Costs of PRRS & ROI of interventions

Use of an economic simulator

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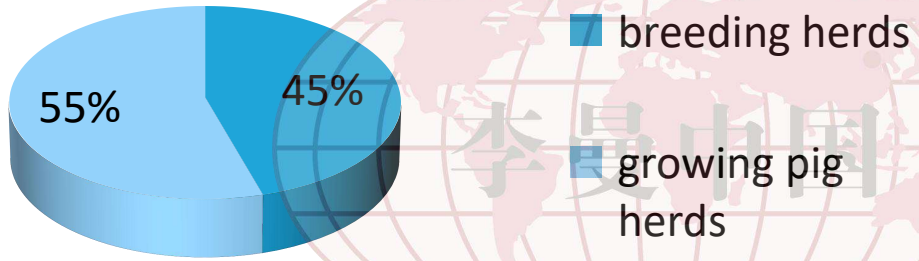
Economic impact of PRRS

- Holtkamp et al., 2013:

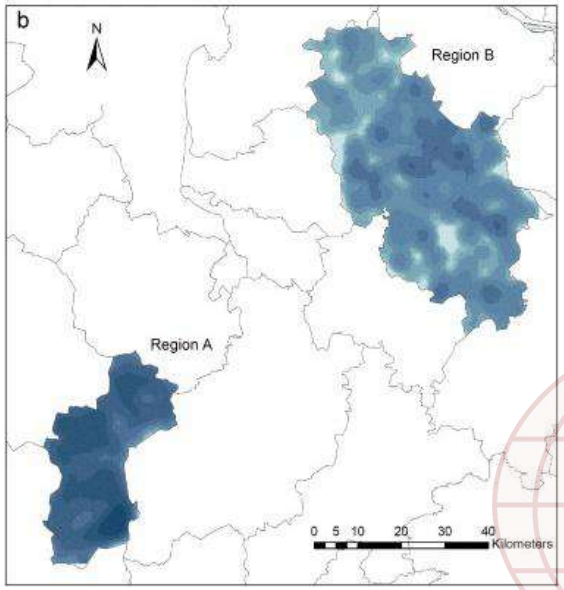
$664 million losses in 2013 (USA):



http://www.respig.com/images/prrs-weak-stillb.jpg

- **$115 per sow**
- **$4.7 per pig marketed**

How to combat PRRS?



Fahrion et al. 2014: Evaluating perspectives for PRRS virus elimination from pig dense areas with a risk factor based herd index

?

?

€ $ £ ?

Objectives

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- Create a **practical calculation tool** for farmers and veterinarians

- Assess
  - **economic impact** of disease for different disease severities and
  - **efficiency of intervention strategies** at **farm level**

Agenda

- Cost model
  - theoretical background
  - farm example
- Intervention strategies
  - theoretical background
  - farm example
- Practical application

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Cost model

Model requirements

Adaptable to farm specific …

- Production system
- Production rhythm
- Suckling period
- (Re-)productive performance
- Disease severity
- Prices

Model process

1. Production model

- processes to farm outputs

2. Epidemiological model

- impact of PRRS at different stages

3. Gross margin and enterprise budget analysis

- costs & revenue

4. Partial budget analysis

- net losses due to PRRS

Epidemiological model – impact of PRRS

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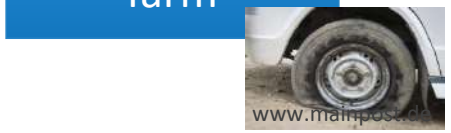
	Parameter	Change
Breeding	Return-to-estrus rate %	↗
	Abortion rate %	↗
	Piglets born alive / sow / litter	↘
	Pre-weaning mortality %	↗
	Weight at weaning kg	↘
Nursery	Days in nursery	↗
	PRRS morbidity in weaners %	↗
	Mortality in weaners %	↗
Fattening	Days in fattening	↗
	PRRS morbidity in fatteners %	↗
	Mortality in fatteners %	↗

Quantification of impact



Given affected farm

same features

Negative farm

Diseased model:

Production inputs
- Abortion rate
- Weight at weaning
- Duration of fattening
- …

Production outputs
- Piglets weaned
- Inseminations needed
- kg feed consumed
- …

Costs and Revenue
- Revenue for pigs slaughtered
- Replacement cost
- Feed costs
- …

Negative model:

BASELINE production inputs
- **BASELINE** abortion rate
- …

Production outputs
- …

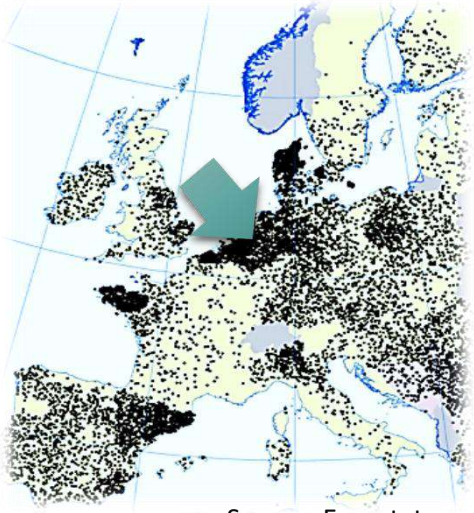
Costs and Revenue
- …

Δ = loss due to PRRS

Farm example

- Farrow-to-finish farm
- 1000 working sows
- no PRRS vaccination
- 1-weekly production rhythm
- 3 weeks of suckling
- 35% replacement rate per year
- 30 kg weight of pigs at end of nursery
- 120 kg live weight of pigs at finishing

