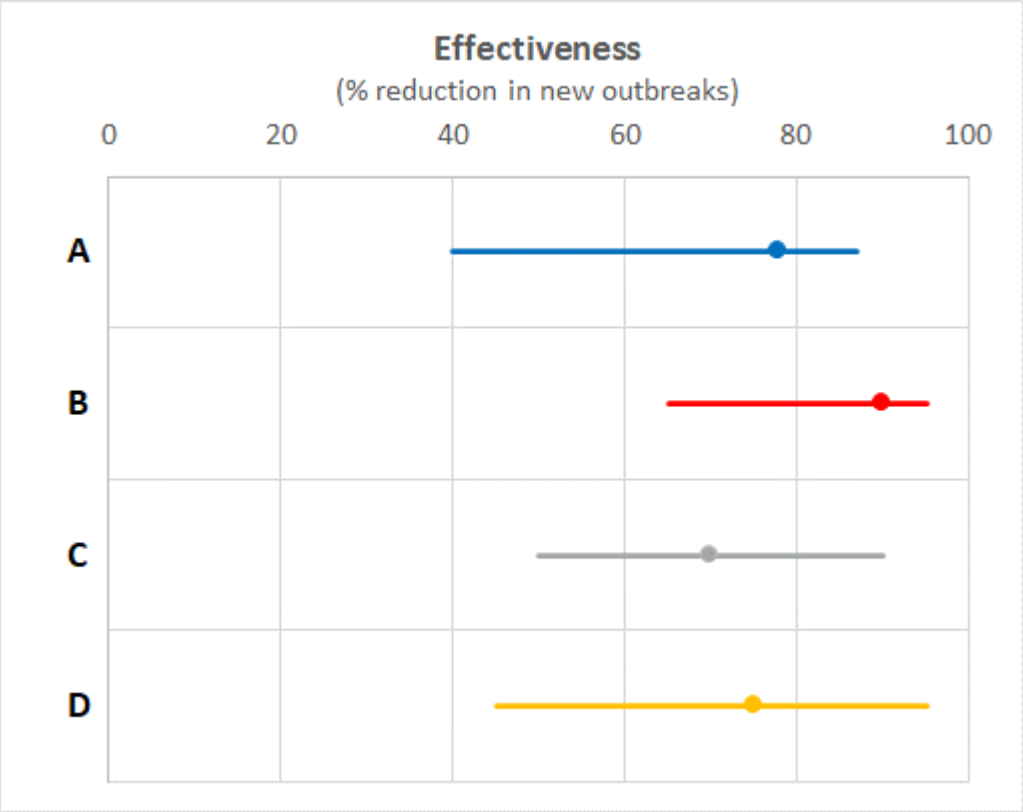


Expert	Reasoning
A	The double fence is a rather permanent structure and therefore most likely still present after 2 years. However, the condition of the fence and whether it's still as effective as directly after placing it (not rooting under, not damaged etc) after 2 years could be questioned. If we consider that weekly inspections and repairs if needed take place this should not affect the condition of the fence. However, repairs might be costly as well. Any (negative) influence of the fence on the premium quality schemes should also be taken into account. Type I farms might normally use a greater acreage to keep their pigs on or switch from land. When a double fence is placed it would be likely that they prefer this area since it will protect their pigs better. Altogether I consider it quite likely that the double fence is still present/used after 2 years.
B	the double fence is a BSM very expensive, but the large expenditure should be done only one time, then this will be not removed but only checked for damages. Otherwise, the farmers will take care about the fence after they will implement this increasing the sustainability

C	It is not expensive to maintain once it has been built.
D	Considering the huge investment, farmers will take care of fences, guaranteeing the sustainability of the measure. However, proper maintenance of the fencing system over two years will be very difficult in FT1 (especially those using electrical devices).

BSM: DOUBLE FENCE **FARM TYPE II**

Definition: Double row of fencing made from metal net or wire or electric wires around the perimeter of the outdoor area of a minimum height of 1.5 m and with a minimum distance of 1.5 m between fence rows, and weekly inspections of the fence by the farm personnel, to identify rooting and fence damages, especially after strong wind, rainfall or snowfall

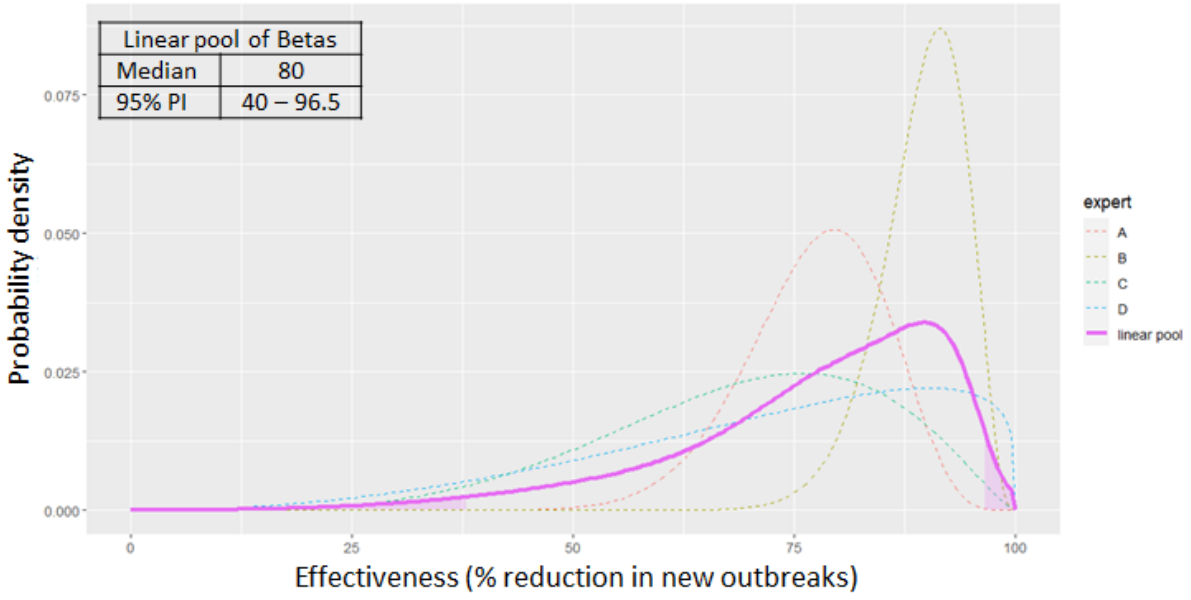


Expert	Reasoning
A - low	Similar to type I farms. The idea of the double fence (enclosure of the domestic pig roaming area) will be similar in type II farms compared to type I farms, therefore the probabilities should be the same as well as the reasoning. The differences between type I and type II have been assessed in the meeting on the 27th. To my opinion we are here asked specifically for our judgement of this specific outdoor BSM. Since this will have the same effect in both farm types (and taking into consideration that contact with wild boar provides the biggest risk) to my opinion we should have the same probabilities for effectiveness. 10/2: risk of introduction via humans is could be more important for FT2.
A - high	Similar to type I farms. The idea of the double fence will be similar in type II farms compared to type I farms; therefore, the probabilities should be the same as well as the reasoning. Following discussion (10/2): Although overall we considered the risk of becoming infected to be lower in type II farms in comparison to type 1 farms, I still consider the potential (positive) effect of implementing this BSM to be quite similar in FT1 and FT2, since the type 2 farms might have "ineffective" fences. The effect on the FT2 is a little less in comparison to FT1 since it is estimated that there was already some kind of fencing and it is in close proximity to the farm buildings, hence in the baseline situation it was already less likely that wild boar roam around the outdoor area. Following discussion (10/2) slightly lower upper and median (99-->87 and 85-->78).

B - low	the low probability is a little bit higher in Type II because the farm land is smaller and better under control, and given the higher pig density (i.e., the same number of pigs in a smaller area near the farm), avoid the entrance of wild boar is more efficient in preventing the infection than in Type I where the number of contacts between pigs are lower.
B - high	not the 100% of outbreaks will be prevented because the human factors and the not application of other BSM could affect the 100% farms biosecurity, but given the higher pig density (i.e., the same number of pigs in a smaller area near the farm), avoid the entrance of wild boar is more efficient in preventing the infection than in Type I where the number of contacts between pigs are lower.

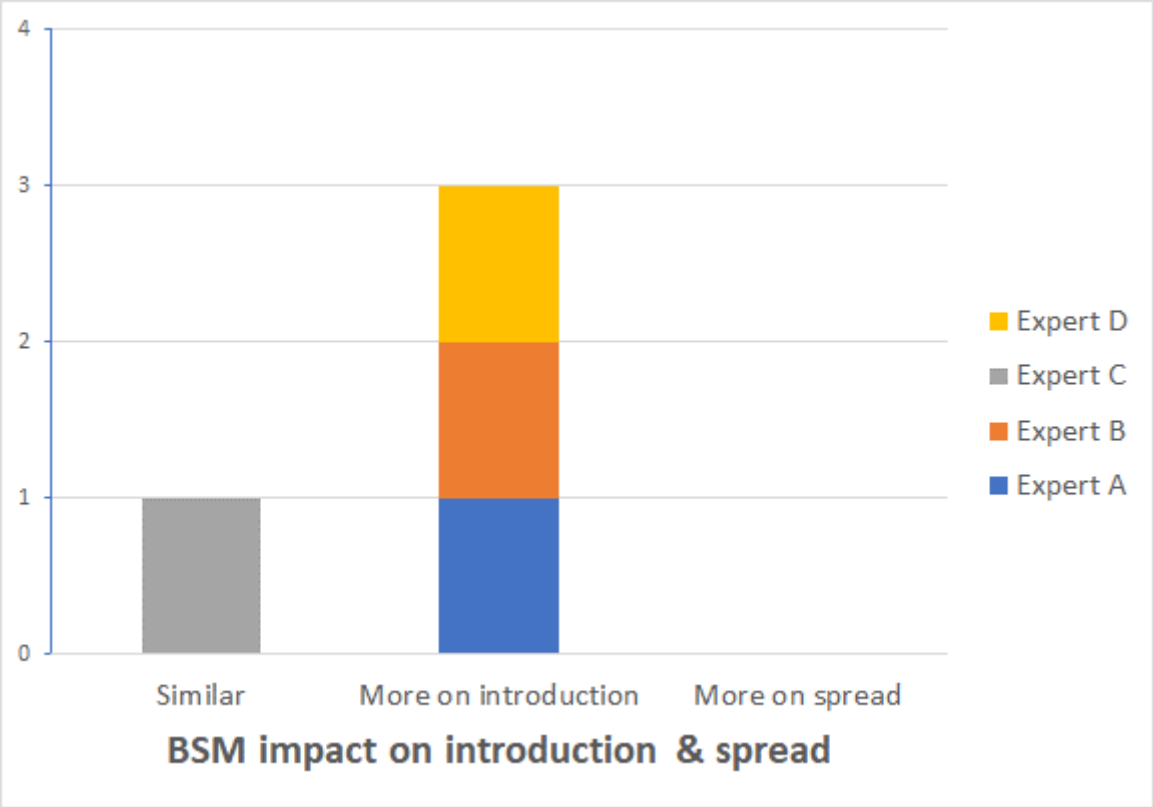
C - low	double fence divide territory between wild and domestic pigs. This way domestic pigs can be infected with ASFV only by anthropogenic factors.
C - high	Domestic pigs can be infected with ASFV by anthropogenic factors.

D - low	Absence of wild boar populations inside the farm area; Easy weekly revision of the fences (or even more frequently) Human(farm personnel) movements in/out of the farm STILL implies risk less probability of indirect pathways for ASF introduction related with sympatric species Probability of pathways for ASF introduction related with carcasses
D - high	Direct contact with animals (live or carcasses) is prevented Sporadic human (external to the farm) access is minimised (and less probable than FT1) No specific measures are been applied regarding farm personnel



BSM: DOUBLE FENCE **FARM TYPE II**

Definition: Double row of fencing made from metal net or wire or electric wires around the perimeter of the outdoor area of a minimum height of 1.5 m and with a minimum distance of 1.5 m between fence rows, and weekly inspections of the fence by the farm personnel, to identify rooting and fence damages, especially after strong wind, rainfall or snowfall

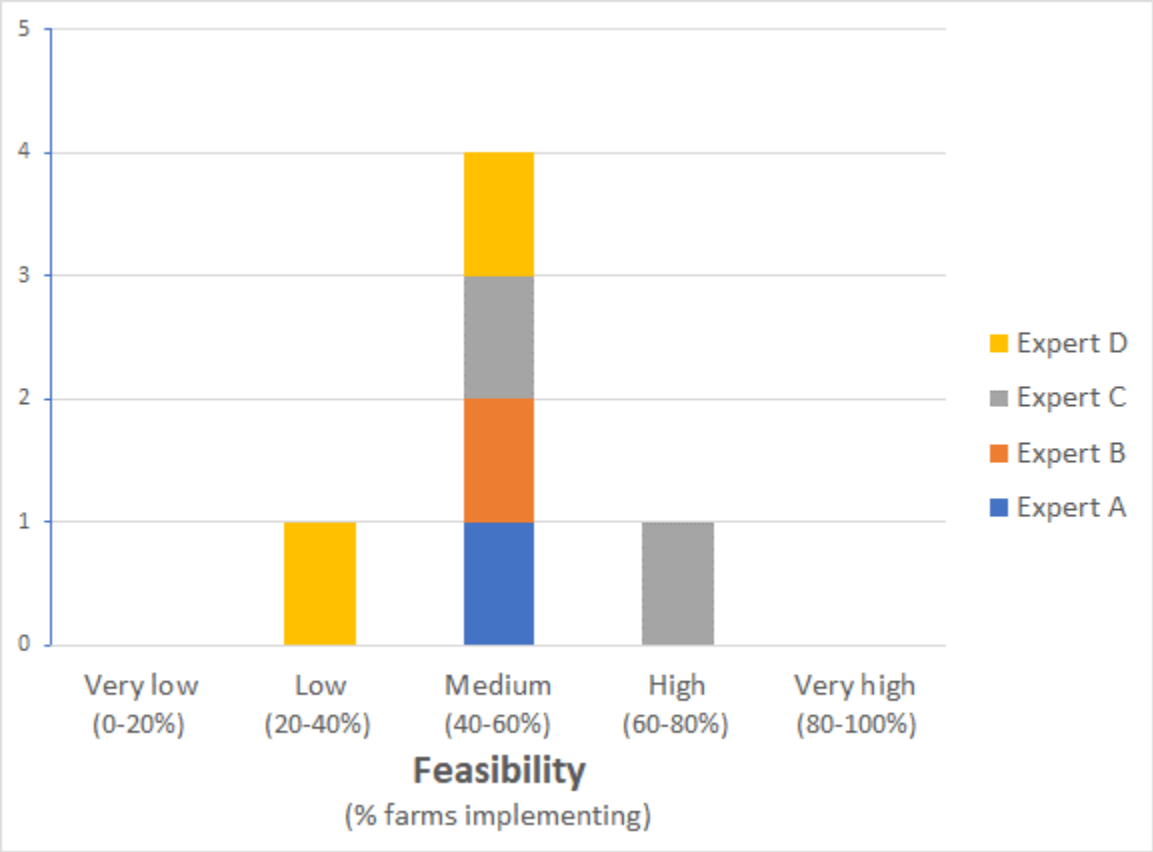


Expert	Reasoning
A	Introduction of ASFV into the farm will be limited by double fence; see reasons upper probability. However the impact on spread could also be significant; diseased animals cannot leave the farm premises easily. The double fence will however not prevent human actions that might spread ASFV. Small (wild) animals can still go under the double fence and spread the virus. Overall I think that infected wild boar might be more interested to enter the farm premises and introduce the virus compared to a diseased domestic pig willing to leave the premises. The risk that people spread the virus from out of the premises is similar in comparison to Type I. Therefore, I choose the option that this measure has more impact on introduction.
B	the double fence is a very efficient BSM to avoid the nose to nose contact between wild boar and domestic pigs, able to prevent the introduction of the disease. Of course, if the farm become infected, this measure will have an impact also preventing the spread...

C	separation of wild and domestic population is the most important measure.
D	Circulation of animals is limited in both directions in/out of the farm, The barrier may minimise more the number of wild board accesses than the domestic pig "escapes" out of the barrier (Expert A's explanation), while human movements remain invariable with its implementation.

BSM: DOUBLE FENCE **FARM TYPE II**

Definition: Double row of fencing made from metal net or wire or electric wires around the perimeter of the outdoor area of a minimum height of 1.5 m and with a minimum distance of 1.5 m between fence rows, and weekly inspections of the fence by the farm personnel, to identify rooting and fence damages, especially after strong wind, rainfall or snowfall



Expert	Reasoning
A	For type II farms this will be a bit bipolar. Larger and professional type II farms will most certainly see the benefits of a double fence. There will also be some pressure from other pig (indoor) pig farmers to make sure outdoor pigs are well protected against the risks coming from wild boar. Still the costs will be substantial (subsidies will be very helpful!) which might reduce their willing to implement the fence. However, I still thing a high percentage of type II farmers will consider it feasible to place the fence. On the other hand we should also consider the pet pig households. I think these private individuals are much less educated on the risks of ASF (e.g. culling) and they might also care less (in relation to economic losses etc). I am not sure, when not well educated, whether they would be willing to invest quite a substantial amount for a double fence. I consider implementation in this category to be low. Combining these two and taking into account that there are almost as many pet pig holdings as professional holdings in the Netherlands I chose medium feasibility. In other countries the pet pig holdings might be less numerous however implementation will still be quite low resulting in them being a quite big risk to commercial pig farmers.
B	to put in place double fence in not so large land as well as Type II could be even more possible and more feasible in type II rather than type I, considering that these last

	already have a different farming practised more careful on the close pigs and avoid contact with wild boar. But this always depend on farmer sensibilization (or obligation?)
C	answer is tricky - we need a fence, and this is possible in 80-100% of farms. But is 80-100% for all 3 types of fence, so I don't know what the correct answer is only for double fence!
D	High economic investment Farmer's perception about its effectiveness The problem of the land between fences could be more easily managed, since FT2 are spatially separated Political reasons (pressure from indoor sector) can push some farmers to start its implementation in FT2

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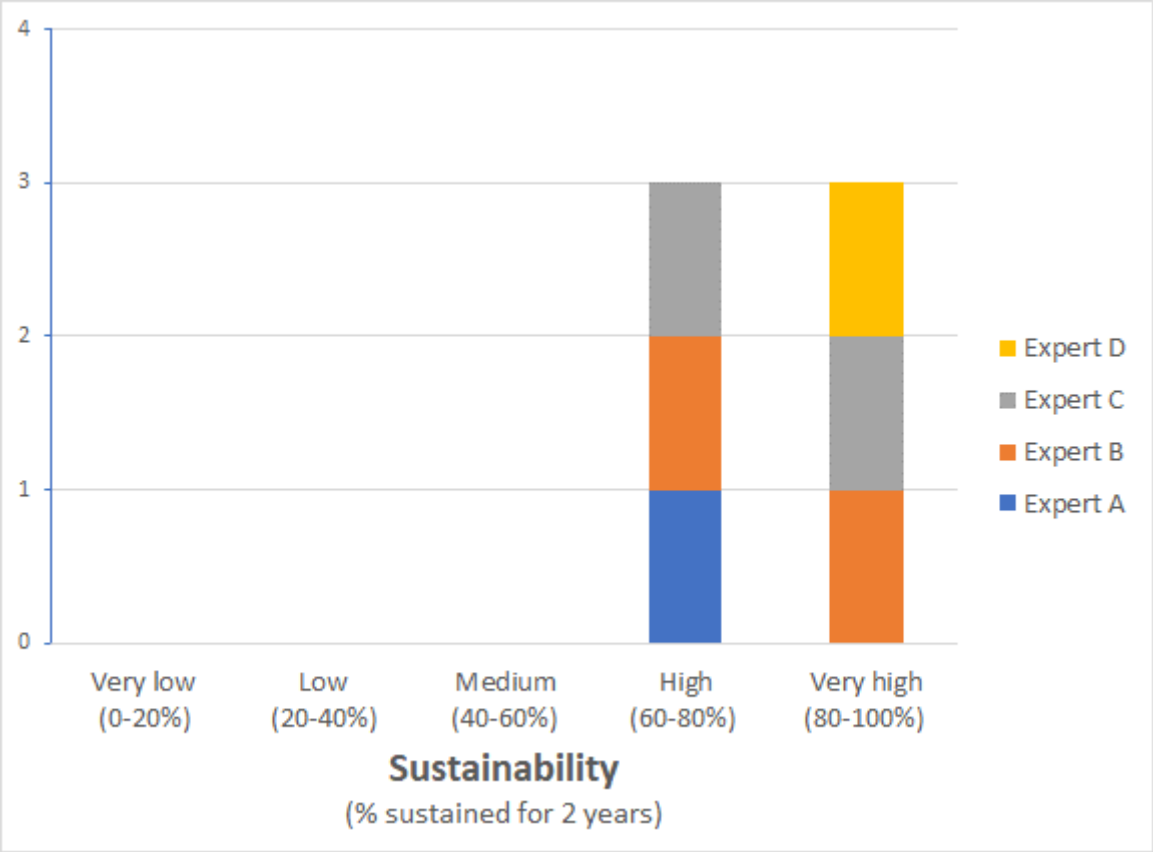
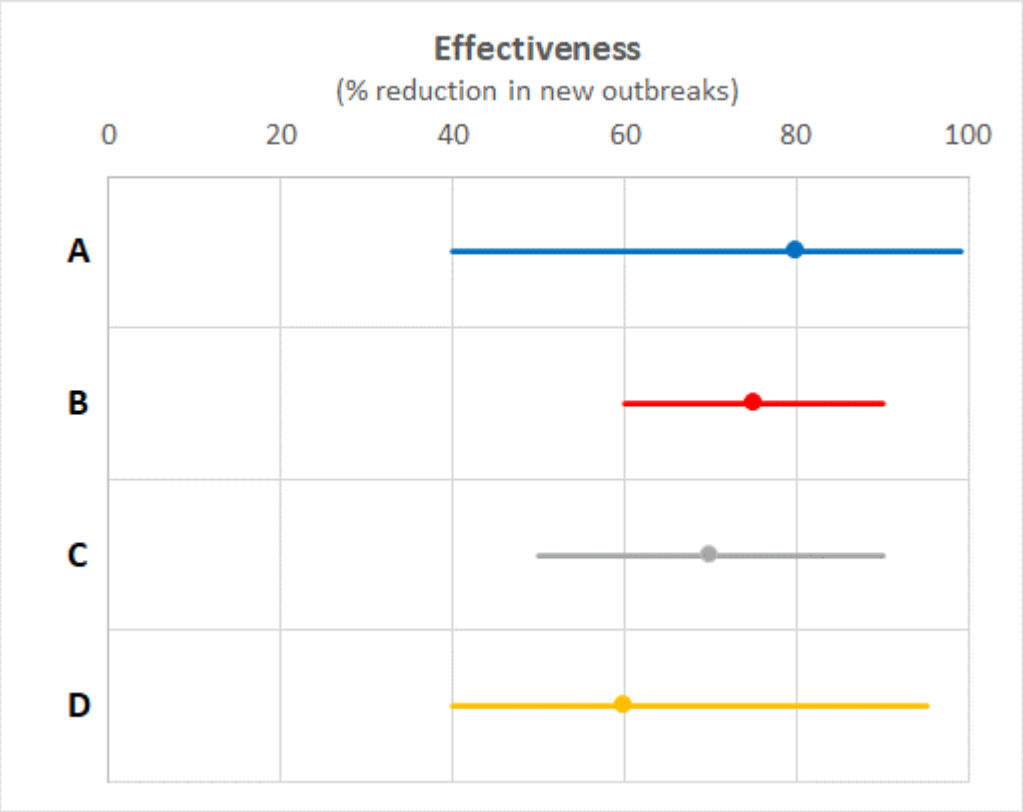


Expert	Reasoning
A	Similar to reasoning for type I farms. Maintenance might be a bit easier due to the fact that the fence is closer to farm buildings.
B	in type II maybe the sustainability could arrive to very high (rather than Type I), because this type of farm is more incline to change their mind and farming practised more similar to indoor

C	is not expensive to maintain if is built.
D	Considering the high investment, farmers will assure fence maintenance, guaranteeing the sustainability of the measure.

BSM: SINGLE SOLID FENCE **FARM TYPE I**

Definition: Single row solid fence made from metal, masonry or other solid material around the perimeter of the outdoor area of a minimum height of 1.5 m, with measures to prevent rooting, e.g. mesh skirt buried underground or cement underground



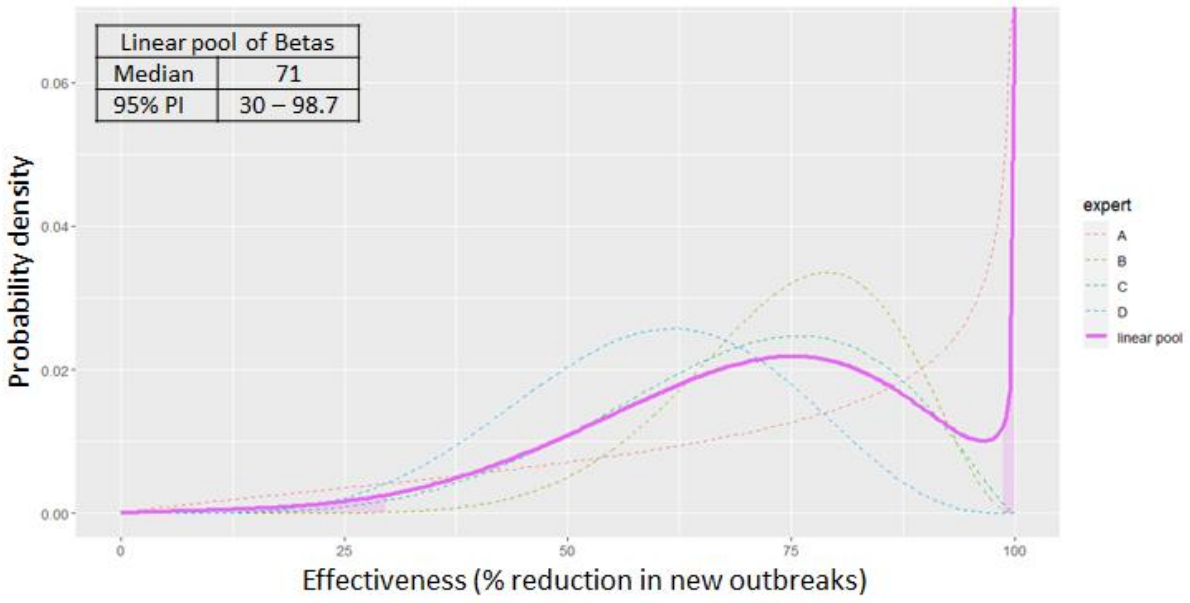
Expert	Reasoning
A - low	General BSM not well implemented; e.g. via e.g. contaminated boots, introduction of diseased animals, rodents transmitting ASFV. One fence might not fully prevent that infected wild boar would still manage to jump over the fence or "climb" up the fence and nose-nose contact would be possible. Comparing the risk of rooting for BSM 1 with the risk of climbing for BSM 2 I finally reached the same lower probability for both BSMs. What about the passages in the fences? Applies to all fencing option. Maybe a cattle grid would be needed?
A - high	Single solid fence will reduce direct contact risk to very low. Single solid fence will provide visible barrier for people (which also makes it easier to make general BSM obliged). Type 1 farms currently have no form of fence, a single solid fence will make a huge difference. Since all type I farms will implement a single solid fence the overall risk of spread will reduce as well. Rooting is prevented so this risk is not present compared to BSM1. The solid structure might also prevent rodents from getting into the premises. Solid fence will most likely stop natural water flow if present (or heavy rainfall) to spread ASFV into the fenced area. Comparing again here BSM 1 (no prevention of rooting as a limiting point) to BSM 2

	(risk of climbing as a limiting point) results again in my estimation that the probabilities are equal. As discussed during the meeting 10/2 the risk of jumping is probably of less importance than the prevention of rooting. I slightly lowered my high probability for BSM 1, so I'll leave my high probability up at 99 for BSM 2 to have the positive difference related to prevention of rooting for BSM 2. I will however put my median down to 80, to have it similar to BSM1.

B - low	the lower probability is a little bit lower than that of double fence, considering that this BSM is a little low efficient than the previous one
B - high	the upper probability is a little bit lower than that of double fence, considering that this BSM is a little low efficient than the previous one

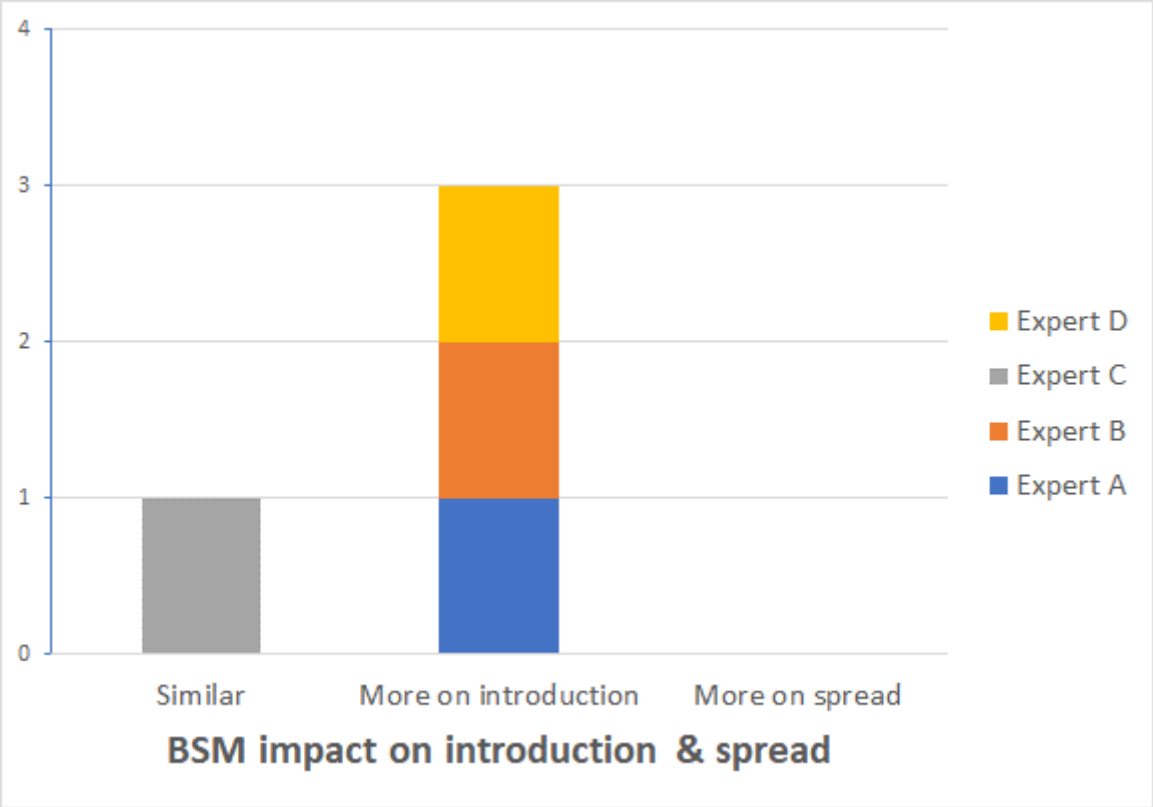
C - low	single solid fence divide territory between wild and domestic pigs. This way domestic pigs can be infected with ASFV only by anthropogenic factors.
C - high	Domestic pigs can be infected with ASFV by anthropogenic factors.

D - low	Presence of wild boar populations inside the farm area (bigger ones) implies a risk Potential accesses of wild boar by rooting are mostly prevented, but they can enter by jumping Human accesses (personnel external to the farm) can be easier compared to double fence system Indirect pathways for ASF introduction related with sympatric species different than wild boars
D - high	Direct contact with animals (live or carcasses) is prevented Most wild boar accesses to the FT1 area would be prevented However, no specific measures are been applied regarding farm personnel



BSM: SINGLE SOLID FENCE **FARM TYPE I**

Definition: Single row solid fence made from metal, masonry or other solid material around the perimeter of the outdoor area of a minimum height of 1.5 m, with measures to prevent rooting, e.g. mesh skirt buried underground or cement underground

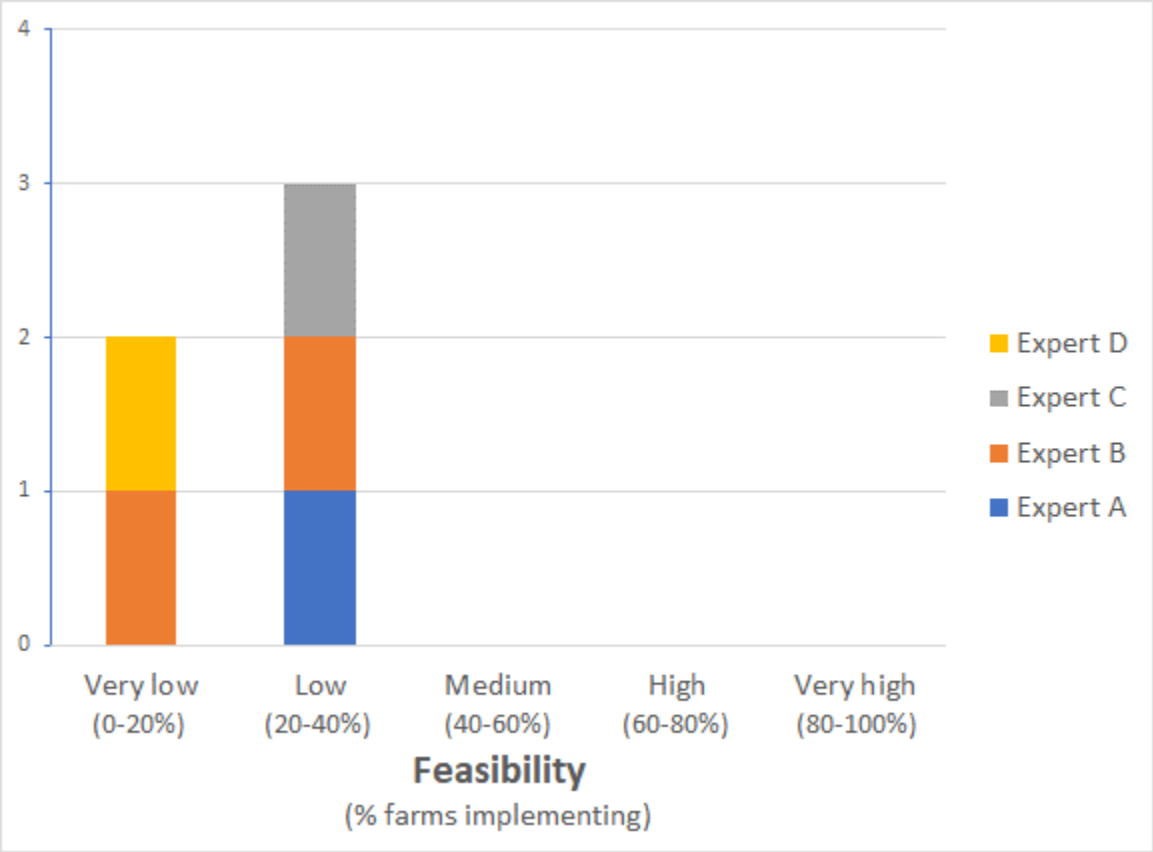


Expert	Reasoning
A	Type I farms had no fence before. Fencing them with an effective single solid fence will mainly reduce the risk of introduction. Spread might also be reduced; diseased animals cannot leave the farm premises easily. The single solid fence will however not prevent human actions that might spread ASFV. Small (wild) animals are prevented to go under the single solid fence; the risk of introduction or spread via them is almost zero (assuming that passages are also well made!). For type I farms the impact on introduction is however much larger when comparing the situation before vs after implementation.
B	the single solid fence is very efficacy BSM to avoid the noise to noise contact between wild boar and domestic pigs, able to prevent the introduction of the disease. Of course, if the farm become infected, this measure will have an impact also preventing the spread...

C	separation of wild and domestic population is the most important measure.
D	Circulation of animals is limited in both directions in/out of the farm, The barrier may minimise more the number of wild board accessing than the domestic pig "escaping" out of the barrier (Expert A's explanation), while human movements remain invariable with its implementation.

