

Evaluating the likelihood of disease detection in pigs at saleyards and abattoirs using scenario tree modeling

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DAFWA

PFG Surveillance system

Objectives:

1. Assess the **likelihood of exotic disease detection** (*Sensitivity of detection*) with current disease surveillance activities at pig saleyards and abattoirs
2. Identify potential **improvements** of PFG surveillance



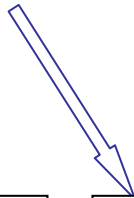
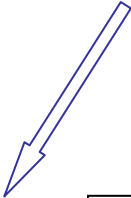
Current disease surveillance activities

Site

Farm



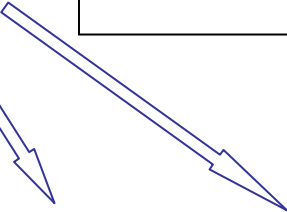
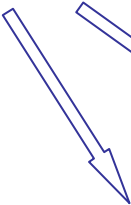
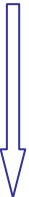
Truck



Saleyard

Domestic Abattoir

Export Abattoir



Farm

Domestic Abattoir

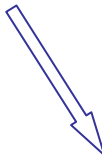
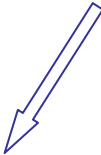
Export Abattoir

Potential Inspection point

Selection of pigs for selling

Loading

Transport



Saleyard

Abattoir

Unloading

Unloading

Saleyard pen (pre-sale)

Holding pen

Saleyard pen (post-sale)

Lairage

Loading

Race to slaughter

Slaughter line

Current disease surveillance activities - Saleyard

Potential Inspection point

Inspection responsible

Selection of pigs for selling

Loading

Transport



Unloading

Saleyard pen (pre-sale)

Saleyard pen (post-sale)