www.atlas-agrarstatistik.nrw.de/



Source: Eurostat

Negative versus example scenario

	Parameter	Negative farm
Breeding	Return-to-estrus rate %	10.0
	Abortion rate %	2.0
	Piglets born alive / sow / litter	12.7
	Pre-weaning mortality %	11.0
	Weight at weaning kg	6
Nursery	Days in nursery	45
	PRRS morbidity in weaners %	-
	Mortality in weaners %	3.0
Fattening	Days in fattening	119
	PRRS morbidity in fatteners %	-
	Mortality in fatteners %	1.5

→ «reference» farm / scenario

Negative versus example scenario

	Parameter	Negative farm	Example farm
Breeding	Return-to-estrus rate %	10.0	↗ 13.5
	Abortion rate %	2.0	↗ 3.9
	Piglets born alive / sow / litter	12.7	↘ 11.4
	Pre-weaning mortality %	11.0	↗ 13.5
	Weight at weaning kg	6	↘ 5.5
Nursery	Days in nursery	45	↗ 50
	PRRS morbidity in weaners %	-	↗ 20.0
	Mortality in weaners %	3.0	↗ 10.0
Fattening	Days in fattening	119	↗ 127
	PRRS morbidity in fatteners %	-	↗ 20.0
	Mortality in fatteners %	1.5	↗ 3.0

«Moderately» affected in all farm parts

Costs

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=> Negative farm:

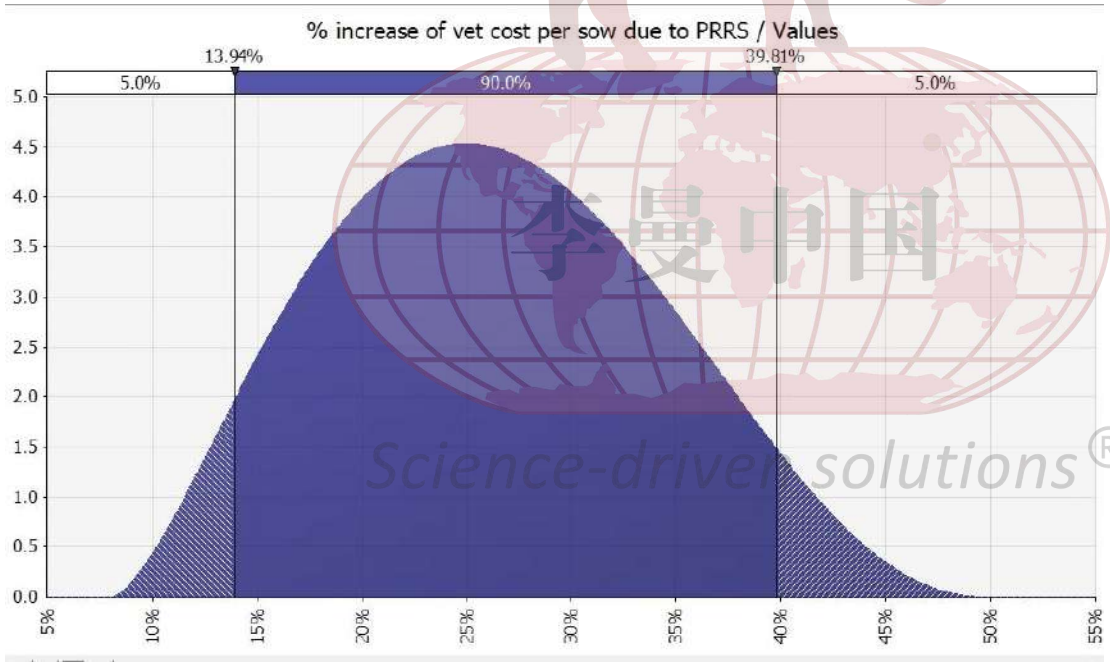
Gross margin (revenue – variable c.): USD 759/sow/yr.

Diseased farm:

- flat ↗ in vet & labour cost

Model specifications

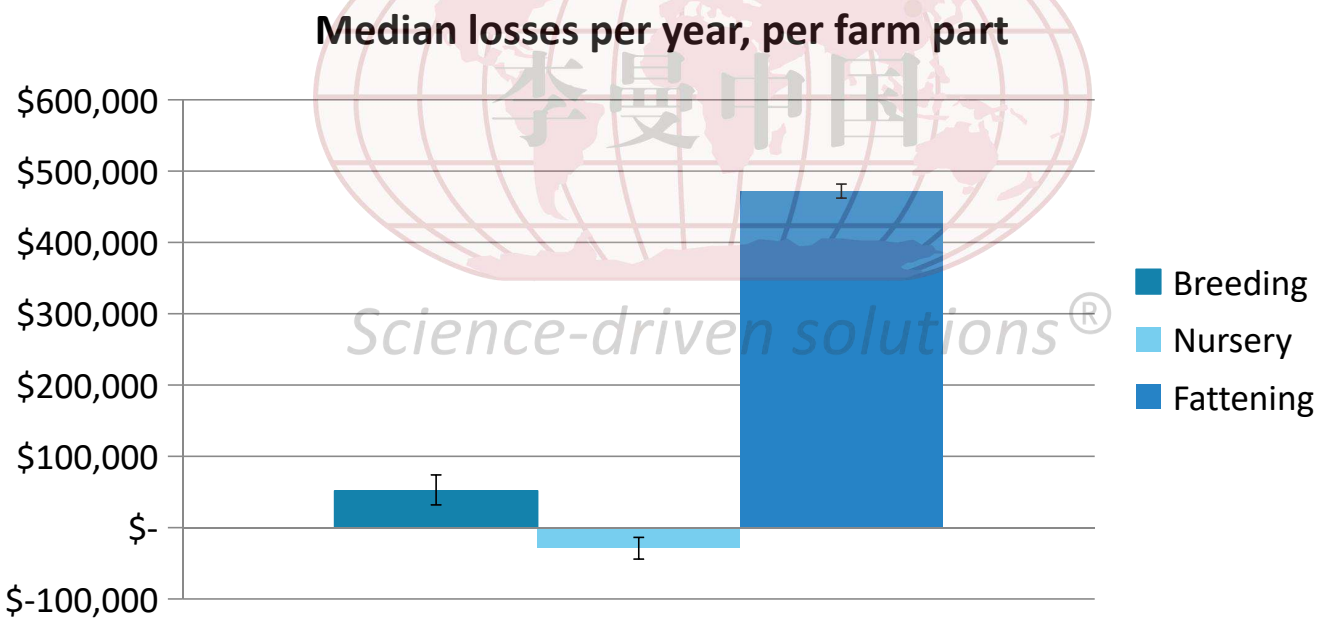
…Uncertainty and variability?



=> distributed inputs ***and outcomes***!