BSM: SINGLE SOLID FENCE **FARM TYPE I**

Definition: Single row solid fence made from metal, masonry or other solid material around the perimeter of the outdoor area of a minimum height of 1.5 m, with measures to prevent rooting, e.g. mesh skirt buried underground or cement underground



Expert	Reasoning
A	I think most farmers can see the importance of this measure. However, the farming system in type I farms is not very suited to build a single solid fence around (large acreage, natural surroundings, difficult soil/rocky conditions?) and/or it might affect the assumptions/conditions under which these type I pigs are kept (e.g. premium price, similar situation as with keeping free range/outdoor poultry inside during AI outbreak/risks; can these eggs still be sold as outdoor?). Costs are probably high. Overall, I consider the feasibility for single solid fence similar to double fence.
B	the implementation of this measure is difficult considering the necessary force and money to build a solid fence around the large land as Type I farm

C	answer is tricky - we need a fence, and this is possible in 80-100% of farms. But is 80-100% for all 3 types of fence, so I don't know what the correct answer is only for double fence!
D	Huge economic investment Environmental regulations may not allow its implementation

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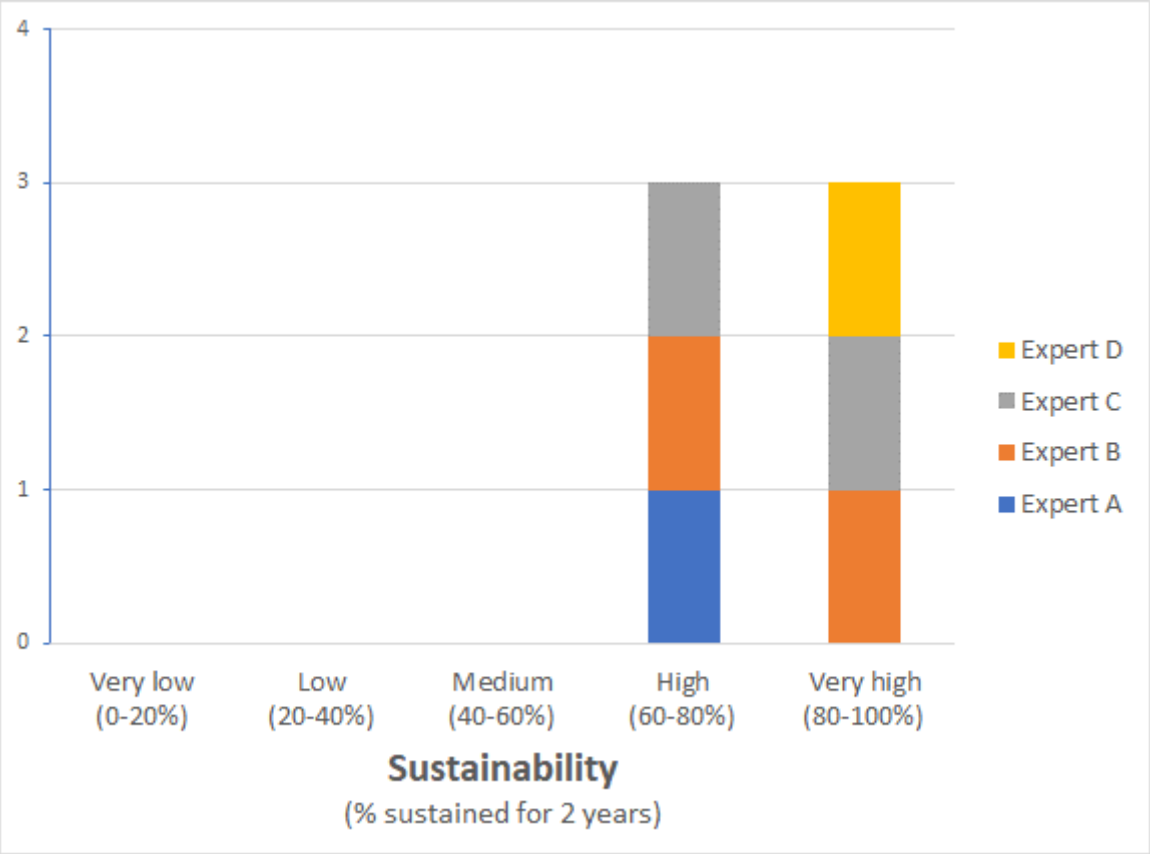
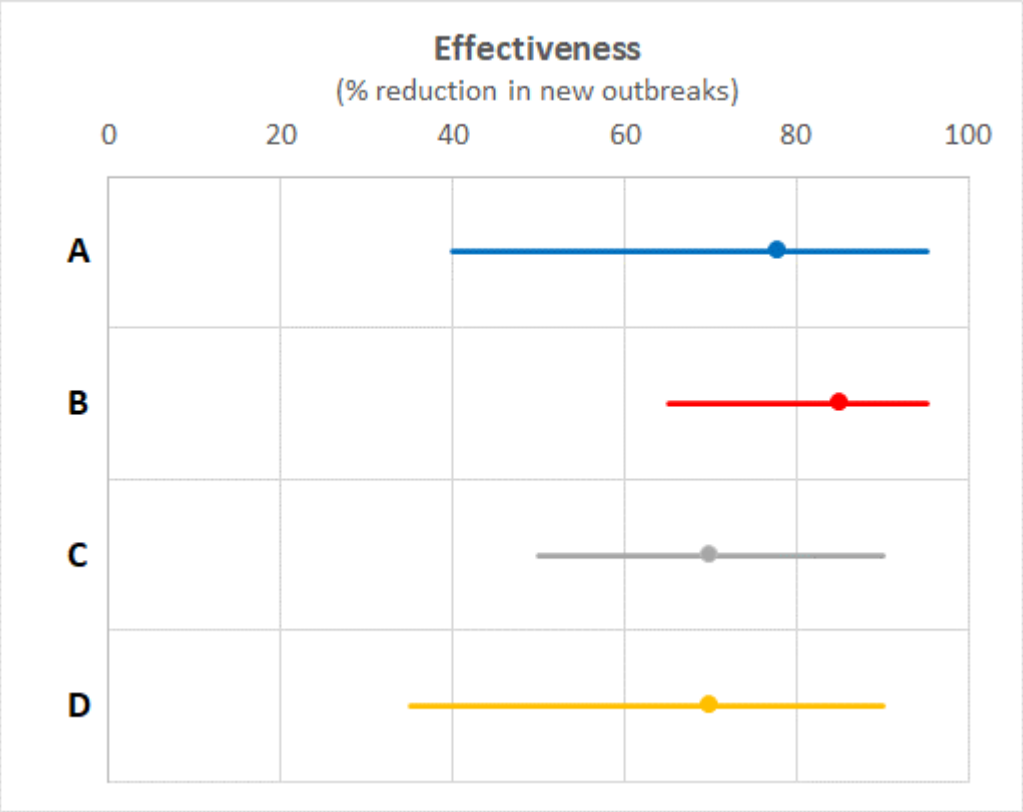


Expert	Reasoning
A	The single solid fence is a rather permanent structure and therefore most likely still present after 2 years. The condition of this fence and whether it's still as effective as directly after placing it (not damaged etc) after 2 years will be better in comparison to double fence. Repairs might be costly as well. Any (negative) influence of the fence on the premium quality schemes should also be considered. Type I farms might normally use a greater acreage to keep their pigs on or switch from land. When a single solid fence is placed it would be likely that they prefer this area since it will protect their pigs better. Altogether I consider it quite likely that the single solid fence is still present/used after 2 years.
B	the damage to solid single fence may could be lower than double fence and for this reason the sustainability is higher. However, considering the high investment, about the 80% (including also a 100%) of the farmers could take care about the solid fence and guarantee the sustainability

C	It is not expensive to maintain once it has been built.
D	Considering the huge investment, farmers will take care of fences guaranteeing the sustainability of the measure. Even a damage could exist on the fence (meaning high risk for ASF introduction/spread), the percentage of this situations should be little, since structure of single solid fence is hard.

BSM: SINGLE SOLID FENCE **FARM TYPE II**

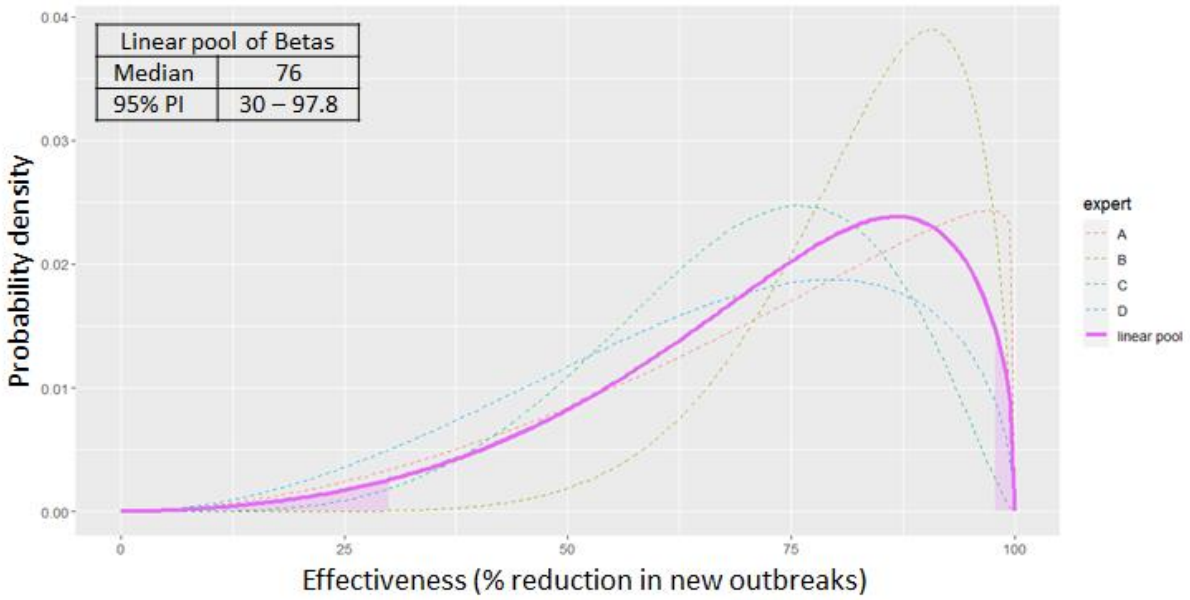
Definition: Single row solid fence made from metal, masonry or other solid material around the perimeter of the outdoor area of a minimum height of 1.5 m, with measures to prevent rooting, e.g. mesh skirt buried underground or cement underground



Expert	Reasoning
A - low	Similar to BSM2 for type I. 10/2 Changed the median in line with my change for type I farms, kept upper on 99 since prevention of rooting is more important than jumping.
A - high	Similar. Following the discussion (10/2) and taking into account that we consider the risk of becoming infected to be lower in FT2 (closer to farm buildings, some kind of fence in baseline) but on the other hand the effect of the fence itself is similar made me slightly reduce my estimates for FT2. (99--> 95 and 80--> 78)
B - low	the lower probability is a little bit lower than double fence but higher than type I, considering that this BSM is a little less efficient than the double fence one but the land is smaller and better controlled than Type I
B - high	the upper probability is a little bit lower than double fence but higher than type I, considering that this BSM is a little less efficient than the double fence one but the land is smaller and better controlled than Type I

C - low	single solid fence divide territory between wild and domestic pigs. This way domestic pigs can be infected with ASFV only by anthropogenic factors.
C - high	Domestic pigs can be infected with ASFV by anthropogenic factors.

D - low	Absence of wild boar populations inside the farm area less probability of indirect pathways for ASF introduction related with sympatric species less probability of pathways for ASF introduction related with carcasses Human (farm personnel) movements in/out of the farm still implies risk
D - high	Direct contact with animals (live or carcasses) is prevented and also sporadic access of wild boar under the fence However, no specific measures are been applied regarding farm personnel



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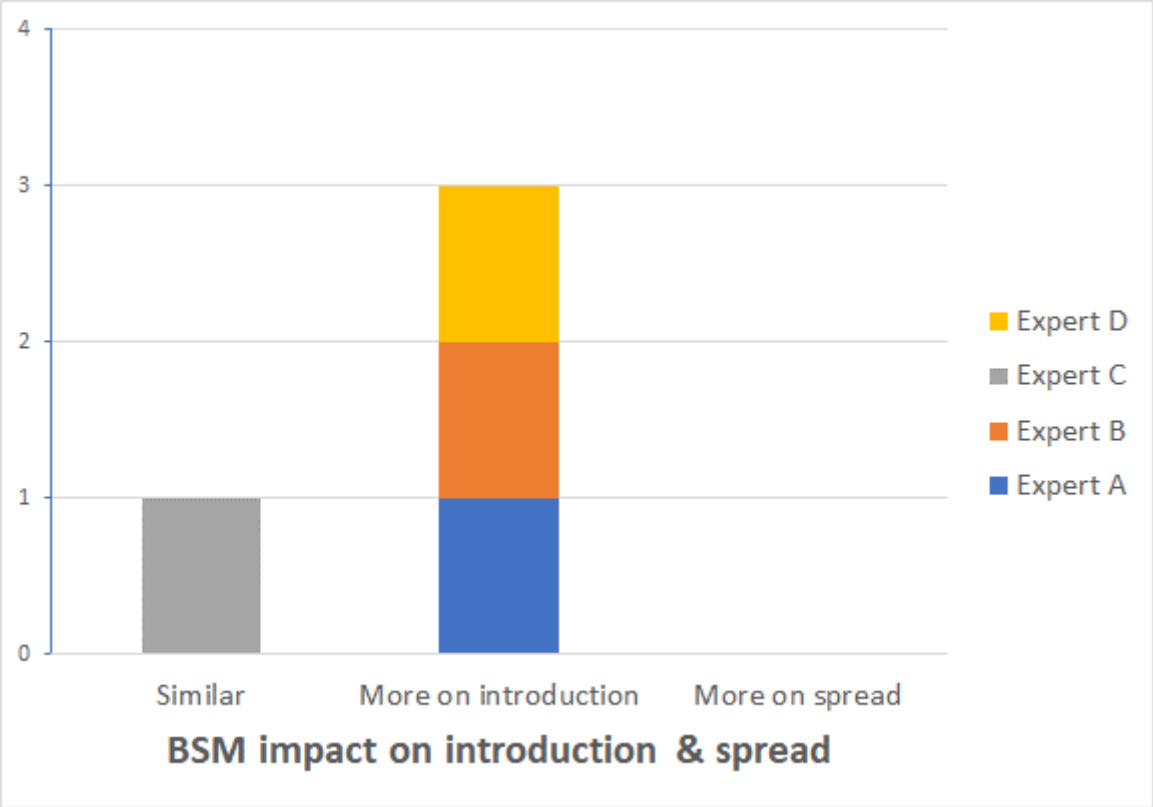
Definition: Single row solid fence made from metal, masonry or other solid material around the perimeter of the outdoor area of a minimum height of 1.5 m, with measures to prevent rooting, e.g. mesh skirt buried underground or cement underground



Expert	Reasoning
A	Although type II farms had already some kind of fence only now this single solid fence will be very effective against introduction of diseased wild boar or other wild animals. Spread will be limited as well, but reasoning as mentioned for type I farms still applies. Therefore also here chosen for more impact on introduction.
B	the single solid fence is very efficacy BSM to avoid the noise to noise contact between wild boar and domestic pigs, able to prevent the introduction of the disease. Of course, if the farm become infected, this measure will have an impact also preventing the spread...

C	separation of wild and domestic population is the most important measure.
D	Circulation of animals is limited in both directions in/out of the farm, The barrier may minimise more the number of wild board accessing than the domestic pig "escaping" out of the barrier (Expert A's explanation), while human movements remain invariable with its implementation.

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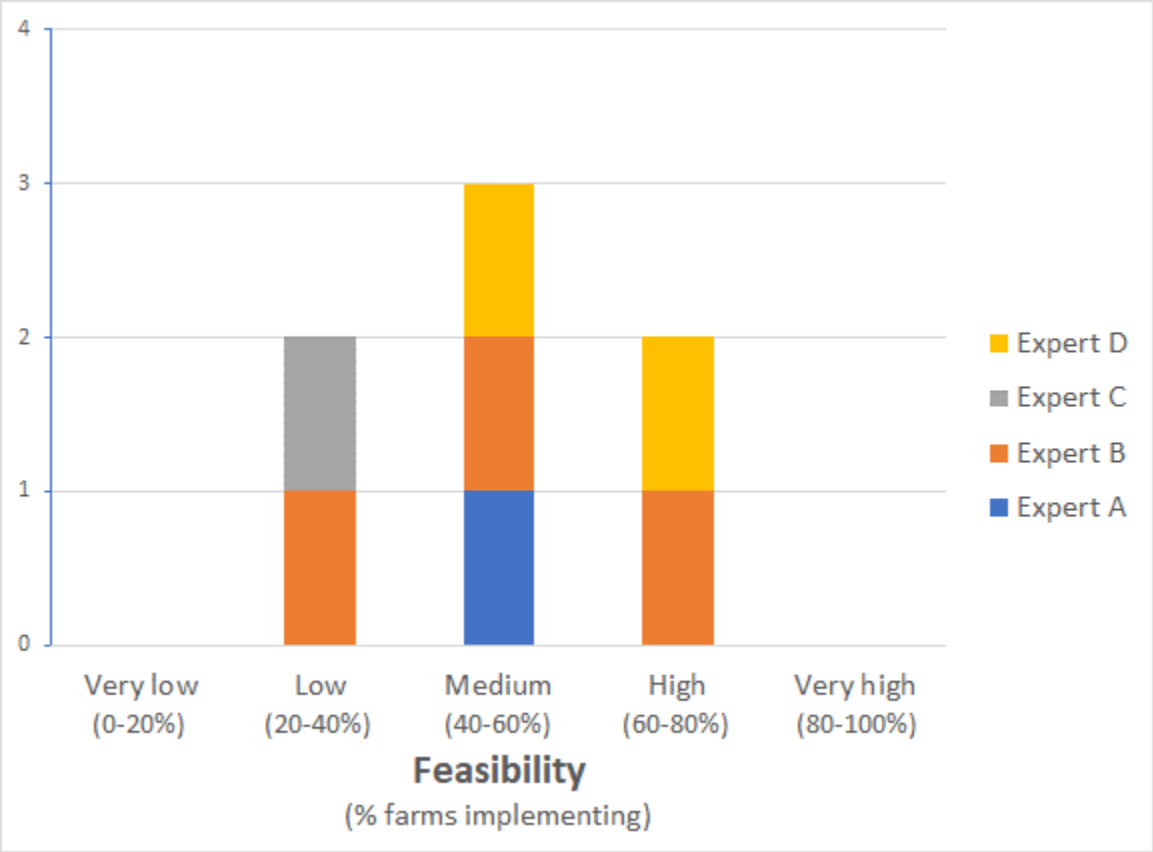

Expert	Reasoning
A	I think most farmers can see the importance of this measure. For type II farms it will be easier to make the fence (close to farm buildings, most likely the soil conditions are better for building the structure). Most likely the assumptions/conditions under which these type II pigs are kept will not be affected by this single solid fence. Extra information: In NL the 3-star "Beter Leven" from the animal welfare organization requires pigs in this scheme to have a free sight of minimum 5 meters. A single solid fence could prevent this. Private persons keeping pet pigs might be more willing to build a single solid fence around their premises in comparison to a double fence. Costs are probably high. Overall I consider the feasibility for single solid fence similar to double fence and more feasible for type II farms in comparison to type I farms and higher in comparison to a double fence due to the fact that private individuals will most likely implement it better/easier. Related to the discussion 10/2 (one expert mentioned that although feasible, in the Balkan region it is not very likely that farmers will actually implement it), I changed my opinion from high to medium.
B	

	this measure is difficult to implement considering the necessary force and money to build a solid fence around the farm, but a little bit high than Type I farm given the smaller area and the probably different farming production
C	answer is tricky - we need a fence, and this is possible in 80-100% of farms. But is 80-100% for all 3 types of fence, so I don't know what the correct answer is only for double fence!
D	High economic investment Farmers have a better perception about the effectiveness of this fence compared to the double

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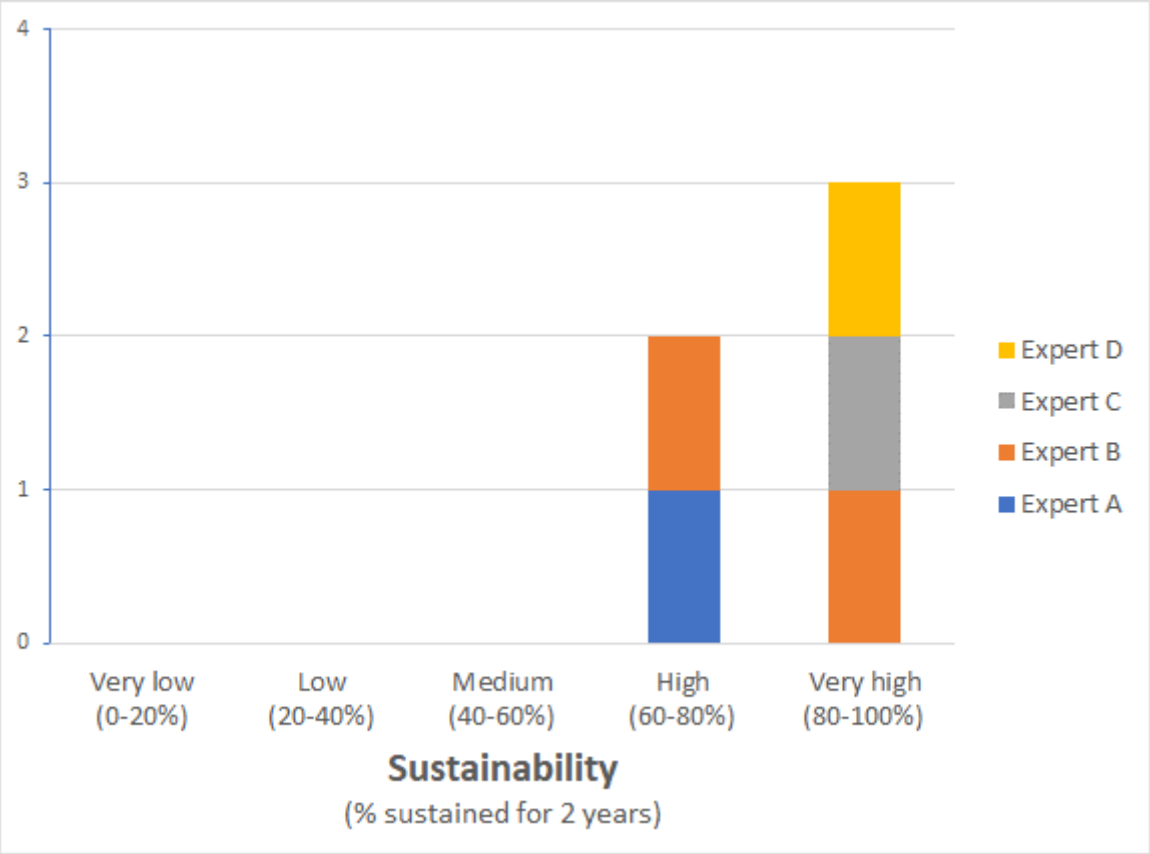
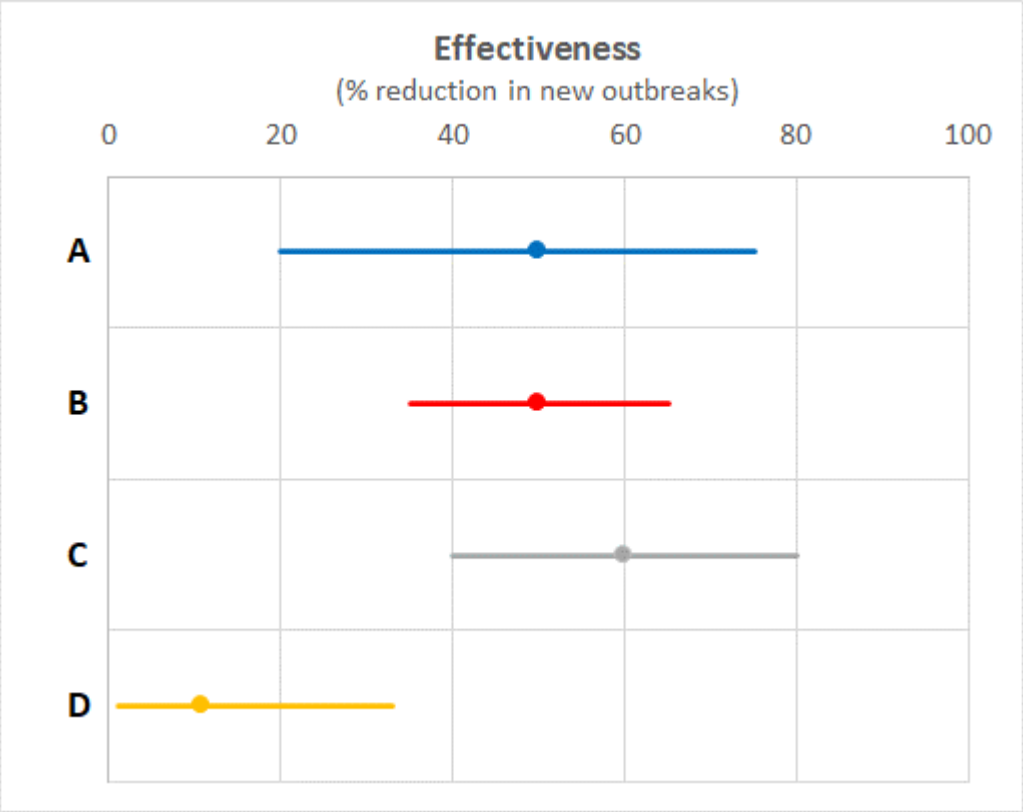


Expert	Reasoning
A	The single solid fence is a rather permanent structure and therefore most likely still present after 2 years. The condition of this fence and whether it's still as effective as directly after placing it (not damaged etc) after 2 years will be better in comparison to double fence. Repairs might be costly as well. Any (negative) influence of the fence on the premium quality schemes should also be taken into account. Altogether I consider it quite likely that the single solid fence is still present/used after 2 years.
B	the damage to solid single fence may could be lower than double fence and for this reason the sustainability is higher

C	It is not expensive to maintain once it is built.
D	Considering the high investment, farmers will assure fence maintenance, guaranteeing the sustainability of the measure.

BSM: SINGLE FENCE **FARM TYPE I**

Definition: Single row of fencing made from metal net or wire or electric wires around the perimeter of the outdoor area of a minimum height of 1.5 m without measures to prevent rooting



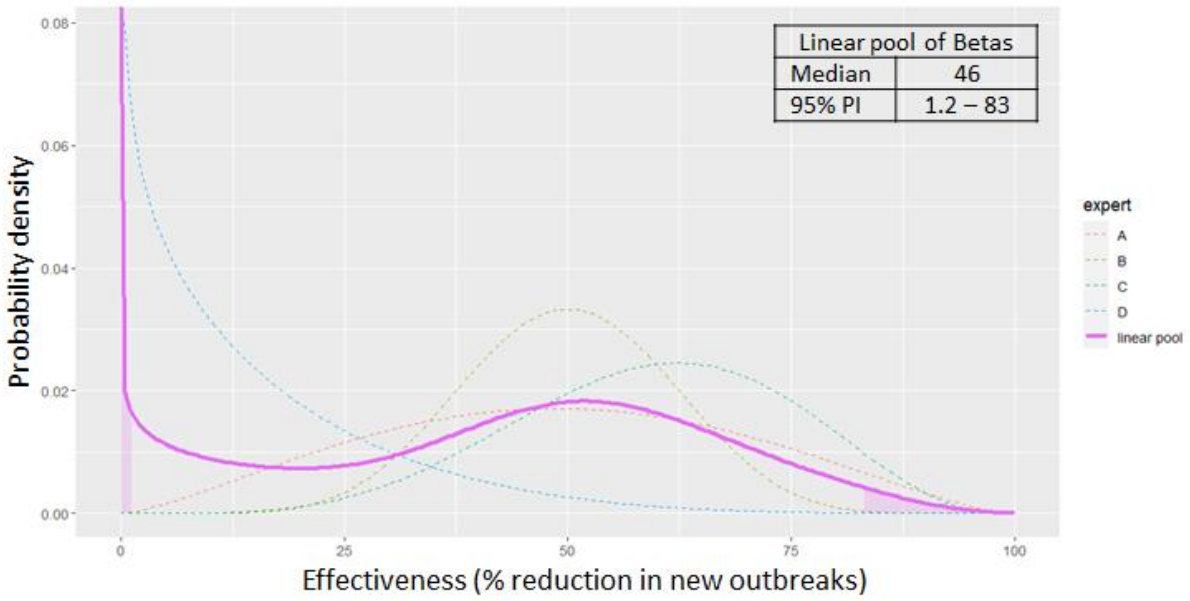
Expert	Reasoning
A - low	General BSM not well implemented; e.g. via e.g. contaminated boots, introduction of diseased animals, rodents transmitting ASFV. The single fence is not as effective against wild boar (or other wild animals) compared to single solid or double fence and will not fully prevent that infected wild boar would still manage to through/over/under the fence and enter the domestic pig premises. Single fence will provide visible barrier, but it is less effective in preventing people to cross the fence or throw food over the fence for example in comparison to BSM 1 or 2. Rooting is not prevented and wild animals/rodents can easily walk under the fence. Natural water flow (or heavy rainfall) is not prevented to enter the fenced area. Type I farms are more "connected" with the environment, making it more likely that contact between diseased animals or contaminated material happens. Considering the discussion of 10/2, Saul and Federica being lower in the median/overall, but Georgi also explaining that a single fence could already make quite some difference, made me to change my median only slightly from 55 to 50. I'll also lower my upper probability slightly from 80 to 75.
A - high	Single fence will reduce direct contact risk, however not as much as single solid fence or double fence. Single fence will provide visible barrier for people (which also makes it easier to make general BSM obliged). Type 1 farms currently have no form of fence, a single fence will make still make a

	difference. Since all type I farms will implement a single fence the overall risk of spread will reduce as well. Comparing to BSM 1 and BSM 2 the probabilities for BSM 3 are lower.

B - low	the lower probability is a little bit lower than that of double fence, considering that this BSM is a little low efficient than the previous one
B - high	the upper probability is a little bit lower than that of solid fence, considering that this BSM is a little low efficient than the previous one

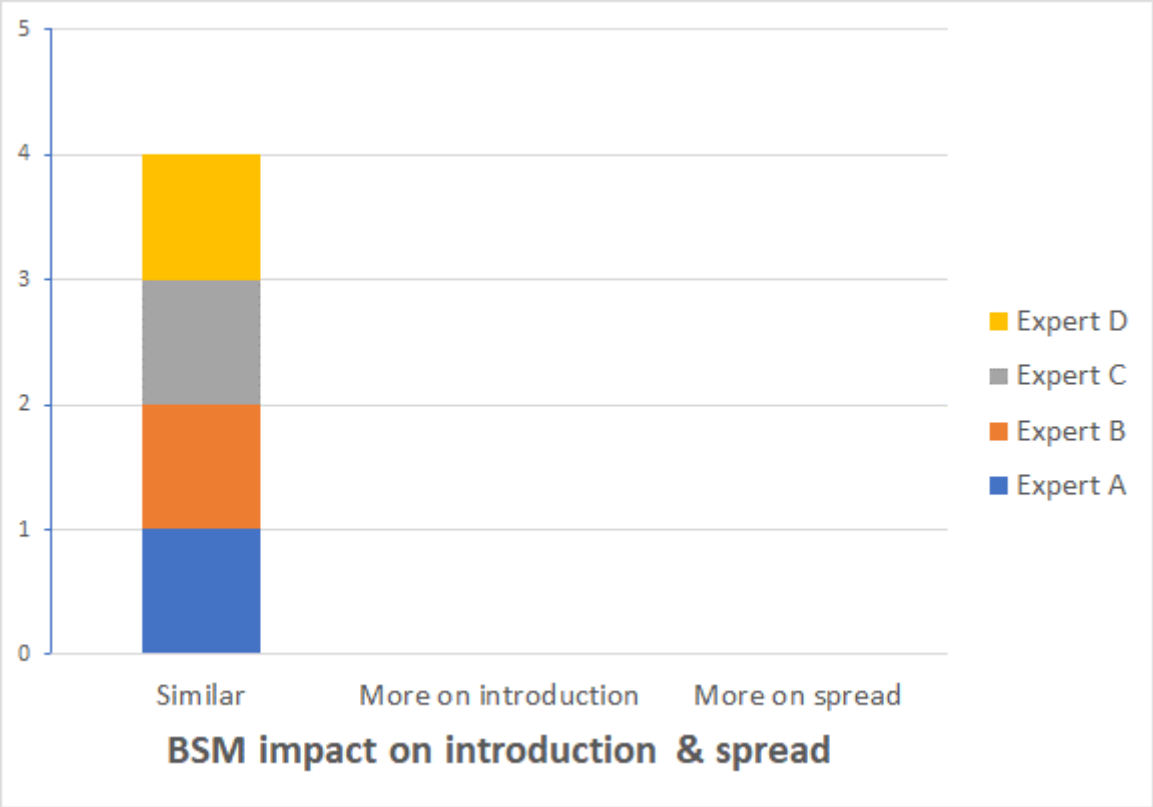
C - low	single fence divide territory between wild and domestic pigs. Domestic pigs can be infected with ASFV only by anthropogenic factors, but also have chance for direct contact with wild boar.
C - high	Domestic pigs can be infected with ASFV only by anthropogenic factors, but also have chance for direct contact with wild boar.

D - low	Direct contacts with external animals are not prevented nor frequent circulation of wild boar under the fence Presence of wild boar populations inside the farm area (bigger ones) implies risk Indirect pathways for ASF introduction related with sympatric species different than wild boars human (farm personnel) movements in/out of the farm implies risk
D - high	To have single fence is better than have no fence, so some outbreaks can be prevented Farm location can be very isolated, with no wild boar populations or pig farms in the surroundings However, no specific measures are being applied regarding farm personnel



BSM: SINGLE FENCE **FARM TYPE I**

Definition: Single row of fencing made from metal net or wire or electric wires around the perimeter of the outdoor area of a minimum height of 1.5 m without measures to prevent rooting

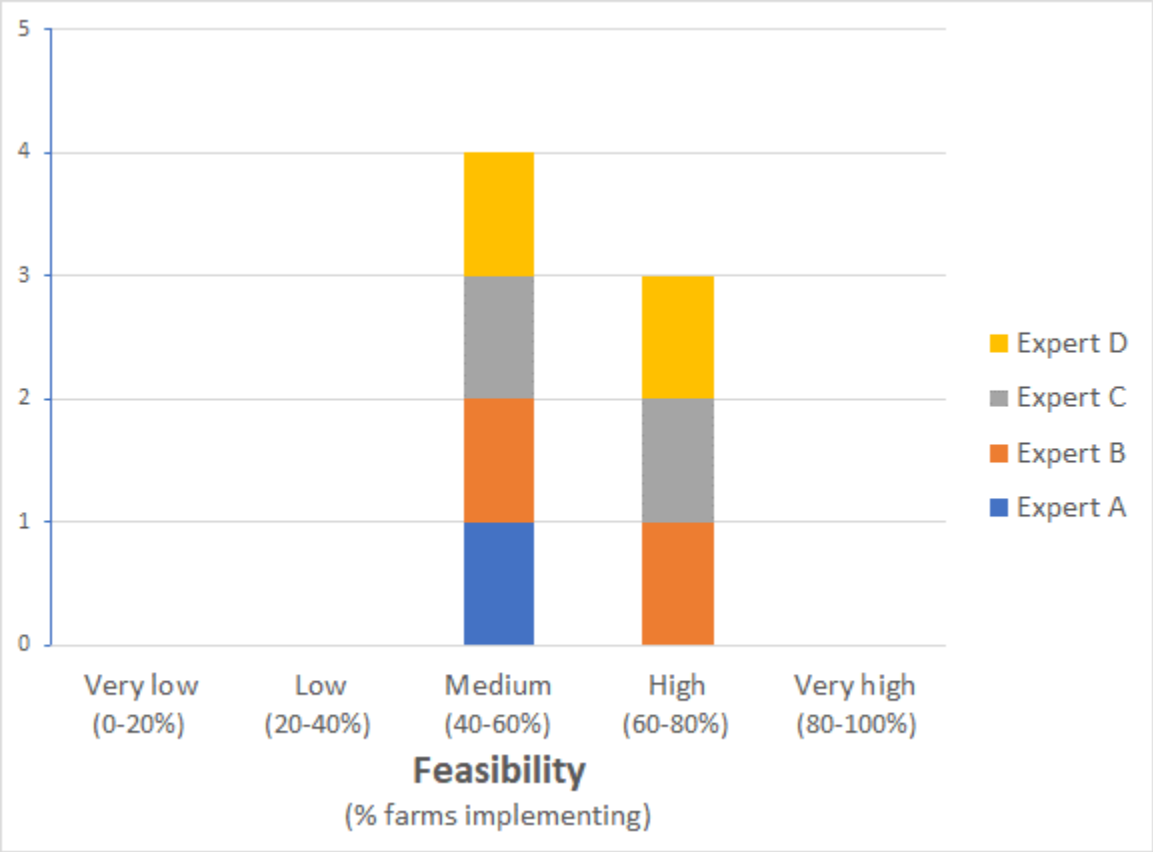


A	A single fence will most likely have a similar effect on introduction and spread. Infected wild boar are less likely to enter the fenced area when a single fence is around it. On the other hand, diseased outdoor pigs are less likely to break out of the premises when a single fence is present compared to no fencing present in the "before" situation.
B	the single fence is not very efficient BSM to avoid the nose to nose contact between wild boar and domestic pigs, but considering the different animal density inside farm than outside farm, this BSM could have a similar impact on spread than introduction

C	separation of wild and domestic population is the most important measure.
D	It is only a physical barrier that can help to separate populations, so the impact of its implementation would affect both introduction and spread equally

BSM: SINGLE FENCE **FARM TYPE I**

Definition: Single row of fencing made from metal net or wire or electric wires around the perimeter of the outdoor area of a minimum height of 1.5 m without measures to prevent rooting

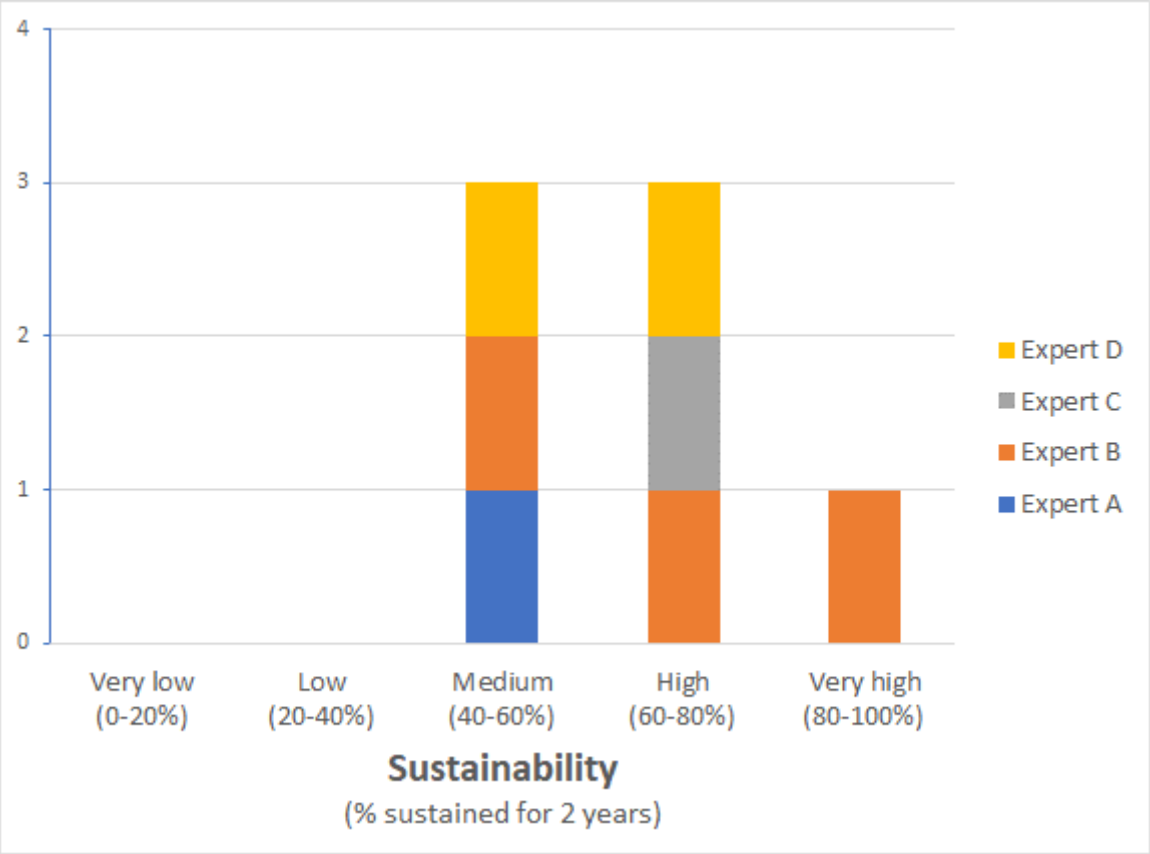


Expert	Reasoning
A	Although some (well informed) type I farmers might also question the effectiveness of BSM3 themselves when suggested as an option it will be of interest to them since it is much simpler and cheaper (although there is still a significant cost) in comparison to a double fence or single solid fence. It might also affect requirements for certain premium schemes. Overall I consider this single fence more feasible for type I farms in comparison to BSM 1 or 2. Considering our discussion (12/2) the feasibility might be slightly higher, but I'll stick to medium but going more towards 60%.
B	the efforts request to apply this measure is not so higher so this measure could be implemented by more farms than the other two type of fences

C	answer is tricky - we need a fence, and this is possible in 80-100% of farms. But is 80-100% for all 3 types of fence, so I don't know what the correct answer is only for double fence!
D	Many FT1 already have this measure, but adapt them to the current definition may imply important economic investment in FT1. Management and control of animals is better than without the fence (farmers understand these advantages) to start doing it. However, could be a difficult implementation in specific sectors/areas (social factors) when fences currently do not exist.