Loading

Producer
Farm manager

Transporter

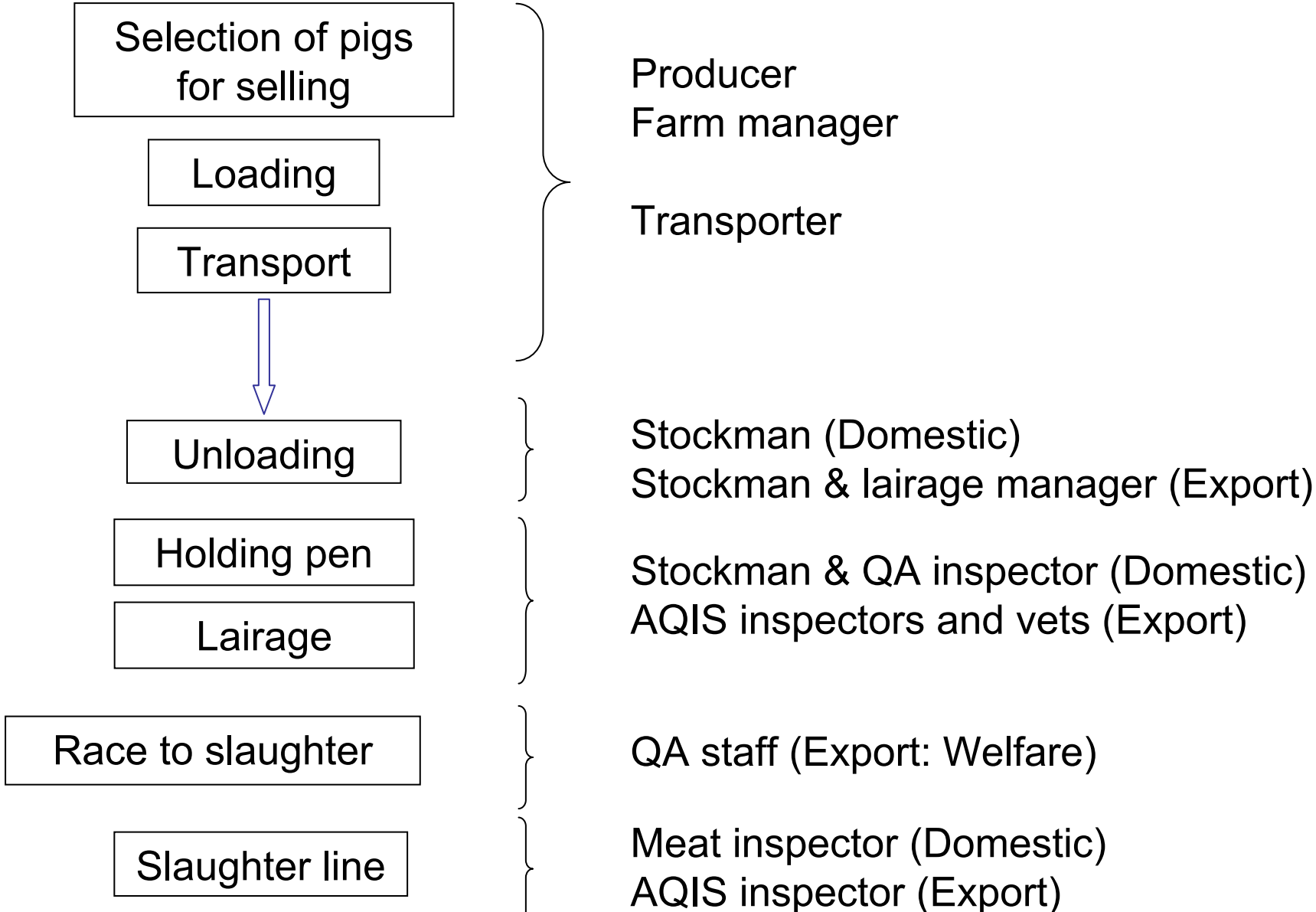
Stockman
Saleyard manager

Government inspectors
Animal Health officers

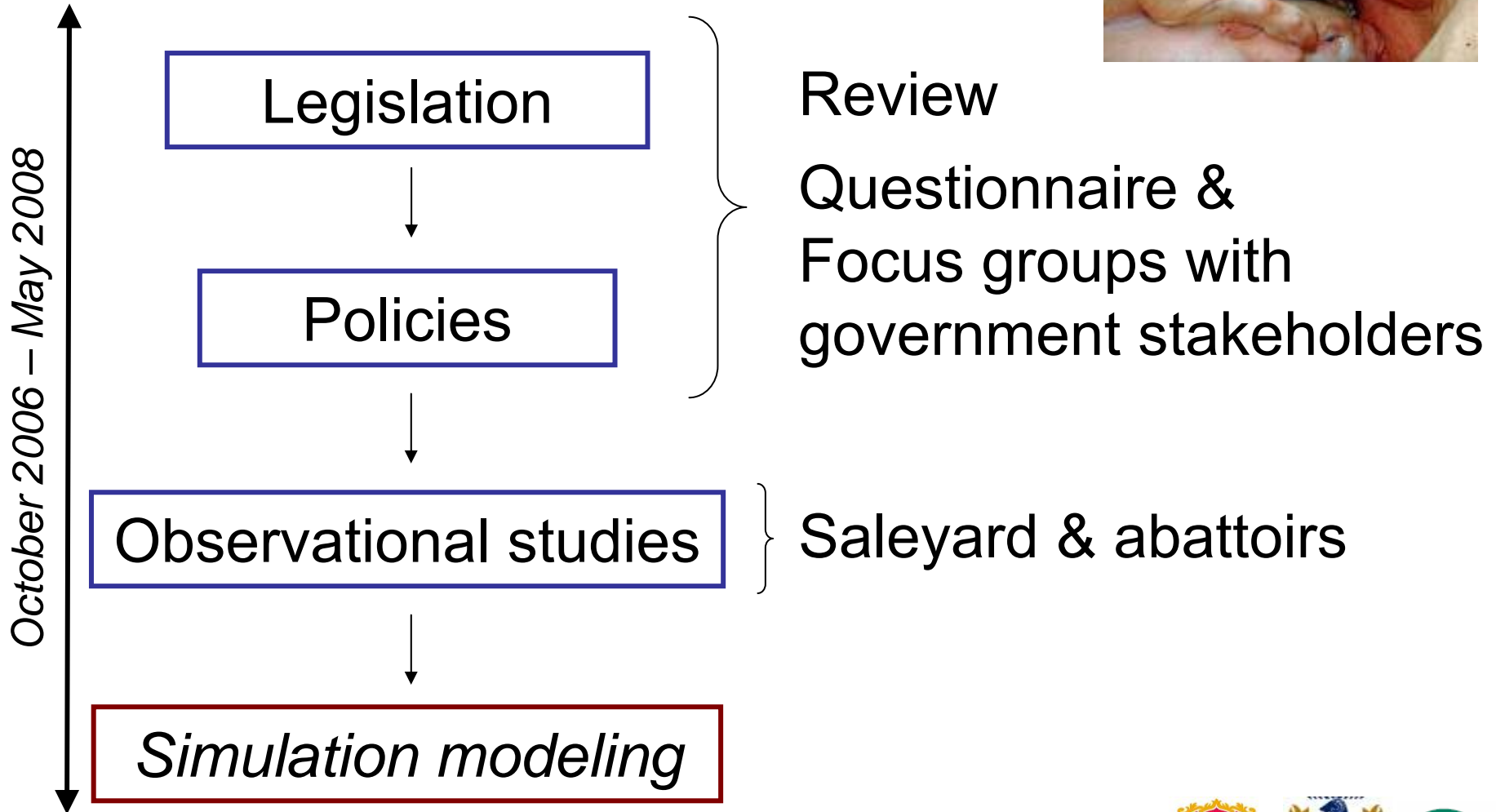
Current disease surveillance activities - Abattoir