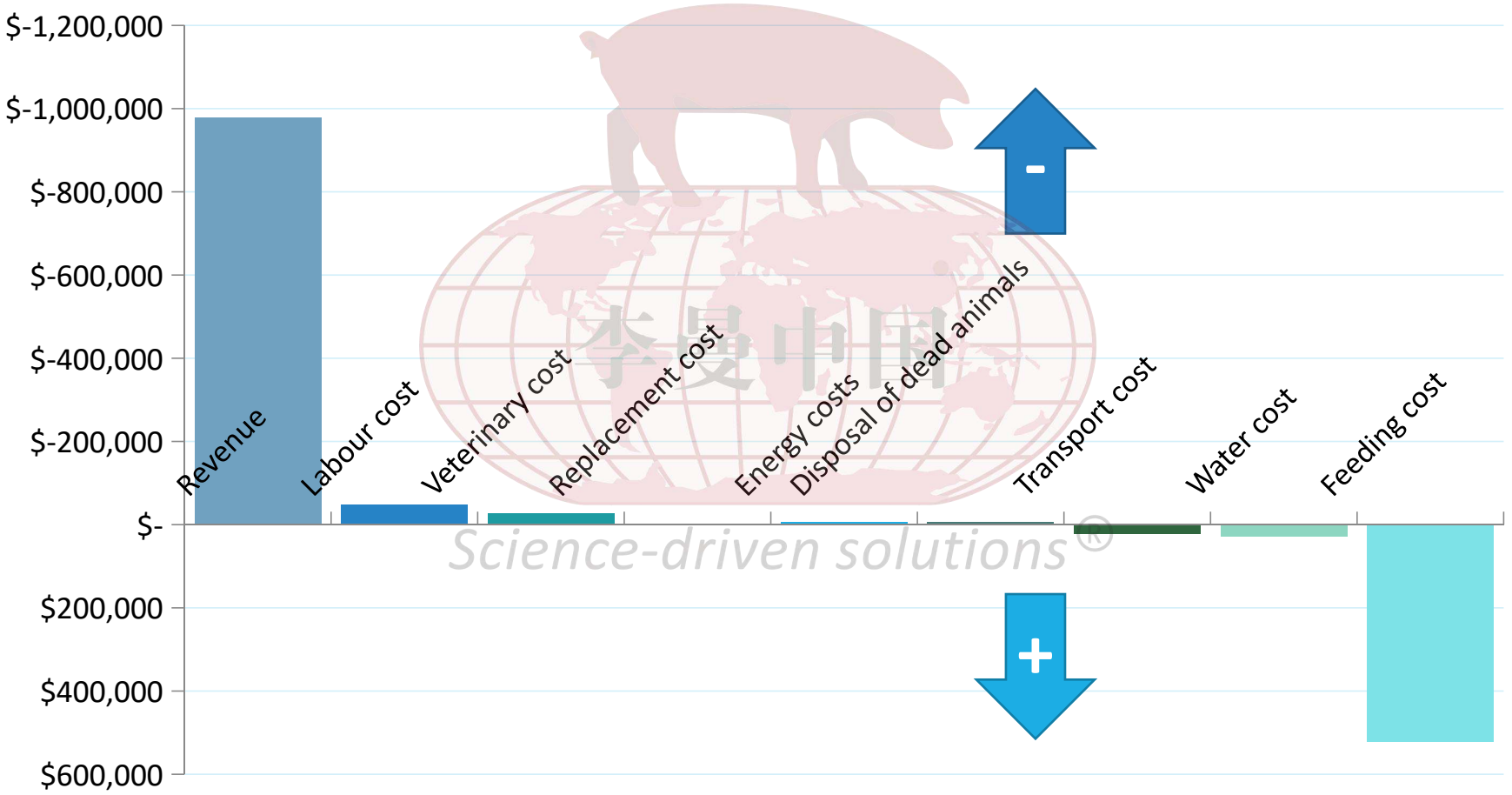
Results – costs of PRRS

Total losses per year	US $
Median	**494'468**
5%ile	449'911
95%ile	542'069



Impact of PRRS on individual costs

Difference to negative status:



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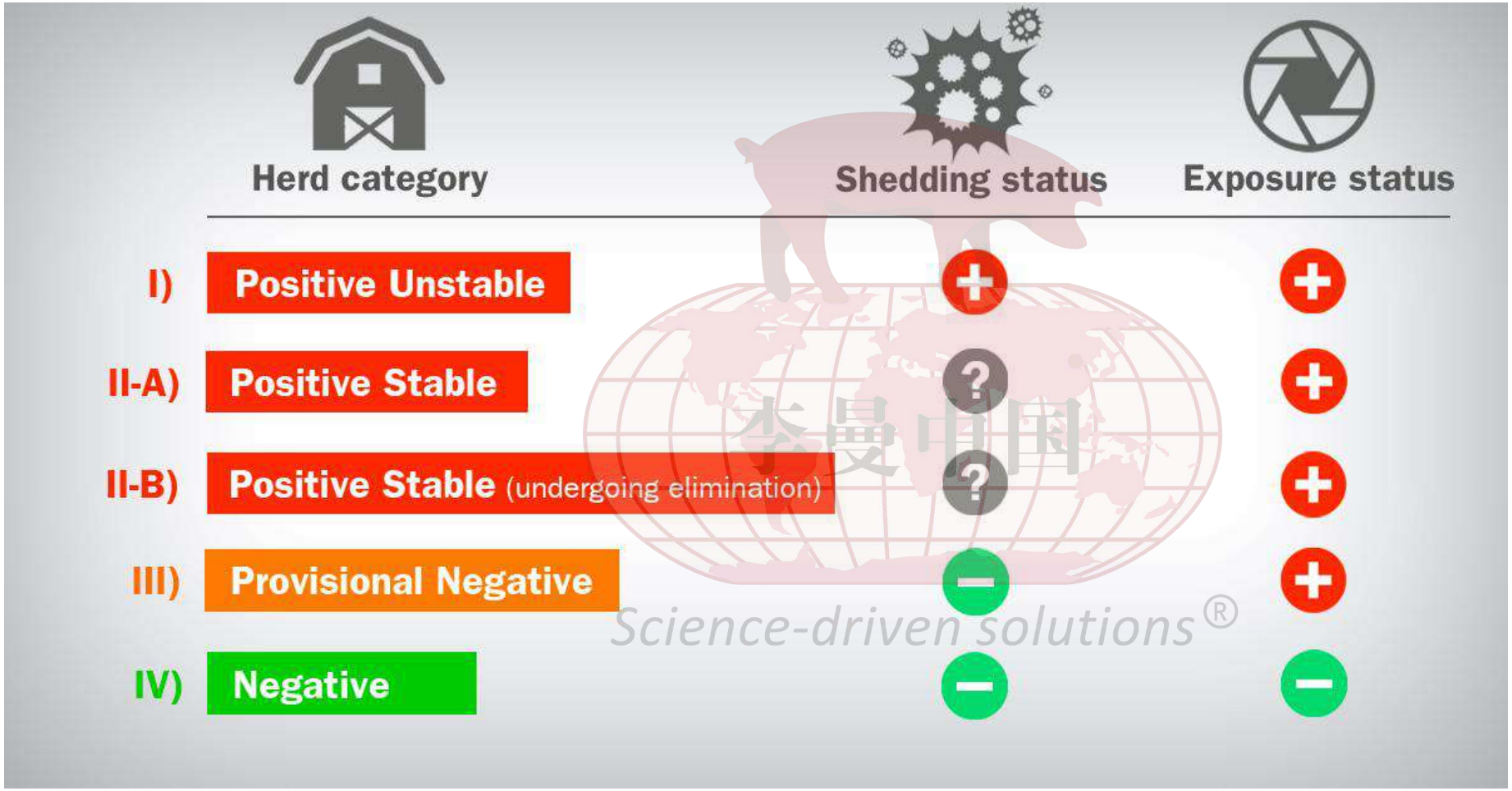
Intervention strategies

Assess the status of your herd first!