BSM: SINGLE FENCE **FARM TYPE I**

Definition: Single row of fencing made from metal net or wire or electric wires around the perimeter of the outdoor area of a minimum height of 1.5 m without measures to prevent rooting

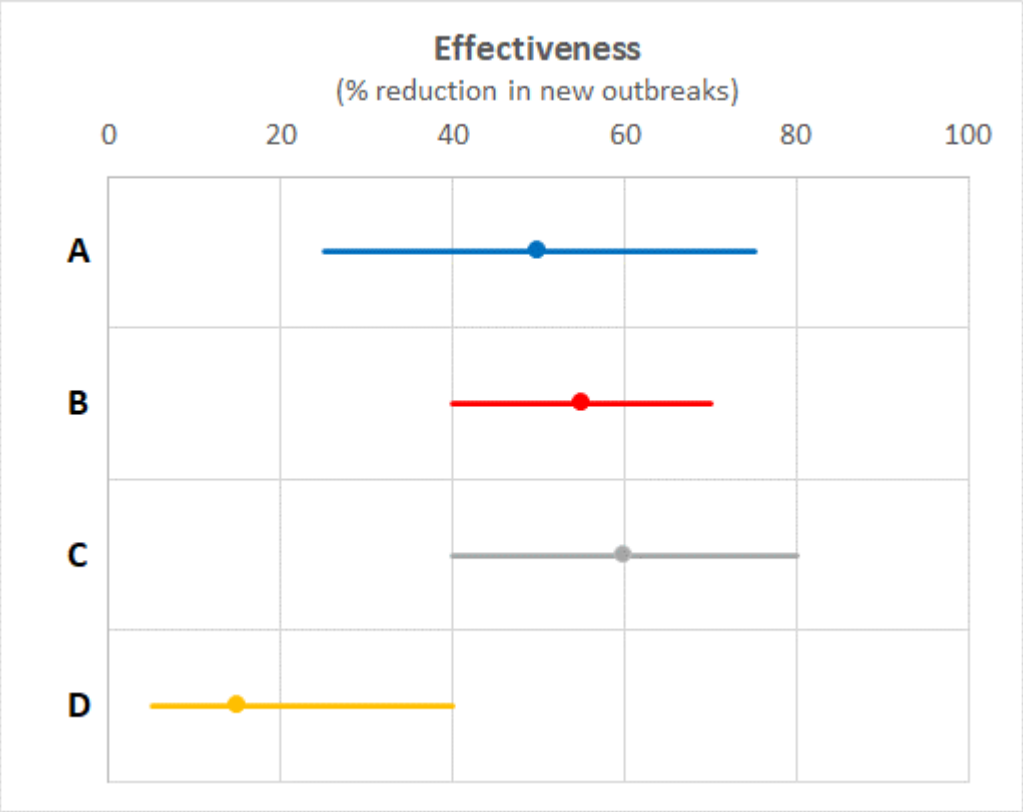


Expert	Reasoning
A	A single fence is not as permanent as a double fence or single solid fence. It might also need much more maintenance. The electric clock for the electric wires could be damaged (lightning) or stolen (happens in NL). Type I farmers might use different areas as "pasture" for their pigs. A single fence to my opinion might be used less or can be easier skipped in comparison to a single solid fence or double fence. On the other hand it is better movable in comparison to BSM 1 and 2, however I am not sure whether farmers will do this. Overall I consider the sustainability to be low for type I farms. After reconsidering (meeting 12/2) I moved up from low to medium.
B	the sustainability of this measure depends more on farmers behaviour and mind than economic resources, so the variability is higher and range from medium to very high. Furthermore, the farmers could have some uncertainty about its effectiveness and be not so motivated to sustain this measure

C	is not expensive to maintain if is built.
D	Farmers' perceptions may affect to the proportion of sustainability. The largest farms will have more problem to sustain the measure considering the effort of further revisions

BSM: SINGLE FENCE **FARM TYPE II**

Definition: Single row of fencing made from metal net or wire or electric wires around the perimeter of the outdoor area of a minimum height of 1.5 m without measures to prevent rooting



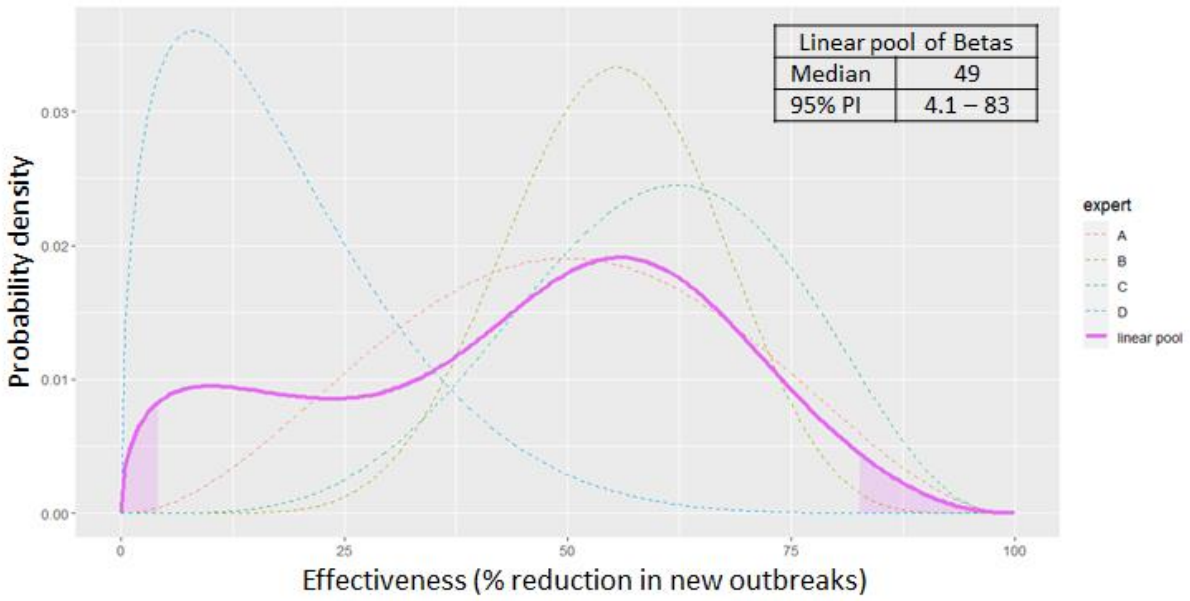
Expert	Reasoning
A - low	General BSM not well implemented; e.g. via e.g. contaminated boots, introduction of diseased animals, rodents transmitting ASFV. The single fence is not as effective against wild boar (or other wild animals) compared to single solid or double fence and will not fully prevent that infected wild boar would still manage to through/over/under the fence and enter the domestic pig premises. Single fence will provide visible barrier, but it is less effective in preventing people to cross the fence or throw food over the fence for example in comparison to BSM 1 or 2. Rooting is not prevented and wild animals/rodents can easily walk under the fence. Natural water flow (or heavy rainfall) is not prevented to enter the fenced area. Type II farms already are considered to have some kind of barrier to keep the pigs on the premises. Farmers might not see the benefits of adjusting this barrier to meet the standards of our definition of a single fence. Applies even more to private individuals with pet pigs.
A - high	Single fence will reduce direct contact risk, however not as much as single solid fence or double fence. Single fence will provide visible barrier for people (which also makes it easier to make general BSM obliged). Type II farms currently already have some kind of barrier, however a single fence will be slightly more effective as a biosecurity measure. Since all type II farms will implement a single fence the overall risk of spread will

	reduce as well. Comparing to BSM 1 and BSM 2 the probabilities for BSM 3 are lower. In line with previous revisions I'll go 5 down here as well for higher and lower.

B - low	the lower probability is a little bit lower than that of double fence, considering that this BSM is a little low efficient than the previous one but higher than Type I farm
B - high	the upper probability is a little bit lower than that of solid fence, considering that this BSM is a little low efficient than the previous one, but higher than the Type I

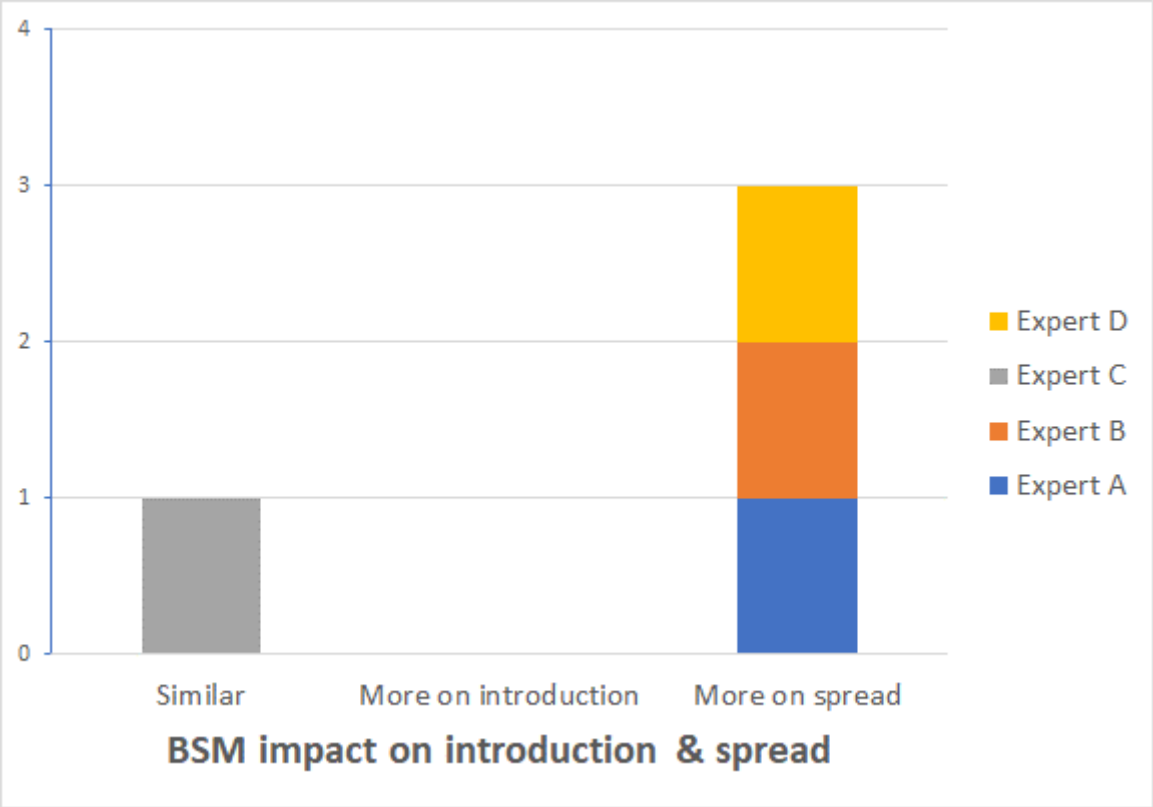
C - low	single fence divide territory between wild and domestic pigs. Domestic pigs can be infected with ASFV only by anthropogenic factors, but also have chance for direct contact with wild boar.
C - high	Domestic pigs can be infected with ASFV only by anthropogenic factors, but also have chanse for direct contact with wild boar.

D - low	Direct contacts with external animals are not fully prevented nor wild boar access under this fence. Indirect pathways for ASF introduction related with sympatric species different than wild boars human (farm personnel) movements in/out of the farm imply risk
D - high	Farm location can be very isolated, with no wild boar population or pig farms in the surroundings Moreover, wild boar are not very attracted to building areas However, no specific measures are been applied regarding farm personnel



BSM: SINGLE FENCE **FARM TYPE II**

Definition: Single row of fencing made from metal net or wire or electric wires around the perimeter of the outdoor area of a minimum height of 1.5 m without measures to prevent rooting

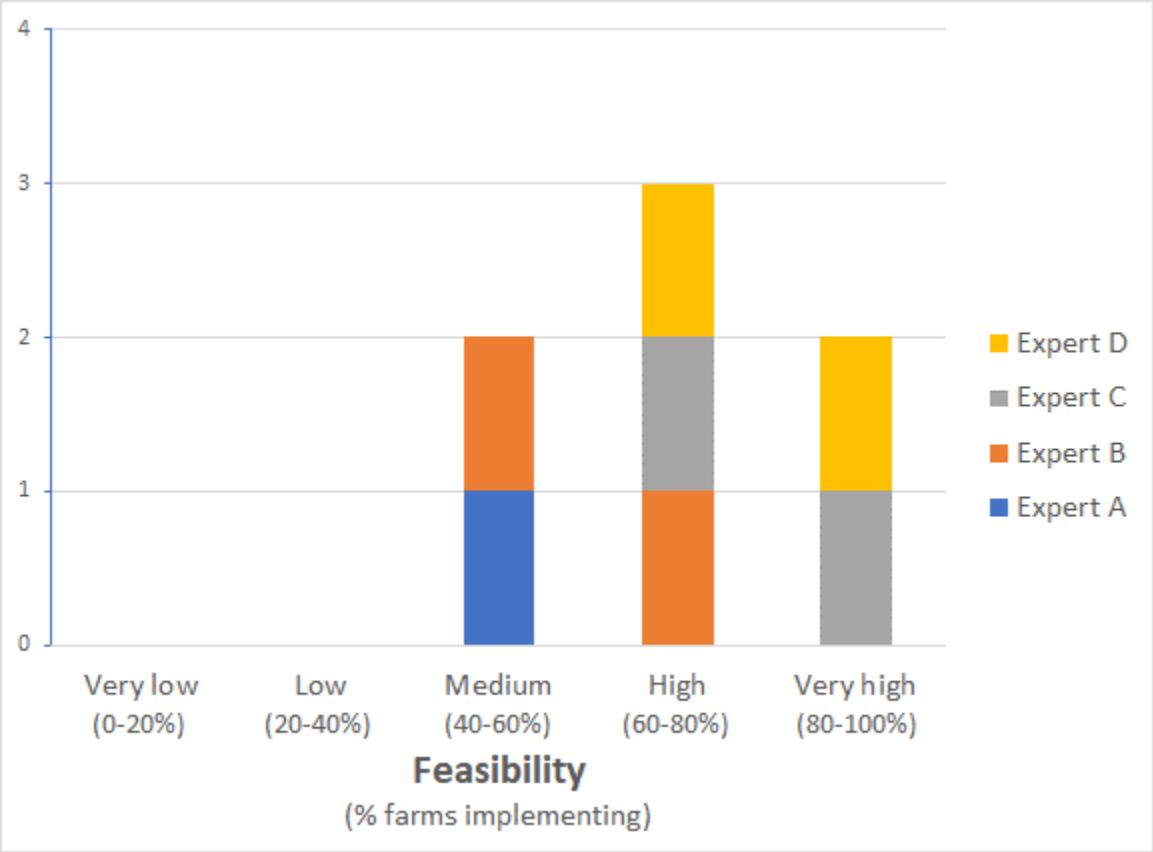


Expert	Reasoning
A	A single fence will most likely have a similar effect on introduction and spread in commercial type II farms. The fence will make it less likely that e.g. wild boar enter the fenced area or domestic pigs leave the fenced area. When thinking about pet pigs from individuals a single fence might be more effective to reduce spread, since the pigs might be better contained in the area in comparison to the situation before and the "farmer" might have a better perception of the risk he/she could spread from his farm (personal hygiene/general BSM better). Therefor I have chosen the option "more impact on spread".
B	the single fence is not very efficacy BSM to avoid the nose to nose contact between wild boar and domestic pigs, but considering the different animal density inside farm than outside farm, this BSM could have more impact on spread than introduction

C	separation of wild and domestic population is the most important measure.
D	Farmed pigs are under spatial control (not free raised) introduction can be easy by direct nose-nose contact through the fence from both pigs and boars

BSM: SINGLE FENCE **FARM TYPE II**

Definition: Single row of fencing made from metal net or wire or electric wires around the perimeter of the outdoor area of a minimum height of 1.5 m without measures to prevent rooting

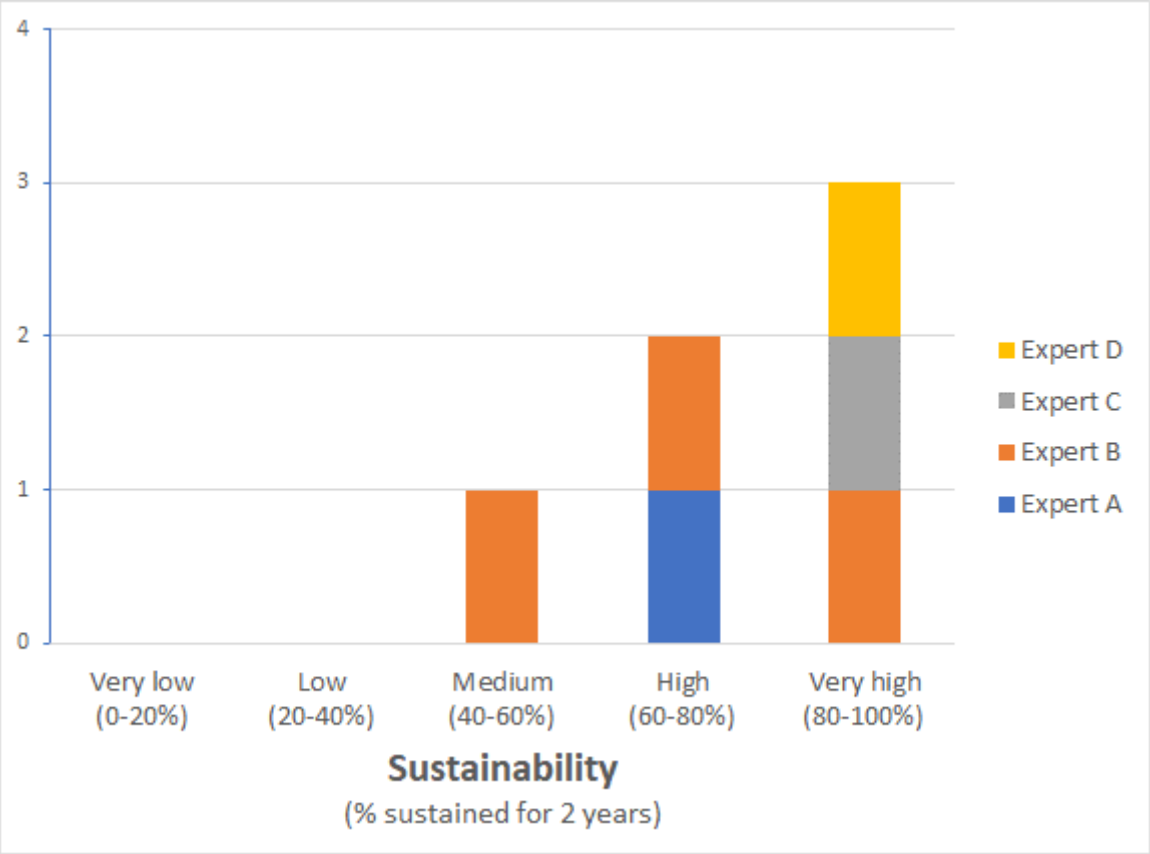


Expert	Reasoning
A	Although (well informed) type II farmers might also question the effectiveness of BSM3 themselves when suggested as an option it will be of interest to them since it is much simpler and cheaper (although there is still a significant cost) in comparison to a double fence or single solid fence. However they might consider it "extra" work since they already have some kind of barrier to keep their pigs in. Pet pig holders might not be so willing to make a single fence or adjust their current barrier into a single fence. I do not think there is much difference for pet pig keepers whether they have to build a single, double or solid fence. Overall I consider this single fence similar feasible for type II farms in comparison to type I farms. There might be a small difference in type II vs type I farms for this measure; the pressure from wild boar and/or contaminated material (e.g. through rainfall) might be lower in type II farms (due to closer to farm buildings and less "connected" with environment) making a single fence slightly more effective in type II vs type I. After discussion I would still like to stick to medium (on the high end), due to my reasoning mentioned above.
B	

	the efforts request to apply this measure is not so higher so this measure could be implemented by more farms than the other two type of fences, otherwise the uncertainty of the efficacy of this measure could affect the feasibility
C	answer is tricky - we need a fence, and this is possible in 80-100% of farms. But is 80-100% for all 3 types of fence, so I don't know what the correct answer is only for double fence!
D	Most FT2 already have this measure Farmers without the simple fence will understand the advantages easily Not a very important economic investment in FT2

BSM: SINGLE FENCE **FARM TYPE II**

Definition: Single row of fencing made from metal net or wire or electric wires around the perimeter of the outdoor area of a minimum height of 1.5 m without measures to prevent rooting

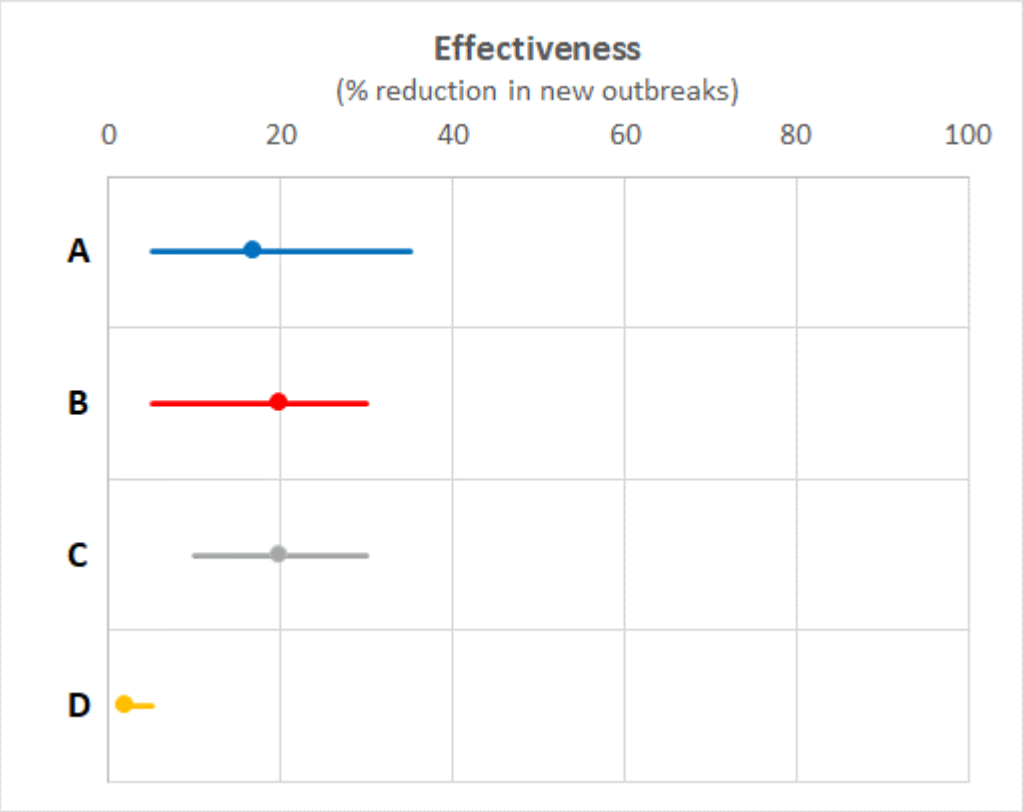


Expert	Reasoning
A	A single fence is not as permanent as a double fence or single solid fence. It might also need much more maintenance. The electric clock for the electric wires could be damaged (lightning) or stolen (happens in NL). Since the single fence will be close to the farm buildings for Type II farmers keeping the fence intact will not be hard. Overall I consider the sustainability to be high for type II farms.
B	the sustainability of this measure depends more on farmers behaviour and mind than economic resources. Furthermore, the farmers could have some uncertainty about its effectiveness and be not so motivated to sustain this measure. So, the variability is higher and range from medium to very high

C	is not expensive to maintain if is built. Also, here farmers have habits.
D	Low effort required for its maintenance

BSM:	NO ACCESS TO STORED FEED	FARM TYPE I

Definition: No access to stored feed in the outdoor area for wild boar and other mammals and birds

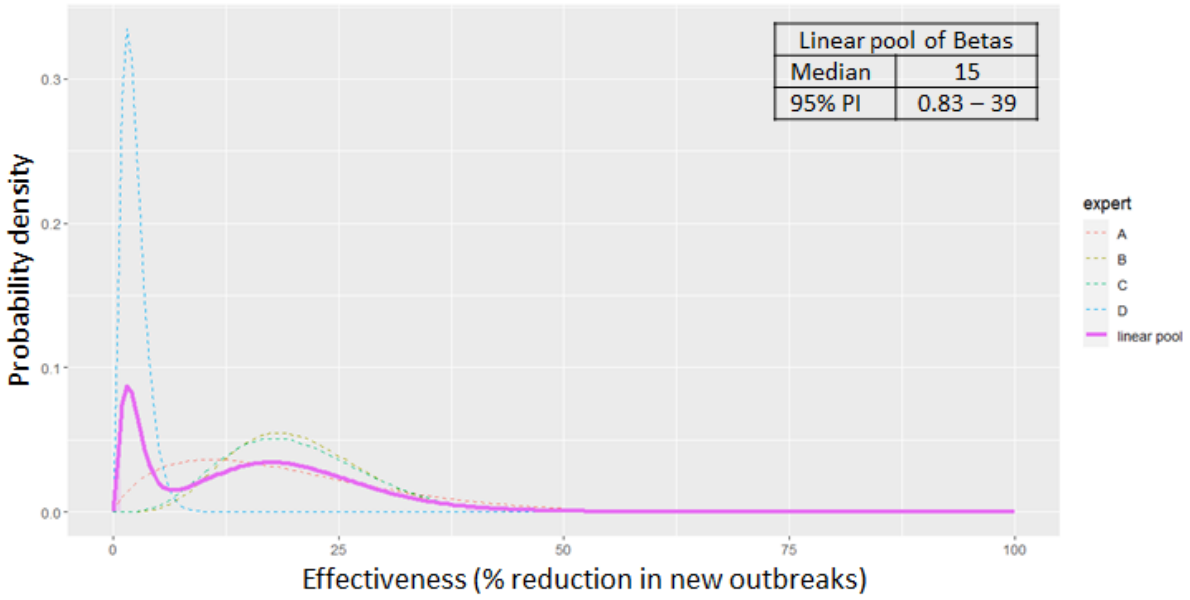


Expert	Reasoning
A - low	Only preventing access to stored feed will not be sufficient. Wild boar or other wild animals or contaminated material might still come into contact with the pigs in type I farms and/or general BSM might not be implemented.
A - high	If there is no access to stored feed it will not attract wild boar or other wild animals/rodents. In that case these animals will have less reason to come close to the farmed pigs from type I farms. Considering the discussion (12/2; Saul other natural resources and mating) I lowered mainly my upper probability (from 50 to 35). I'll keep my median close to my previous estimate (from 20 to 17).

B - low	the lower probability is just a little bit lower than the presence of single fence
B - high	the upper probability is just a little bit lower than the presence of single fence

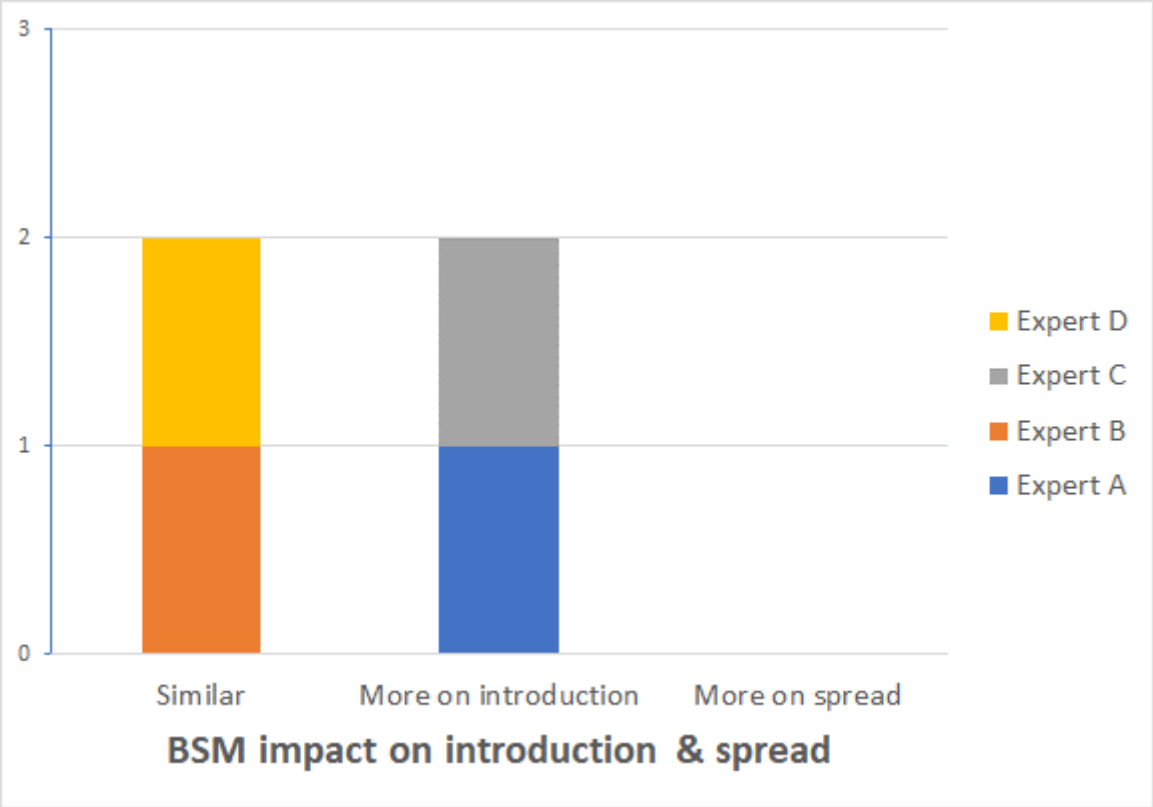
C - low	not protected feed became a baiting place for wild boar.
C - high	protected feed will not attract wild boar, but populations will continue cover same area

D - low	Natural resources are still available in FT1 for both wild boars or domestic pigs, and this allows for interactions (acorn, water) Mating season could also attract wild boar to the FT1 area even more than food
D - high	Natural resources are still available in FT1 for both wild boars or domestic pigs, which can favour interactions (acorn, water) Mating season could also attract wild boar to the FT1 area In other European contexts food could be more important than natural resources



BSM:	NO ACCESS TO STORED FEED	FARM TYPE I

Definition: No access to stored feed in the outdoor area for wild boar and other mammals and birds

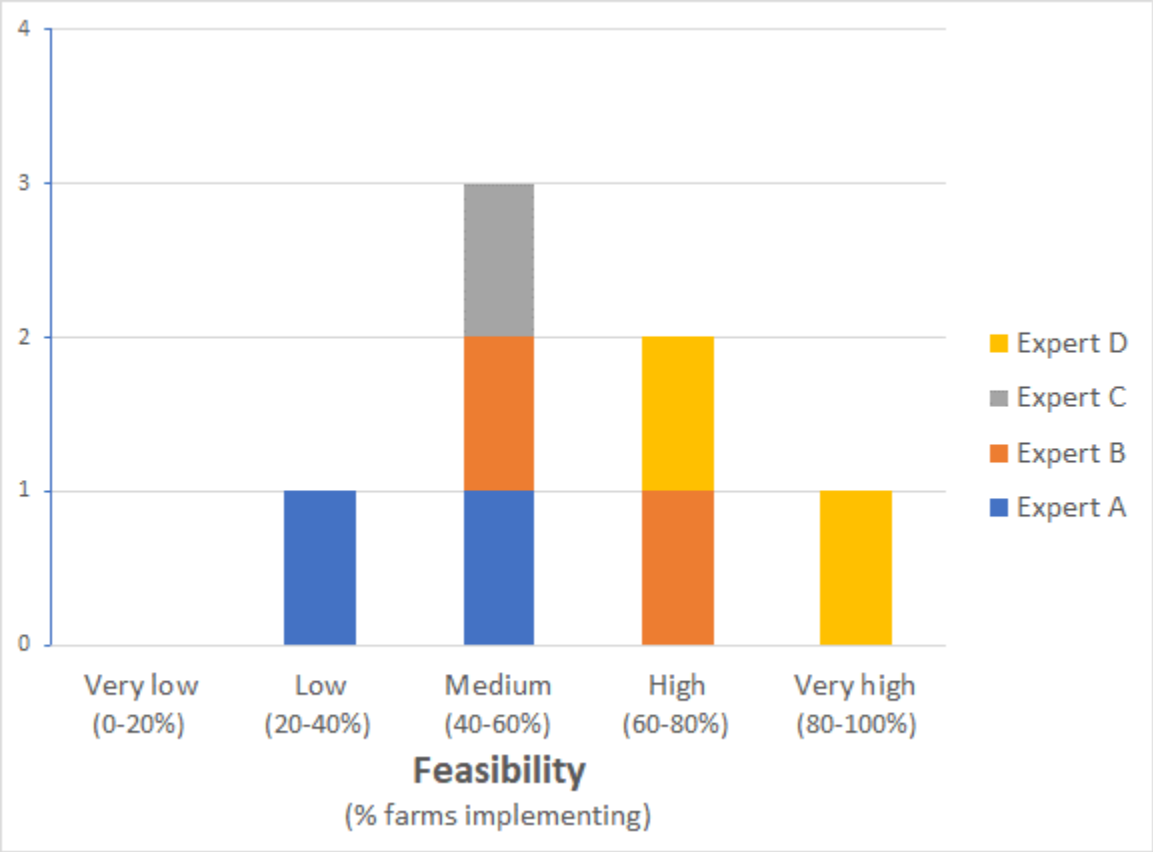


A	Both introduction and spread will be reduced by this BSM. Mainly wild boar will be attracted less to the farmed pigs. This might reduce introduction into the type I pigs from wild boars. It might also reduce the risk of spread from infected type I pigs to wild boar or other wild animals. Listening to one of the experts (12/2 culling of pigs), I moved up to more impact on introduction.
B	the uncertainty about this measure is so large that I don't feel able to consider the measure more or less effective in spread or introduction

C	if feed is free from ASFV, then wild boar can bring infection. Spreading is not important, because farm will be stamped out.
D	Animals different from pigs can act as a cause of introduction (when attracted by food) and as vector/carrier for ASF spreading (getting the infection at the infected farm), since fence systems can be present or not in the baseline situation according to basic BSMs

BSM:	NO ACCESS TO STORED FEED	FARM TYPE I

Definition: No access to stored feed in the outdoor area for wild boar and other mammals and birds

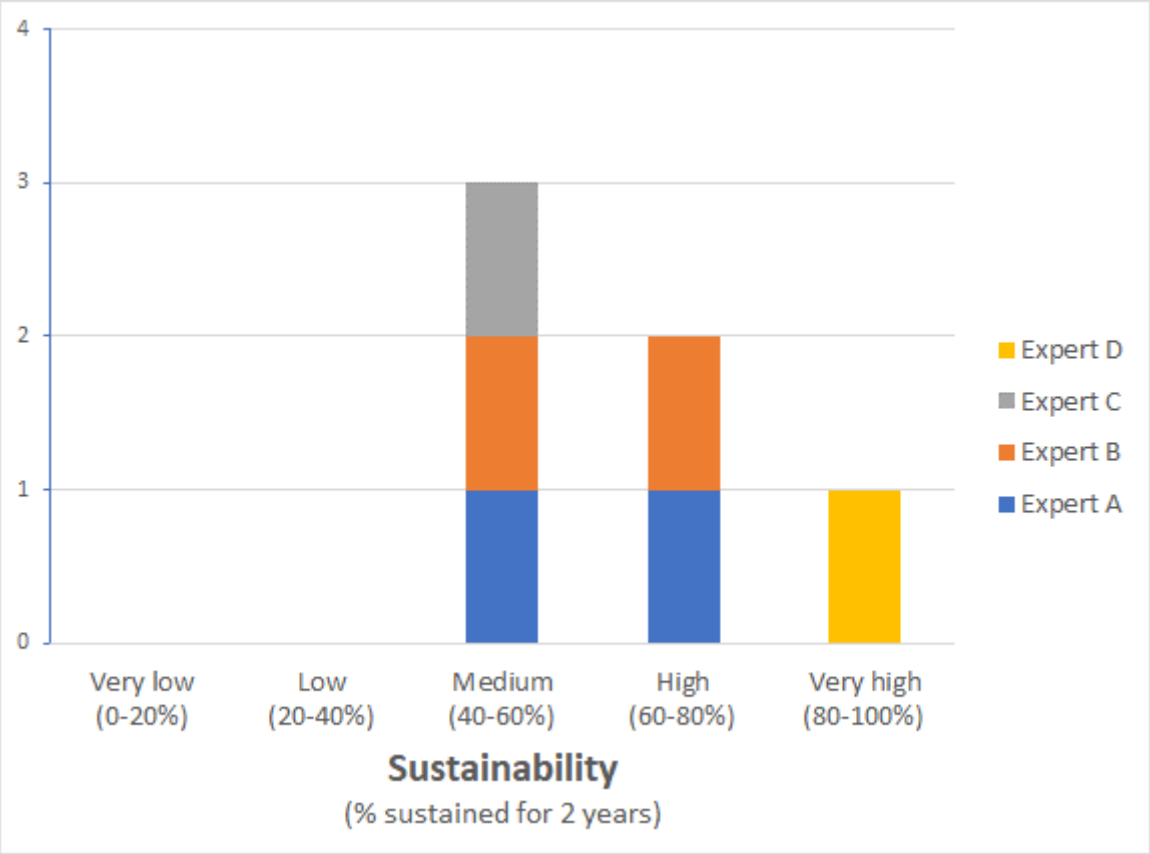


A	For type I farms preventing access to stored feed might be harder compared to type II farms, if the feed is to be stored near the location where the pigs are kept. Storing the feed so that access is not possible is very hard and requires for example a large closed box for pelleted feed, which might be difficult to handle. Storage of hay etc without access is even harder due to its volume. Costs will be substantially lower in comparison to e.g. a double fence if only some kind of box would be needed. Feasibility for implementation would therefore be low. After hearing from the others (12/2) that already existing structures might be used or pigs are brought to a farm building, but keeping my uncertainty in mind I included also medium now in my estimation.
B	not so difficult to apply, not so much expensive, and maybe the farmers already take care about this, if they want to save feed and money

C	farmers have difficulties to understand this measure is important!
D	Low cost. Small FT1 could have more feasibility problems in the areas of interest (as structures, buildings or silos are needed).

