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THE RISK OF THE INTRODUCTION OF FOOT AND MOUTH DISEASE THROUGH IMPORTATION OF SWINE PRODUCTS FROM BRAZIL

Study carried out in 2005

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Topics

- Why should the exporting country conduct a risk assessment?
- Structure of the swine industry
- Study's rationale and methodology
- Results and discussion

Why conduct a risk assessment?

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- Risk assessments provide the basis for establishing sanitary measures, notably in international trade of animals and animal products
- The SPS agreement (WTO) defines its use and the OIE Code lays down the guidelines for its application
- Usually importing countries undertake the risk assessment, but would-be exporters may do it with a view to facilitate the process of establishing sanitary protocols. In such cases, the work must be carried out by independent consultants and peer-reviewed

This risk assessment was commissioned because:

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- *Despite the long time with no occurrences of FMD in commercial pig farms and their inclusion in the free zone with vaccination, Brazilian swine industries still suffer from restrictions to trade due to FMD and to the failure of some countries to recognize the principle of regionalization, as laid down in the SPS agreement and the OIE Code.*

- *The use of systematic vaccination in cattle is also a matter of much confusion for the analysis of risks in pigs, since these are a fully susceptible species to FMD in Brazil. Hence, the sensitivity of clinical examinations in pigs should be very high across the production chain.*

- *The last FMD outbreak in commercial pig farms occurred in 1993 and vaccination has never been practiced.*

This risk assessement:

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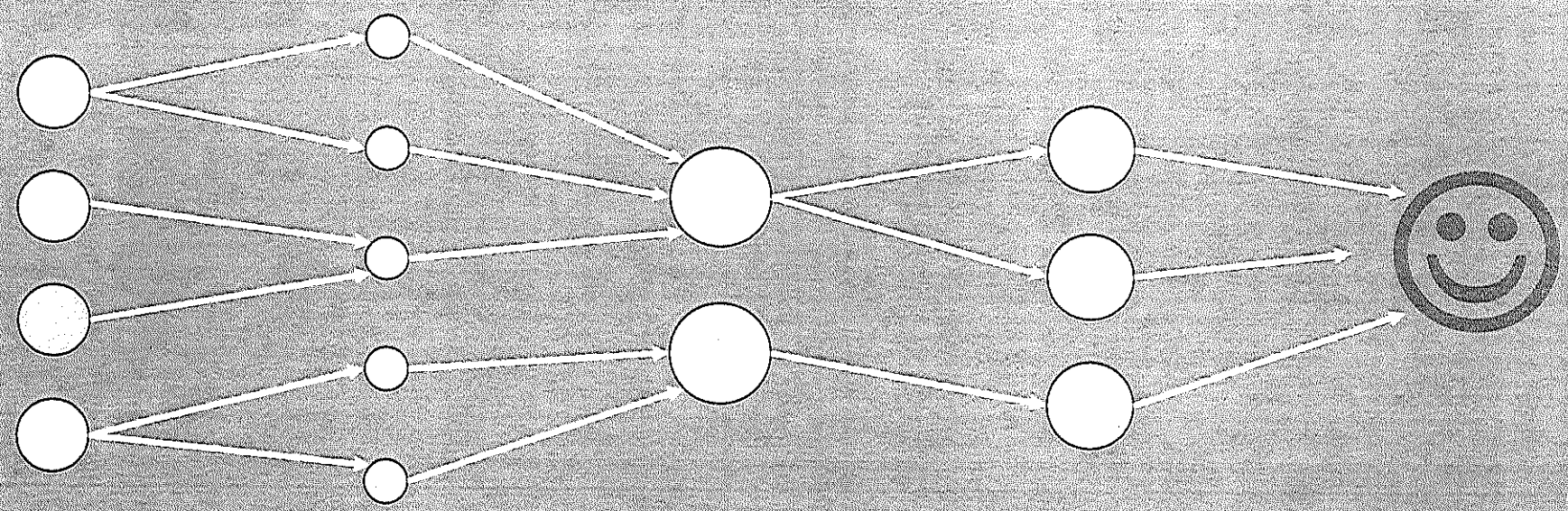
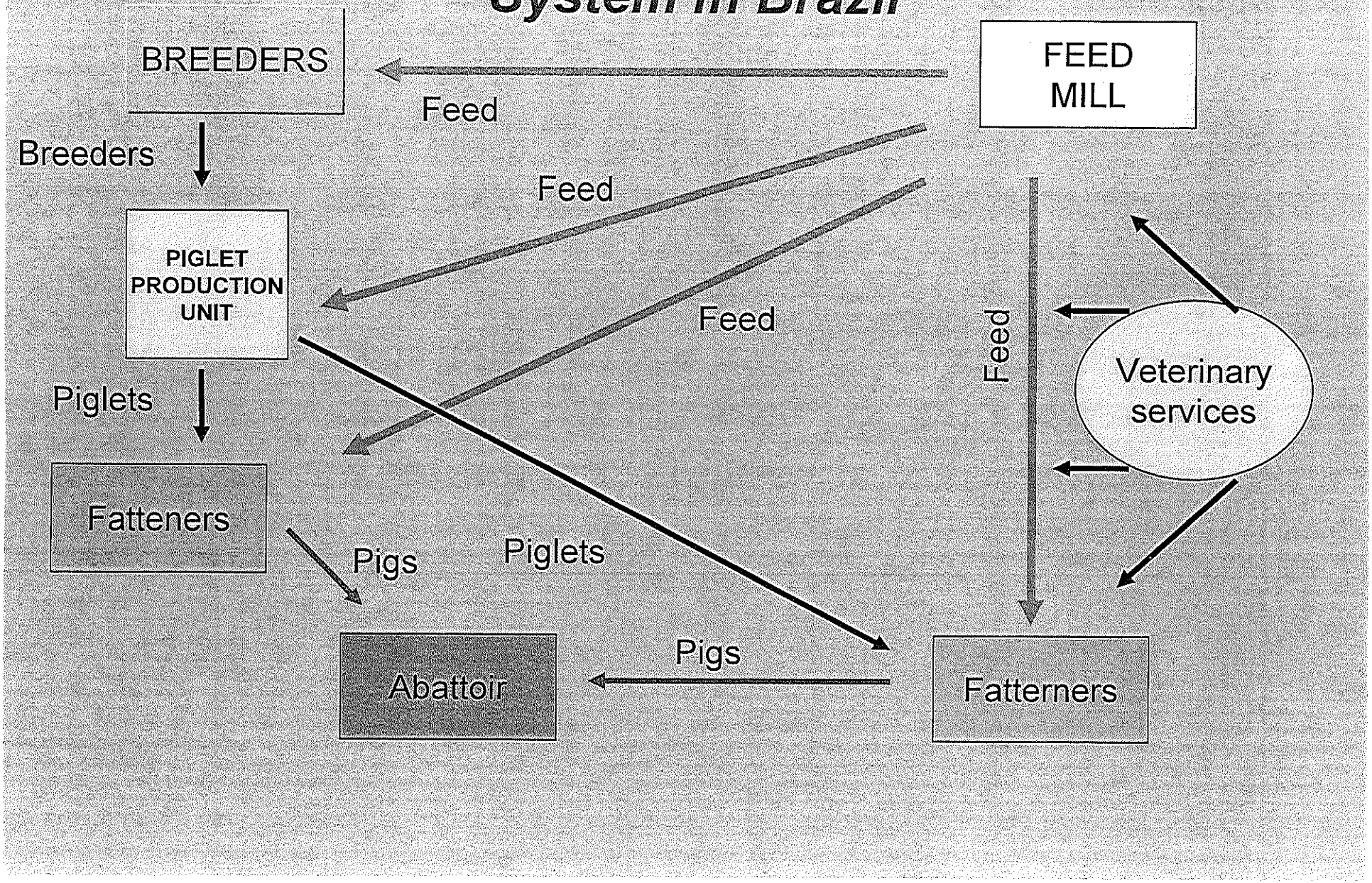
- Is focused on the *release assessment*
- Was carried out in 2005. The model is to be reviewed in 2008, in order to tune it to the new epidemiological situation and to introduce data from a field survey on biosecurity standards
- It is being used as a planning tool by the industry, with a view to strengthening biosecurity measures and make all stakeholders aware of their relative contribution to the overall risk management.