Intervention strategies

Elimination procedures

1. Depop / repop (D/R)
2. Close & roll-over (C&R)
3. Test & removal (T&R)

for:

- *farms with sows*
- *T&R: stable, seroprev. <25%; no vacc.*

Vaccination protocols:

4. 3-monthly mass vaccination of sows (MS)
5. Vaccination (6-60) of sows
6. MS and vaccination of piglets
7. 6-60 and vaccination of piglets

- *farms with sows*
- *depending on current vacc.*

Biosecurity & Management

8. Improvement in Biosecurity & Management (BSM)

9. - 12. Combinations of vaccinations & BSM

- *all farms*

Effect of interventions – assumed improvement

Elimination procedures

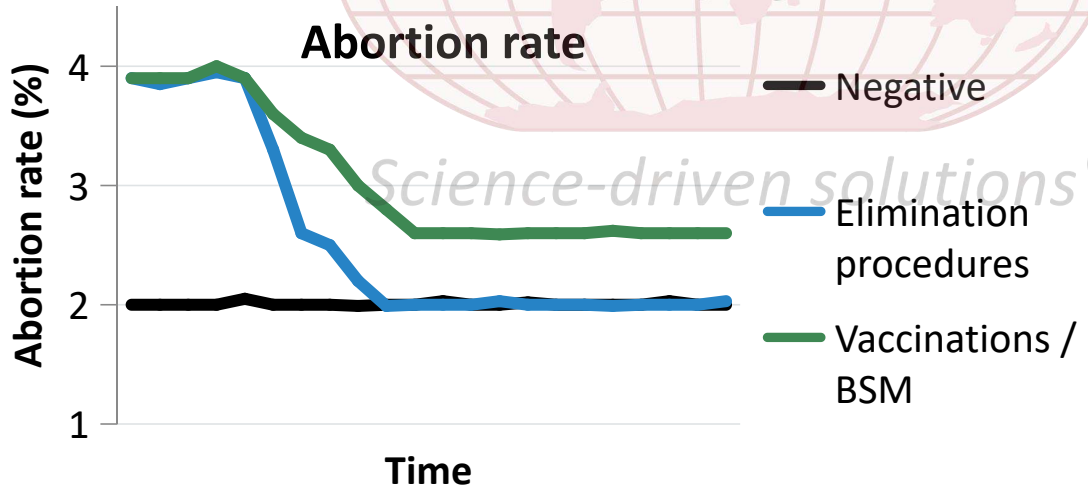
Vaccination protocols

Biosecurity & Management

Combinations

Farm negative => all performance / disease parameters take **baseline values** of negative herd

Parameters **improve by certain %**
=> expert opinion



Improvement ↗

- if currently not vaccinating sows
- if unstable

Costs of interventions

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Intervention	Costs
1. Depop / repop (D/R):	• gap period (no production): costs↘ • and revenue ↘ • cleaning & desinfection • restocking whole herd
2. Close & roll-over (C&R):	• gilts for 6 months in advance: purchase costs ↘, feed costs etc. ↗ • space requirements
3. Test & removal (T&R):	• laboratory costs • replacement cost ↗
4. -7. Vaccination protocols:	• basic immunization • regular vaccination costs
8. Biosecurity & Management (BSM):	• dependent on farm situation

biosecurity

Quantification of impact

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Diseased model:

Production inputs

Production outputs

Costs and Revenue

Negative model:

BASELINE production inputs

Production outputs

Costs and Revenue

1. D/R

2. C&R

3. T&R

4. MS

5. 6/60

6. MS & piglets

7. 6/60 & pig.

8. BSM

12. 6/60 & pigl. + BSM

...

Δ

Calculation of outcome

Net present value of (future)

extra revenue and **extra costs**

due to an intervention over **5 years**.

= «Expected Value» (EV)

Practical application

Practical application of the model

- Why should I use the calculator?
- What do I need to enter?
- Which kind of results can I expect?

Practical application – «quick & dirty»

Breeding:	
Please indicate:	
Average number of working sows in your farm	1000
Length of suckling period (weeks)	3
Return to estrus rate (%)	10.0%
Abortions (%)	2.0%
Average piglets born alive per sow per litter	12.7
Average preweaning mortality (%)	11.0%
Average weight of your pigs at weaning	6
Nursery:	
Please indicate:	
Average days of your weaners in nursery	50
Average weight of your weaners sold	25
Percentage of weaners **clinically** affected by PRRS **(including those later dying)** (%)	20%
Mortality in weaners (%)	10%
Fattening:	

all other input parameters (prices etc.):

➢ default values (country specific)

+
- **fast**
- **only most important data necessary**

–
- **rough estimate**
- **does not account for farm specific situation**

Practical application – «detailed and precise»

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Fattening:

Enter your farm data	Enter value:	
Please indicate:		
Average days of fattening until your pigs go to slaughter	127	
Average days of downtime between turns	5	5
Average weight of your pigs at slaughter	120.3	
Percentage of fatteners **clinically** affected by PRRS **(including those later dying)** (%)	20%	
Mortality in fatteners (%)	3%	

Enter your economic data	EUR	Default values
Please indicate:		
Price per unit live weight of a fattener sold	1.2	1.2
Total veterinary cost per fattening pig	1.3	1.3
Fatteners' feed price/1000 weight units	280	280
Energy cost per pig produced (incl. water except drinking water for animals)	2.5	2.5
Transport cost per unit live weight slaughter pig	0.02	0.02
Do you pay transport also when buying fatteners, please select from dropdown list:	yes	
If yes, please indicate cost per weight unit pig	0.04	0.04
Labour cost per pig produced	4.5	4.5
Building cost per pig produced	5	5
Equipment cost per pig produced	2	2
Inspection, Levy and Insurance cost per pig produced	1	1
Any other variable cost per pig produced	0	0
Any other fix cost per pig produced	1.5	1.5

Cost model

possibilities for adjustment: own versus default values (country-specific)

- mainly prices
- sows:
  - replacement rate
  - production rhythm
  - current vaccination scheme!