BSM:	NO ACCESS TO STORED FEED	FARM TYPE I

Definition: No access to stored feed in the outdoor area for wild boar and other mammals and birds

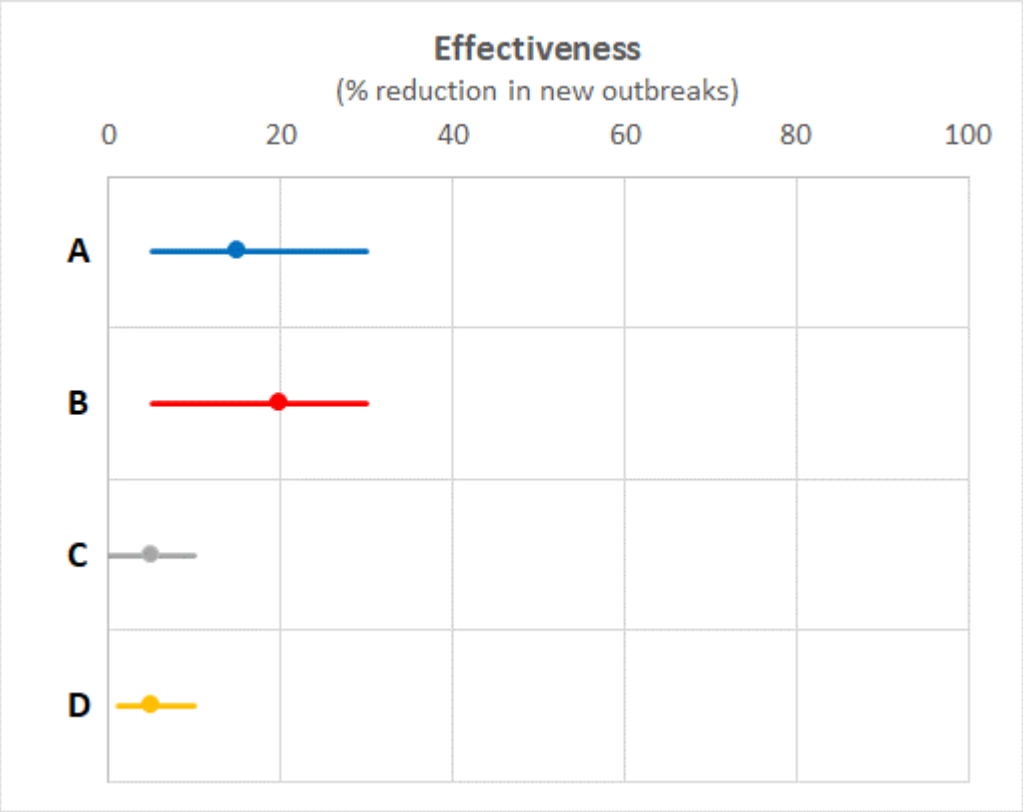


Expert	Reasoning
A	Keeping feed stored without access might be impractical (opening-closing, handling etc). Keeping this up for 2 years might therefor be not obvious. On the other hand, if the required materials (e.g. box) or buildings/structures are present they are likely to be rather permanent and could easily sustain for 2 years. Combining these reasons made me go for a medium sustainability. Following the discussion (12/2) and Federica and Saul mentioning that farmers may already do this made me go from medium to medium-high.
B	not so difficult to apply, not so expensive, and maybe the farmers already take care about this, if they want to safe feed and money

C	is difficult to change habits and keep them for 2 years - is not a hardware, but a software (habits)!
D	Fixed establishments (storage areas) are needed, which can be easily maintained throughout time

BSM:	NO ACCESS TO STORED FEED	FARM TYPE II

Definition: No access to stored feed in the outdoor area for wild boar and other mammals and birds



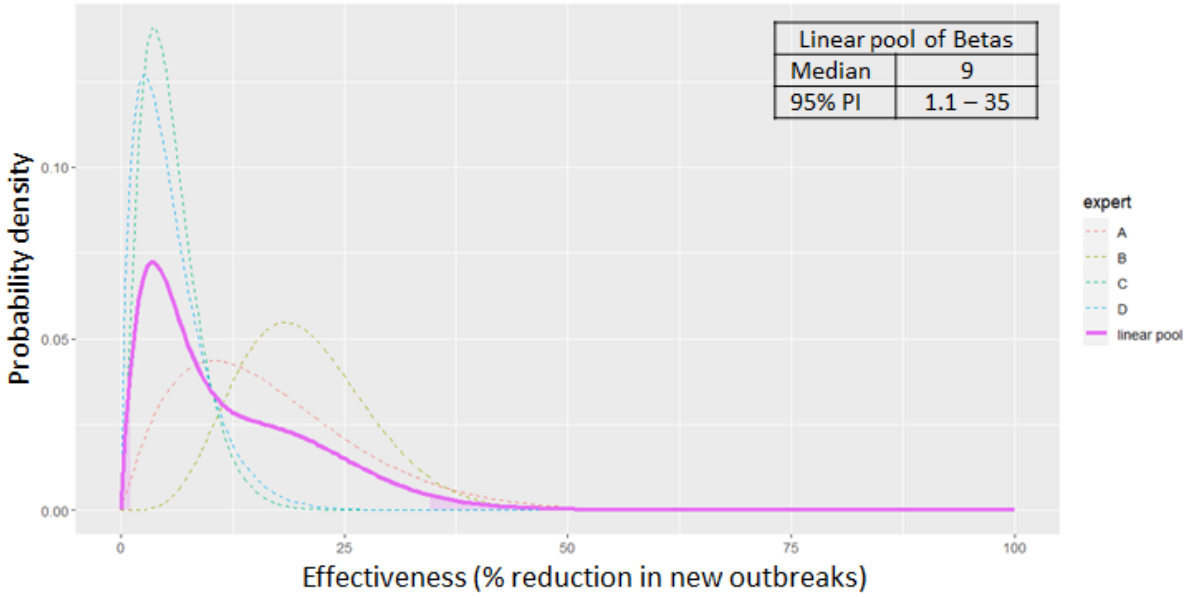
Expert	Reasoning
A - low	Only preventing access to stored feed will not be sufficient. Wild boar or other wild animals or contaminated material might still come into contact with the pigs in type II farms and/or general BSM might not be implemented. Baseline risk was lower in type II farms (feed in silo's in/near farm buildings, although might be in "dirty" part of the farm, which might pose a risk (external biosecurity)) in comparison to type I, therefore the probabilities here should be lower in comparison to type I (not taking into account the infectiveness of the feed itself).
A - high	If there is no access to stored feed it will not attract wild boar or other wild animals/rodents. In that case these animals will have less reason to come close to the farmed pigs from type II farms. Compared to type I farms the attractiveness for wild boars to type II farms might be slightly lower since they are closer to farm buildings which would normally "scare" wild boar away. However this is not a direct effect of the BSM and therefor the probabilities for type II farms are similar to type I farms. Following the discussion (12/2) taking into account the baseline risk (lower for type II) I went down quite a bit (from 50 upper to 30 and median from 20 to 15)

B - low	this measure has the same efficacy as in Type I where the pigs are limited to the main area, but the wild boar have no deterrent to the access

B - high	re have the same efficacy as in Type I where the pigs are limited to the main area, but the wild boar have no deterrent to the access

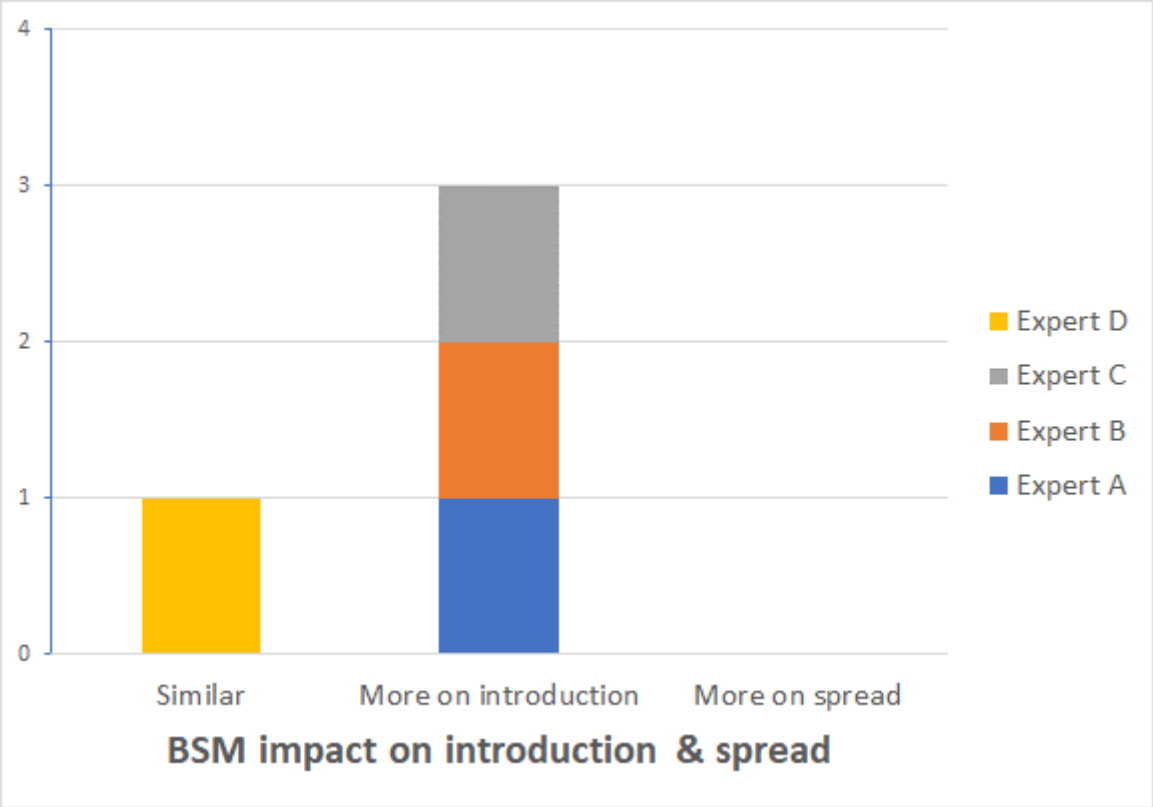
C - low	if farm has fence somehow and farm is ASF free, storage of feed does not matter
C - high	measure can work in not more than 10% of farms

D - low	Direct contact is not avoided with this measure Wild boars can still be attracted by mating season or water
D - high	Low interest of wild boar for building areas and a possible lesser effect of attraction



BSM:	NO ACCESS TO STORED FEED	FARM TYPE II

Definition: No access to stored feed in the outdoor area for wild boar and other mammals and birds

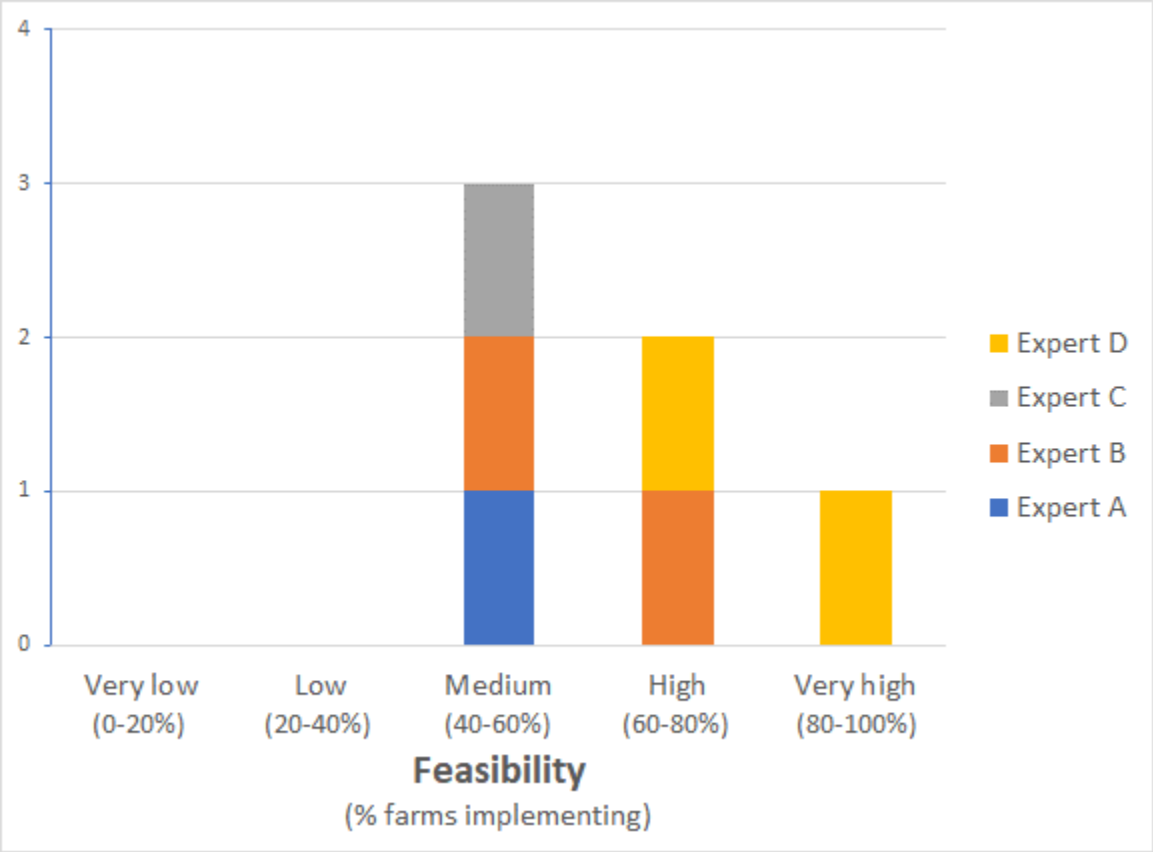


Expert	Reasoning
A	Both introduction and spread will be reduced by this BSM. Mainly wild boar will be attracted less to the farmed pigs' area. This might reduce introduction into the type II pigs area from wild boars. It might also reduce the risk of spread from infected type II pigs to wild boar or other wild animals. I consider no difference in this for type II farms compared to type I. After one expert's remarks (culling) I switched to more on introduction.
B	the attraction of stored feed for wild boar is a risk for disease introduction

C	is not important measure against ASF in farms type II - only in case that feed is used without 30 day storage
D	Animals different from pigs can act as a cause of introduction (when attracted by food) and as vector/carrier for ASF spreading (getting the infection at the infected farm), since fence systems can be present or not in the baseline situation according to basic BSMs

BSM:	NO ACCESS TO STORED FEED	FARM TYPE II

Definition: No access to stored feed in the outdoor area for wild boar and other mammals and birds

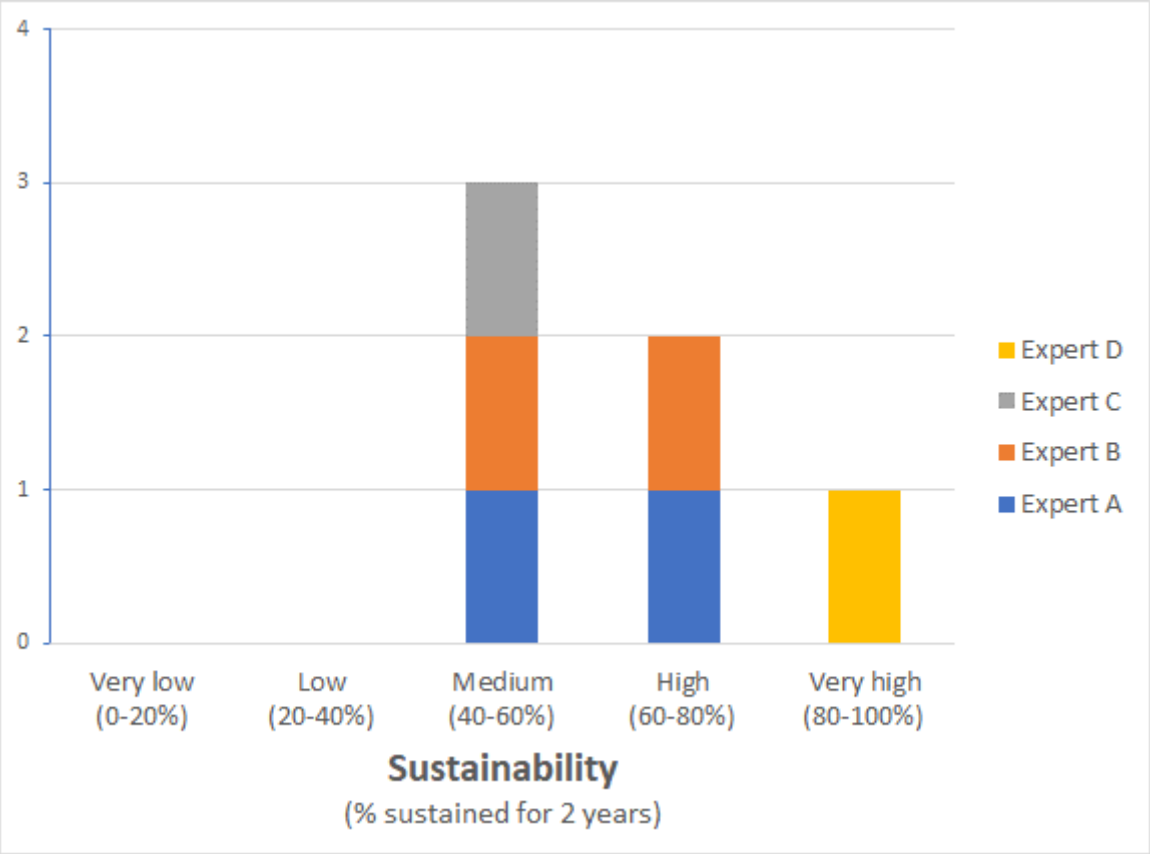


Expert	Reasoning
A	For type II farms preventing access to stored feed might be better possible in comparison to type I farms, since feed might be stored in already existing building (which should be or could be made sufficiently closed). The volume of e.g. stored hay might pose a challenge for type II farms as well. Costs will be substantially lower in comparison to e.g. a double fence and might be lower in comparison to type I farms as well since there are already farm buildings present. Feasibility for implementation would therefore be medium. Following the discussion (12/2) I'd stick to medium but on the high end (60%).
B	not so difficult to apply, not so much expensive, and maybe the farmers already take care about this, if they want to safe feed and money

C	farmers have difficulties to understand this measure is important!
D	Low cost. Traditional farmers can be more narrow-minded to understand the usefulness of this BSM.

BSM:	NO ACCESS TO STORED FEED	FARM TYPE II

Definition: No access to stored feed in the outdoor area for wild boar and other mammals and birds

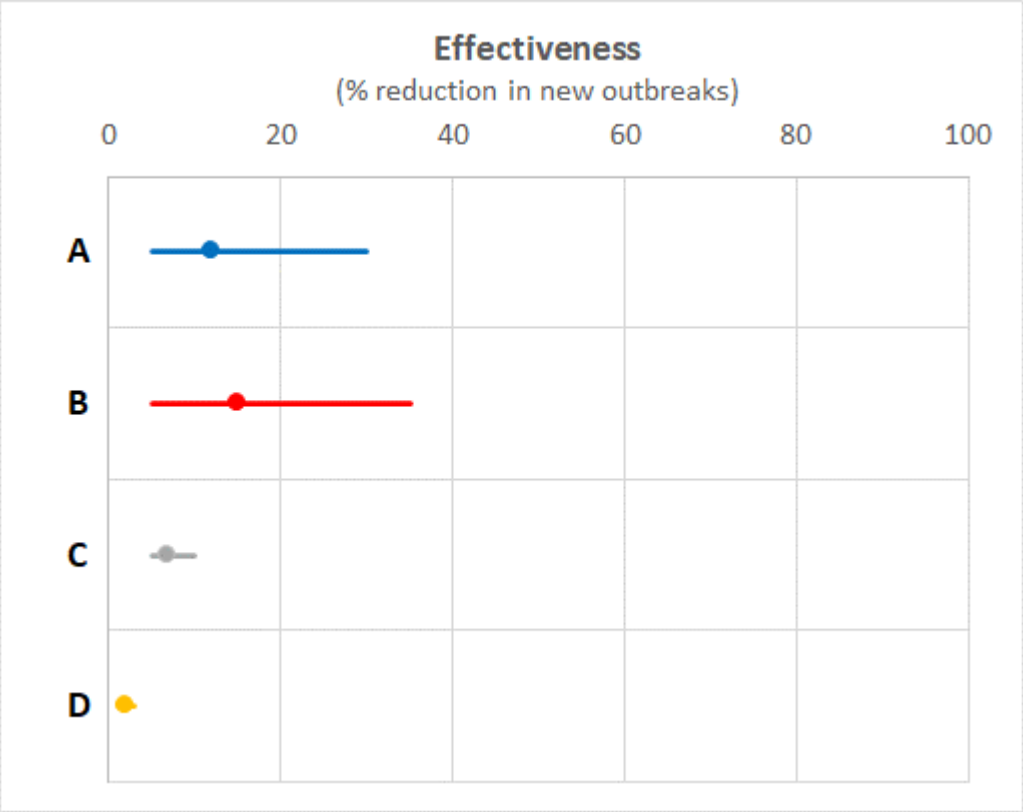


Expert	Reasoning
A	Keeping feed stored without access might be impractical (opening-closing, handling etc). Keeping this up for 2 years might therefor be not obvious. For type II farms this might be slightly easier in comparison to type I farms since storage might take place in already existing buildings. If the required materials (e.g. box) or buildings/structures are present they are likely to be rather permanent and could easily sustain for 2 years. Combining these reasons made me go for a medium sustainability. Following the discussion and my switch from medium to medium/high for type I I changed it here in type II as well to medium/high.
B	not so difficult to apply, not so much expensive, and maybe the farmers already take care about this, if they want to save feed and money

C	is difficult to change habits and keep them for 2 years - is not a hardware, but a software (habits, understanding)!
D	Fixed establishments (storage areas) are needed, which can be easily maintained throughout time

BSM:	REMOVAL OF UNEATEN FEED	FARM TYPE I

Definition: No uneaten feed should be left in the outdoor area after feeding



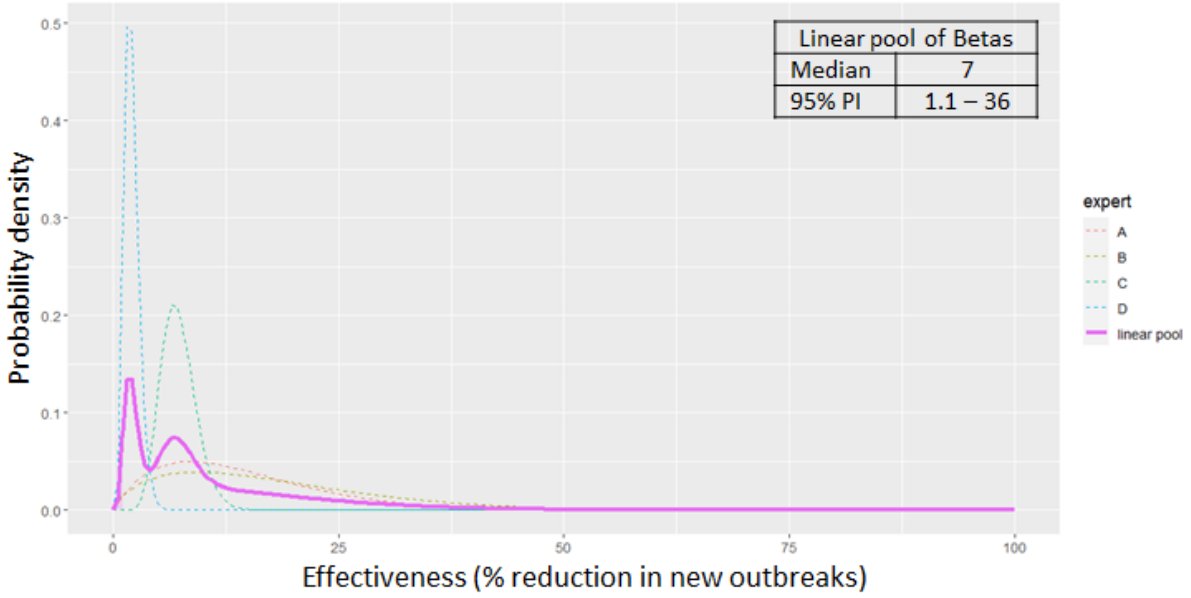
Expert	Reasoning
A - low	Only removal of uneaten feed will not be sufficient. Wild boar or other wild animals or contaminated material might still come into contact with the pigs in type I farms and/or general BSM might not be implemented. Following the discussion (12/2) I reconsider my probabilities to be a bit lower.
A - high	If there is no uneaten feed it will not attract wild boar or other wild animals/rodents. In that case these animals will have less reason to come close to the farmed pigs from type I farms. Following the discussion (12/2) I've reconsidered my probabilities; a bit lower, since the influence of this measure is not so high; it is quite likely that some uneaten feed remains (or the smell is of interest), on the other hand stored feed (with access) will be more attractive. I'll lower my median to 12 and my upper to 30.

B - low	this measure will have important consequences in avoiding ASF spread within wild boar, but without any other measure which avoid contacts with pigs in Type I farm the efficacy in prevent the number of outbreaks will be negligible
B - high	

	this measure will have important consequence in avoiding ASF spread within wild boar, but without any other measure which avoid contacts with pigs in Type I farm the efficacy in prevent the number of outbreaks will be negligible

C - low	in Type I populations cover same territory, so removal of uneaten feed like a measure cannot prevent spreading of ASF, just can reduce little bit a chance for that.
C - high	removal of uneaten feed will reduce attraction for wild boar but will not separate them from domestic pigs.

D - low	direct contact may not be prevented with other pigs or wild boar Even when the uneaten food is removed, smell attracting wild boar remains (they don't know if food is there or not)
D - high	Pig and wild boar populations can be still in contact



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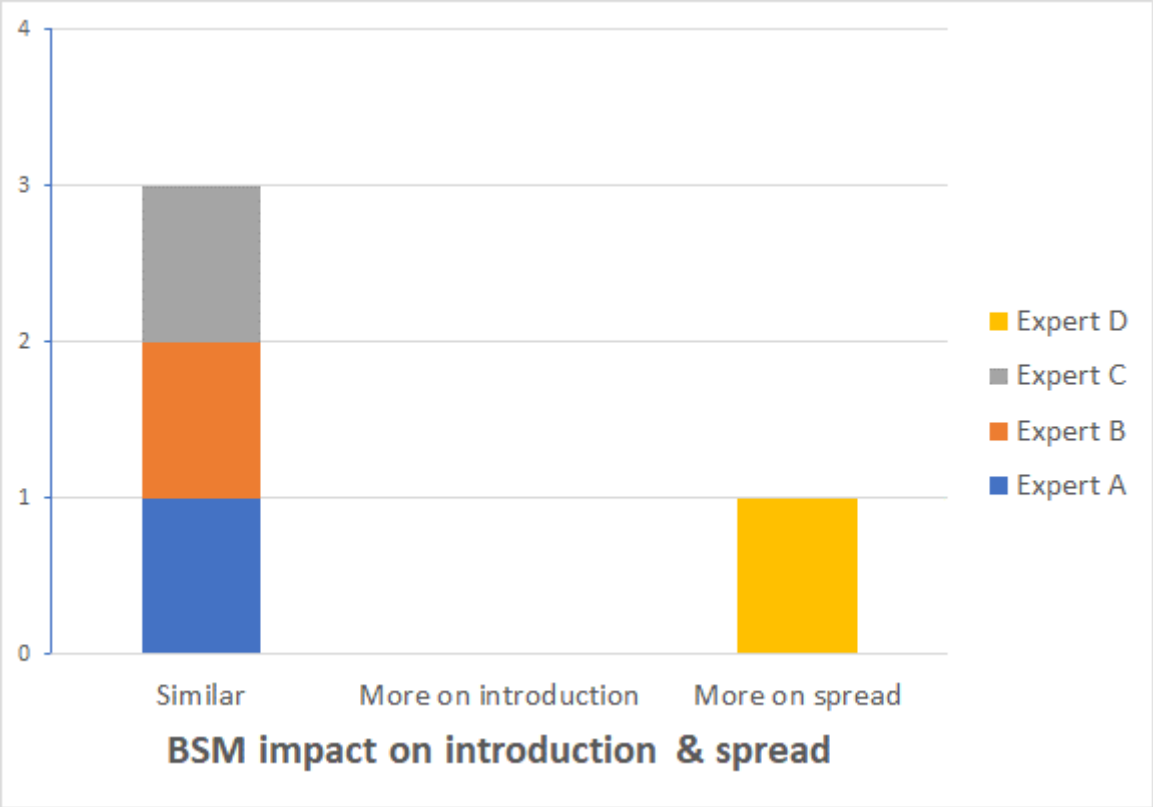
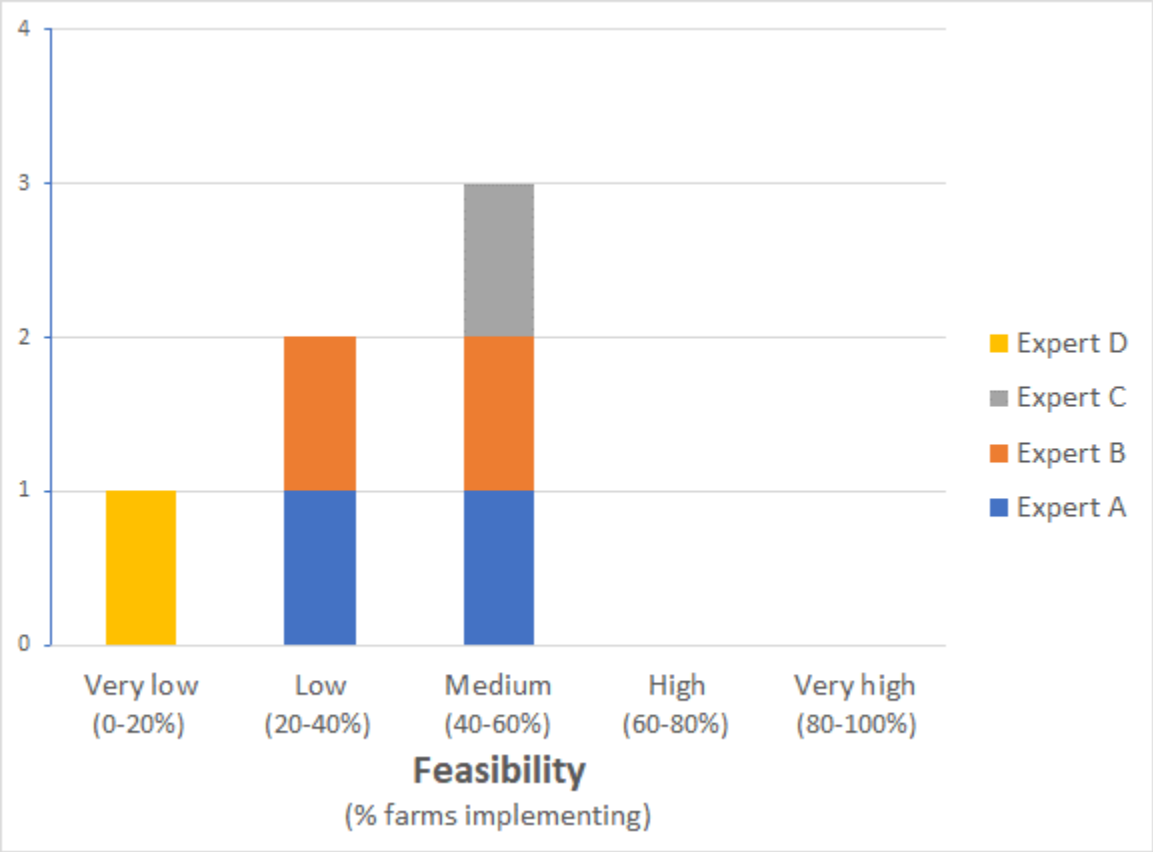


Expert	Reasoning
A	Both introduction and spread will be reduced by this BSM. Mainly wild boar will be attracted less to the farmed pigs. This might reduce introduction into the type I pigs from wild boars. It might also reduce the risk of spread from infected type I pigs to wild boar or other wild animals.
B	the uneaten feed could attract the wild boar, otherwise the uneaten feed is not the main attractive thing, the wild boar could be attracted by several more interesting things, so applying this measure the risk in disease introduction or spread is the same

C	uneaten feed attracts pigs and they visit the place every day. Pigs from both populations can move few kilometres and spread ASFV.
D	Even when the uneaten food is removed, the smell attracting wild boar remains (they don't know if food is there or not), allowing for a possible introduction from the exterior. However, due to the absence of the potential transmission source (food), spread is less likely

BSM:	REMOVAL OF UNEATEN FEED	FARM TYPE I

Definition: No uneaten feed should be left in the outdoor area after feeding



Expert	Reasoning
A	For type I farms removing uneaten feed might be harder compared to type II farms, since the pigs are kept far away from farm buildings. However, the uneaten feed might just be taken away in a car for example, which should not be too difficult. It would just need a change in mind set of the farmer. If he/she sees the benefit of this BSM they might be very willing to implement it. We could question at what moment and how frequently the uneaten feed should be removed to have the maximum benefit of the BSM. Costs will be very low and mainly come from extra time needed to collect the uneaten feed (and probably it's disposal). Feasibility for implementation would therefore be high. Following the discussion (12/2) and taking into account feed on the ground (and therefore scattered) it will be much harder. And we should consider after each feeding. Therefore, my estimation should go from high to low/medium.
B	its feasibility depends on farmer attention and constancy, and I don't think this will be easy to apply (the farmer should stay in front of the animals for the time the animals are eating and then pay attention to remove, but they have several things to do while the animals are eating)

C	farmers have difficulties to understand this measure is important!
D	Extra effort, and technically difficult in FT1 Farmers will say that there is not extra uneaten food (even if it is not true)

BSM:	REMOVAL OF UNEATEN FEED	FARM TYPE I

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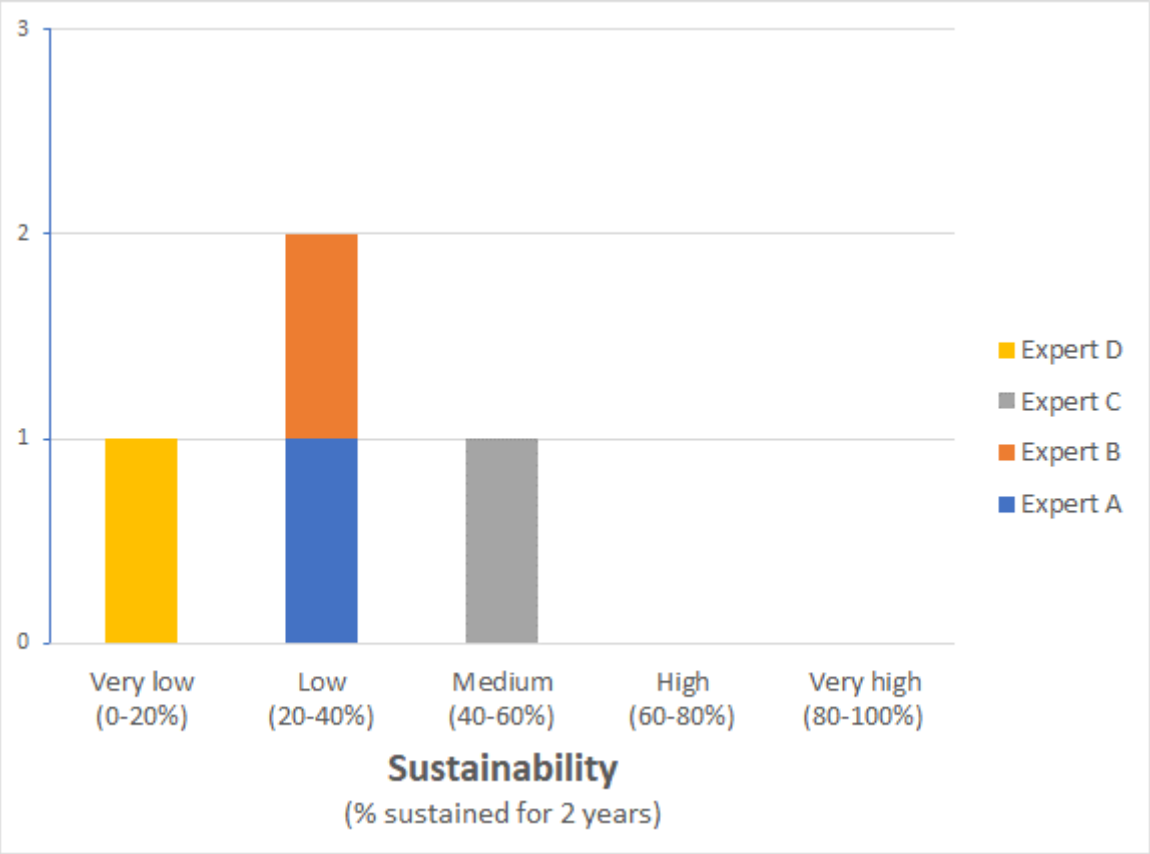
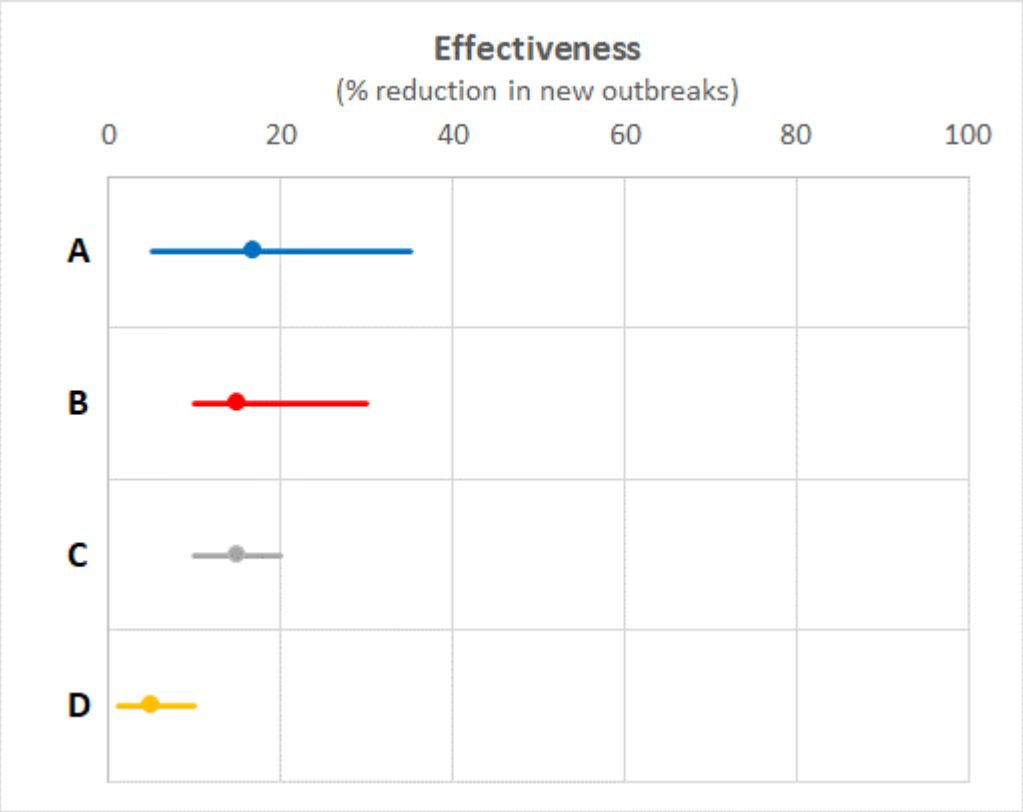