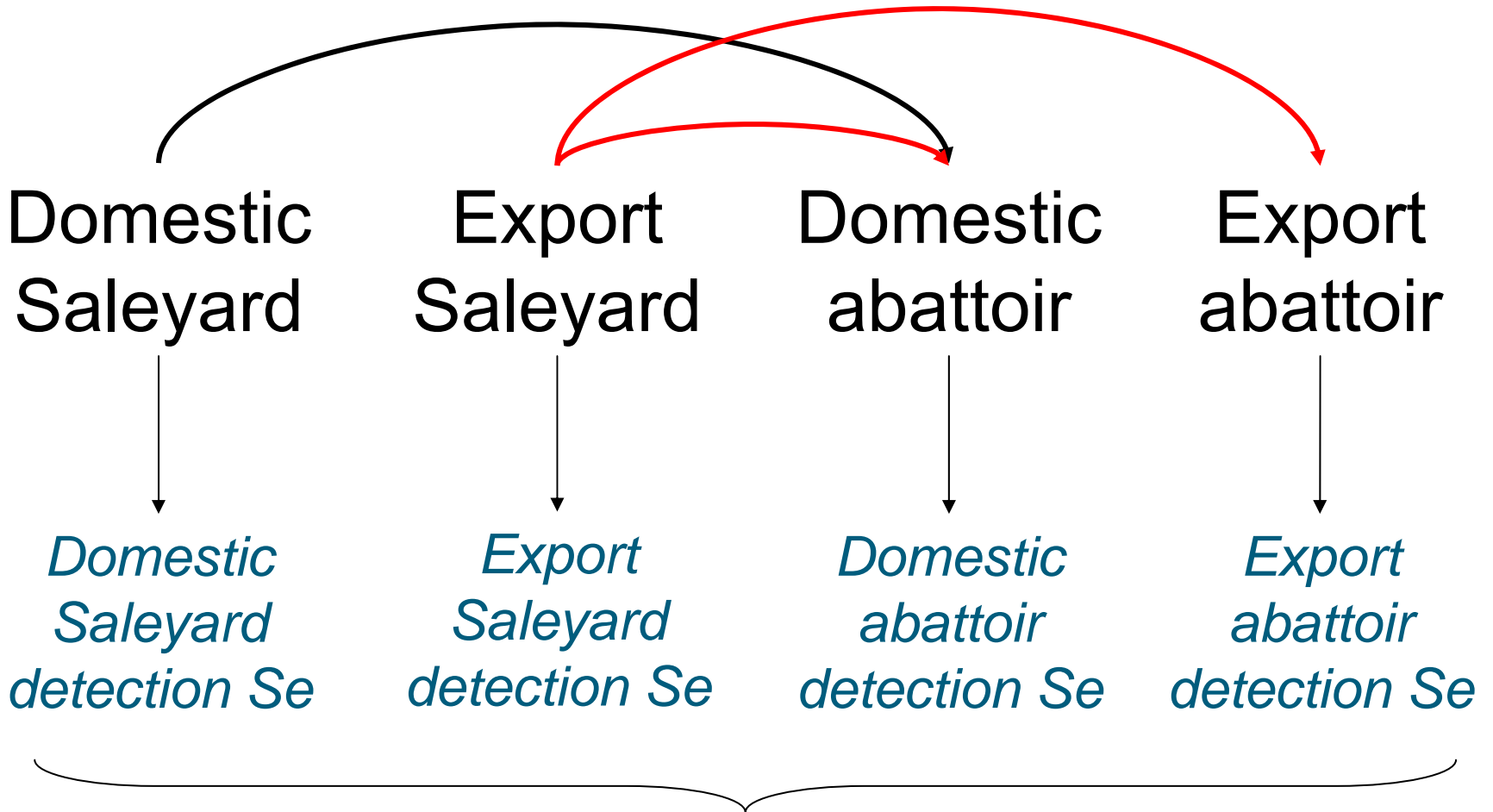
Potential Inspection point

Inspection responsible



Methodology





Sensitivity of PFG Surveillance System

Why is saleyard surveillance particularly important?

Saleyard



*Saleyard
detection Se*

- High proportion of **small scale producers** (>90%)
 - Limited interaction with these producers otherwise;
 - Higher risk of disease introduction:
 - *Lack of understanding of swill feeding; and,*
 - *Poor biosecurity practices*
- Central point of commingling of animals from **many sources**
- Presence of **ruminants**