Practical application – «detailed and precise»

Intervention	*Value / possible for your farm type?*
Depop/repop (D/R)	*YES*
Cleaning and desinfection / sow (incl. water, energy, chemicals etc.)	10.00
Extra labour cost / sow	30.00
Other cost / sow	0.00
Close & roll-over (C&R)	*YES*
Extra cost (building etc.) for providing space to all replacement gilts needed for the following 6 months (time period of herd closure) / sow	30.00
Test & removal (T&R)	NO
If you do **not vaccinate against PRRS**: how many out of 18 samples taken from **sows** were antibody-positive?	0
Total cost for serological testing per sow	30.00
Only for farrow-to-finish herds: cost for strict compartmentalization of sows after T&R (to avoid spill-back)	*5.00*
Did you detect wild type virus in suckling pigs within the last 12 months?	yes
Biosecurity & Management (BSM)	YES
What do you think will be the overall % increase in total costs for permanently improving biosecurity and management	2%
Did you detect wild type virus in weaning pigs within the last 12 months?	yes
Did you detect wild type virus in fattening pigs within the last 12 months?	yes

Interventions

- **Costs**
- **Diagnostics:**
  - seroprevalence in sows
  - herd stability

➢ T&R ?
➢ % improvement

Readout «Cost of PRRS in your farm»

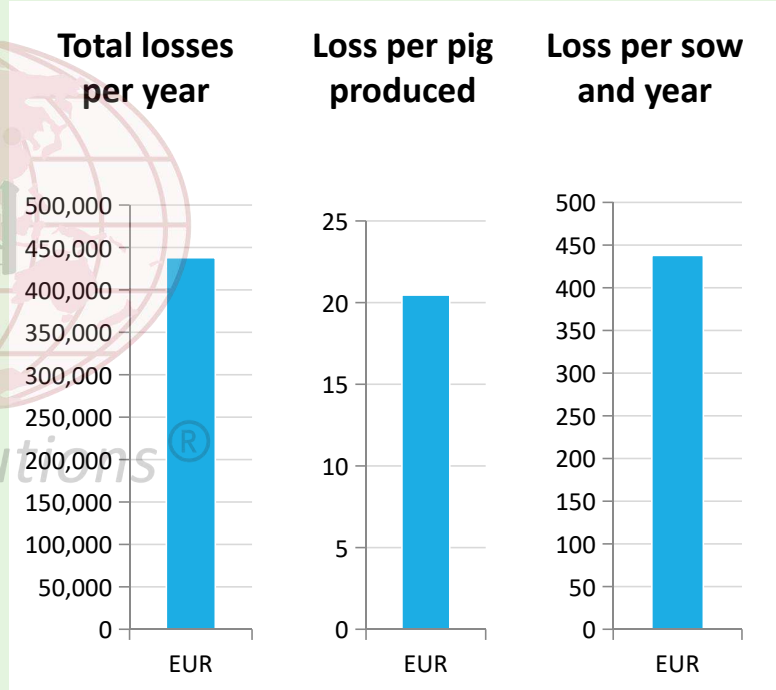
Basic outputs:

Loss due to PRRS per year in your farm:

	Median	5%ile	95%ile	
Breeding part	46'355	28'702	66'741	EUR
Nursery part	-24'886	-38'723	-11'764	EUR
Fattening part	416'338	408'574	424'476	EUR
Total losses per year	437'912	413'727	463'465	EUR