Expert	Reasoning
A	Removing uneaten feed should become a natural habit for the farmer. Keeping this up for 2 years should be well possible. There is of course a risk that this BSM is gradually implemented less sufficiently, due to fact that it is extra work, other priorities, not seeing the need for it anymore etc. Combining these reasons made me go for a medium-high sustainability. Following the discussion (12/2) on feasibility (feed on the ground) I should move from medium/high to low.
B	its feasibility depends on farmer attention and constancy, and I don't think this will be easy to apply (the farmer should stay in front of the animals for the time the animals are eating and then pay attention to remove, but they have several things to do while the animals are eating)

C	is difficult to change habits and keep them for 2 years - is not a hardware, but a software (habits, understanding)!
D	Same reasons. Maybe they will do it at the beginning some days/weeks, then if an audit is coming, but they will likely interrupt it

BSM: NO WILD BOAR BAITING **FARM TYPE I**

Definition: No baiting or similar activities that might attract wild boar should be done within 500 m of the outdoor area

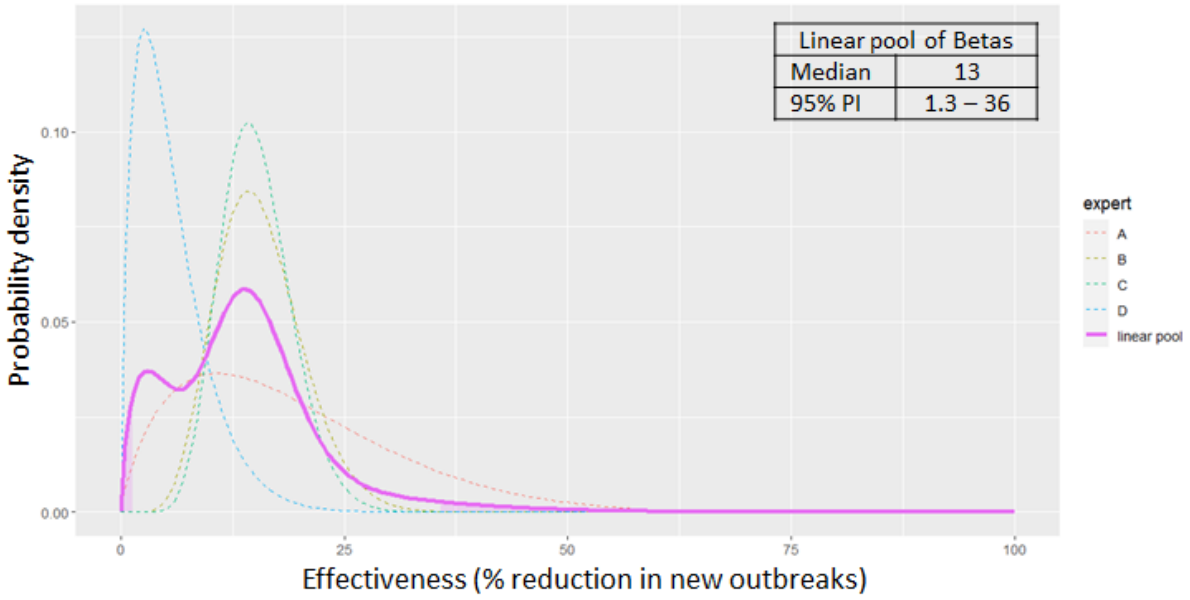


Expert	Reasoning
A - low	Only no wild boar baiting will not be sufficient. Wild boar or other wild animals or contaminated material might still come into contact with the pigs in type I farms and/or general BSM might not be implemented. Probabilities are estimated to be similar to storing feed and removing uneaten feed appropriately. All 3 BSM reduce the attractiveness of the location of the farmed pigs to wild boar.
A - high	If there is no uneaten feed it will not attract wild boar or other wild animals/rodents. In that case these animals will have less reason to come close to the farmed pigs from type I farms. Following the discussion (12/2) and the answers to the previous feed BSMs, I lowered my upper and median (more in line with storage of feed; 5-17-35 instead of 5-20-50).
B - low	this measure will have important consequence in avoiding ASF spread within wild boar, but without any other measure which avoid contacts with pigs in Type I farm the efficacy in prevent the number of outbreaks will be negligible
B - high	

	this measure will have important consequence in avoiding ASF spread within wild boar, but without any other measure which avoid contacts with pigs in Type I farm the efficacy in prevent the number of outbreaks will be negligible

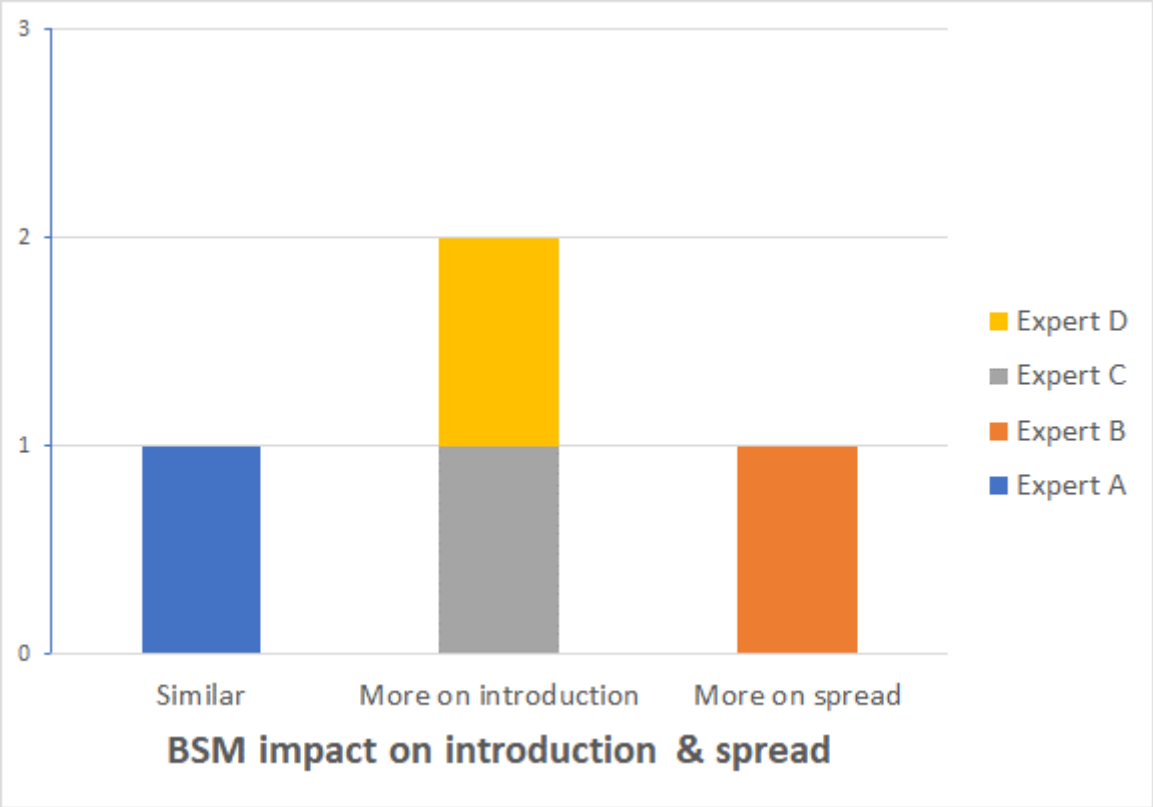
C - low	baiting around farms will increase chance for contact between 2 populations
C - high	measure will not exclude other contact between 2 populations

D - low	No specific fence limits wild boar access into the FT1, so interactions are still not prevented Wild boar are still attracted by natural resources (acorn, water) or pig food into the farm, or even mating period. In addition, pigs could be attracted to the baiting areas
D - high	low wild boar density in the area and low FT1 density as well could affect here



BSM: NO WILD BOAR BAITING **FARM TYPE I**

Definition: No baiting or similar activities that might attract wild boar should be done within 500 m of the outdoor area

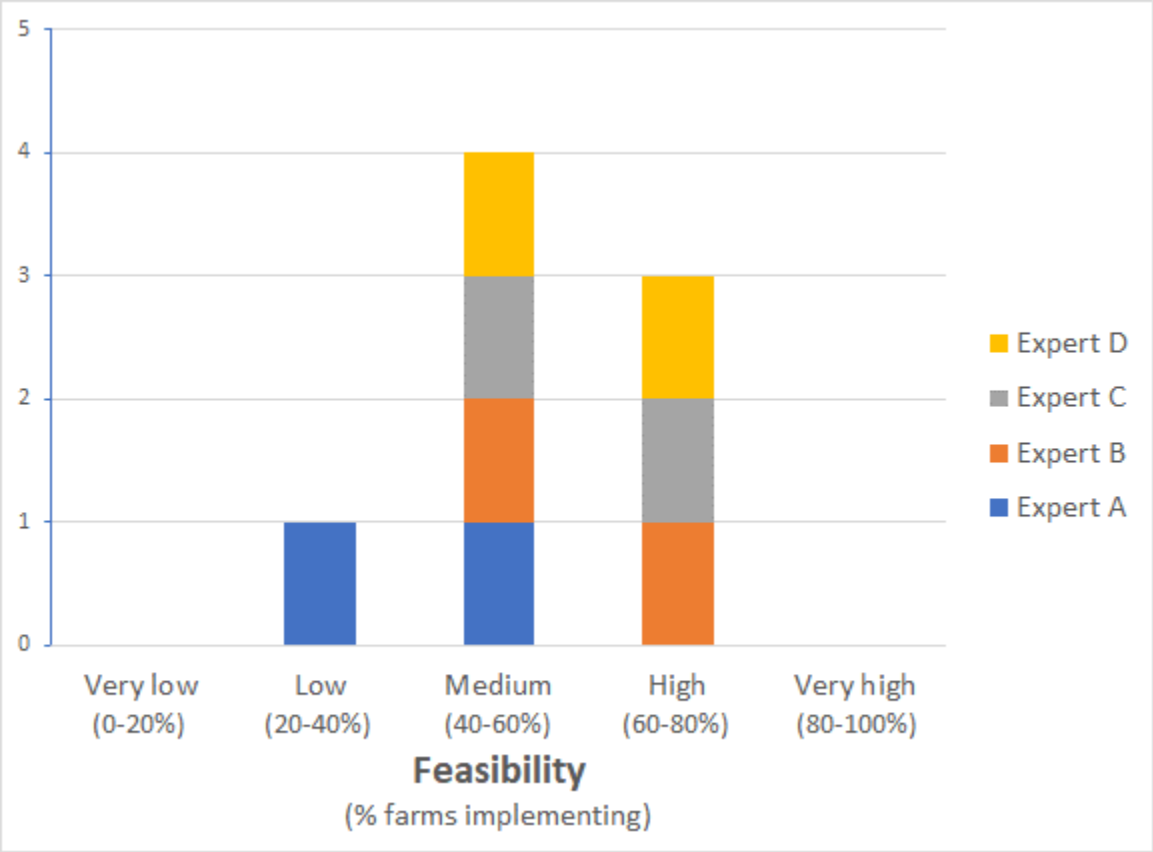


Expert	Reasoning
A	Both introduction and spread will be reduced by this BSM. Mainly wild boar will be attracted less to the farmed pigs. This might reduce introduction into the type I pigs from wild boars. It might also reduce the risk of spread from infected type I pigs to wild boar or other wild animals. Giving the discussion (12/2) I heard suggestions in both direction and therefore stick to similar.
B	The main risk is given by the direct contact between wild boar and people and the not control of food used, rather that the proximity with outdoor farm. So, the first risk is of disease spreads rather than disease introduction

C	domestic pigs will cover same territory, so will not spread ASFV in new territories
D	Less attraction of wild boar to FT1 areas after implementing this BSM

BSM: NO WILD BOAR BAITING **FARM TYPE I**

Definition: No baiting or similar activities that might attract wild boar should be done within 500 m of the outdoor area



Expert	Reasoning
A	Farmers of type I farms cannot do much about the baiting yes/no themselves. No wild boar baiting should be done by hunters. Therefor it is hard to estimate the feasibility for this. It depends highly of how efficient/relevant hunters consider this BSM, whether they are obliged to stop baiting (sanctions) and/or how their relationship with the farmers of type I farms is. However, stopping the baiting activities should not be difficult. Following the discussion (12/2, easy measure etc) I will move up from low to low/medium, although my opinion stays pretty strong on the fact that I think that the farmers don't have a big voice in the change of this habit from hunters. Costs will be very low or non-existing for the farmer (considering he should not be the one to compensate hunters). Considering all of this the feasibility for implementation by the farmer would therefore be low, since he does not have much influence on it.
B	This measure probably is more focus on people in general rather than farmers. If this measure is put in place by the authorities, for example with advices, or even more fines, this measure could have a high or very high feasibility

C	should have understanding from farmers and hunters
D	Many farmers are aware of risk presented by wild boars. However, could be conflicts of interests between farmers and hunters in shared farming areas. This specific BSM would be more difficult to implement out of the borders of the farming area.

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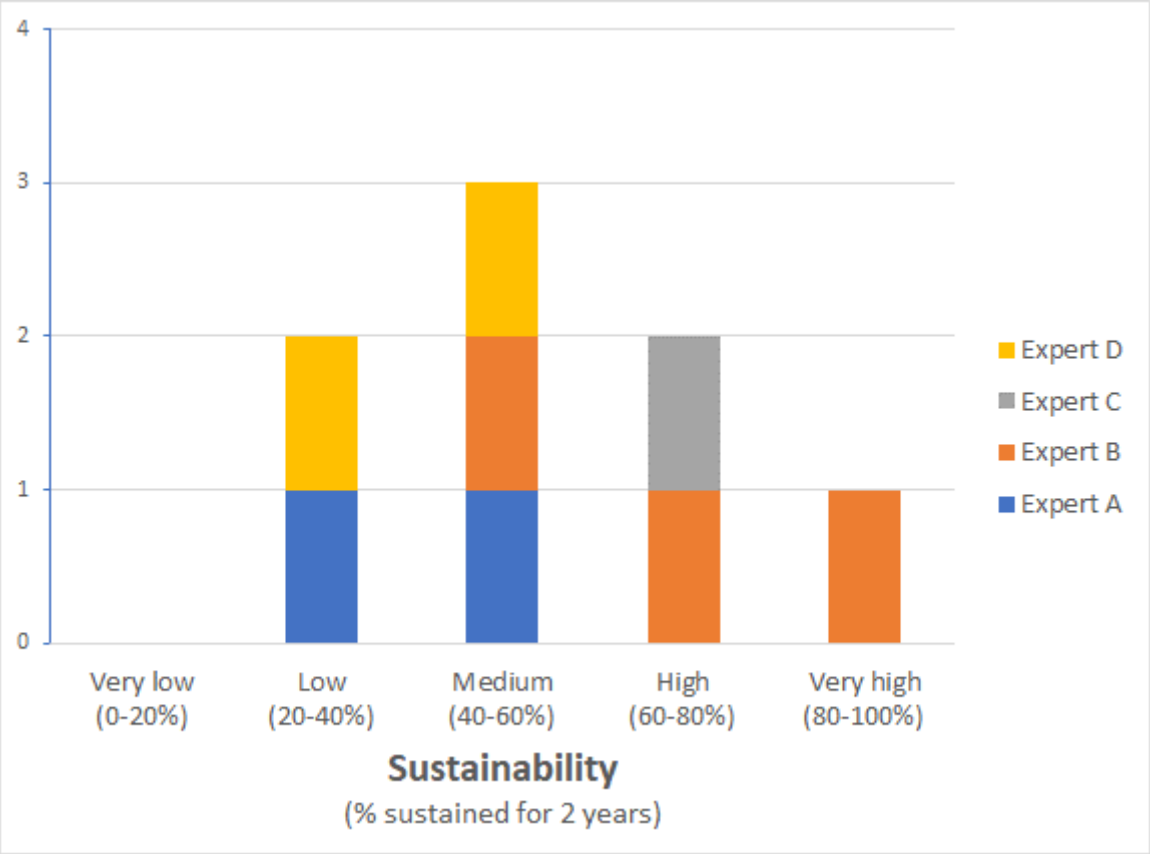
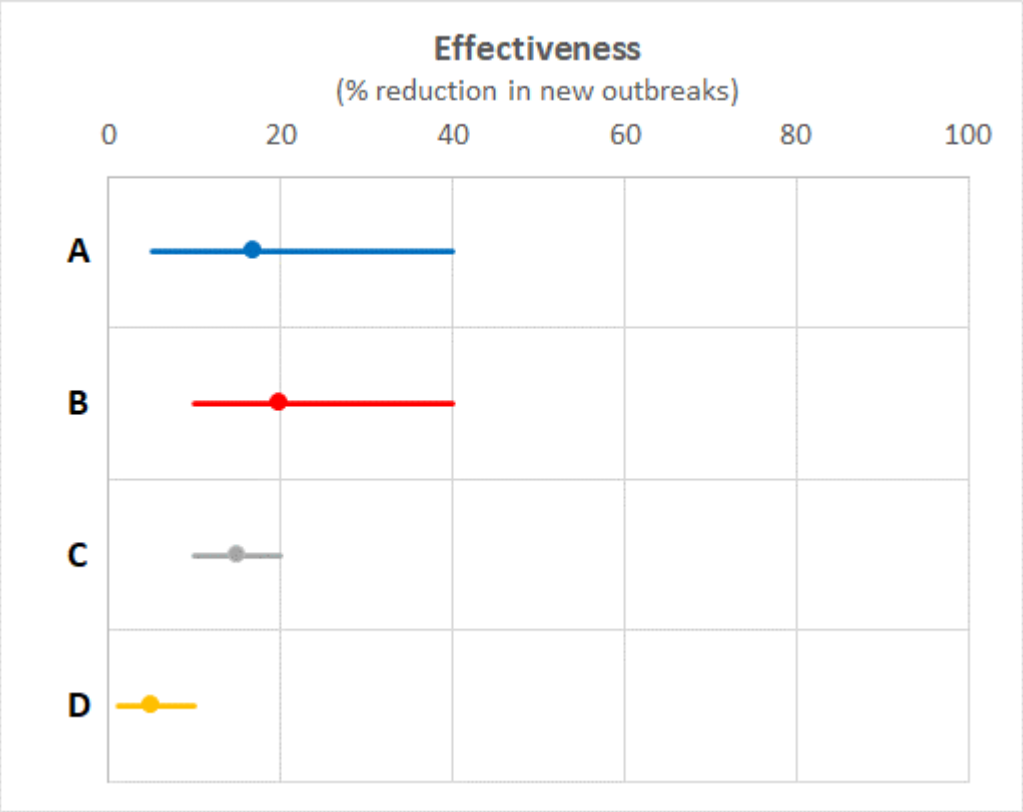


Expert	Reasoning
A	No wild boar baiting is something that likely is not to be done by the farmer. Sustainability is therefor hard to estimate. If rules would to be set for hunters it would not be difficult to sustain this for 2 years. However, if it would be a voluntary ban of baiting the duration depends highly on the hunters perceptions; there is of course a risk that this BSM is gradually implemented less sufficiently or wild boar baiting could start again. Combining these reasons made me go for a low sustainability from the point of view of the farmer. Following the discussion (12/2, farmers being hunters as well) I increase my uncertainty from low to low/medium (hunter/farmer vs only hunter and farmer has no influence on the BSM).
B	as well as feasibility, the sustainability could be very high, based on the way this measure is put in place. Otherwise, if the target people do not understand very well the importance of this measure, its sustainability will be affected

C	It is easy implemented measure
D	Farmer's level of awareness for this measure will remain invariable over time. Conflicts are called to appear over 2 years between farmers and hunters (because of the hunter's interests) which could comprise the sustainability of the measure.

BSM: NO ACCESS TO WATER **FARM TYPE I**

Definition: Access of wild boar and other animals to water including ponds and streams on the farm should be prevented



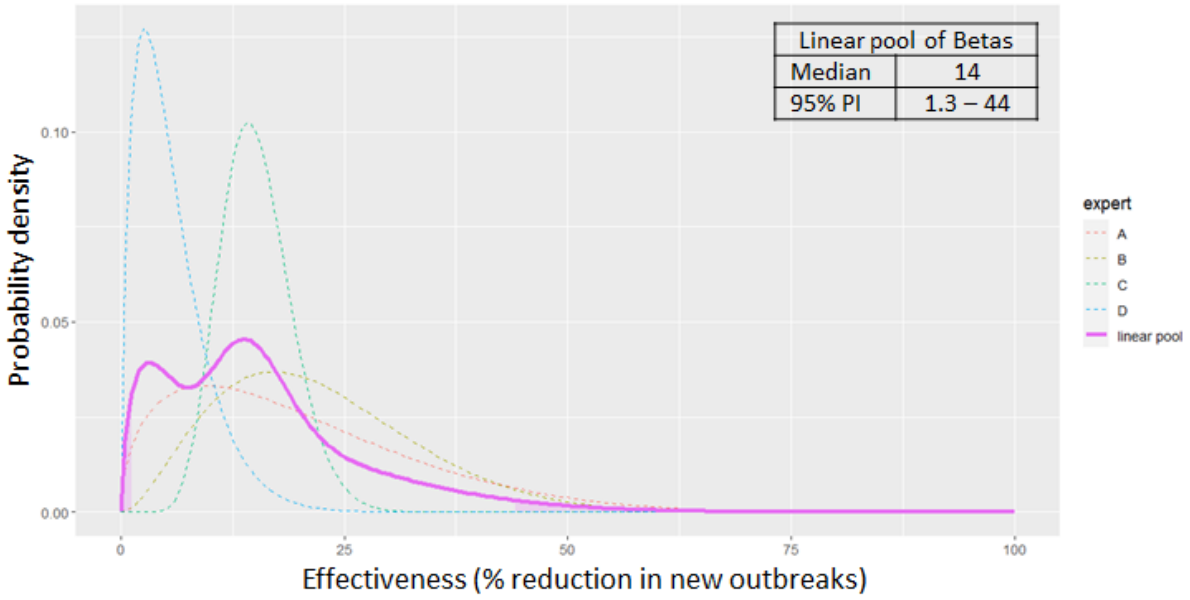
Expert	Reasoning
A - low	Only preventing access to water will not be sufficient. Wild boar or other wild animals or contaminated material might still come into contact with the pigs in type I farms and/or general BSM might not be implemented. Executing this BSM effectively will be very hard; it would require a construction or some kind of fencing which prevents wild boar from accessing the water source (feasibility).
A - high	If there is no access to water, it will not attract wild boar or other wild animals/rodents. In that case these animals will have less reason to come close to the farmed pigs from type I farms. Also the risk of contaminated material or dead wild boar (material) taken with the water to the location of the type I farmed pigs is reduced to nearly zero. The probabilities are estimated to be similar to BSM 4-6 since the principle is similar. The effect of the reduced risk of transport of virus via the water is considered minimal. Considering the discussion (12/2) although Federica considered it quite an important BSM, the others mentioned this BSM not being that important. Overall, I would like to go more into the lower direction as I did for the feed BSMs. Upper goes from 50 to 40 and median from 20 to 17.

B - low	the number of outbreaks prevented applying this BSM could vary based on the seasonality, ranging from minimum of 10 to maximum of 50% considering that in

	winter the water is not the first attractive resources (rather than female pigs), while during the summer several wild boar could be attracted by water, as well as other animals
B - high	the number of outbreaks prevented applying this BSM could vary based on the seasonality, ranging from minimum of 10 to maximum of 50% considering that in winter the water is not the first attractive resources (rather than female pigs), while during the summer several wild boar could be attracted by water, as well as other animals

C - low	water around farms will increase chance for contact between 2 populations
C - high	measure will not exclude other contact between 2 populations

D - low	Direct contact opportunities are still available and human pathways still exist If assessed alone, effectiveness is reduced (measures should be combined in general to increase effectiveness)
D - high	Wild boar could change home ranges looking for more suitable places (with available water)? Differences in the number of water points could exist in particular scenarios and regarding seasonality



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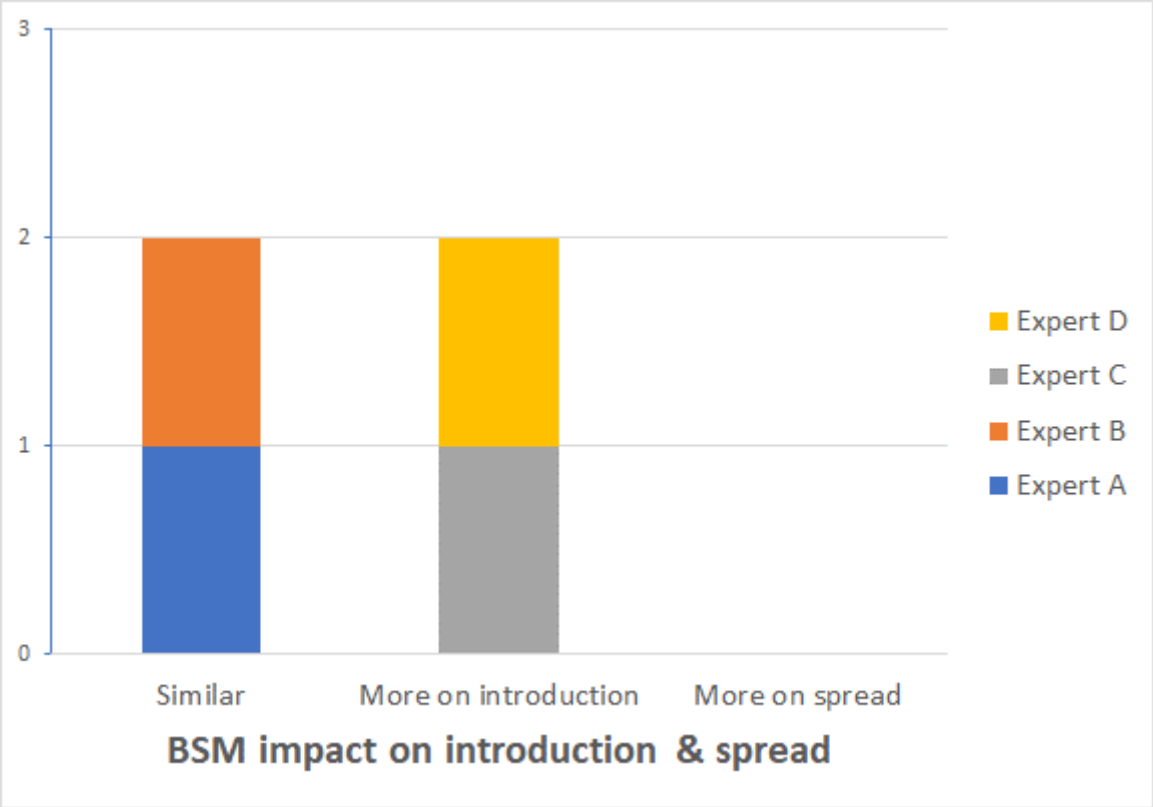
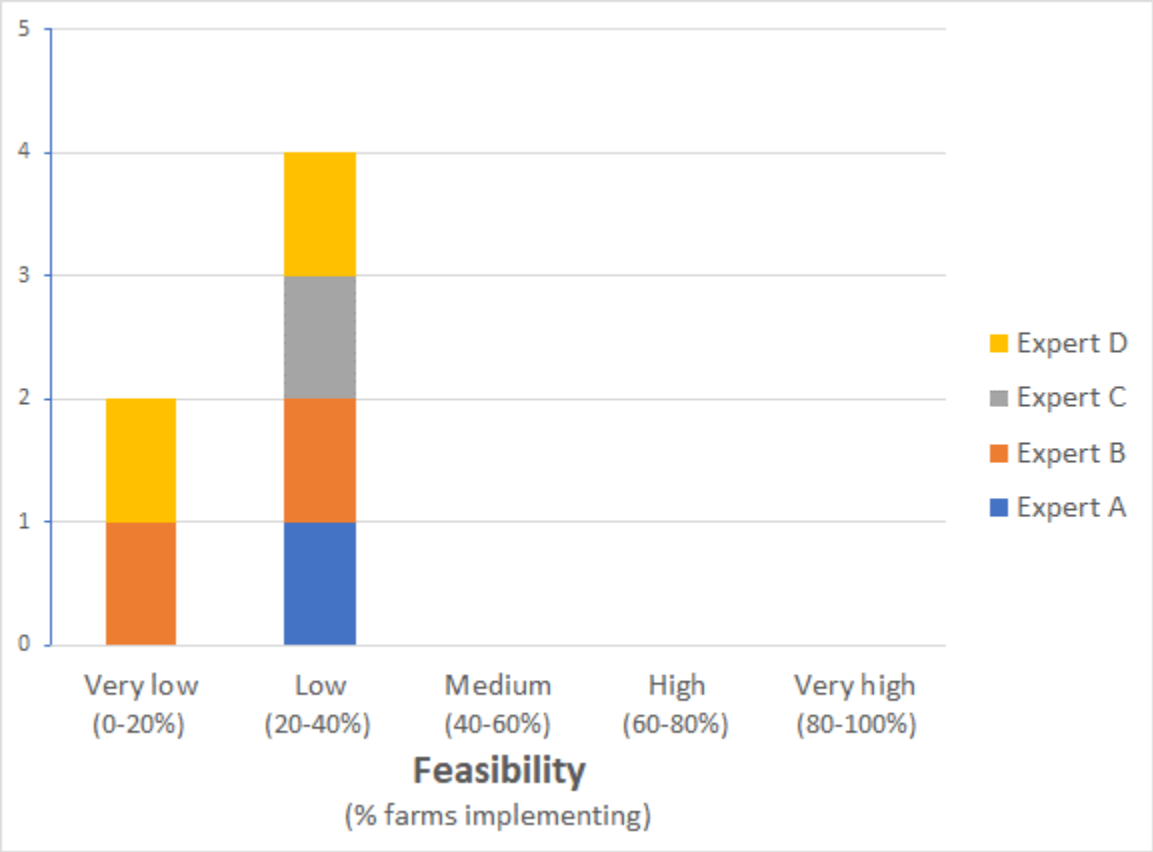


A	Both introduction and spread will be reduced by this BSM. Mainly wild boar will be attracted less to the farmed pigs. This might reduce introduction into the type I pigs from wild boars. It might also reduce the risk of spread from infected type I pigs to wild boar or other wild animals.
B	the measure could have similar impact on introduction and spread depending on seasonality considering the different disease seasonality in domestic pig farms and wild boar population

C	domestic pigs will cover same territory, so will not spread ASFV in new territories
D	The frequency of water points is higher in farmed areas than in the wild boar natural habitat, so they are highly attracted by this resource. If this BSM is implemented, the risk of introduction will be reduced. Risk of spread from infected streams or rivers could be very diluted according with water body size and speed

BSM: NO ACCESS TO WATER **FARM TYPE I**

Definition: Access of wild boar and other animals to water including ponds and streams on the farm should be prevented



Expert	Reasoning
A	No access to a natural water source (river, pond etc) will be feasible to type I farms. However, it would mean that the type I farms pigs should get their water from another source (e.g. ground water, daily provision of water etc) and the water for the pigs should be not accessible to e.g. wild boar. In a situation as for type I farms where there is no fencing present, we could never guarantee that there is no access to a shared water source by the farmed pigs and wild boar or other wild animals. Only if the water source would be made in such a way that only the farmed pigs have access to it will guarantee full effectiveness of this BSM. The feasibility of this is however low since it will require quite a construction which might be costly as well. Feasibility for effective (!) implementation would therefore be low.
B	very difficult to prevent access to ponds in the large outdoor pig farms

C	most of farms are located there because of easy water access
D	High economic investment (higher when more water points are available). Difficult to convince farmers about the necessity of its implementation. In other European contexts could be easier to implement. Management of temporary points its very complicated.

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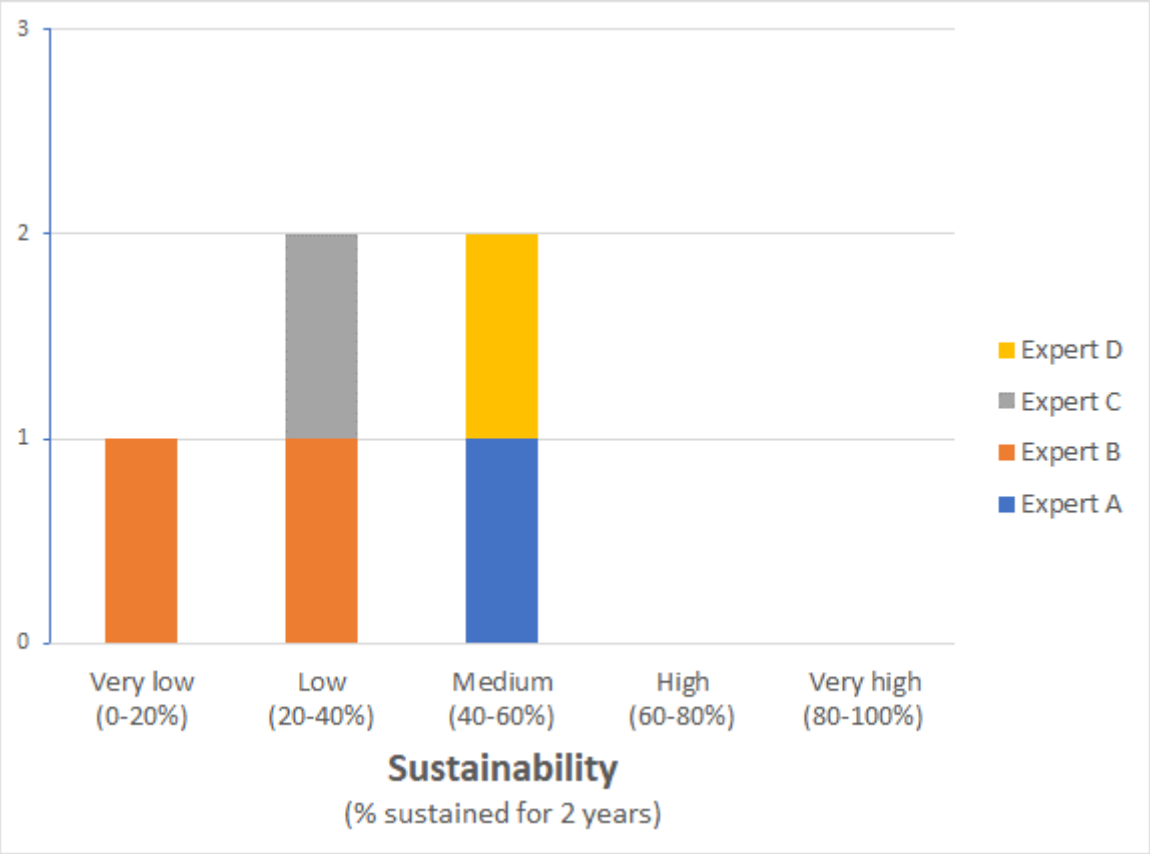
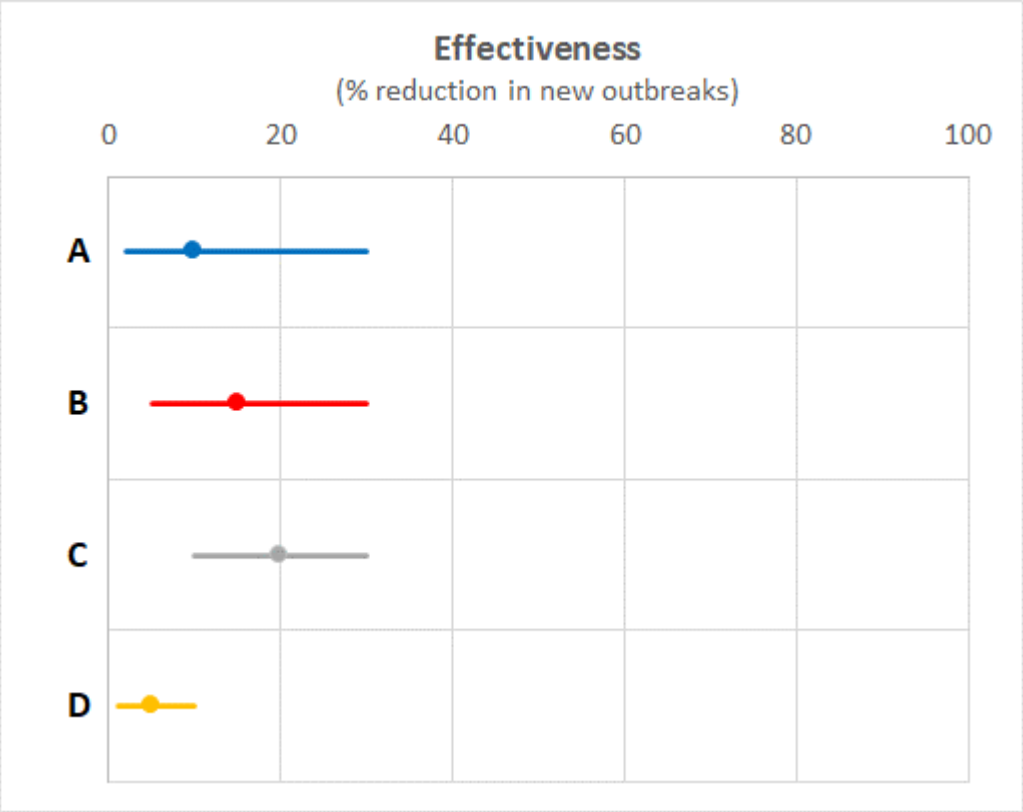


Expert	Reasoning
A	If a construction/fence has been made, preventing access to water could be sustained quite easily, since I consider it to be a permanent structure. Keeping this up for 2 years should be well possible. Overall, these reasons made me go for a medium-high sustainability. Considering the discussion (12/2 Georgi and Federica think it is very unlikely to be able to build something) made me change from Medium/high to medium only.
B	difficult to apply = difficult to maintain

C	is not an easily implemented measure
D	After investment, aware farmers will take care of the maintenance. However, temporary water points are very difficult to manage in this sense

BSM:	DAILY INSPECTION	FARM TYPE II

Definition: Daily inspection of the outdoor area by the farm personnel, to identify carcasses or parts of carcasses, especially after strong rainfall, including checks in all areas close to the boundary

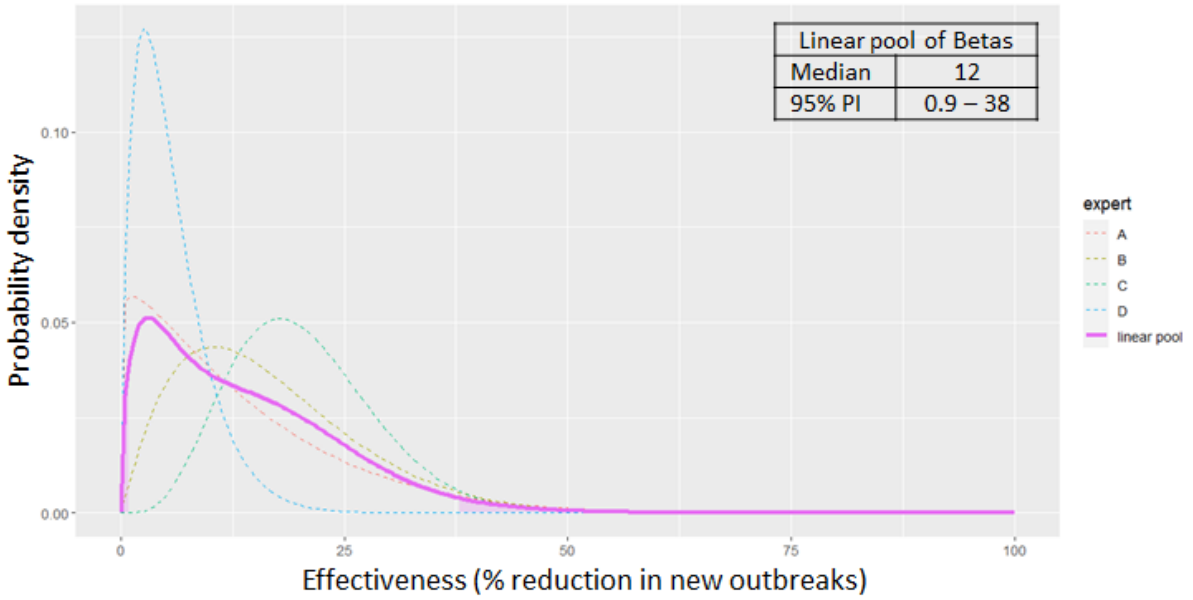


Expert	Reasoning
A - low	General BSM not well implemented, e.g. via e.g. contaminated boots, introduction of diseased animals, rodents transmitting ASFV. Walking on the outer premises of the farm could pose an extra risk of general BSM are not well implemented. Daily inspection will still allow contaminated material to stay in close proximity of the farm or even flow under the fence after heavy rainfall, especially in the period between two inspections. Introduction may already have taken place in the meantime. Daily inspection does nothing to prevent wild boar or other wild animals from coming close to the farm or even entering the farm premises. Correct disposal of (possibly) contaminated material is also crucial with this BSM.
A - high	Daily inspection will only reduce the risk of contaminated material being in the close proximity of the farm for a period longer than 24h, therefor reducing the risk of transmission just slightly. Daily inspection however will allow for a more adequate response to risks; the farm is fenced, so removing contaminated material timely is crucial. Following the discussion (15/2); inspection border will result in better control of the fence (all types of fences), however ASFV could still spread within 24h, I also mentioned it at the upper probability for the fact that 24h is better in comparison to e.g. 1 week, however after the discussion I'll reduce this upper bound and the median since we have to consider all type II farms in EU and their fencing and general BSM etc. 2-15-40 becomes 2-10-30.