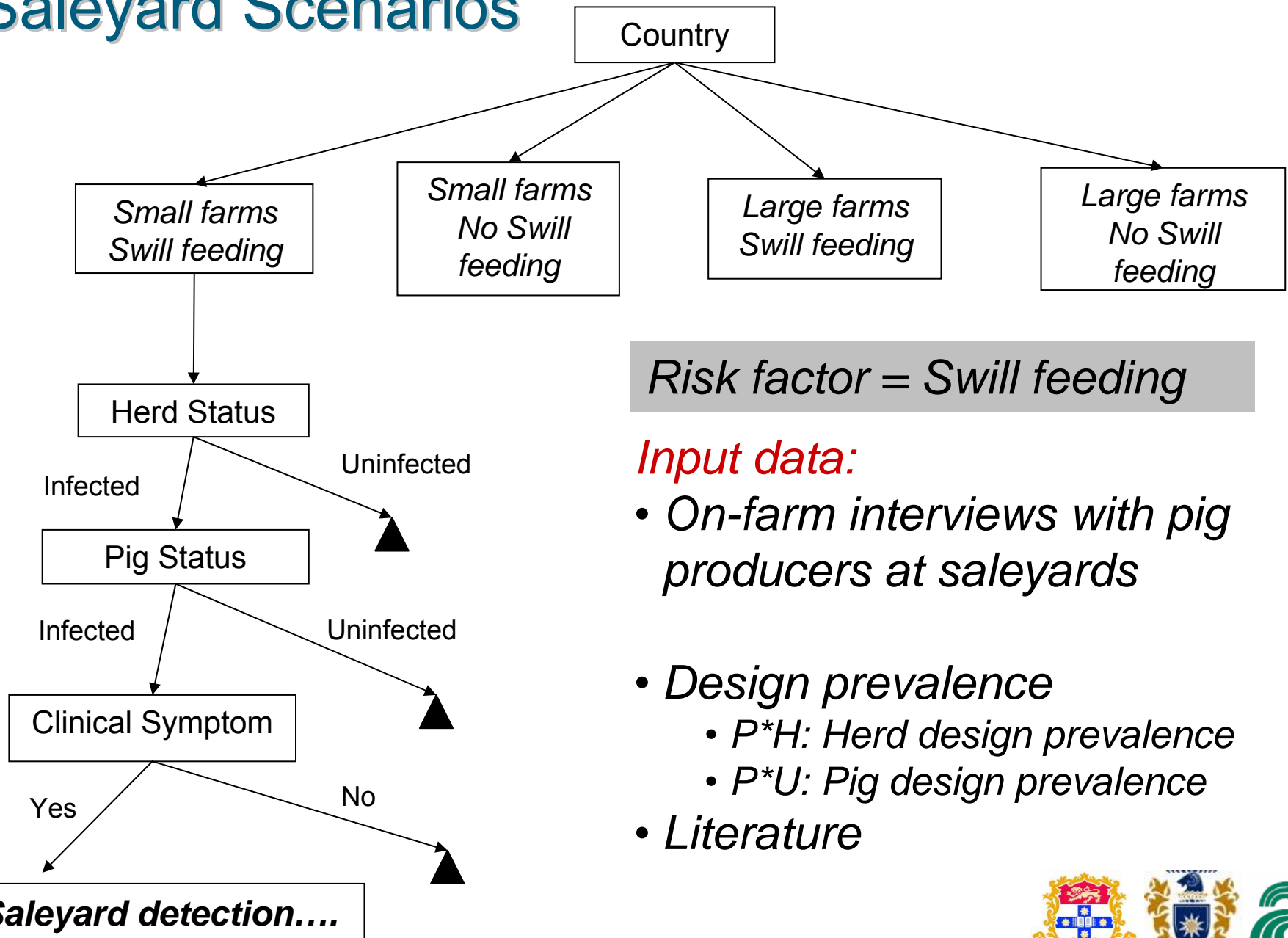


Methodology

1. **Scenario trees** (*Martin et al., 2007*) and **stochastic simulation modeling** to assess the likelihood of detecting Foot and Mouth Disease with the current disease surveillance activities
2. **Sensitivity analysis** to determine which part of the pathway has most effect on the likelihood of detection - *How sensitive is the model to various input values?*



Saleyard Scenarios



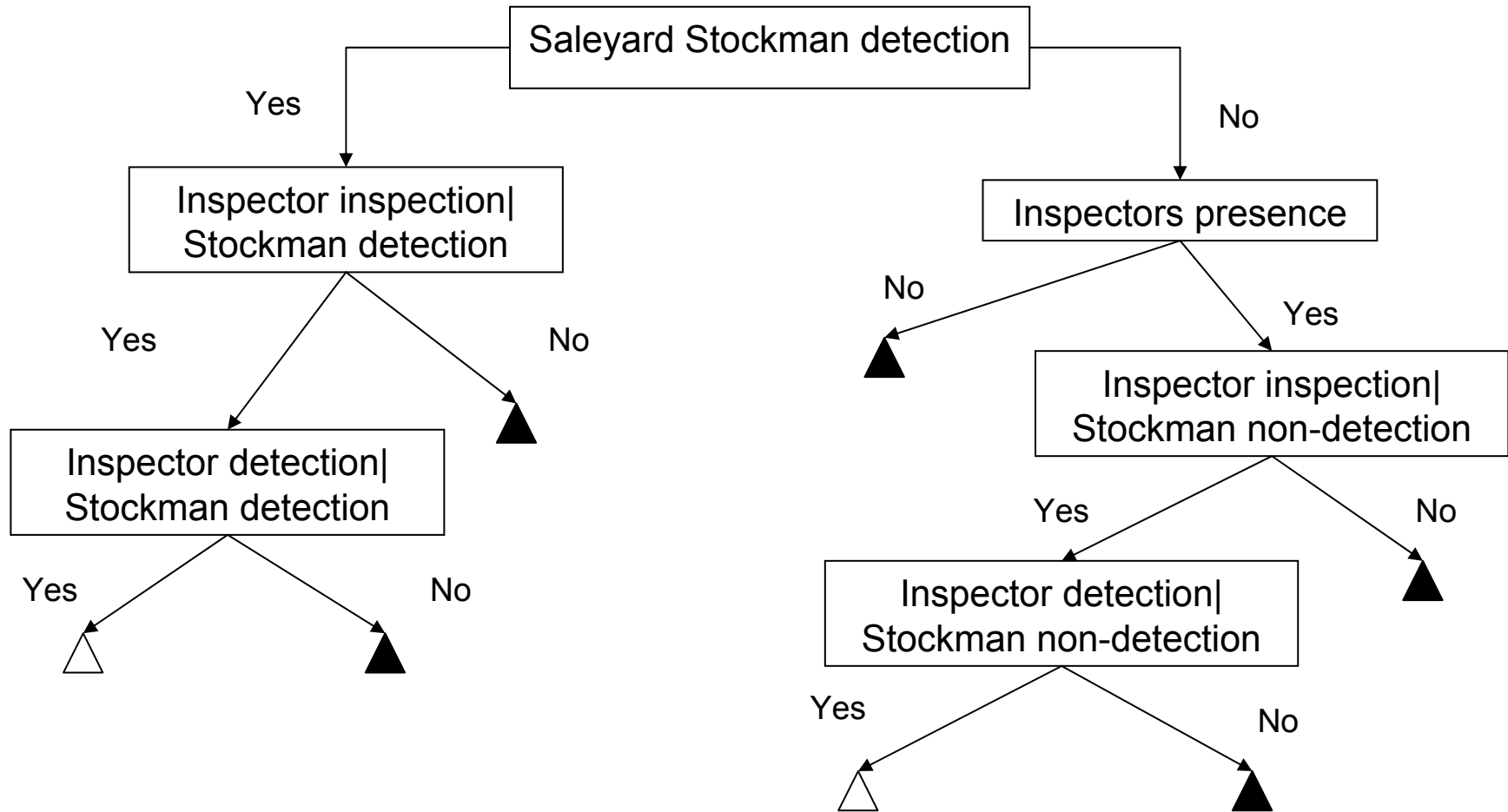
Risk factor = Swill feeding

Input data:

- *On-farm interviews with pig producers at saleyards*
- *Design prevalence*
 - P^*H : Herd design prevalence
 - P^*U : Pig design prevalence
- *Literature*



Saleyard Scenarios



Input data:

- *Review of legislation, resources and current activities*
- *Focus groups with saleyard stakeholders*
- *Observational studies at saleyards*



Simulation model

Foot and Mouth Disease

Given the country is infected at P^*H 0.01 and P^*U 0.30

Evaluation during a 2 week period at a representative saleyard location for:

1 sale day for the export saleyard

2 sale days for the domestic saleyard

Domestic saleyard scenario

Export saleyard scenario



Saleyard Output summary

	<i>Domestic Saleyard</i>	<i>Export Saleyard</i>
<i>Unit CSe (95% CI)</i>	<i>0.0009 (0.0004 – 0.0015)</i>	<i>0.0009 (0.0004 – 0.0015)</i>
<i>Saleyard CSe (95% CI)</i>	<i>0.12 (0.06 – 0.20)</i>	<i>0.24 (0.16 – 0.35)</i>

Unit CSe – Probability that an average pig will be detected

Saleyard CSe – Probability the component (saleyard) detects disease at the specified design prevalences



Sensitivity analysis – Saleyards

when Stockman

Detection = 1

Domestic Saleyards

CSe = 0.15

Export Saleyards

CSe = 0.29

when Inspector

presence = 1

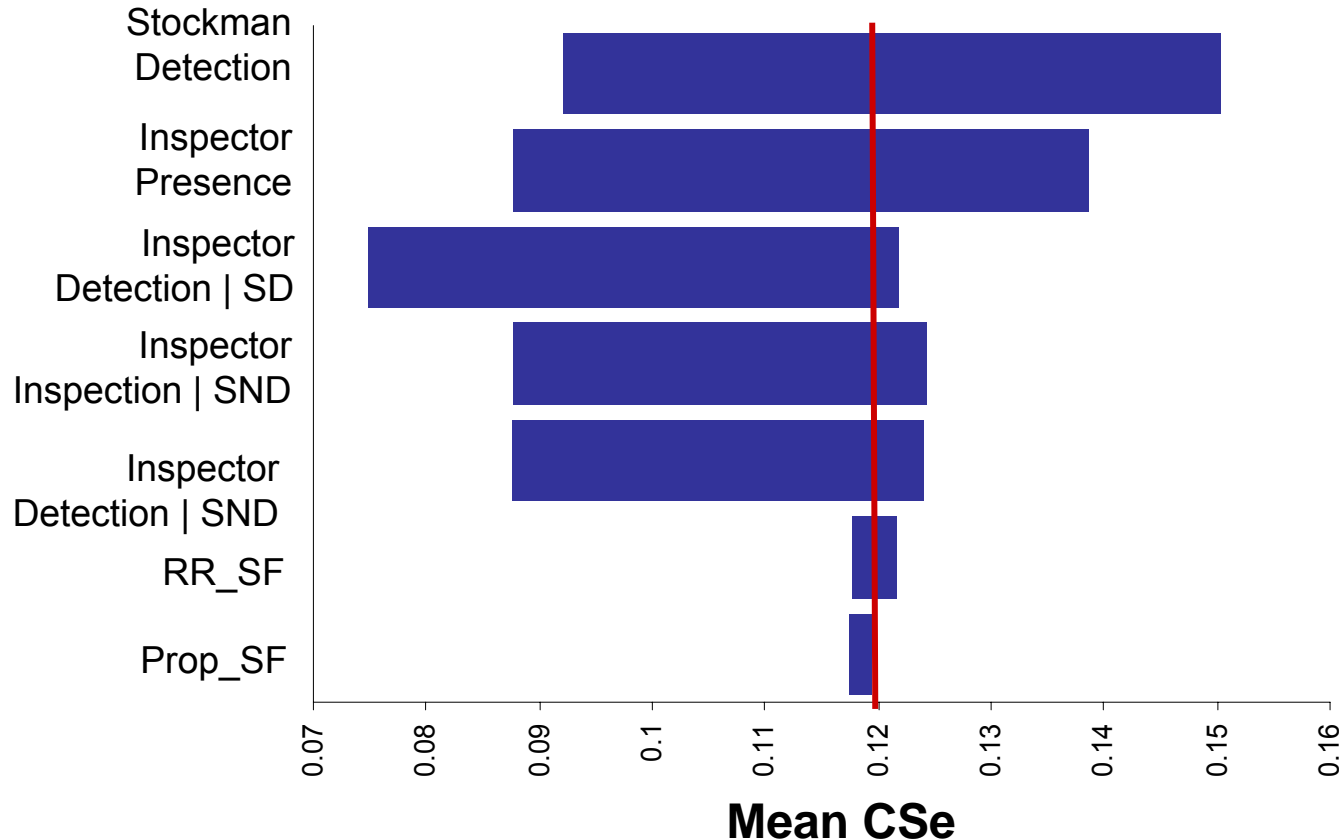
Domestic Saleyards

CSe = 0.14

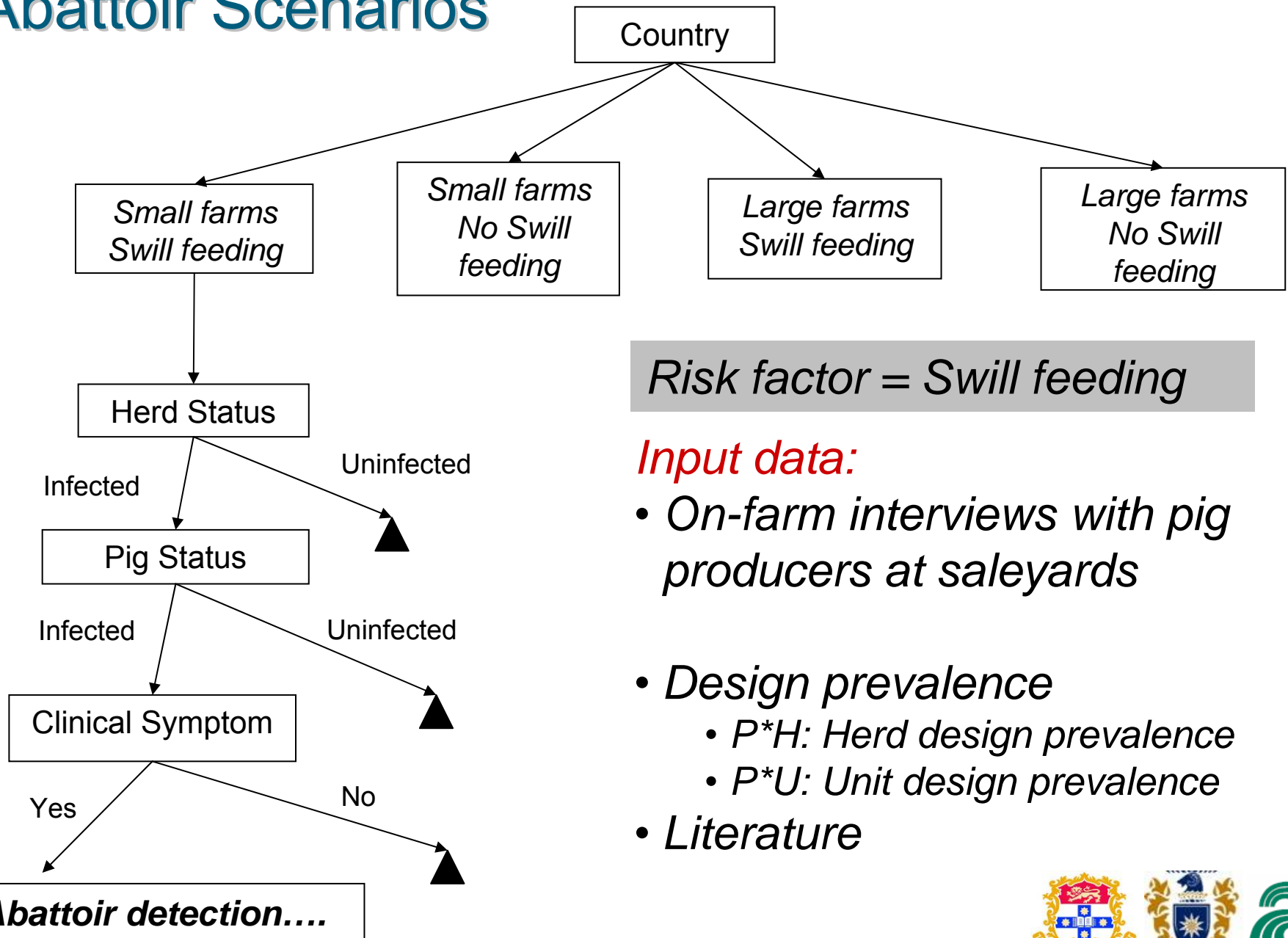
Export Saleyards

CSe = 0.28

Inspector detection !