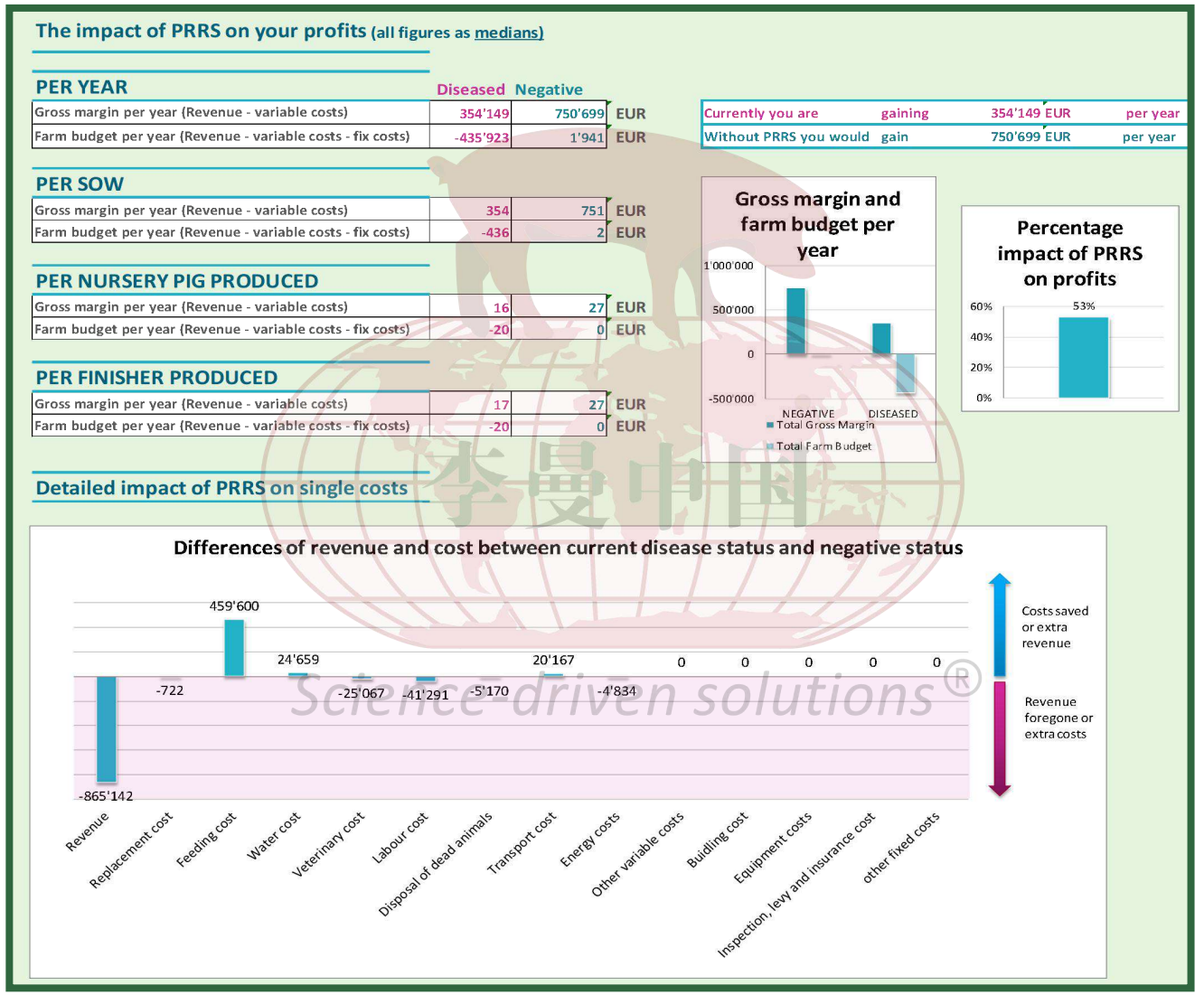
Loss due to PRRS, per head:

	Median	5%ile	95%ile	
Loss per pig produced	20	19	22	EUR
Loss per sow and year	438	414	463	EUR



Readout «Cost of PRRS in your farm»

Optionally:

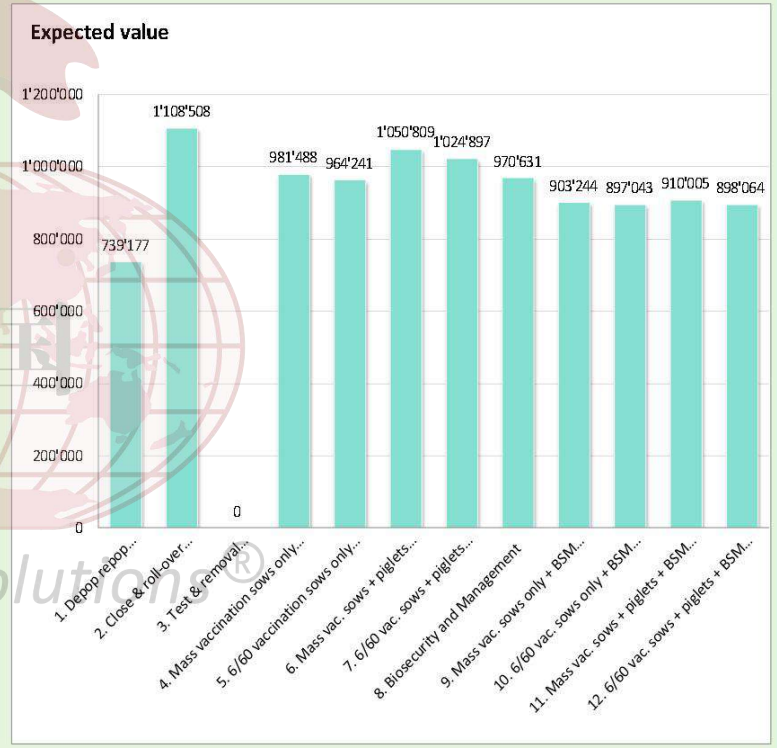


Readout «Interventions in your farm»

Basic outputs:

Expected value for your farm in 5 years for each measure:

	total			per sow			
	Median	5%ile	95%ile	Median	5%ile	95%ile	
1. Depop repop *(for herds holding sows)*	739'177	518'193	904'107	739	518	904	EUR
2. Close & roll-over *(for herds holding sows)*	1'108'508	774'245	1'381'475	1'109	774	1'381	EUR
3. Test & removal *(for stable sow herds that don't vaccinate with seroprevalence <25%)*	0	0	0	0	0	0	EUR
4. Mass vaccination sows only *(for sow herds that do not vaccinate)*	981'488	789'283	1'171'940	981	789	1'172	EUR
5. 6/60 vaccination sows only *(for sow herds that do not vaccinate)*	964'241	727'476	1'156'130	964	727	1'156	EUR
6. Mass vac. sows + piglets *(for sow herds that do not vaccinate piglets)*	1'050'809	839'552	1'246'763	1'051	840	1'247	EUR
7. 6/60 vac. sows + piglets *(for sow herds that do not vaccinate piglets)*	1'024'897	815'901	1'219'884	1'025	816	1'220	EUR
8. Biosecurity and Management	970'631	743'148	1'192'475	971	743	1'192	EUR
9. Mass vac. sows only + BSM *(for sow herds that do not vaccinate)*	903'244	730'492	1'095'019	903	730	1'095	EUR
10. 6/60 vac. sows only + BSM *(for sow herds that do not vaccinate)*	897'043	724'786	1'089'047	897	725	1'089	EUR
11. Mass vac. sows + piglets + BSM *(for sow herds that do not vaccinate piglets)*	910'005	728'644	1'099'708	910	729	1'100	EUR
12. 6/60 vac. sows + piglets + BSM *(for sow herds that do not vaccinate piglets)*	898'064	717'178	1'089'254	898	717	1'089	EUR



Readout «Interventions in your farm»

Optionally:

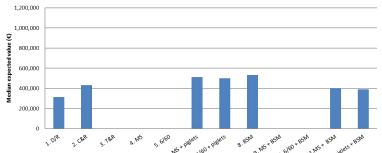
Cash flow over the 5 years period (medians)

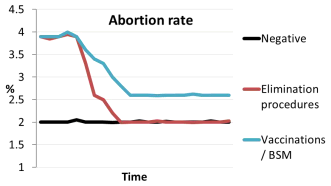
All economic outputs (medians)

	Total Expected Value	Expected value per sow	Payback period	Interest rate of return	Cost-Benefit Ratio	Rank
1. Depop repop *(for herds holding sows)*	739'177	739	3 years	73%	1.14	11
2. Close & roll-over *(for herds holding sows)*	1'108'508	1'109	<1year	#ZAHL!	1.68	1
3. Test & removal *(for stable sow herds that don't vaccinate with seroprevalence <25%)*	0	0	<1year	#ZAHL!	#NV	12
4. Mass vaccination sows only *(for sow herds that do not vaccinate)*	981'488	981	<1year	4822%	1.65	4
5. 6/60 vaccination sows only *(for sow herds that do not vaccinate)*	964'241	964	<1year	4737%	1.65	6
6. Mass vac. sows + piglets *(for sow herds that do not vaccinate piglets)*	1'050'809	1'051	<1year	5378%	1.66	2
7. 6/60 vac. sows + piglets *(for sow herds that do not vaccinate piglets)*	1'024'897	1'025	<1year	5232%	1.66	3
8. Biosecurity and Management	970'631	971	<1year	#ZAHL!	1.51	5
9. Mass vac. sows only + BSM *(for sow herds that do not vaccinate)*	903'244	903	<1year	2782%	1.44	8
10. 6/60 vac. sows only + BSM *(for sow herds that do not vaccinate)*	897'043	897	<1year	2735%	1.44	10
11. Mass vac. sows + piglets + BSM *(for sow herds that do not vaccinate piglets)*	910'005	910	<1year	2850%	1.42	7
12. 6/60 vac. sows + piglets + BSM *(for sow herds that do not vaccinate piglets)*	898'064	898	<1year	2966%	1.42	9

Explanation	*Interpretation*
Expected value: *Indicates the total benefit or loss from the intervention multiplied by the probability of success*	*The highest the EV the more profitable the intervention is in terms of extra amount of money generated. Negative EV means the intervention generate losses*
Payback period: *Indicates the number of years until the cost of interventions are covered by its benefits*	*Long payback period could mean that the farmer needs to rely on his/her saving for longer time*
Interest rate of return *: Indicates the interest rate at which the cash flow of an intervention do not generate any benefit or losses*	*The higher the interest rate the more profitable the intervention is. If farmers identify another investment strategy that generate interest rate higher than the IRR of an intervention, then investment in the intervention should be reconsidered. Negative IRR means the intervention generate losses. In some cases it cannot be calculated.*
Cost-benefit ratio *: Is a relative measure that indicates how much benefit is obtained per one euro expend on the intervention.*	*CBR higher than 1 means the intervention is profitable (e.g. CBR=2 means the intervention generates twice as much benefit than its expenditure). CBR equal to 0 means the intervention breaks even. CBR lower than 1 means the intervention is not profitable.*
Rank *: Indicates the ranking of the intervention according to the expected value.*	*The lower the number the better the intervention. Example: rank = 1 means that this is the best intervention and Rank = 2 means that it will be the second best intervention*

Summary & conclusions





- Considerable losses in moderately PRRS-affected farms
- Highest impact in fattening (revenue foregone)
- Different intervention strategies have been proven to work against PRRS >>> model can estimate their economic efficiency
- Remember: it is an economic PRRS model!
  - cost-efficiency, simplification
- Prudent use!
- Useful tool for veterinarians / farmers!

Thank you very much for your attention!

Contact

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