B - low	given that this measure could have a greater effect on spread than introduction, the number of avoid outbreaks is not so high
B - high	given that this measure could have a greater effect on spread than introduction, the number of avoid outbreaks is not so high

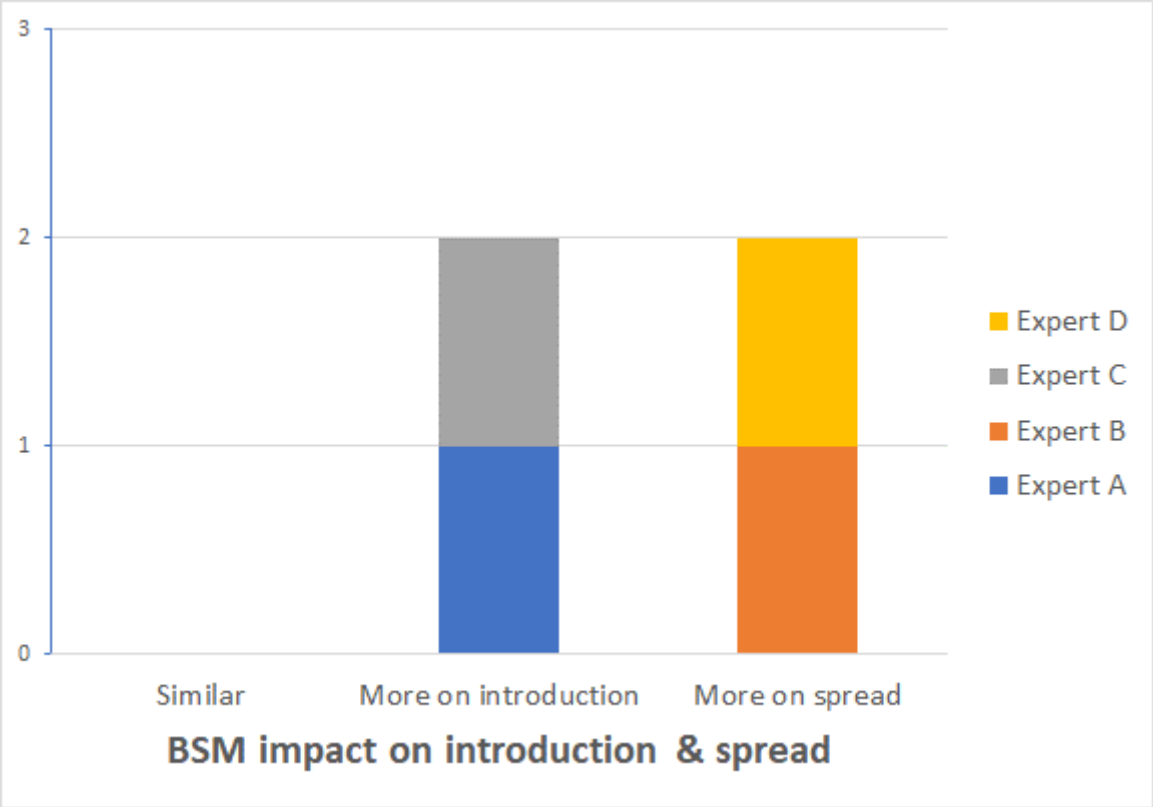
C - low	farms have border, inspection helps to keep it functional
C - high	inspections cannot prevent introduction of AFS themselves.

D - low	All of the main risks of introduction are still present (wild boar accesses, humans or even other sympatric species)
D - high	It may prevent the punctual introduction of ASF from a dead infected animal in the surroundings, but it has no more effects. Relatively good efficacy of FT2 current borders in areas of interest for population separation (pigs-boars).



BSM:	DAILY INSPECTION	FARM TYPE II

Definition: Daily inspection of the outdoor area by the farm personnel, to identify carcasses or parts of carcasses, especially after strong rainfall, including checks in all areas close to the boundary

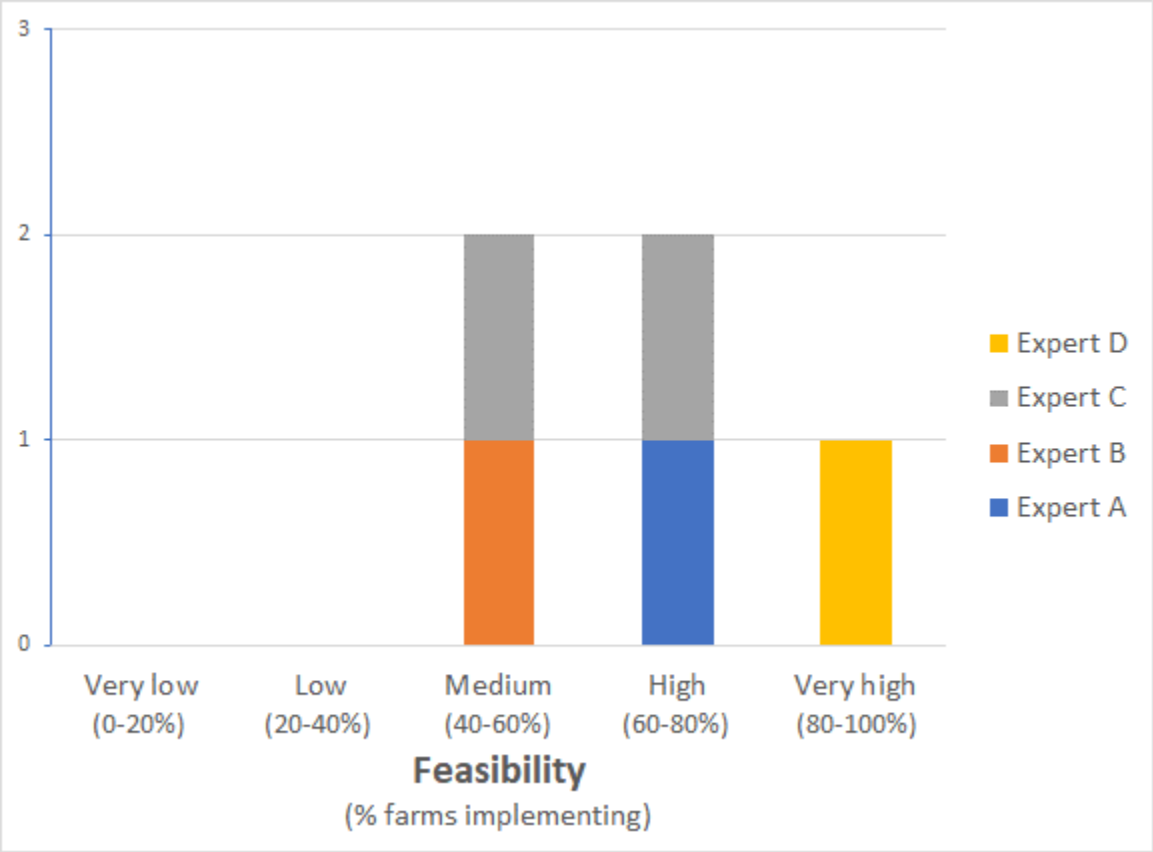


Expert	Reasoning
A	Given the definition mentions identifying carcasses or material this BSM will only have effect on the introduction. It would need another definition to also have impact on spread. Following the discussion (15/2) there was also some evidence for impact on spread. However, for me the effect on introduction is still most important.
B	the daily inspection could have a very high impact in preventing the spread of the disease rather than the virus introduction, considering that the period of 24 hours is enough to prevent virus introduction if no other BSM is applied

C	if few pigs escape from borders, they will not go far. Also, we expect these domestic pigs to be free from ASF.
D	Considering that ASF can be introduced from several pathways into the FT2, the implementation of this specific BSM could prevent more the spread than the introduction (through removal of carcasses or dead animals).

BSM:	DAILY INSPECTION	FARM TYPE II

Definition: Daily inspection of the outdoor area by the farm personnel, to identify carcasses or parts of carcasses, especially after strong rainfall, including checks in all areas close to the boundary



Expert	Reasoning
A	Daily inspection is of course feasible, but it requires discipline and a sense of urge from the farmer. I wonder whether the farmers of type II farms consider it effective enough to spend time to it. It will take time, but further it will not include a large cost. I therefor consider it medium feasible. Following the discussion and the opinion of the others that it is well feasible, I went up from medium to high.
B	the daily inspection in Type II (limited area to check) is not so difficult and maybe this measure is unknowingly and automatically applied by the farmers

C	It is possible, because farmers usually feed animals every day.
D	It is a null or low-cost measure, easy to implement and to raise awareness about

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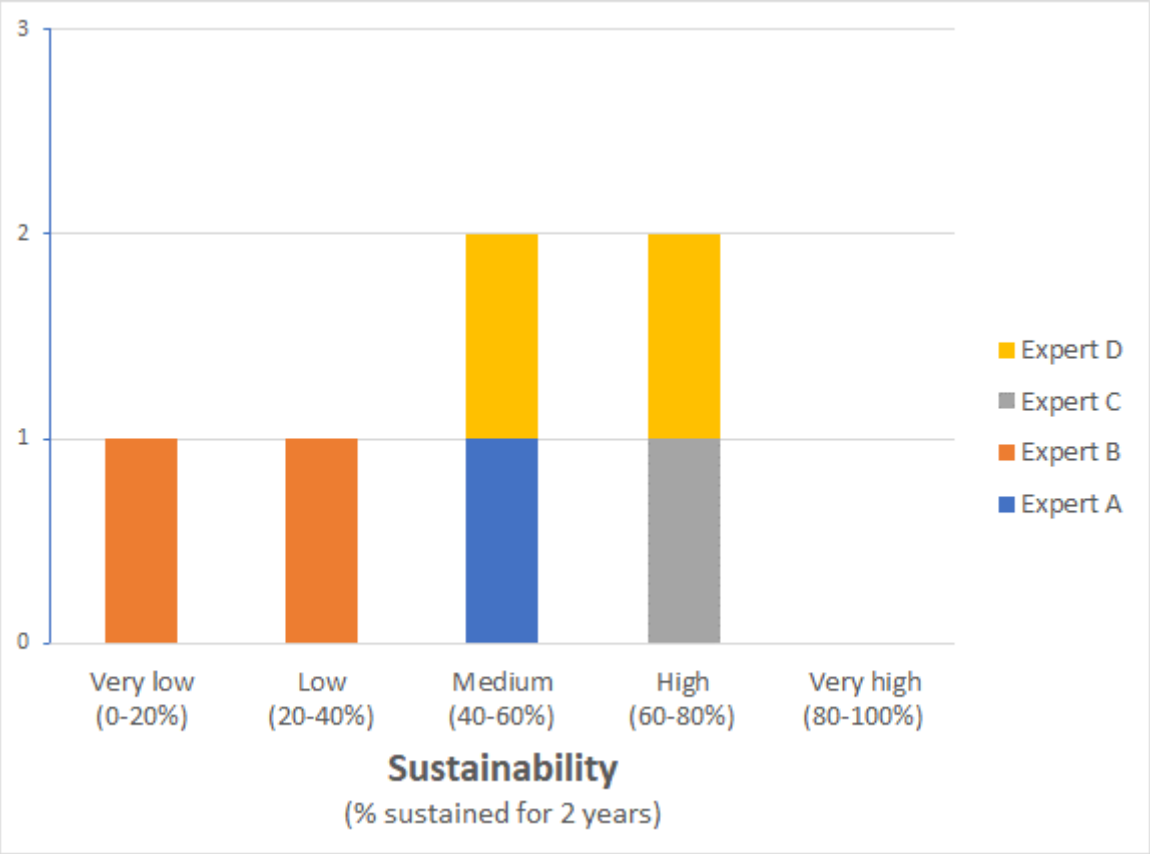
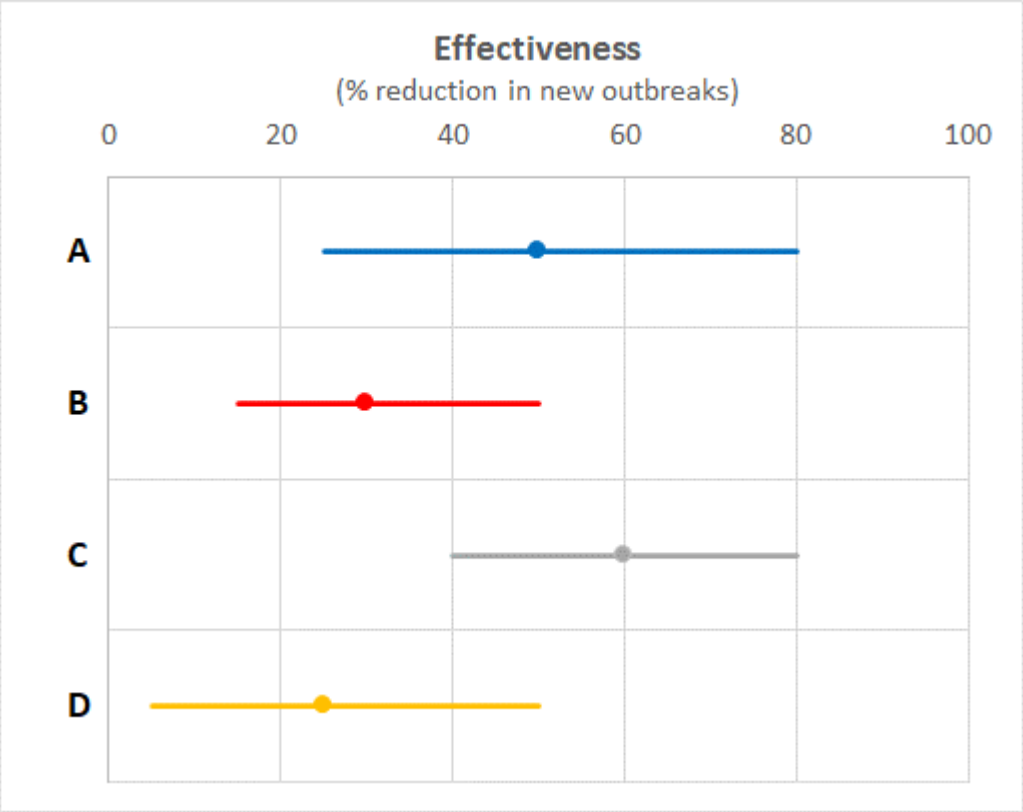


Expert	Reasoning
A	Keeping this BSM up for 2 years requires even more discipline from the farmer. If it becomes a habit however it will be sustainable. However it would be very possible that e.g. the frequency of inspection will go down or that it will not be performed as effectively anymore over time. I therefor considered the sustainability to be medium. Following the discussion and only taking into account the sustainability of this BSM with this definition, I'll stick to medium since I think that mainly keeping up the habit and in the correct way can be hard, farmers will tend to lower the frequency etc.
B	this measure could be sustain for the artificial water bodies but it is more difficult to artificial bodies. For this reason, I think that could be there also 0% of farmers which sustain the BSM

C	possible, because farmers usually feed animals every day.
D	Farmers may relax this practice in time if NO dead will boar appear in the surroundings, using daily inspection time for other operations of the daily management of the farm ("saving" time of the journey)

BSM:	CLEANING/DISINFECTION FACILITIES	FARM TYPE II

Definition: Facilities for cleaning and disinfection of footwear, protective equipment and vehicle wheels (easily accessible and ready for use at any time) must be used upon entering and leaving the outdoor area



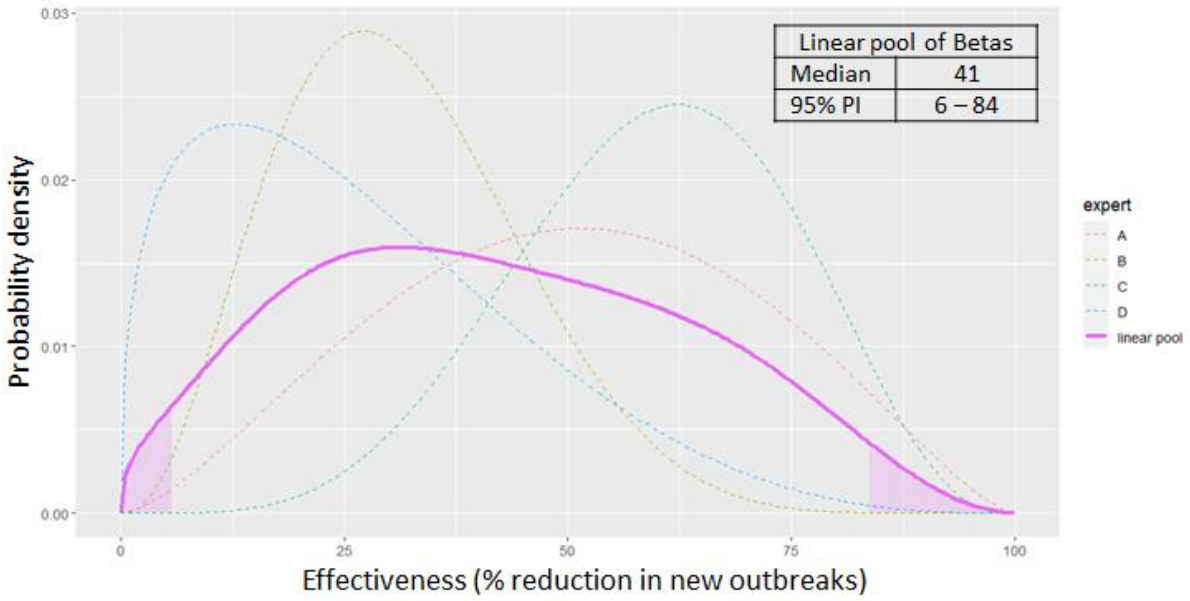
Expert	Reasoning
A - low	This BSM will not, by itself, reduce the risk of direct contact between e.g. wild boar and type II pigs. Other general BSM might not be implemented well. The products used for C&D might not be effective enough or not used properly. Or the weather conditions might affect their effectiveness. Disposal of wastewater might be done improperly (e.g. via the area where the pigs are kept).
A - high	This BSM is already part of the general BSM in the EU strategic approach to my opinion (1d), but slightly broader in its definition. Extra attention to this important BSM is however good, since to my opinion this is likely not well performed at the moment at all type II farms (especially not in the less professional type II farms or keepers of pet pigs). A good C&D will largely reduce the risk that virus stays on boots or other materials and can be spread from there to the area where the pigs are kept. If we consider the risk of direct contact with e.g. wild boar already lower for type II farms (due to some kind of fence/barrier and close proximity to farm buildings), a good C&D might have quite a good influence on mitigating the risk of introduction of ASFV. As we consider ASFV to be readily present in the affected area it is assumed to be likely that boots, wheels etc will be contaminated with ASFV (which will also survive well). The risk of spread can also be reduced.

	Following the discussion (15/2) and taking into account that a specific extra C&D facilities should be made near the outdoor area (remark: type II farms will most likely be connected to the farm building and C&D will be upon entrance of the farm buildings). Risk via humans more important role in type II farms. However other (direct contact) pathways still occur. Therefore, it highly depends on the level of fencing in these type II farms and to a minor aspect the other general BSMs and therefor I think that the range/uncertainty should be high. Effect of cold weather on the effectiveness should be considered as well. I'll stick to my judgements.

B - low	the minimum number of prevented outbreaks is reduced by the fact that this BSM could prevent only human pathways not animal pathways if applied alone
B - high	the maximum number of prevented outbreaks is similar to those prevented by avoid access to stored feed

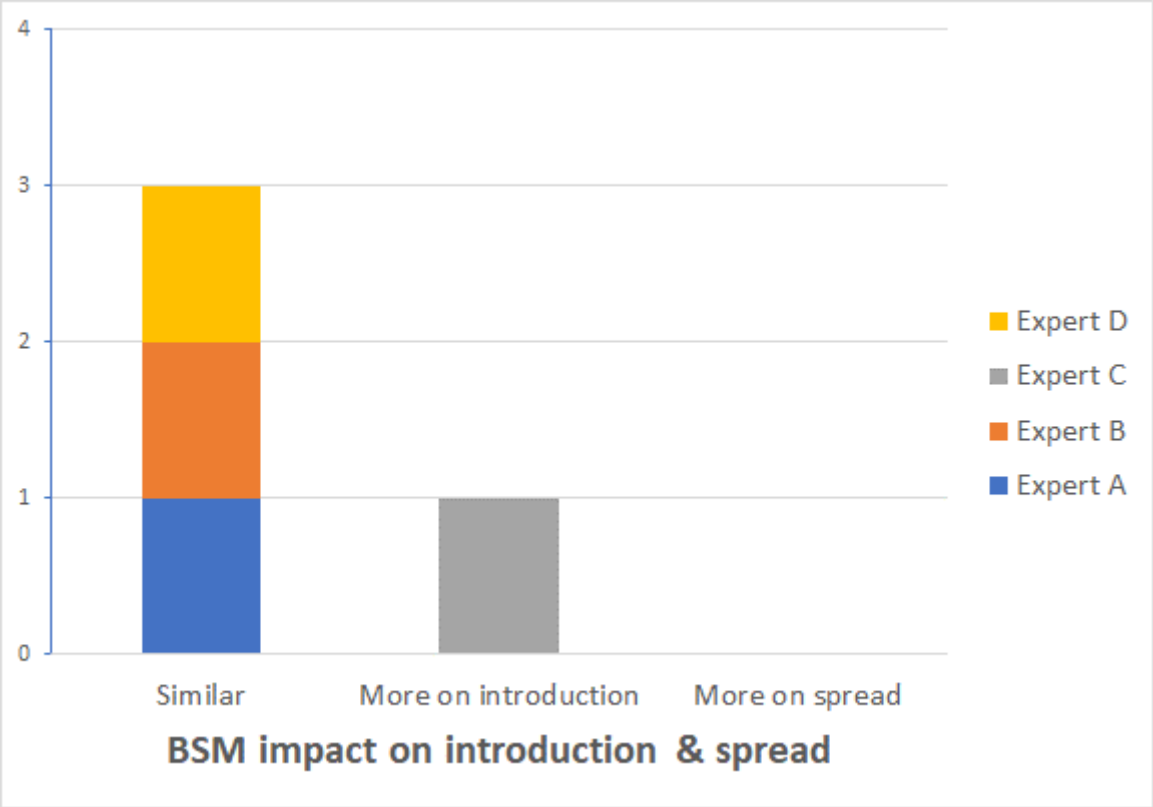
C - low	because is Type II, most probable way for introduction of ASFV is by humans and equipment.
C - high	measure is not the only one and should be combined with others, like protective clothes.

D - low	Introduction by human through footwear/clothes and vehicles may be a main pathway in FT2 Direct contact and attractiveness for wild boar are not avoided Risk coming from contaminated food is still present
D - high	Other pathways are still present, however, including other sources coming from humans not avoided with this BSM



BSM:	CLEANING/DISINFECTION FACILITIES	FARM TYPE II

Definition: Facilities for cleaning and disinfection of footwear, protective equipment and vehicle wheels (easily accessible and ready for use at any time) must be used upon entering and leaving the outdoor area

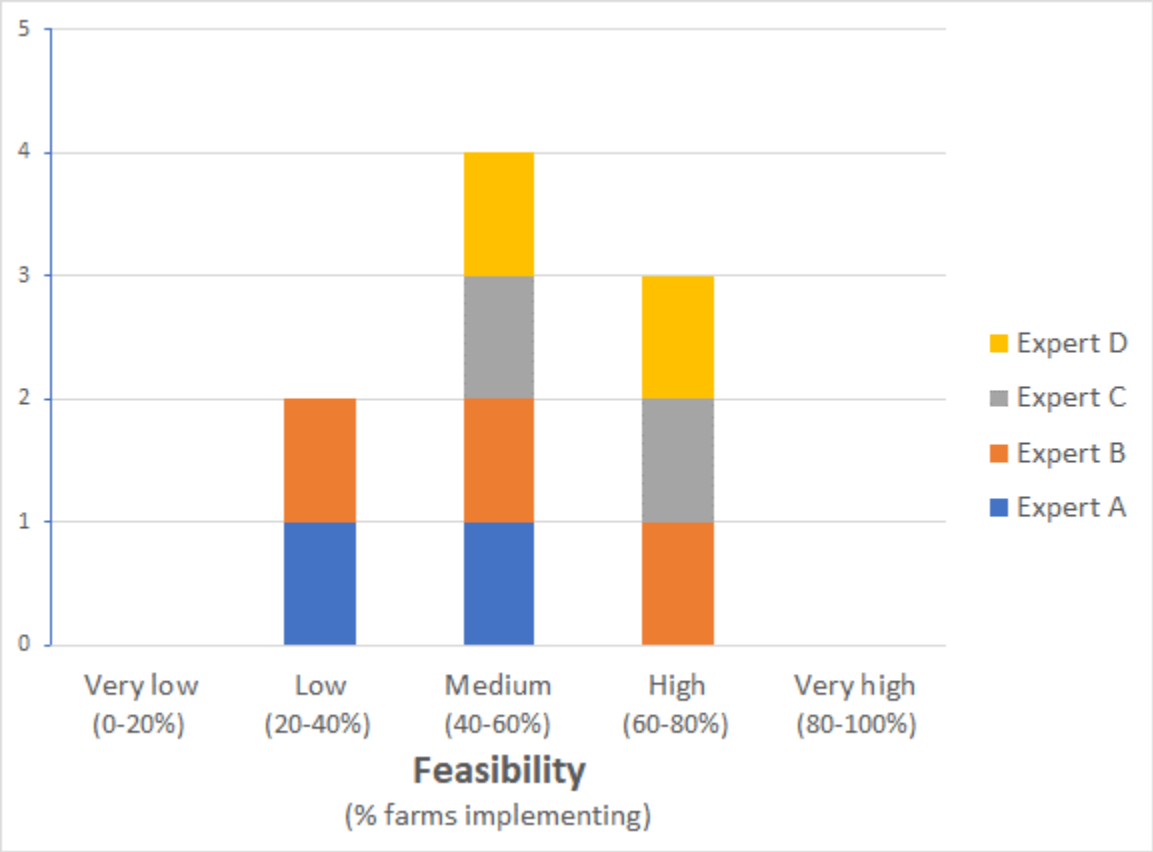


Expert	Reasoning
A	Following the definition of this BSM it has an impact on both introduction and spread since the C&D should be done upon entering and leaving the outdoor area.
B	If the disinfection of facilities will be done at the entrance and exit from the farm, this BSM will prevent both introduction and spread of ASF

C	Usually cleaning is on the entrance, not on the exit.
D	It has a high impact on both according to the definition

BSM:	CLEANING/DISINFECTION FACILITIES	FARM TYPE II

Definition: Facilities for cleaning and disinfection of footwear, protective equipment and vehicle wheels (easily accessible and ready for use at any time) must be used upon entering and leaving the outdoor area

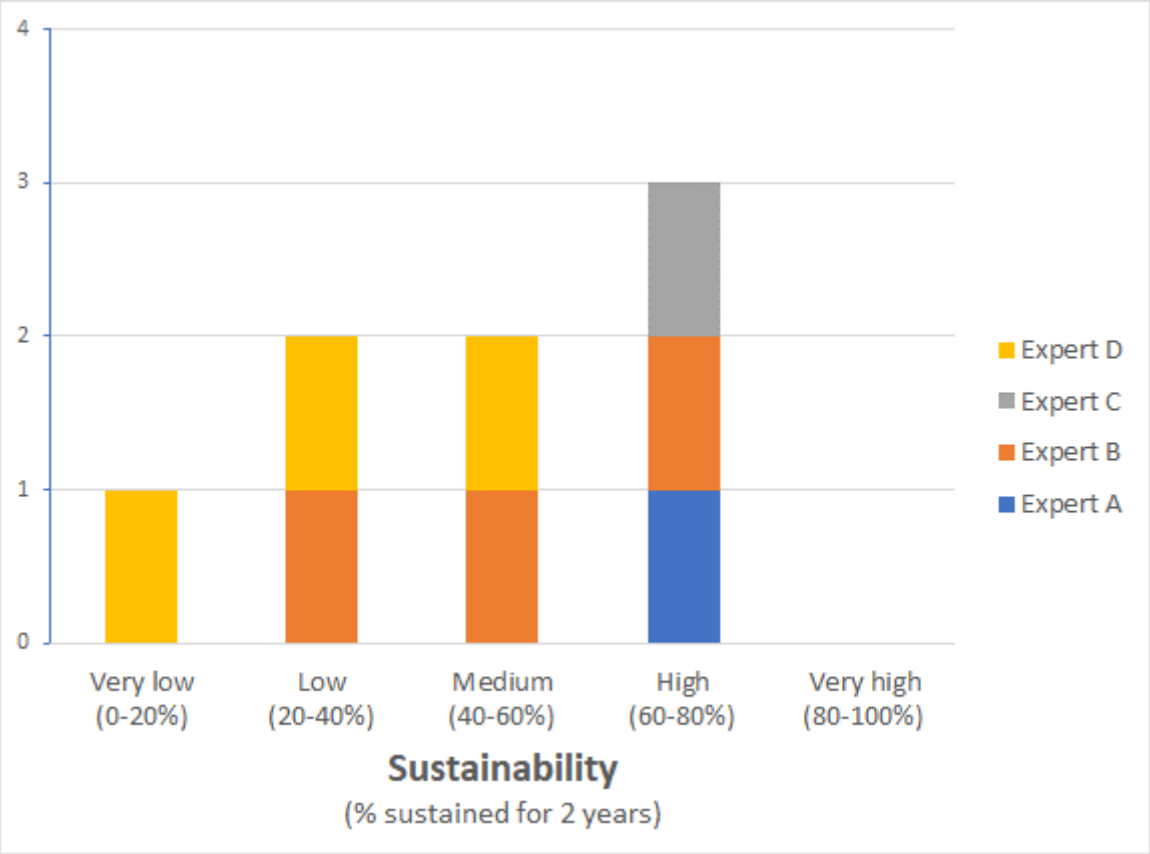


Expert	Reasoning
A	If well placed (in the walking route) the usage of the C&D equipment will be good. Implementation is of course feasible. However, costs and practical issue might make it slightly less feasible. There is also some cost and extra effort since a good C&D will cost extra time. Overall I think however that, especially for the more professional type II farms this BSM is highly feasible. However, less professional type II farms or pet pig holdings might not consider it interesting enough to spend their money on and/or they might lack awareness and knowledge. Combining these two reasons results in a medium feasibility for me. 15/2; taking into account that it has to be an extra/separate C&D facility specifically for the outdoor area makes it much less feasible (extra cost, extra effort, less "believe" from the farmer). Therefore, I'll go from medium to medium/low.
B	the feasibility could be theoretically very high, given the BSM is low expensive, but also very low, given that this strictly depend on farmer behaviour and education and sensibilization to the disease, their cultural level and social condition

C	this type of facility costs money, can also have conflict with environment institutions.
D	Difficult implementation in rural areas according to social factors and awareness of effectivity. New facilities can bring new costs for a proper implementation

BSM:	CLEANING/DISINFECTION FACILITIES	FARM TYPE II

Definition: Facilities for cleaning and disinfection of footwear, protective equipment and vehicle wheels (easily accessible and ready for use at any time) must be used upon entering and leaving the outdoor area

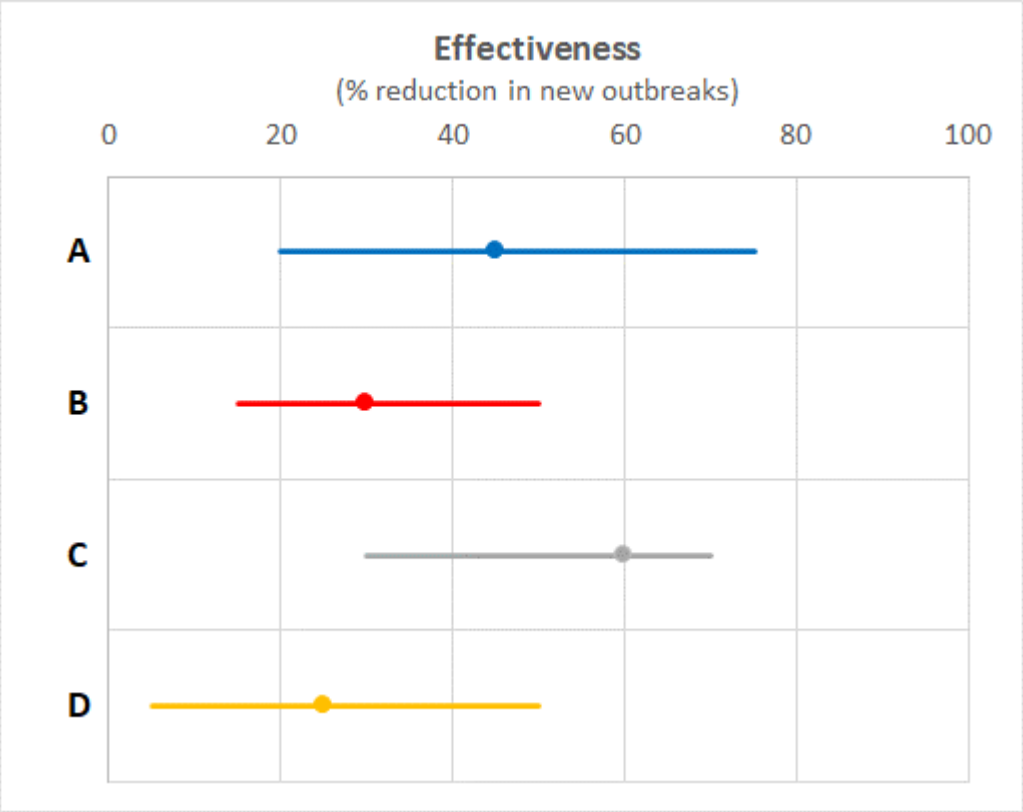


Expert	Reasoning
A	If installed logically and correctly and if the equipment is of good quality, it is likely to sustain for 2 years. Using the C&D facilities correctly requires of course discipline, which might deteriorate over time. The facilities might need maintenance, but this normally will be not too costly. Overall I however consider it a highly sustainable BSM for all type II farms (also pet pig keepers).
B	the sustainability could be theoretically very high, given the BSM is low expensive, but also very low, given that this strictly depend on farmer behaviour and education and sensibilization to the disease, their cultural level and social condition

C	when rules and habits are established, it is easy to fulfil.
D	It can start in a good way, but farmers will relax with time and abandon a proper implementation. When facilities are implemented, sustainability could not be very difficult in FT2

BSM: PROTECTIVE CLOTHING **FARM TYPE II**

Definition: Requirement to enter outdoor area either with protective clothing belonging to the farm or with disposable clothing, which must be removed before leaving the outdoor area



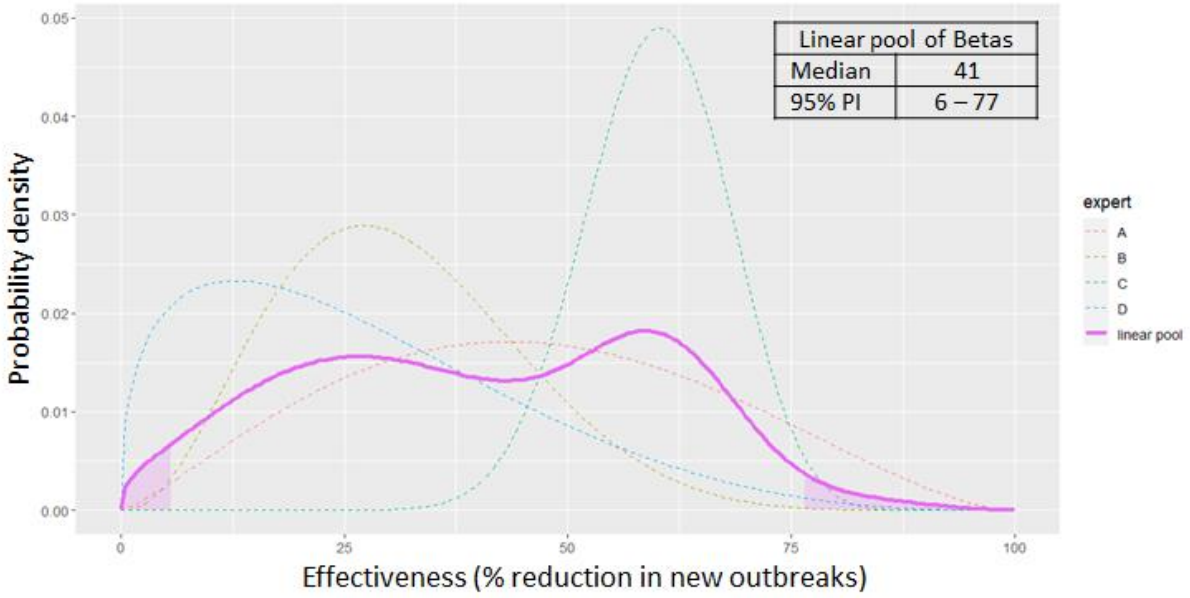
Expert	Reasoning
A - low	This BSM will not, by itself, reduce the risk of direct contact between e.g. wild boar and type II pigs. Other general BSM might not be implemented well. Only protective clothing is not effective against potential contamination of boots, hands or other material. The protective clothes might not be used properly (e.g. multiple use etc). Storage of the protective clothes might not be good (e.g. contact possible with contaminated material, or not in a closed storage). Disposal or washing of the used clothing might be done improperly (e.g. possibly contaminated coveralls might be taken in a car to a house and from there contaminate other materials). Following the discussion (15/2) we should consider both clothing and footwear and on the other side we should also consider this BSM to be well implemented. The only thing we're missing here in this definition is that vehicle wheels and materials are not mentioned (e.g. stay on farm, C&D etc). Therefore, I think that the estimates should be in line with C&D but mainly slightly lower upper, lower and median (minus 5).
A - high	Wearing protective clothing will reduce the risk that a person enters the farm premises with contaminated clothes or that one leaves with virus (or virus containing

	material/dirt) on his/her clothes. For people coming into contact with the pigs or who have been in contact with wild boar for example this BSM will be mainly effective. Following discussion 15/2: in line with C&D but minus 5 due to wheels and material not taken into account.