Abattoir Scenarios



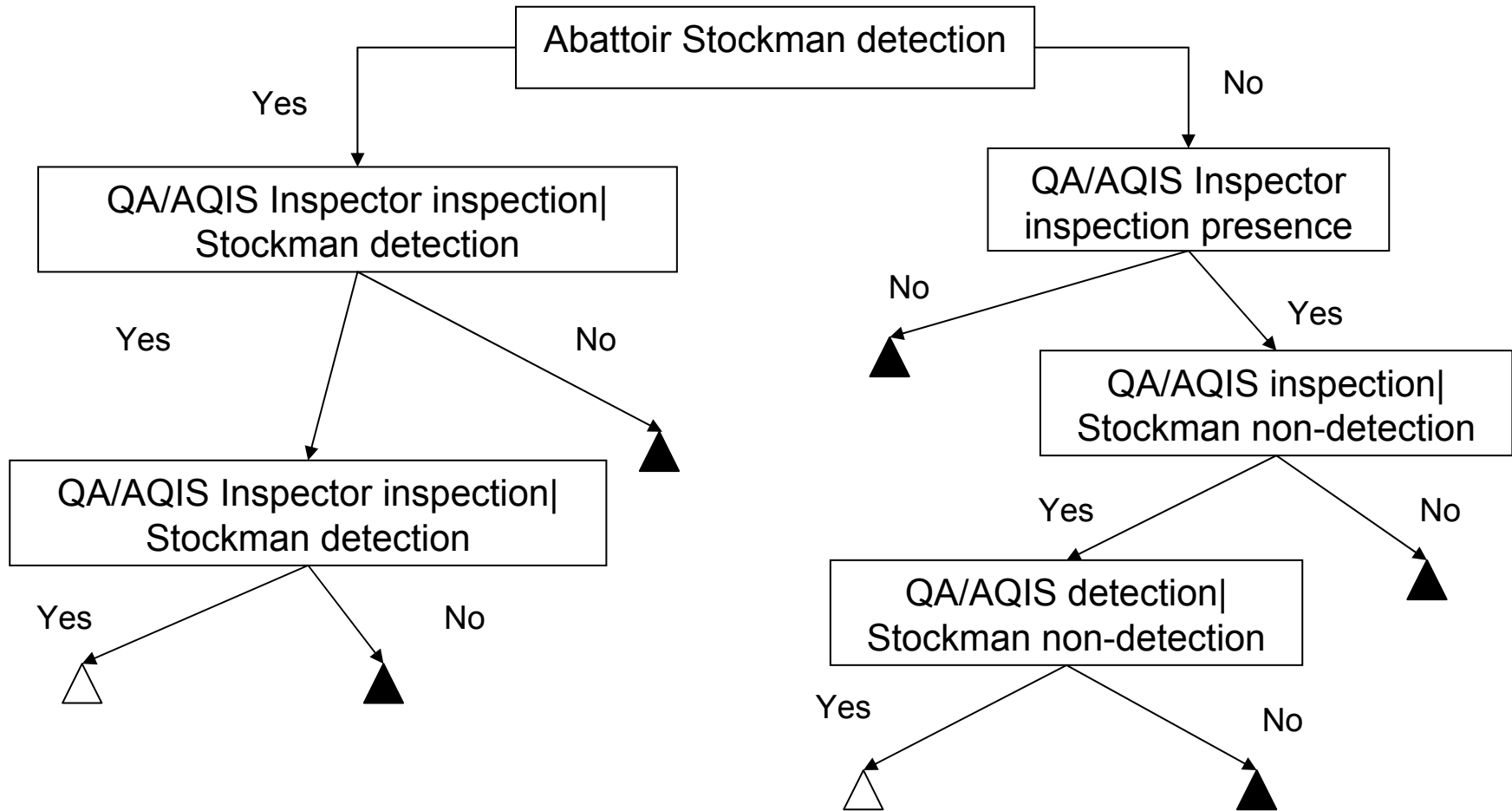
Risk factor = Swill feeding

Input data:

- *On-farm interviews with pig producers at saleyards*
- *Design prevalence*
 - P^*H : Herd design prevalence
 - P^*U : Unit design prevalence
- *Literature*



Abattoir Scenarios



Input data:

- *Review of legislation, resources and current activities*
- *Focus groups with abattoir stakeholders*
- *Observational studies at abattoirs*



Simulation model

Foot and Mouth Disease

Given the country is infected at P^*H 0.01 and P^*U 0.30
Evaluation during a 2 weeks period at a representative
abattoir location for:

Domestic abattoir scenario