B - low	equal to disinfection
B - high	equal to disinfection

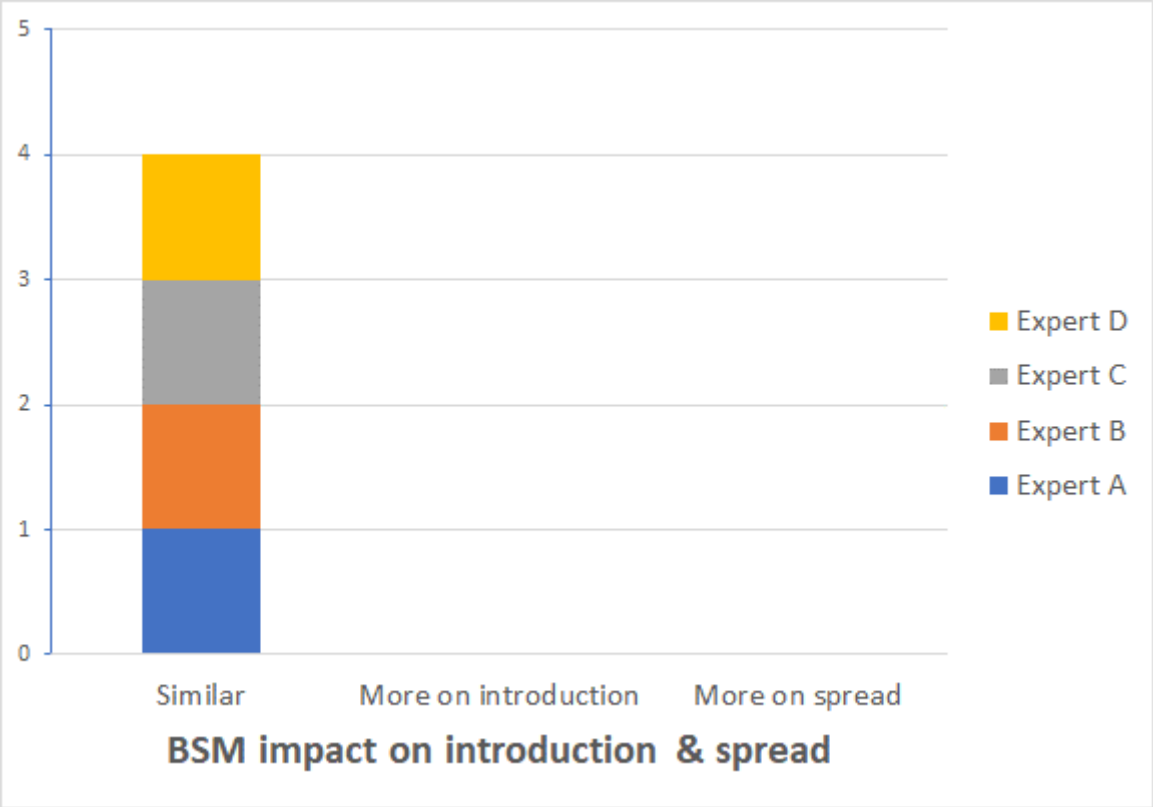
C - low	because is Type II, most probable way for introduction of ASFV is by humans and equipment.
C - high	this measure is not enough, because is not the only one important

D - low	Introduction by human through contaminated clothes is a main pathway in FT2 Direct contact and attractiveness are not prevented for wild boar Risk coming from food or vehicles is still present
D - high	Other pathways are still present, including other sources coming from humans that not avoided with this BSM



BSM: PROTECTIVE CLOTHING **FARM TYPE II**

Definition: Requirement to enter outdoor area either with protective clothing belonging to the farm or with disposable clothing, which must be removed before leaving the outdoor area

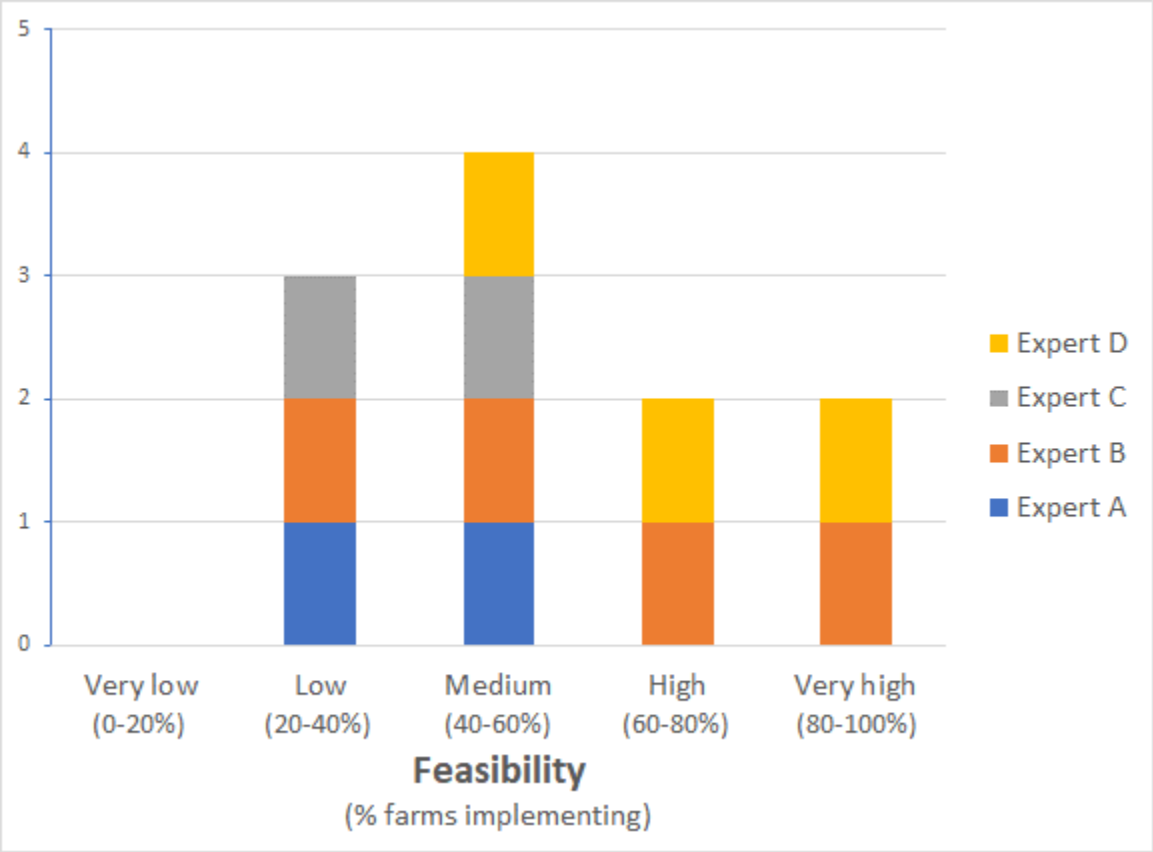


Expert	Reasoning
A	Following the definition of this BSM it has an impact on both introduction and spread since the protective clothing should be worn upon entering and removed before leaving the outdoor area.
B	considering the infected area of interest (all target populations infected), use of protective clothing will prevent more the introduction than spread, when the farmer comes from forest (if hunter) or other farms that could be infected

C	protective clothing are used just for inside farm. This way they are one additional barrier between wild and domestic population.
D	This measure can prevent both introduction (if the farm is free) and spread (if it is affected)

BSM: PROTECTIVE CLOTHING **FARM TYPE II**

Definition: Requirement to enter outdoor area either with protective clothing belonging to the farm or with disposable clothing, which must be removed before leaving the outdoor area

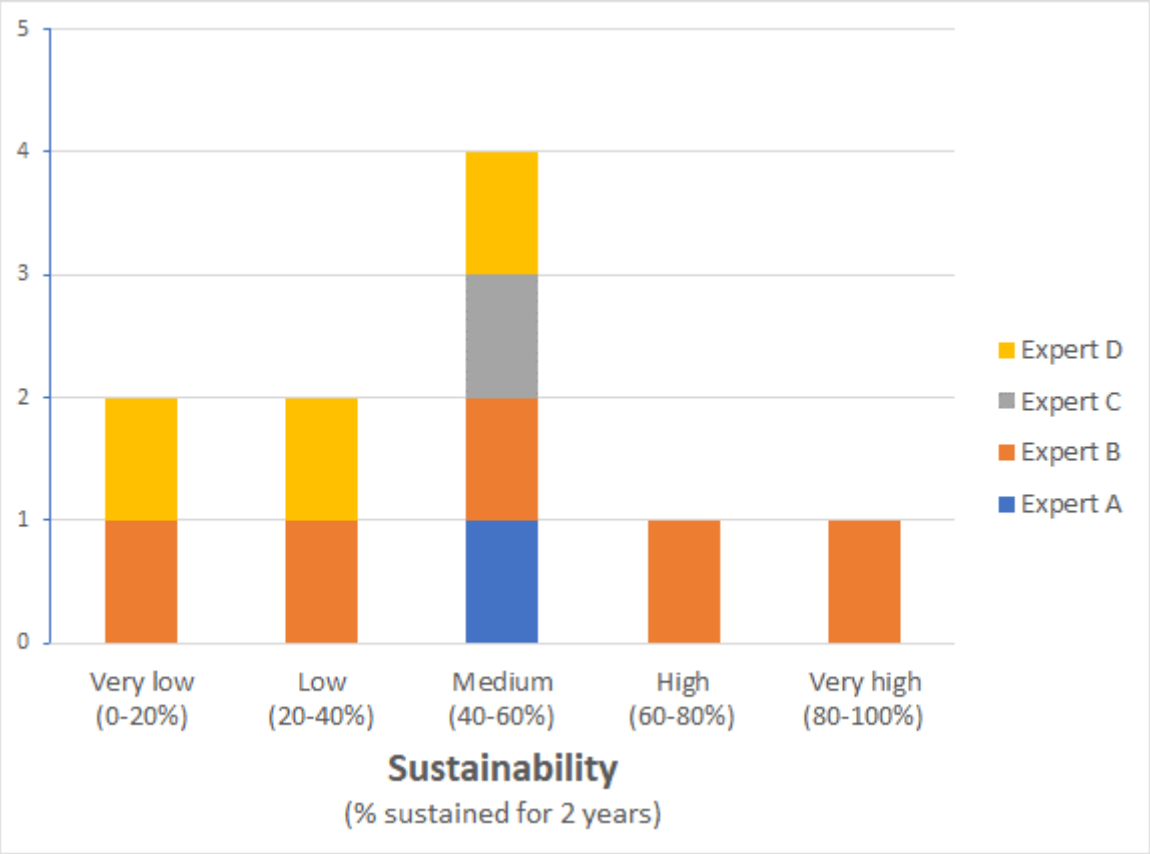


Expert	Reasoning
A	Implementation is ofcourse feasible. Costs could be overseen; washing machine or disposable clothing. There is also some cost and extra effort since putting on the protective clothing will cost extra time. Overall I think however that, especially for the more professional type II farms this BSM is highly feasible. However, less professional type II farms or pet pig holdings might not consider it interesting enough to spend their money and time on and/or they might lack awareness and knowledge. Combining these two reasons results in a medium feasibility for me. Following the reasoning (15/2) that we have to consider an extra/specific change of clothing/footwear near the outdoor area I consider it possibly even less feasible since it will take extra time, farmers might not see the importance of a 2-stage change of clothes etc. However, I'll stay on medium following the discussion.
B	the feasibility could be theoretically very high, given the BSM is low expensive, but also very low, given that this strictly depend on farmer behaviour and education and sensibilization to the disease, their cultural level and social condition

C	is easy to distinguish between wearing protective clothing or not, so workers should use them.
D	It is an easy measure which does not need much investment. Two changes of clothes (for the stables) could reduce the feasibility Some traditional FT2 farms (which may be backyard farming compatible with FT2) can be family-run and farmers will not understand why they should change their clothes "at home"

BSM: PROTECTIVE CLOTHING **FARM TYPE II**

Definition: Requirement to enter outdoor area either with protective clothing belonging to the farm or with disposable clothing, which must be removed before leaving the outdoor area



Expert	Reasoning
A	Wearing protective clothing will need to become a behaviour of the farmer. This might deteriorate over time. Sufficiently numbers of protective clothes should always be in stock. Overall I however consider it a medium sustainable BSM for all type II farms (also pet pig keepers). Sustainability is lower in comparison to the C&D facilities, since these will be part of the layout/structure of the farm and therefor become a habit more easily, while putting on protective clothing will always stay an extra act.
B	the sustainability could be theoretically very high, given the BSM is low expensive, but also very low, given that this strictly depend on farmer behaviour and education and sensibilization to the disease, their cultural level and social condition

C	when rules and habits are established, it is easy to fulfil.
D	It will be very difficult to keep the continuous training of the farmers, necessary to maintain this practice for 2 years without making mistakes The two changes (stables-thing), again, could decrease a lot the sustainability

Appendix E – Rapporteurs' records of discussions in EKE Meetings 2-4

This appendix contains the rapporteurs' record of discussions in EKE Meetings 2, 3 and 4, which were held on 10, 12 and 15 February 2021 respectively.

The main part of this section records the discussions for the four questions considered for each combination of BSM and farm type, which occupied all of meetings 2 and 3 and the first half of meeting 4. For each combination, Questions 1 and 2 (effectiveness of BSMs and relative impact on introduction and spread) were discussed together, followed by Questions 3 and 4 on the feasibility and sustainability of the chosen BSMs. The section ends with the discussion of Control Measures that will took place at the end of Meeting 4. Experts are identified by their code letters A-D, the facilitators as F1 or F2 and the Observers by their code letters E-F.

Clarification of definitions at the start of EKE Meeting 2

At the beginning of EKE Meeting 2, F1 initiated a discussion to share the understanding of different participants of the nature of boundary typically present around Type I farms.

One expert said that usually some fence exists around Type I farms in The Netherlands, to keep the pigs in a certain area, mostly this is a *single fence* (electric fence, wire fence), often without any rooting prevention. They are not very good to prevent the contact.

Another expert said that in Spain national regulation requiring fences around Type I farms exists, without providing any information on the technical characteristics of these fences Similar to The Netherlands, these are often *single fence*s without measures preventing rooting.

A third expert said that in Sardinia Type I farms existed that did not have any fence or only used natural barriers (plants, woods) to keep the pigs in. Currently such farms are banned.

It was agreed to consider the current variability of fences around farms of Type I and their usual limited effectiveness, when answering the questions about the non-fence-BSMs and the specific fence definition when answering the questions about the fence-BSMs.

F1 also provided clarification on the definition of the Area of interest

Comments on the Questionnaire 2

F1 invited the experts to comment on their experience of working on the questionnaire.

A considered the questionnaire well prepared, the definitions clear and easy to reply the questions. It needed a lot of thinking; several points of view were included in each question and it took a lot of time (4 working days to reply).

B explained that every step was more difficult than the previous one because: i) they had to imagine a hypothetical scenario and think what farmers will do; ii) they had to consider all the pathways, and move beyond their country to find better practices. It took 1.5 days to reply.

C considered this questionnaire more difficult compared to the previous one. C explained that the key point was the fences for which couldn't decide exactly which is the best. To this respect expert C is not very sure if the answers are correct.

D shared the same comments with other experts. Comparing and identifying variabilities between the questions was the most difficult task. The judgements were changes as long as assessing the BSMs and in many cases he had to reconsider the answers for previous replies. It took 3 days to reply.

E highlighted that the fact that they have to imagine a situation when you need to apply only one BSM is difficult because in reality several BSMs are implemented.

F underlined the importance of having clear definitions.

Overview of individual responses

Also at the start of EKE Meeting 2, F1 displayed 4 pairs of graphs, one for each of the 4 questions in Questionnaire 2, summarising the responses of the four experts to the different combinations of BSM and farm type. In particular, he invited the experts to comment on any surprises or major patterns the experts saw in these graphs.

Overview on effectiveness of the BSMs

There were no surprises. Overall a high effectiveness was considered for fence BSMs compared to non-fence BSMs, wih D giving lower ratings for the latter compared to other experts. D commented that non-fence BSMs could be more effective if used in conjunction with fences; however, combinations of BMSs were not considered in this EKE.

A noted that gates or other types of structures in fences allowing people, vehicles etc to pass were not part of the considerations on BSMs.

Overview on the impact of the BSMs

B found it difficult to differentiate between BSMs' effectiveness regarding introduction versus spread. B noticed that some replies judge that the *single fence*s are more important to spread the diseases. Difficult to say because there are some other factors that influence the spread (e.g. the density of the population).

Overview on the feasibility of the BSMs

There were no surprises. B wanted to re-evaluate the judgment on cleaning and disinfection and *protective clothing*.

Overview on the sustainability of the BSMs

B also was surprised about the low sustainability values for the *single fence* options. B expected for type I farm from high to very high.

C and D did not see major surprises.

C wondered about the similar sustainability results of fence-BSMs for both farm types; once feasibility has been overcome, sustainability seems to be falling into place. It is highly likely to maintain them for the next years.

Q1 EFFECTIVENESS AND Q2 RELATIVE IMPACT ON INTRODUCTION AND SPREAD (discussed together)

Biosecurity measure	***Double fence* – Farm Type I**
Start time/date	10:40 (55 min duration)
Experts' reasoning for judgements	A considered that the human spread factors are not affected by a *double fence*, therefore it ranks slightly lower on spread than introduction mitigation. In addition, rooting is not preventing, neither the water or the small animals. The median is high because if implementing it will be a good measure. B did not present new elements not already captured and clarified that not all the outbreaks are caused by direct contact. C considers the *double fence* to be more effective than a *single fence* and feels that it affects both introduction and spread risk to a similar extent. C highlighted that there is no big difference between fences. D did not present new elements not already captured but explained that type I farm in forests the wild boar may exist within the fence.
Discussion	**Q1** A highlighted that structures in the fence allowing passage of animals, humans, vehicles are a small proportion of entire fence area, but a weak point through which wild boar (wild boar) can enter. F1 asked whether a specific protection at gateways should be considered in the assessment? R1 suggested that gateways are parts of the fences and correct implementation of gateways in the fence should be assumed in the EKE; the WG might need to consider this point in the SO. A and D agreed that a *double fence* also has a deterring effect on non-farm persons. B considers that a *double fence* without measures preventing rooting lacks an important element increasing the effectiveness of the BSM. C did not consider rooting to be an issue for effectiveness of a *double fence* that is inspected regularly. F1 asked about the nose-to-nose contact between wild boar and dp (domestic pig) and how much a *double fence* would reduce it. B, D and C consider this reduction to be complete. D and A feel that wild boar can still enter the outdoor area (e.g. jump over/rooting under first fence, through gateways).

	F1 asked about risk pathways other than direct contact, humans (hunters, walkers, visitors) such as small animals (e.g. rodents) or water. C considers water to be a relevant risk (except for rivers flowing by the farm); does not recall that rodents have been implied in the context of ASF outbreaks, could however contaminate stored feed. B considered the risk associated with rodents and water in the context of her estimation. A considers water and rodents to contribute to the risk to a small degree. F1 asked about the not-specified things that needed to be taken into considerations B and the other experts confirmed that when estimating the values, the additional measures were considered to be in place/carried out as normal. F1 asked D about the lower median value/ the others about their higher medians. D explained having considered mainly extended large outdoor farms without much extrapolation to other situations. C placed the median in the centre of lower and upper limit. D considers wild boar contact most important, humans less, rodents and water even less important. B, A and C agreed with this sequence. F1 summarised that the main pathways identified are contact with wild boars, humans, water and rodents. **Q2** F1 inquired about the reasons for this BSM being considered to be more effective on introduction A had considered that diseased wild boar roaming around freely will have a high probability to encounter dp, which will be removed by BSM; kept dp are considered to roam less that wild boar, therefore less impact on spread from affected dp. The *double fence* mainly reduces the introduction but the spread outside the farms via humans is not prevented. In addition, the domestic pigs cannot go out and move for long distances. This why it is considered more effective on introduction. B considered spread as also covering spread to other indoor pig farms, which cannot be prevented by this BSM, as the latter is largely through humans. The impact on direct contact is higher but not as high as for the people. C and D felt that the impact of this BSM is similar on both (introduction and spread). D continues to believe this after listening to A and B. C feels that the *double fence* prevents the movement into both directions. C explained

	that it might take 3 weeks from infection to detection of the disease in the farm, during which the disease can spread outside the farm if there is no fence.

Q3 FEASIBILITY

Biosecurity measure	***Double fence* – Farm Type I**
Rationales for feasibility ranking	F1 noted that the quantitative labels were missing from the graph displayed for this BSM. However, they were included in all subsequent graphs. Experts A, B and D agree that the financial expenses are the major reason impeding the feasibility of this BSM. C considers that some type of fence has to be constructed anyway but agrees that this point reduces the feasibility. A pointed out that this constraint can be overcome by subsidizing the fence construction. B mentioned that the size of Type I farms is bigger, and the cost is higher compared to the Type II farms. C underlined the importance of a legislative obligation for the fences. The training and the education of the farmers is a long process and is not effective all the time. F2 inquired about the willingness of farmers to implement this BSM. C agreed. B inquired about the need for sanctions in case of non-compliance to be considered. F2 confirmed that for Q3 and Q4 sanctions should not be considered, but that sanctions might be relevant for the brainstorming on control measures. B pointed out that low feasibility due to farmers' scepticism could be overcome by increasing awareness of farmers about BSMs. C on the other hand considers that awareness campaigns have a limited effect. C agrees with the point raised by D regarding the perceived "loss" of land between the two rows of the *double fence*.

Q4 SUSTAINABILITY

Biosecurity measure	***Double fence* – Farm Type I**
Rationales for sustainability ranking	Experts consider that once a fence has been constructed, sustainability is not an issue, but some repairs may need to be carried out eventually.

	F2 asked experts if the discussions had changed their positions or made them think about additional factors that could impact on sustainability of this BSM. B highlighted that some farmers may not apply the *double fence* in the correct way. F2 asked experts if they would change their assessments. B and D indicated they would. C and A will change it to higher values.

Q1 EFFECTIVENESS AND Q2 RELATIVE IMPACT ON INTRODUCTION AND SPREAD (discussed together)

Biosecurity measure	***Double fence* – Farm Type II**
Start time/date	13:30 h
Experts' reasoning for judgements	**Q1** B, C did not add any reasons beyond those already provided. D is surer about the judgement on question 2 based on A's and B's reasoning. A and D consider that the proportionate impact of the BSM is higher in Type I farms. The BSM is considered to affect the baseline risk. B highlighted that the contact between pigs inside the outdoor farm is higher in Type II farms, which facilitates an outbreak even in the scenario of low number of direct contacts with infected wild boar, and also increases the probability of spread from that type of farm. B explained that the outdoor area is limited, and the fence will be more effective. B considers that Type I and Type II farms differ in terms of contacts with other farms (selling/buying pigs, breeding etc). F1 asked the other experts to confirm. A and D were not sure about that due to a large variability of farms. A considered that the mentioned reasons concern more the baseline risk of the farm types than the effectiveness of the BSM. C did not consider a change the assessment of the BSM's effectiveness and noted that the fence types that are being assessed in the EKE are not what is used in certain areas, where the fence used are rather a mix of the assessed fences, e.g. a solid wall with a line of wire on its top.

	D explained that every value was moved to the right, because there are not wild boars inside the farm and the area of type II farms is limited. Nonetheless the human factor still exists. **Q2** C and D consider the effectiveness for introduction and spread to be similar, yet D noted that the mitigation of introduction is slightly higher because the main introduction risk, direct contact to wild boar, is effectively reduced, while the main spread risk, humans, is less effectively reduced by the BSM. B considered that the probability of wild boar entering is lower. Contacts between pigs inside the farm is lower. In Type I the pigs are more widespread. B believes that the level of spread within the farm affects the spread outside the farm. The impact of the fence is higher because there is also less contact between the animals within the farm. D explained that the baseline situation is different, and the effectiveness is different, maybe a little higher for introduction because any kind of separation has more impact on introduction. F1 summarised that the introduction has more to do with wild boar but the spread more with human factors.
Discussion	

Q3 FEASIBILITY

Biosecurity measure	***Double fence* – Farm Type II**
Rationales for feasibility ranking	D corrected the judgement to high. B raised the point that different farming practices implanting in type II farms, eg breeding, with different needs may have an impact to the willingness of the farmers to have a *double fence*. So fencing is in any case necessary for keeping animals close and separated during breeding. A explained that there is variability in Type II farms from professional farms (with commercial activities) to non-professional (hobby or pet farms). The BSM is considered to be well accepted and feasible for professional farmers who understand the benefits and want to implement biosecurity measures, compared to the hobby or backyard farmers. As a result, the proportion of different types of Type II will affect the feasibility. A explained that there is political pressure to outdoor farmers to bring the pigs indoors, because they considered a risk for indoor farmers. One of the observers added that in Germany they experience similar situation with the Organic farmers insisting to keep the pigs outdoors.

	One expert stated that in Spain this conflict does not exist, because outdoor farms are restricted to the Southwest part of the Country while the indoors are mainly in the North Another expert pointed out that for the East Balkan pigs that traditionally are moved through the forest, the feasibility of this measure is very low. B changed to medium.

Q4 SUSTAINABILITY

Biosecurity measure	***Double fence* – Farm Type II**
Rationales for sustainability ranking	Less variability between experts from high to very high. C and D confirmed the assessment to be very high, as this BSM is easier to be maintained for Type II farms. C stated that the size of type II is smaller compared to type I farms and the area to be covered by fence is smaller. B reasons that the farmers of this type are more inclined to improve the biosecurity of their farm. However, if no outbreaks occur within several (2) years, the sustainability might wane due to lowered concerns of the farmers. A considers that the difference between Type I and 2 farms is not large to be reflected in a different level of sustainability. B considered that 60% of Type II and 40% of Type I will sustain this measure but considers increasing it. D explained that Type II farms that are located close to other Type II farms might have more conflicts with their neighbours to sustain this measure compared to Type I farms. F1 pointed out that 2 levels of sustainability can be selected to reflect a large degree of uncertainty of the assessment.

Q1 EFFECTIVENESS AND Q2 RELATIVE IMPACT ON INTRODUCTION AND SPREAD (discussed together)

Biosecurity measure	***Single solid fence* – Farm Type I**
Start time/date	14:50

Experts' reasoning for judgements	C did not present further reasons than those already provided and focussed the reasoning on the prevention of direct contact. D highlighted that the main advantage/different is the prevention of rooting, which leads to higher effectiveness regarding direct contact. Yet human-related pathways are less affected. The effect on introduction and spread were considered to be similar. A considers that rooting and rodents are prevented, and the water also may stay outside the fence. Nevertheless, that wild boar could climb over the solid fence. D explained that rooting is the more frequent behaviour compared to climbing which is considered sporadic.
Discussion	**Q1** B noted that the main reason for considering the effectiveness to be lower than for the *double fence* is the reduced impact on human factors and listed the same reason for introduction being better mitigated than spread like for the *double fence*. D considers the solid fence more effective because of the prevention of rooting, which D considers more important that jumping/climbing of wild boarwild boar. Small animals are also considered to be more effectively kept out by the solid fence. Regarding climbing/jumping versus rooting, D and G consider rooting more important/frequent behaviour to reach something attractive, however, E underlined that wild boar can jump up to 2.5 m if they want (but usually that is not the case). C insisted that wild boar do not dig long tunnels and they do not jump under normal circumstances so neither rooting nor jumping play a role for this question. B considered that humans can cross a solid fence easier than a *double fence*. A and D agreed. **Q2** No further points were discussed.

Q3 FEASIBILITY

Biosecurity measure	***Single solid fence*** **– Farm Type I**
Rationales for feasibility ranking	High costs were considered by all experts to be the main reason leading to a low feasibility. C considered that any kind of material could be used (e.g. used tyres) which might increase the feasibility, but still the extension of

	Type I farms leads to higher costs. Old tires cannot be considered as solid material, according to A. A explained that there are some specific rules for farms subject to quality schemes or standards that may not allow solid fences if they want to their status and keep their premium quality. D considered environmental regulations might prohibit solid fences in certain environments. B noted that this type of fence is considered a risk for flooding in some areas of the EU. In other areas, a *single fence* around the farm is required by law and it can be made from any (solid) material. D explained that a (single) solid fence has a negative effect on the continuity of the habitats of animal species, which is a conservation issue. B intended to maintain the view that a low proportion would apply the measure. F1 summarised the economical and legal issues that the experts pointed out.

Q4 SUSTAINABILITY

Biosecurity measure	***Single solid fence* – Farm Type I**
Rationales for sustainability ranking	The BSM is considered to be robust and to have low maintenance costs by A and C. B considers that it is easier to damage the *single solid fence* than both rows of the *double fence*, therefore in the absence of regular inspection a damage in the solid fence might have a large effect on the introduction risk. D noted that the huge investment by the farmers will motivate them to better maintain it. The experts did not feel the need to change their assessments based on the discussions at the meeting.

Q1 EFFECTIVENESS AND Q2 RELATIVE IMPACT ON INTRODUCTION AND SPREAD (discussed together)

Biosecurity measure	***Single solid fence* – Farm Type II**
Start time/date	16:10
Experts' reasoning for judgements	Experts summarised their reasoning without providing additional reasons.

Discussion	D considered to change the estimates to higher values. F1 underlined that a new pathway has been identified, the introduction through carcases. D raised the possible presence of carcasses in the vicinity of the farm perimeters as a risk pathway which would be prevented by this BSM, but would also need to be considered for the other fence-BSMs, which would mitigate this risk less well. A explained that parts heavy rainfall can transport infected materials and carcases across the *double fence* into the farm. This might be more important for *double fence* or *single fence* compared to *single solid fence*. B considered that in an affected area, carcasses would be removed as part of control measures in place. The risk pathway associated to carcasses outside the fences is considered higher than rodents/small animals and humans. Experts expressed the view that no changes to their estimates would be needed.

Q3 FEASIBILITY

Biosecurity measure	***Single solid fence* – Farm Type II**
Rationales for feasibility ranking	D also considers environmental regulations to be an issue for Type II farms. A considers that building regulations may lower the feasibility of this BSM. A and D consider that farmers/private owners might accept this BSM more than the *double fence*. No further points than those listed previously were raised. B stated to reconsider the first estimate. While C considers that it is practically feasible to implement this BSM, they consider that it will not be implemented to a large degree in all areas of the EU due to resistance of farmers. In the light of this, A considered to lower the estimate to medium.

Q4 SUSTAINABILITY

Biosecurity measure	***Single solid fence* – Farm Type II**
Rationales for sustainability ranking	All experts ranked the sustainability as high or very high. No difference compared to *double fence* and solid fence in Type I farms was considered by the experts. No changes of the individual judgements were considered necessary after the group discussion.

Q1 EFFECTIVENESS AND Q2 RELATIVE IMPACT ON INTRODUCTION AND SPREAD (discussed together)

Biosecurity measure	***Single fence* – Farm Type I**
Start time/date	17:20 h
Experts' reasoning for judgements	Experts did not present any reasoning not already covered in their completed questionnaires. The judgment of D deviated very much from the others because D considered that transmission through direct contact is not prevented at all by that BSM. The measure was considered to influence prevention of spread, while for introduction no effect was perceived. A considered it less effective to prevent the contact. Given that no other BSM or control measure is in place, the effect could be quite big. C agreed with A and added that on the affected farms without or with low level of biosecurity the existence of one *single fence* might make big difference to the spread of the disease.
Discussion	**Q1** C explained that the effectiveness of this BSM was considered to be lower compared to the other fences because rooting and nose-to-nose contact are not prevented by this BSM. If not, solid it is easier to be damaged by trees felled down after strong winds. B explained the halving of the effectiveness due to less mitigation of climbing, rooting, nose-contact, human factors. A explained the lower effectiveness estimate by a partial reduction of the mitigation capacity estimated for the other fences and greater susceptibility to damage by trees etc. One expert's estimates are based on the observed intrusions of wild boar (through gaps under/holes in fences) in Spanish outdoor farms with *single fence*s. Direct contact is not prevented, and all the pathways mentioned for

	introduction are in place. This is the reason why Spanish farmers requested *single solid fence*s. One expert reported that *single fence*s are considered to be insufficient for mitigation of the introduction risk in Italy as they are quickly and easily breached by wild boar. One expert highlighted that in Bulgaria a *double fence* is requested for commercial farms (one around the farm perimeter, a second around the animal area. However, the most frequently implemented barrier is a *single fence*. A considers that *single fence*s are easily breached but is aware that farmers often perceive that a single (electric) fence is sufficient. **Q2** D explained that the BSM has no effect on introduction by direct contact with wild boar but might have a small effect on spread. However, D reconsidered this estimate based on the group discussion. B highlighted to also have uncertainty about this estimate and noted that the possibility of spread is not prevented.

Q3 FEASIBILITY

Biosecurity measure	***Single fence* – Farm Type I**
Rationales for feasibility ranking	The individual feasibility estimates range from medium to very high, with most considering it to be medium-high. One expert stated again that in Spain this is a must for farms. A indicated that there might be a *single fence* in most cases, however with needs to upgrade the biosecurity level. B doubts that *single fence*s are practically feasible for Type I farms as they often are located in remote areas and often very extended. C highlighted that Type I farms are not necessarily large and underlined that among the fence options, this is the (financially) most feasible one. F1 inquired if an existing *single fence* lower than 1.50 m can simply be extended/upgraded to be high enough. C explained that a *single fence* would need to be replaced, while a solid fence could be enhanced by adding a second line on its top. One expert reported that for Bulgarian farmers such an/any investment would impact on feasibility. One expert stated that Type I farms in Sardinia were popular for farmers as they did not need to invest into feed sources. Consequently, when free-roaming pig production was banned, many owners opted for closing the farm/culling the pigs instead of investing into fences. A stated that no data has been used since farmers might question the effectiveness of a *single fence*; rather the assumption that farmers aware of ASF (especially indoor pig farmers) consider this fence as not effective. D considered that still some Type I farms without fences exist in the EU and that the owners would easily be convinced that a *single fence* improves animal management. B agrees with D and A and suggests emphasizing the effect on controlling diseases/ASF that this BSM offers (in the context of raising awareness) to increase the feasibility. A pointed out that it is possible that some quality schemes might require that pigs be kept unfenced.

Q4 SUSTAINABILITY

Biosecurity measure	***Single fence* – Farm Type I**

Rationales for sustainability ranking	The individual judgements were more disperse than for feasibility (low-very high, majority on very high). A considered that sustainability in terms of maintenance efforts depends on the material used, e.g. electric fences need more maintenance than metal grids. One expert reported that in Bulgaria metal grids are mostly used which have low maintenance and pointed out that this type of fence needs to be repaired immediately to avoid exit/entry of animals, therefore regular checking is needed for this BSM. B noted that the sustainability depends mainly on farmers' perceptions and behaviour, which is highly variable and should be reflected in the judgements' width. D has concern about the sustainability in very large/extended farms because of the maintenance costs and the efforts of checking. B pointed out that if a farmer has built an extended fence, maintaining it might be the logical result of having made the considerable investment. A noted regarding electric wires' that power is often lost due to a wire touching ground (due to pigs digging, branches falling from trees, grass growing), therefore a large regular control/maintenance effort is needed. On the other hand, single electric fences can be easily moved to fresh pasture areas. Both reasons apply also to feasibility of this BSM.

Q1 EFFECTIVENESS AND Q2 RELATIVE IMPACT ON INTRODUCTION AND SPREAD (discussed together)

Biosecurity measure	***Single fence*** **– Farm Type II**
Start time/date	09.50
Experts' reasoning for judgements	The individual median judgments were in the range of 40-60, with one expert considering the effectiveness as much lower (<20). The experts were divided as to applicability to spread and introduction (2 similar, 2 more on spread). All estimates showed a high degree of uncertainty. This could be explained by the variety of the fences and different types of farms (hobby farms, professional farms). No additional reasons or modifications of what experts had written in the questionnaire were made.
Discussion	Q1 F1 stated that A's reasoning that (hobby) farmers might not see benefits in improving existing *single fence*s relates more feasibility. F1 inquired about the difference between D and A.

	A considered that for this farm type the pressure from wild boar in the surroundings is lower than for Type I farms. D considered that wild boar will not enter Type II farms frequently, based on data on wild boar entering Type I farms more frequently if farm buildings were further away. The presence of humans and buildings discourage wild boar to come close to the farms. C did not consider that the effectiveness of this BSM is the same for Type I and 2 farms, but due to the lower baseline risk of Type II farms, the same effectiveness level has been selected for both farms. Q2 A considered that pet pig farms usually have poor fences from which pigs can easily escape and are located in areas with lower wild boar pressure. If the owners build proper fences, they might realize the importance of preventing spread out of their farm. A further considered that wild boar are reluctant to approach buildings. B asked whether the risk of spread from outdoor to indoor pigs has been considered. D considers Type II farms usually are not fenced, so building of one would impact spread more than introduction risk which is considered to be lower for this farm type.

Q3 FEASIBILITY

Biosecurity measure	***Single fence* – Farm Type II**
Rationales for feasibility ranking	The judgment pattern is similar to the one for Type I farms. All experts consider that the costs are low (smaller area, less materials, less effort). A considers that farmers of Type II farms might be more influenced by the views of the indoor pig farmers and therefore inclined to invest in building the fence. D explained that the costs for building the fence are acceptable as the investment is lower than for other farm types and fences. One expert reported some restrictions existing in Bulgaria in areas reserved for hunting that negatively impact the feasibility of having a fence, while Type II farms need to have a fence by law. A noted that a *single fence* is less likely to interfere with existing building/environmental regulations than solid or *double fence*s.

Q4 SUSTAINABILITY

Biosecurity measure	***Single fence* – Farm Type II**
Rationales for sustainability ranking	The reasons/factors affecting sustainability were similar to those for Type I farms. A and D consider the maintenance of this BSM to be easier on Type II farms since they are close to the buildings. B raised the same concern about farmers' perceptions and behaviour and indicated that the uncertainty about the estimate increased during the group discussion.

Q1 EFFECTIVENESS AND Q2 RELATIVE IMPACT ON INTRODUCTION AND SPREAD (discussed together)

Biosecurity measure	***No access to stored feed* – Farm Type I**
Start time/date	10:30
Experts' reasoning for judgements	Three experts' median values ranged between 20-30, one expert had a much lower estimate (<5). No additional reasons or modifications of what experts had written in the questionnaire were made. D underlined his view that, if implemented on its own, this BSM has hardly any effect on introduction and spread. A agreed with that and indicated that A would probably reduce the uncertainty by lowering the upper estimate. C explained that as animals are culled when an outbreak is confirmed and therefore the risk of spread is reduced, this BSM is considered as not effective. B considered the lower value of the baseline risk estimate for farm Type II for this estimate.
Discussion	**Q1** A highlighted that not in all areas of the EU the natural resource presence is high in areas of Type I farm, therefore the importance of access to stored feed might vary across the EU. In areas or seasons where the natural resources are limited the stored feed may attract wild boar. F1 inquired about the proportion of the baseline risk caused by access to stored feed on this farm type. C considered this BSM to be important as it reduces the attractiveness to wild boar.

	A considered to lower the median of the estimate. B considered that the climate/weather/season affects the importance of this BSM. During summer stored food might be attractive. D stated that in the light of the discussions D would probably increase the upper estimate slightly. **Q2** A indicated a tendency to change the impact to be more on introduction. B indicated to be considering the impact to be similar for spread and introduction after the discussions. D highlighted that animals attracted to feed move in and out of the farm therefore spread and introduction risk are affected in a similar way by the BSM. C explained that the impact on spread is lower because in any case the animals are culled after the confirmation. B agreed but highlighted that the detection of the disease may be delayed.

Q3 FEASIBILITY

Biosecurity measure	***No access to stored feed*** **– Farm Type I**
Rationales for feasibility ranking	A considers that some investments into establishing suitable structures are needed. B highlighted uncertainty about how this is currently done but considers farmers to have a genuine interest in protecting the feed. One expert considers it easy to implement and explained that in Spain old closed buildings for storing feed and tools or silos exist in the outdoor farm area. One expert reported that in Italy feed is stored in farm buildings. If there is no place on the farm, feed is stored in another place outside the farm. C stated that pigs kept in forests are not fed in the forests but in places where they spend the night (building are present there) and considered it simple to protect the feed, e.g. by placing it on a vehicle. Movable silos do not need building permits in Italy, Bulgaria and Spain. C reported that farmers do not consider storage of feed an important factor. R2 informed the experts that several MS reported having farms on which animals are daily moved back from pastures/forests to a night area, where

	they are fed and in that case the feed is stored there. If pigs are fed in the forest/ on pastures, the feed is stored near in the forest/on the pasture. A indicated confusion about the feasibility of this BSM and F1 suggested to increase the estimate across several feasibility options.

Q4 SUSTAINABILITY

Biosecurity measure	***No access to stored feed* – Farm Type I**
Rationales for sustainability ranking	C considered that closed feed storage is a new behaviour that is difficult to keep up over time (2 years). Expert A agreed. A reason might be that the farmers do not consider it important (e.g. compared to fences). D noted that even if some farmers drop out over time, more than 80% would keep it up. B considered that farmers do not appreciate the importance of the BSM high enough to continue implementing it over 2 years.

Q1 EFFECTIVENESS AND Q2 RELATIVE IMPACT ON INTRODUCTION AND SPREAD (discussed together)

Biosecurity measure	***No access to stored feed* – Farm Type II**
Start time/date	11:58 CET
Experts' reasoning for judgements	F1 reminded experts that the contribution of the risk factor to the baseline risk needs to be considered, before estimating how much it would be reduced by applying the BSM. No additional reasons or modifications of what experts had written in the questionnaire were made.
Discussion	**Q1** D does not consider that this risk factor contributes much to the baseline risk of this farm type. It might become more effective if combined with other BSMs. Based on the explanation of F1 A wondered if the estimate needs to be reconsidered.

	B considered that the value would be similar to Type I farms as it reduces the entry of wild boar, which is why also a higher impact on introduction of the disease is perceived. C considers that Type II farms have a structure (barrier) impeding wild boar access, therefore low effectiveness is considered. C considered it more important that fresh feed is not fed before 30 d of storage. R1 clarified that the latter should be considered to be applied as part of the baseline scenario that experts should consider when making estimates. A highlighted that wild boar are less likely to roam across Type II farms (due to presence of humans and buildings), therefore, the BSM would have less effect as the baseline risk caused by access to feed is lower than for Type I farms. D considered the baseline risk related to access to feed is lower on Type II farms. C agrees with that. However, the fact that less natural feed is present in the vicinity of Type II farms, access to feed become more attractive. **Q2** There were no specific discussions on introduction and spread for this BSM/farm type

Q3 FEASIBILITY

Biosecurity measure	***No access to stored feed* – Farm Type II**
Rationales for feasibility ranking	C considers owners of Type II farms are better educated and usually pursue higher objectives yet might have difficulties appreciating the importance of this message. F3 summarised that experts felt that building regulation issues are not relevant since buildings already exist on these farms.

Q4 SUSTAINABILITY

Biosecurity measure	***No access to stored feed* – Farm Type II**
Rationales for sustainability ranking	C stated that habits and attitudes of the farmers cannot easily be estimated.

Q1 EFFECTIVENESS AND Q2 RELATIVE IMPACT ON INTRODUCTION AND SPREAD (discussed together)

Biosecurity measure	***Removal of uneaten feed* – Farm Type I**
Start time/date	13:45
Experts' reasoning for judgements	A and B were quite uncertain. A, B and C felt that the BSM is relevant but that it does not prevent direct contact when implemented on its own. F1 summarised that experts felt that natural resources and seasonality may have an impact on the effectiveness of this BSM.
Discussion	**Q1** B considered this BSM to have a low impact on prevention of introduction, lower than the prevention of access to stored feed. F1 inquired about the amount and duration of feed being left after feeding and how often it might happen. A inquired about type of feed (pellets, mash, roughage) and use of troughs or feeding on the ground. A considered feed on the ground to be more attractive for wild boar. D stated that small farms usually feed close to farm buildings and usually no feed remains after feeding. In larger farms feed can be put simply on the ground, especially if the farmers are not aware of the risk; also in this case no feed will remain, but the odour prevails and attracts wild boar. B agreed that this varies between farmers. The amount of feed remaining depends on the seasonal availability of natural feed. In any case farmers do not remove feed and do not use troughs in Type I farms. B added that the remaining feed would be eaten later by the pigs. C stated that on Type I farms not a lot of additional feed will be provided. F1 summarised that experts felt that farmers may not very often provide feed but if they do, feeding pigs on the ground is common. F1 asked how attractive this remaining feed is in comparison to other factors contribution to the baseline risk of Type I farms. A considered that for a farm on sand/bare ground this might be large and lower for farms on green pastures. B considered this contribution to be low with a degree of variability based on season and availability of natural feed resources, therefore the BSM is considered to have medium effectiveness. C considered this factor not important.

	D considered this BSM to be very important in times where no natural feed resources are available and underlined that the odour remains and could be very attractive. **Q2** Experts felt that the impact of this BSM was higher on spread because the introduction would happen in any case since no other measures are in place to prevent it.

Q3 FEASIBILITY

Biosecurity measure	***Removal of uneaten feed*** **– Farm Type I**
Rationales for feasibility ranking	The individual estimates ranged from very low to high. A considered it feasible only if troughs are used. C considered that it is intended that the feed is removed after each feeding. B stated that usually farmers need to do other things while pigs are feeding, therefore it is not feasible to remove feed after each feeding. D reported that farmers do not consider this BSM necessary as they do not think that any feed remains and therefore might agree to it easily. C estimates that farmers do not consider this BSM relevant as often these farmers do not invest much into their Type I farm. R2 asked if it is probable that feed is removed in extended Type I farms where feeding may take place once per several days. D stated that in these farms, farmers prefer to exploit the natural resources and provide limited feed. But if they do, they provide feed every day from a silo remaining in the outdoor area, in amounts that will be consumed immediately by the pigs. B highlighted that in hot seasons farmers regularly (daily) need to bring water to the outdoor area, which is when they provide also feed. In addition, farmers avoid leaving feed out for several days in the outdoor area in summer, while in winter this is different. One expert pointed out the ADKAR model of change that has been used in studies of farmers in the context of antimicrobial use. A had missed that feed would be on the ground and therefore needs to change the estimates.

Q4 SUSTAINABILITY

Biosecurity measure	***Removal of uneaten feed* – Farm Type I**
Rationales for sustainability ranking	The individual estimates were slightly skewed to low and very low. In general, experts considered that in the long run, farmers would tire of the effort; especially as not implementing this measure cannot easily be detected by the authorities and therefore might not be sanctioned.

Q1 EFFECTIVENESS AND Q2 RELATIVE IMPACT ON INTRODUCTION AND SPREAD (discussed together)

Biosecurity measure	***No wild boar baiting* – Farm Type I*** ***= distance too low, implementation by hunters, not farmers**
Start time/date	14:46
Experts' reasoning for judgements	B considered the type of bait more important than the distance of the baiting and felt it to have more impact on spread (due to the risk of the bait being contaminated and leading to infection of wild boar/due to the wild boar meeting at baiting spots). B considered that 500 m is too close to the farm and should be at least 3000 m. A, C and D agreed that 500 m is not enough, and C suggested that it should be rather 1-3 km. A suggested at least 2 km. C considered the effectiveness to be higher than removal of feed and to affect mainly introduction. A felt that the effectiveness is similar to the removal of feed. D reasoned that the BSM will reduce the introduction risk as it lowers the attractiveness of the farm surroundings for wild boar. C stated that mostly maize or wheat grain are used to bait wild boar and pointed out that in the strategic approach baiting is only allowed to attract wild boar for killing (as part of reducing the wild boar density). D also considered maize to be most popular type of bait. B did not consider that baiting contributes much to the baseline risk of Type I farms. C considered that this BSM reduces the probability that outdoor pigs leave the outdoor area.
Discussion	

Q3 FEASIBILITY

Biosecurity measure	***No wild boar baiting* – Farm Type I**
Rationales for feasibility ranking	The range of individual estimates was low to very high. A and B considered that this measure does not have to be implemented by the farmer, while D considered that it could also be implemented by a farmer, but they could be disinclined to do it as they might want to bait wild boar to kill them. E highlighted that in several EU MS hunters have to pay farmers for damage done by wild boar due to baiting, therefore no/little baiting is usually done close to (outdoor) farms. C considered that baiting is usually done by hunters and considered that this BSM is easily implemented as long as hunters can be convinced. B pointed out that experts should consider the distance of 500 m round the farm in which baiting should not take place. One expert confirmed that baiting is usually done by hunters and agreed that baiting is not frequently practised close to farms in The Netherlands. D confirmed that hunters are responsible for implementing this BSM. Farmers would have to agree with hunters what to do in the farmed area (when both use the same land). However, the bigger problem would come when applying the BSM outside the farm borders, where farmer cannot determine what happens in the neighbouring property. R1 clarified that the BSM should be estimated regardless who is responsible for its implementation. A pointed out that for this BSM to work, training and education of hunters is necessary, and their motivation might be limited. All experts agreed. B was unsure about the estimates after listening to the discussions, D would increase the estimates, C considered to widen the estimate.

Q4 SUSTAINABILITY

Biosecurity measure	***No wild boar baiting* – Farm Type I**
Rationales for sustainability ranking	C highlighted that the most important step is convincing hunters (feasibility), as soon as that has been achieved, the BSM will be continuously applied as hunters save costs.

	D considered to lower the sustainability as hunters are responsible for implementing this BSM as the level of awareness is important and generates variability. A considered that it is difficult to estimate what hunters would do, especially if applying the BSM is voluntary. B thought that hunters' lack of direct interest in the effect of the BSM might reduce the sustainability compared to feasibility. A interpreted the question from the farmer's point of view; B referred to the farmer who is usually also a hunter; C and D considered the hunters.

Q1 EFFECTIVENESS AND Q2 RELATIVE IMPACT ON INTRODUCTION AND SPREAD (discussed together)

Biosecurity measure	***No access to water* – Farm Type I**
Start time/date	16:35
Experts' reasoning for judgements	No modifications or additional reasons were provided. D considered that this measure does not mitigate a wide range of risk factors and that it impacts introduction more than spread. One expert explained that in Mediterranean areas the water in summer might be more attractive than females.
Discussion	F1 inquired about the type and number of water bodies on Type I farms. C considered that large volume water bodies (rivers, lakes) are not of concern as they dilute the amount of potentially available virus very much. Smaller water bodies, especially with mud, however, may preserve virus for a long time. In addition, there might be water tanks. D considered ponds, rivers, streams, water tanks to be present on Type I farms; usually one pond/river or artificial water source is present per area. One expert considered the presence of ponds or small streams (not rivers) and that many farms in The Netherlands would not have such a natural water source in the outdoor farm area. One expert considered that in Italy in certain periods pigs will be given access to natural water sources like rivers, while in the dry period an artificial water sources (e.g. tank) would be used. Ponds may only periodically be present (after rains) and disappear in the summer.

	G inquired about the correct nomenclature for natural and artificial water sources, e.g. a partially dried-up river becomes a pond or a water hole? Maybe F could advise the WG and help creating a glossary for the opinion. One expert indicated that also in Bulgaria natural water resources can dry up completely or partially. Another expert indicated the same for Spain. F1 asked experts to consider the contribution of access to water sources to the number of outbreaks and how many could be prevented by applying the BSM. B stated that it would vary depending on the period of the year and that contact to natural streams or rivers passing through the outdoor are might be difficult to achieve. A considered to lower the estimate to be in line with feed access and that reducing the attraction for wild boar is the main element of this BSM. D had considered the effectiveness to be very low, as on its own, this BSM would not reduce the infection risk to a high degree. A pointed out that for reducing this access effectively in a way a fence is required. B considered that this BSM might actually reduce the number of outbreaks a bit more than initially estimated. F1 summarised that experts felt a large degree of uncertainty related to this measure

Q3 FEASIBILITY

Biosecurity measure	***No access to water* – Farm Type I**

Rationales for feasibility ranking	A pointed out that to prevent access to water, some sort of fence would need to be constructed, which limits the feasibility. B underlined that access to a river can only be limited with a specific permit and building fences around rivers may not be possible while it might be more feasible around artificial ponds. D confirmed that particularly in the dry season farmers need to bring water from municipal sources to the outdoor area and agreed that fences with gates are needed. B note that maintaining natural water sources/mud might not be allowed due to control of vector-borne diseases, while A mentioned that access of dp to mud/water pools is desirable for animal welfare reasons. C considered this BSM to have a low feasibility because the dp need access to water and often farm location has been chosen because of the water presence. D considered this to be possible (but not highly feasible) in analogy to fencing of water sources for cattle where gates were installed that cattle could pass but no wildlife species. Costs would increase with size of water body, but it could be limited to a *single fence*. G informed the experts that in the study mentioned by D the gate was combined with another measure, namely prevent livestock from using water sources preferred by wild animals. One expert highlighted that their individual estimate considered that in the Northwest of the EU it is less likely to have a natural water source on a Type I farm. F1 summarised that experts felt that fencing natural sources of water may raise legal (environment) and welfare issues.

Q4 SUSTAINABILITY

Biosecurity measure	***No access to water* – Farm Type I**
Rationales for sustainability ranking	Individual estimates ranged across all possible options and reflected a high degree of uncertainty. D considered that it will be easy to convince farmers to continue implementing the measure once they have started it. Regarding temporary water sources, D saw more difficulties to estimate sustainability.

	A noted that the sustainability depends very much on the way this access will be prevented (which have a different feasibility), but for expensive interventions the likelihood to sustain them is considered to be high. B considered it difficult to convince farmers to implement and sustain this BSM. C agreed with this. It was highlighted that wild boar might break through a fence around the water source in dry periods.

Q1 EFFECTIVENESS AND Q2 RELATIVE IMPACT ON INTRODUCTION AND SPREAD (discussed together)

Biosecurity measure	***Daily inspection* – Farm Type II**
Start time/date	09:06
Experts' reasoning for judgements	Most experts considered that this BSM only allows identifying carcasses or parts thereof/other contaminated material inside and in the surroundings of the outdoor area. B considered that the inspection takes place on the outer perimeter of the farm, not directly in the outdoor area. C highlighted that the *daily inspection*s also assist in maintaining the border/barrier around the farm intact. No additional reasons/modifications were presented.
Discussion	**Q1** F1 highlighted that it should be considered that farmers correctly behave when applying the BSM. R1 clarified that experts should assume that identifications of potentially contaminated material would be done once per day and that any material found would be correctly removed without contaminating further farm areas/animals. F1 asked experts whether they agree that this BSM will aid in maintaining the border of the Type II farms and therefore mitigate the introduction and spread risk. D and A agreed. B had initially considered % of outbreaks in any farm type; using the correct definition, B lowered the effectiveness estimate as 24h would be long enough to lead to an outbreak if contact to contaminated material takes place.

	D agreed that introduction across the border cannot be effectively mitigated with this BSM, but rather through removal of contaminated/carcass material. A pointed out that the area under/near the contaminated material needs to be decontaminated in addition to removal and considered to lower the upper value due to the variability of Type II farms' borders across the EU. B wondered about identification of faeces compared to carcass. E clarified that virus survival on the soil depends on the soil type; if acidic, little virus survival, worst is sand as virus can survive for a couple of days. It was underlined that the part removal is the most important mitigation measure. Faeces of wild boar can be differentiated from dp faeces; especially if blood is contained, the virus load will likely be high and the faeces detectable. One expert reported that a recent message from Dutch government contained the warning that the virus can survive in soil/slurry for 120 d. **Q2** The choices of the experts depended on whether they felt that the BSM is mainly allowing to identify contaminated material (intro) or mainly allowing maintaining outside borders (similar).

Q3 FEASIBILITY

Biosecurity measure	***Daily inspection* – Farm Type II**
Rationales for feasibility ranking	The individual judgements show a large variability of experts' views, ranging from low to very high. D considered that it would be easy to convince farmers about the effectiveness of this BSM to identify and remove contaminated material. A agreed that farmers will be quite aware of this. Depending on the layout of the farm, efforts might be large (e.g. if an outdoor area is detached from the stable building). B pointed out that detection (and removal) of carcasses is part of the official passive surveillance for ASF and would require that the farmer informs the official veterinarian of the finding, which could lead to a series of actions, which farmers might prefer to avoid. C agreed that some farmers might not notify potentially contaminated carcasses but felt that farmers might still remove the carcasses in the proper way (by burying them).

	One expert said that, to incentivise the notification of such finds, in Bulgaria a reward was paid. Experts agreed that *daily inspections* might be done properly but that farmers would not necessarily implement the rules of reporting findings properly.

Q4 SUSTAINABILITY

Biosecurity measure	***Daily inspection* – Farm Type II**
Rationales for sustainability ranking	D considered to increase the estimate slightly after listening to the discussions, but still considered that after a long period of not finding anything or if farm employees are tasked with this BSM, sustainability might reduce. B pointed out that passive surveillance in the affected areas of the EU is not implemented very well. F1 asked B to share the data on this; B referred to the recent EFSA exit strategy opinion. R2 reiterated that it is important that experts not assess the willingness of farmers to notify authorities for this question, but to limit the assessment on the sustainability of *daily inspections* as defined here.

Q1 EFFECTIVENESS AND Q2 RELATIVE IMPACT ON INTRODUCTION AND SPREAD (discussed together)

Biosecurity measure	***Cleaning/disinfection facilities* – Farm Type II**
Start time/date	10:21
Experts' reasoning for judgements	The individual estimates of the experts range from low value of close to zero to high values of 80. F1 commented that it must be considered that farmers use products properly. A highlighted that in certain Type II farms, the outdoor area is accessed directly from the stable building, therefore changing clothing might not be sensible. C requested a clarification whether the BSM entails disinfection when moving between the outdoor area and the buildings of the farm, or at the entrance to the farm or both. R1 explained that the BSM implies that the outdoor area is a separate epidemiological compartment and that the BSM intends a cleaning step

	upon entering and leaving the outdoor area (in addition to cleaning and disinfection upon entry into the farm). D considers that such a cleaning step might have an effect on the human-induced risk of introduction and spread. F1 reiterated that the BSM intends a cleaning step when entering and leaving the outdoor area.
Discussion	**Q1** D considered that this BSM does not contribute much to improving the baseline risk of Type II farms as it only addresses some human-associated risk. A considered the effectiveness of this BSM depends on how good the outside barriers are as these reduce the probability of contamination of the farm premises which in turn influences the reduction rate of the baseline risk by the BSM at hand.

Q3 FEASIBILITY

Biosecurity measure	***Cleaning/disinfection facilities* – Farm Type II**
Rationales for feasibility ranking	Most experts considered that implementing this BSM requires an extra effort of the farmer (also in terms of time) as well as extra costs. C considered that in certain weather conditions (winter) feasibility is hampered temporarily. A reported that the extra time and effort required reduces the BSM's feasibility, as the BSM might be applied only to visitors and not farm staff/owners; even more if this is an extra step for outdoor areas in addition to closed buildings. B considered that on small Type II farms the feasibility could be lower than on large commercial farms and that this is a BSM that cannot easily be controlled by authorities (and therefore not implemented by farmers). C considered that the use of disinfectants might lead to environmental issues (collection and disposal of disinfectant run-off). A stated that on Type II farms with concrete floors this might not be an issue. Obviously, there is a range of farm layouts/structures across the EU and the feasibility of this particular point might not be the same for all situations. B reported that following the discussions, the low and high estimates would be changed to low and high, respectively.

Q4 SUSTAINABILITY

Biosecurity measure	***Cleaning/disinfection facilities* – Farm Type II**
Rationales for sustainability ranking	A wide range of individual estimates exists. B considered that any BSM than cannot be automatized has a low sustainability. D agreed that continuous training and education are needed to achieve a high sustainability of this BSM, especially among farm staff as opposed to farm owners. C and A considered that once the cleaning and disinfection station and the habit of cleaning and disinfection have been established, sustainability will be good.

Q1 EFFECTIVENESS AND Q2 RELATIVE IMPACT ON INTRODUCTION AND SPREAD (discussed together)

Biosecurity measure	***Protective clothing* – Farm Type II**
Start time/date	11:41
Experts' reasoning for judgements	No additional reasons or modifications were reported. All experts considered this BSM to be equally effective for introduction and spread. Several experts highlighted that this BSM is especially effective regarding farmers coming into contact with other domestic pigs or wild boar. A did not consider footwear to be covered by this BSM and requested a clarification.
Discussion	It was clarified that the definition of the BSM includes footwear when referring to 'protective/disposable clothing'. B inquired whether virus persistence on shoes is similar to virus persistence on farm surfaces. E clarified that experts need to consider that clean/ uncontaminated clothing/footwear is put on before entering the outdoor area and that is removed and disposed/cleaned before leaving it.

Q3 FEASIBILITY

Biosecurity measure	***Protective clothing* – Farm Type II**

Rationales for feasibility ranking	The individual estimates covered the entire range of options. Several experts considered this BSM to be easy to implement, while others considered that certain farmers, e.g. hobby, non-commercial farmers, might not consider this BSM important enough to implement it. C had not considered this BSM to apply specifically to the outdoor area in addition to changing clothing when entering the farm premises. When considering this, C's estimate of feasibility is lowered. A highlighted the same. B explained that based on (low) compliance with mask wearing as part of COVID-19 related restrictions, the feasibility of this BSM is considered to be low and expects the farmer to consider that in the absence of fencing this BSM is not relevant, a view that would be difficult to change. D considered that the proportion of Type II farms starting to implement this measure will be medium to very high.

Q4 SUSTAINABILITY

Biosecurity measure	***Protective clothing*** **– Farm Type II**
Rationales for sustainability ranking	Several experts felt that, as with all BSMs relying entirely on human behaviour, sustainability of this BSM will be impeded. B considers that the sustainability of this BSM is low among farmers with lower levels of education or wealth, especially in areas with a low disease pressure. E confirmed that the epidemiological and economic situations impact on the sustainability of this BSM. D stated that there are several practical issues that impede sustaining this measure in the long term.

Review of final estimates comparing BSMs and farm types

The **effectiveness** estimates of double and *single solid fence* are highest with values above 60% for both farm types. The *single fence* has lower values (appr. 50%) for both farm types and all other BSMs have markedly lower values for Type I farms. For Type II farms, cleaning & disinfection and *protective clothing* have slightly higher values than for Type I farms and *daily inspection* and *no access to stored feed* on Type II farms.

A wondered why estimates for the fencing options are higher for Type II farms if their baseline risk is lower. B explained that Type II farms have a different approach to biosecurity that increases the effectiveness of the fence BSMs and that animal density is usually higher in Type II farms which means that a low number of contacts suffices to cause an outbreak.

Experts expressed the view that the overview of the group estimates correctly reflects that experts considered double and *single solid fence*s to be the most effective BSMs to mitigate the risks, as well as the ranking of the other BSMs.

F inquired if it is correct that a higher degree of uncertainty exists around the cleaning and disinfection and *protective clothing* BSMs. F1 explained that it is correct and that it is increased by the larger variability of opinions between experts about these measures. B highlighted that also the group discussions on these points were more diverse and that the uncertainty is also explained by these BSMs relying entirely on human behaviour.

Regarding the impact of the BSMs on **introduction and spread**, it is noticeable that most BSMs were considered to have a similar impact or to impact more on introduction. In Type II farms, the *single fence* is considered to have a larger impact on spread, while in Type I farms its impact is judged to be similar for introduction and spread.

F asked if all pathways were considered by experts when estimates were made about introduction and spread. Experts confirmed that they did.

For Type I farms, all BSMs do not rank very high for **feasibility**, while for Type II farms, no BSMs rank very low for feasibility. For both farm types, all BSMs except access to water and *single solid fence* are considered to have at least medium uptake, often up to 80%, but rarely higher than that.

For all fence-BSMs, **sustainability** is considered to be high (for Type I farms) or very high (for Type II farms), while the sustainability estimates for the behaviour-related BSMs are generally lower.

Potential of awareness campaigns to improve implementation of biosecurity measures

Based on the experience on field, B expressed the view that the success of the control of ASF depends largely on considering more/better the social/ psychological aspects affecting human behaviour.

One expert considered that awareness campaigns did not make a big difference for success of ASF control in Bulgaria, stating that they only influenced the behaviour of people who had not been aware. Those who already knew, usually did not change their behaviour as a result of attending awareness campaigns.

A highlighted that costs and labour efforts associated with improving the biosecurity level may need to be covered by subsidies, for ASF control to be successful. This could be complete reimbursement or partial coverage of costs.

D considered that awareness campaigns have a limited potential to improve the implementation of BSMs in the short term.

Control Measures

Start time/date	**14:43**
Name of Measure	**Rationales**
Register outdoor farm types and define types clearly EU-wide	D stated that knowing what outdoor farms are and where they exist would be the first step to be able to implement other measures in outdoor farms. A highlighted that this should include hobby pig farms (where pigs are kept as companion animals) and non- commercial farms. One expert reported that in Sardinia often a farm is mainly producing sheep and has a low number of pigs in addition. Therefore, also (single) outdoor pigs (in addition to outdoor farms) should be part of this register. Another expert said that in The Netherlands hobby pigs are defined as "a special category of farms with 4 pigs or less" that need a "RE" status (unearned piglets do not count when registering for this status). C stated that approval is different from registration.
Animal identification and registration	C proposed to have an identification number of each individual pig in (outdoor) pig farms (i.e. individual identification of the pigs similar to bovines).
Movement control	C stated that no movement of pigs from a farm to another should be possible without prior registration/ authorisation of the movement. This authorisation includes issuing of health certificates (based on clinical examination). B agreed and suggested to include also a serological ASF-testing of the pigs prior to moving the pigs. D added that a quarantine period before moving animals (at the end of which a clinical examination would need to be done) should be required. D pointed out that in the affected areas movement should not be allowed without testing the animals for ASF.
Active surveillance for ASF in outdoor farms (Well-designed schedule of laboratory examinations)	B proposed to regularly test pigs in outdoor farms/ outdoor pigs for ASF (serologically, virologically) (according to a suitable sampling frame) to support the early detection of ASF.
Improve notification compliance/ passive surveillance	B proposed to improve passive surveillance (early warning, notification of clinical suspicions/carcasses)
Education and training	Carry out awareness campaigns, training etc. on biosecurity to improve compliance with BSMs (clothing, cleaning, carcass detection/removal, etc.)
Improved knowledge on wild boar abundance	Data collection on wild boar abundance and distribution
Evaluation of the biosecurity level	A proposed to assess and score the biosecurity level of outdoor farms by veterinary authorities, farm advisors. D highlighted that contact to wild boar should be covered in these. Depending on the outcome of the assessment, further training and/or improvements of biosecurity should ensue.
Prohibition of pig sales on weekly markets	C proposed the prohibition of pig sales on weekly markets on local, not specialised/ controlled markets.
Control of online trading/selling of pigs	C proposed to control of online trading/selling of pigs.
No on-farm slaughter of pigs	C proposed to prohibit on-farm slaughter of pigs on outdoor farms. B suggested to modify to make the presence and approval of official veterinarians mandatory to control on-farm slaughter.
Prohibition of introducing wild boar	A suggested that introduction of wild boar into different areas for hunting should be prohibited. C considered that such an additional restriction would be a discrimination of outdoor farms.

into new areas for hunting	
Specific ASF control/biosecurity training for hunter-farmers and hunters	B suggested a specific training for hunters and farmers who are also hunters, covering ASF control, biosecurity, carcass management and other relevant matters.
Banning of unfenced outdoor farming of pigs	D proposed that outdoor farming of pigs without a barrier restraining the movements of the dp and preventing entry of wild boar/other pigs should be prohibited.
Risk analysis of outdoor pig farming	B proposed a specific (EU-level) risk analysis of outdoor pig farming that enables MS to take risk-based control measures.
End time	16:35 h CET

Comparison with the eight WG control measures

C commented on the first point that approval is an addition to being registered.

The second point could be enhanced by adding capturing the "outdoor farm type". Several experts expressed the view that outdoor farms are not intensive, that other farm type categories could be more relevant and that hobby pigs should be included.

The third point relates to the experts' proposal for active surveillance; so does the fourth point. B raised concerns about the need to clarify/define what vicinity means.

One expert reported that in The Netherlands outdoor pigs on soil need to be sampled for Toxoplasma (due to the public health risk).

The fifth point relates to experts' points on movement control and quarantine before moving animals.

The sixth point has not been raised by the experts. B disagreed with this point thinking that this measure would exclude self-consumption/ on-farm slaughter of pigs. F1 pointed out that on-farm slaughter is not affected by this measure. D considered that the implementation of this measure might be difficult in certain areas due to slaughterhouse capacities. One expert pointed out that in The Netherlands a certain farm type needs to slaughter their animals in a certain type of slaughterhouse (linked to quality standards or schemes applied by the farm and the slaughterhouse).

The seventh point covers the experts' point on awareness in a slightly different way. One expert supported this measure very much as in the control of ASF in Sardinia key obstacles were overcome when the social components were included in the control efforts. A suggested to add that all people keeping outdoor pigs should be included.

The eighth point adds a new target group for awareness campaigns not mentioned by the experts. A suggested to include hunters in the target group, B suggested to include baiting of wild boar as a topic.

In addition, one expert suggested that control and management of the disease must take account of the season. In Italy, during summer, due to the many food festivals arranged for tourists, slaughter practices might deteriorate, animals are moved to festival locations, control measures might be difficult to implement on all these activities due to the limited capacities of veterinary authorities compared to the number of events.

Applicability of the control measures for the different farm types

A considered that implementation of these measures on hobby pig farms might be difficult. C considered that not many differences would exist between the farm types, except that the inspections on Type I farms might take longer than on Type II farms.

Meeting review and feedback

Participant	Comment/Feedback/Action
B	B pointed out that it took a long time to understand and consider properly the definitions used and suggested to stratify the area of concern into smaller conceptual units to facilitate the experts' work. F1 pointed out that this would have increased the number of questions to be asked to an extent that would have exceeded the time available.
A	A pointed out that the way F3 presented the individual reasons next to the estimate overview for Q3 and Q4 was very useful and that it would have been also welcome for Q1 and Q2.
F1	F1 inquired if following different approaches could lead to better structuring the meeting. A stated that it was fine the way it has been done.
Meeting end time	18:00 h CET

Appendix F – Fact sheet on wild boar ecology and interaction with domestic pig farms

The following information was provided to the participants as part of the Evidence Dossier for the EKE. It is reproduced here because it will not be included in EFSA's Opinion on ASF and outdoor farming of pigs, whereas other parts of the Evidence Dossier will be included in the Opinion.

Wild boar are the ancestors of domestic pigs

The native Eurasian wild boar (*Sus scrofa*) is the ancestor of the domestic pig. Genetic selection has made pigs grow faster and be more prolific. However, pigs and wild boar have essentially the same basic needs regarding water, food, and shelter and both forms share all their pathogens. Wild boar and domestic pigs can crossbreed. The ongoing growth of wild boar populations implies adverse effects on endangered fauna, the invasion of farming areas and urban areas, an increase in road traffic accidents, a health risk for human beings and a notable challenge for animal health.

Wild boar diet

Wild boar are omnivores and display a high diet plasticity with a preference for energy foods such as acorns or corn. While most of their diet is composed of vegetable materials, wild boar consume invertebrate and vertebrate prey when available and will feed on carrion and hunting offal. This generates a risk for the transmission of several pathogens, including ASFV.

Distribution and abundance

Originally from forest environments, the wild boar adapts very well to any terrain that offers shelter and food. Land use is changing across Europe, favouring the wild boar by increasing the forest area and the area devoted to crops that offer shelter and food, such as corn. As a consequence, wild boar populations have exploded numerically in the last decades, and the species can nowadays be found in most of Europe, including urban and peri urban habitats, with densities ranging from less than one to over twenty wild boar per km^2. In parallel, the number of hunters decreases. All this implies a diminishing capacity to act effectively on wild boar populations (Massei et al., 2015; González-Crespo et al., 2018).

Reproduction and population dynamics

Animal populations change in size and structure over time, depending on their reproduction, mortality, and mobility. The population grows when recruitment by reproduction or immigration is greater than mortality. The wild boar is particularly prolific. Reproduction can take place in the first year of life, and each gestation will result in an average of four to six piglets. Although the survival of the young is relatively low, half will reach reproductive age. In most of Europe, wild boar older than one year have low annual mortality, around 50%, and this is mainly due to hunting (Keuling et al., 2013). Locally, the wolf (*Canis lupus*) may contribute to its natural control (Tanner et al., 2019). However, it is estimated that extraction by hunting or predation should exceed 65% of the population if the annual recruitment is to be compensated. In other words, only by extracting two-thirds of the population would it be possible to stop its growth, and this target is difficult to reach (Keuling et al., 2013, 2016).

Wild boar management

Hunting involves the use of a renewable natural resource, as is the case with other forest productions such as mushrooms. But unlike the latter, not hunting (not harvesting the annual production) leads to unwanted growth of certain animal populations. The continuous growth of wild boar populations

would be accelerated in the absence of hunting. However, the current hunting pressure is not enough to stabilize wild boar populations (Massei et al., 2015; Quirós-Fernández et al., 2017). It is therefore needed to address two faces of the problem: that of the capacity of the habitat to accommodate high wild boar numbers and that of hunting. In the former, it is necessary to limit the supply of food and improve crop protection. In the second, it is necessary to achieve greater hunting efficiency and ensure the survival of an activity that provides a service to society.

Spatial ecology and barriers

In adequate habitats, wild boar use relatively small areas of 5 to 10 km^2, show high site fidelity but also a strong individual variation, indicating a high flexibility in space use (Keuling et al., 2008). Piglets and females form groups, while males are more solitary outside the mating season. Yearling wild boar often disperse to new home ranges. Exceptional long-distance movements of over 100 km are occasionally recorded, even of family groups (Jerina et al., 2014). Continuous good habitat (woodlands) represents a corridor for wild boar movements, while open habitats and physical barriers such as highways and fences, but not rivers, can contribute to reduce wild boar movements (Dellicour et al., 2020).

Wild boar behaviour towards pigs and pig farms

Wild boar tend to avoid direct interactions with domestic pigs, except for mating (Cadenas-Fernández et al., 2019) or when orphaned wild boar become adopted by free-range pigs (Triguero-Ocaña et al., 2020). This may be due to differences in the activity patterns of both forms and a potential exclusion due to the competition for acorns (Carrasco-García et al., 2016). However, indirect interactions are frequent and relevant for ASFV transmission. Interactions among wild and domestic ungulates mostly occur around water and feeding points (Kukielka et al., 2013; Laguna et al., 2018). In parts of southwestern Spain and southern Portugal, castrated subadult pigs belonging to the Iberian pig breed are fed on acorn-rich pastures in autumn and winter (*montanera*). A recent study observed 339 indirect (long time window) interactions but no direct (short time window) interaction between 8 GPS-collared Iberian pigs and 6 GPS-collared wild boar, during one full *montanera* season. The frequency of interactions was generally higher near to water points. Wild boar interacted with domestic pigs regardless of the distance to dense vegetation, suggesting that domestic pigs (or pig-associated management) could exert an attractive effect on wild boar and/or show similar preferences when using aggregation points (Triguero-Ocaña et al., 2020). In Sardinia (Italy), wild boar and free-ranging unregistered domestic pigs showed the highest spatial interaction rates in areas close to pig farms, suggesting that (uncontrolled) free-ranging pigs can act as a bridge to transmit ASFV between wild boar and registered domestic pigs (Bosch et al. 2020; Cadenas-Fernández et al., 2019).

Concluding remarks

Wild boar populations and the consequences of wild boar overabundance will keep on growing unless there are drastic changes in any of the following factors: (1) the capacity of the habitat to host abundant wild boar, particularly the amount of food available; (2) mortality from hunting, predation or other control actions; or (3) the emergence of an epidemic with intense and sustained mortality.

References for wild boar fact sheet

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Appendix G – List of additional papers and reports provided by the experts during the EKE

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Report on Type I farms in The Netherlands

Reubens B, Pardon P, De Smet S, Van Colen W and Rombouts P, 2020. Boslandbouw voor buitenvarkens. Rapport opgesteld in het kader van de Operationele Groep P'Orchard. Instituut voor Landbouw-, Visserij- en Voedingsonderzoek (ILVO), Merelbeke, België. 46 p.

Publications on socio-economic factors

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