Export abattoir scenario



Abattoir Output summary

	<i>Domestic Abattoir</i>	<i>Export Abattoir</i>
Unit CSe (95% CI)	0.0008 (0.0004 – 0.0013)	0.0015 (0.0007 – 0.0022)
Abattoir CSe (95% CI)	0.17 (0.11 – 0.26)	0.19 (0.16 – 0.27)

Unit CSe – Probability that an average pig will be detected
Saleyard CSe – Probability the component (abattoir) detects disease at the specified design prevalences



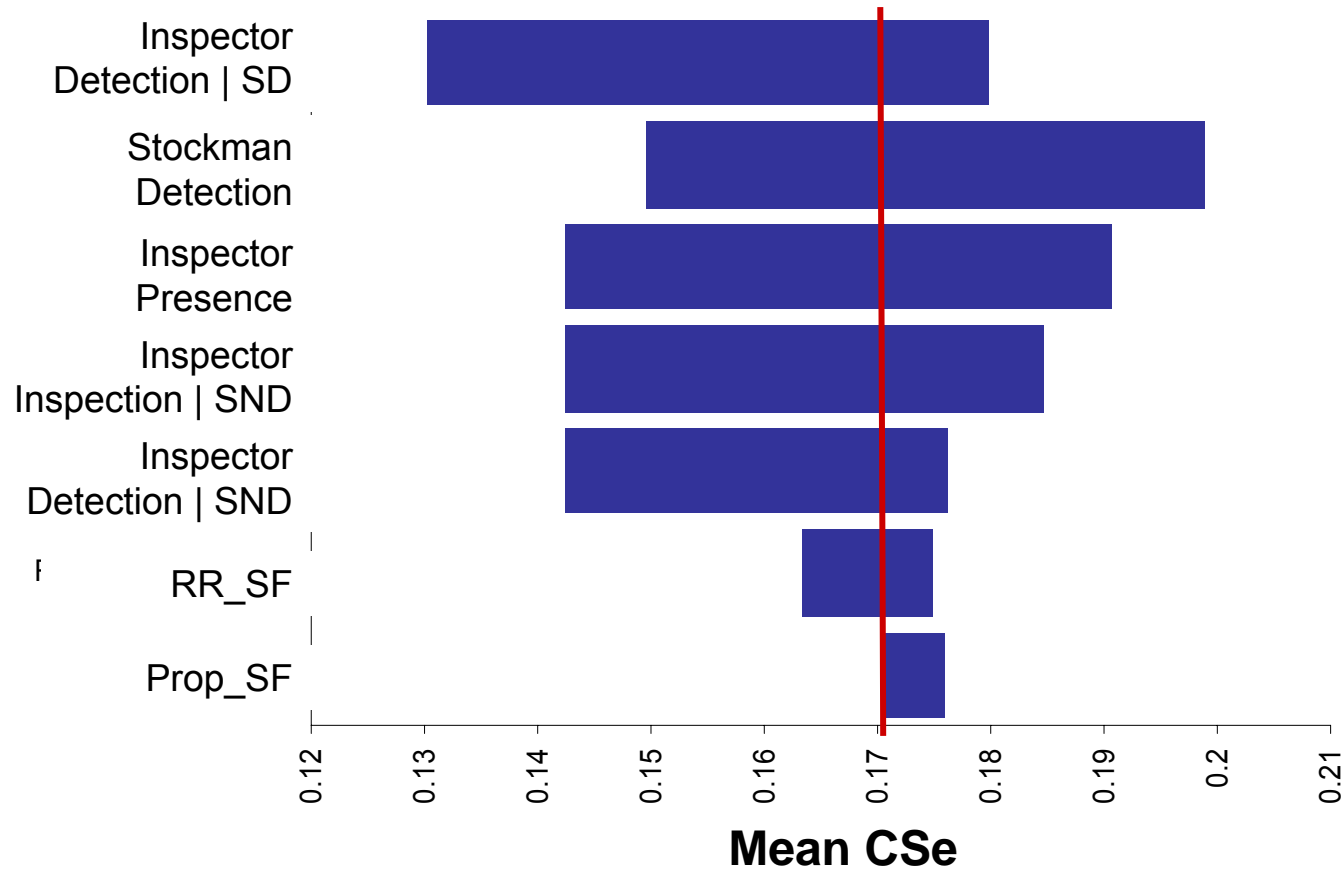
Sensitivity analysis – Domestic Abattoir

*when Stockman
Detection = 1*

**Domestic
Abattoir CSe =
0.20**

*when Inspector
presence = 1*

**Domestic
Abattoir CSe =
0.19**



Inspector detection !



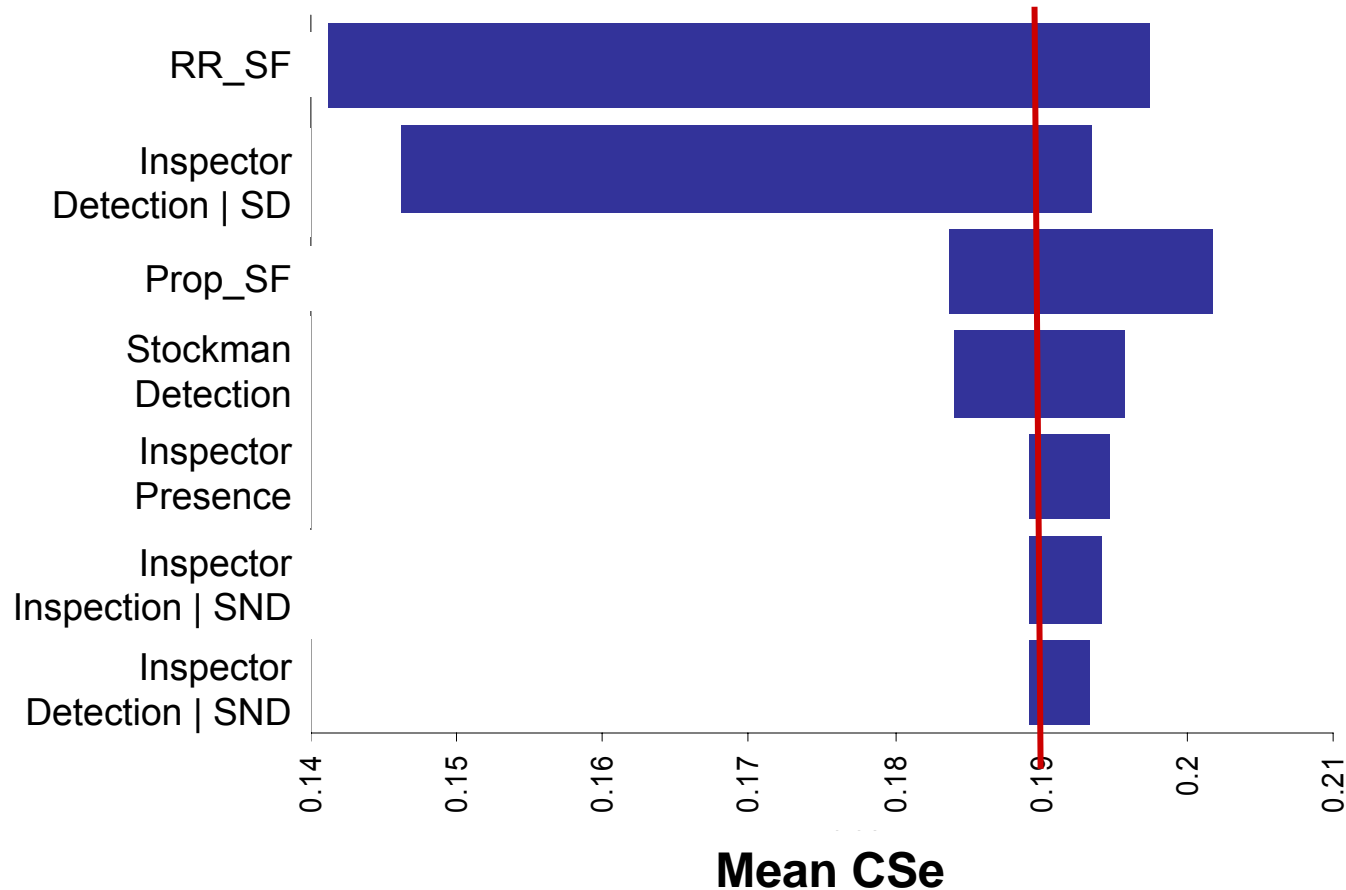
Sensitivity analysis – Export Abattoir

*when Stockman
Detection = 1*

**Export Abattoir
CSe = 0.19**

*when Inspector
presence = 1*

**Export Abattoir
CSe = 0.19**



*Proportion of swill feeding among small-scale producers !
Relative Risk of swill feeding in FMD outbreaks !
Inspector detection !*



Implications

1. **Ability to detect** (*stockmen, inspectors*) at saleyards and domestic abattoirs could be improved
2. Ability to detect **Export abattoirs** > **Domestic abattoirs**;
however, **Export abattoir Se** ~ **Domestic abattoir Se**
(*low proportion of small-scale herds (higher risk) going through the export abattoir*)
3. Input variables with higher impact on the **Sensitivity** of the surveillance system:
 - Ability of Stockmen to detect
 - Presence of inspectors at saleyards and abattoirs
4. Animals not showing **clinical symptoms** will not be detected



How the model can be improved?

- Better estimates of swill feeding among small and large scale producers
- More accurate information on FMD outbreaks in the last 50 years in FMD-free countries like Australia – Association with swill feeding
- Further information on producers not selling through commercial pathways

Next steps....

- Evaluate the Se of detection for all abattoirs & saleyards in Australia
- Combine the 4 SSC (*not independent*) to obtain the overall Se of the PFG surveillance system

QUESTIONS?