> Swine Production chain



Structure of the Pig Production Integrated System in Brazil



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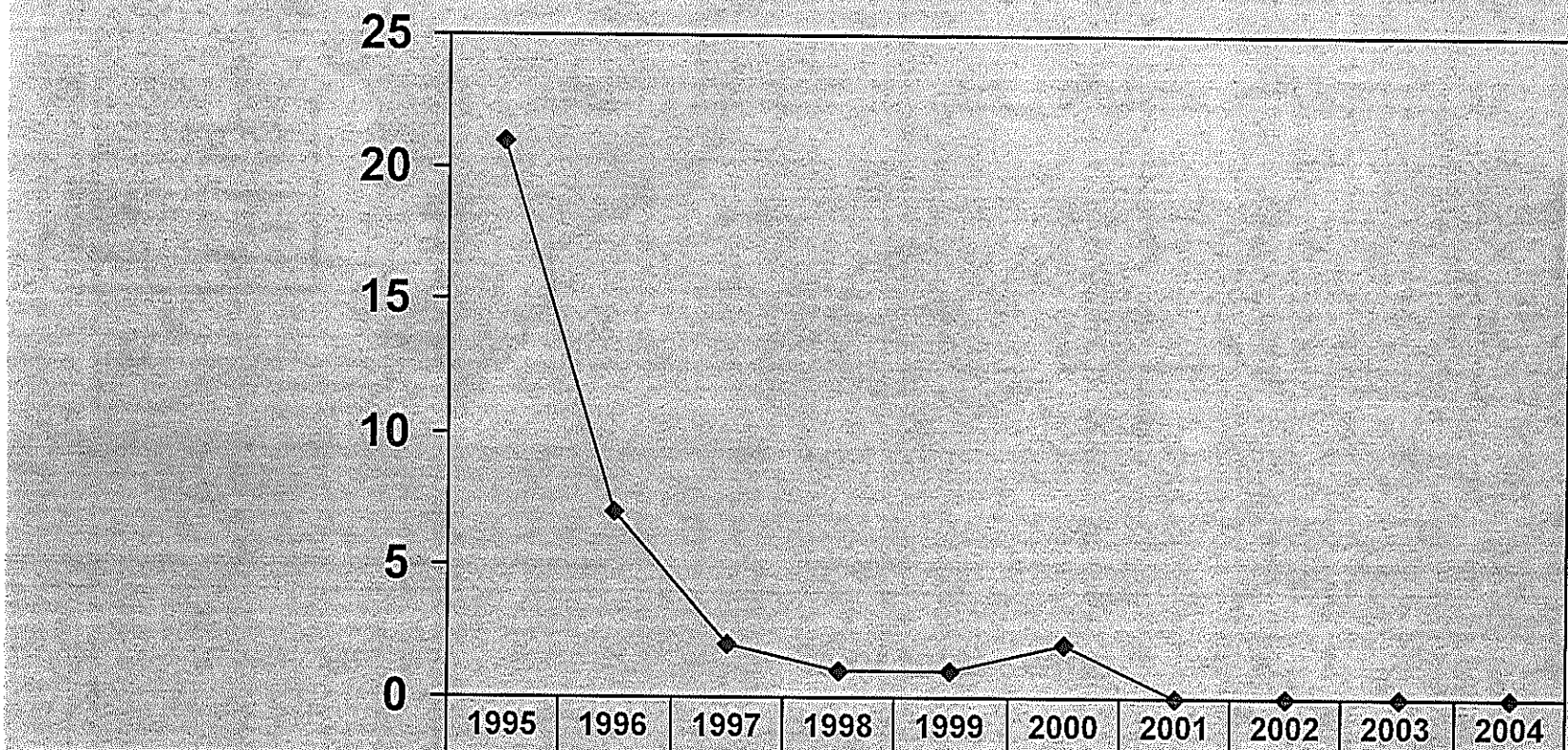
Number of outbreaks that involved pig farms since 1995, only for the regions of the current free zone with vaccination - as of May 2005



	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
# outbreaks w/pigs	21	7	2	1	1	2	0	0	0	0

None was a commercial swine farm

Regional spread of cattle and pig production

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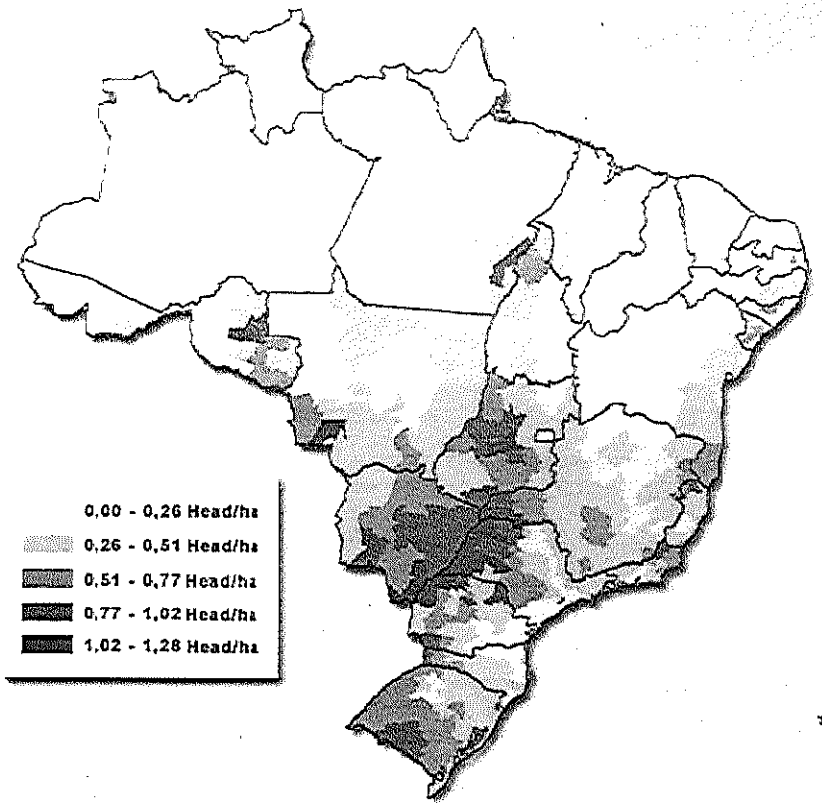
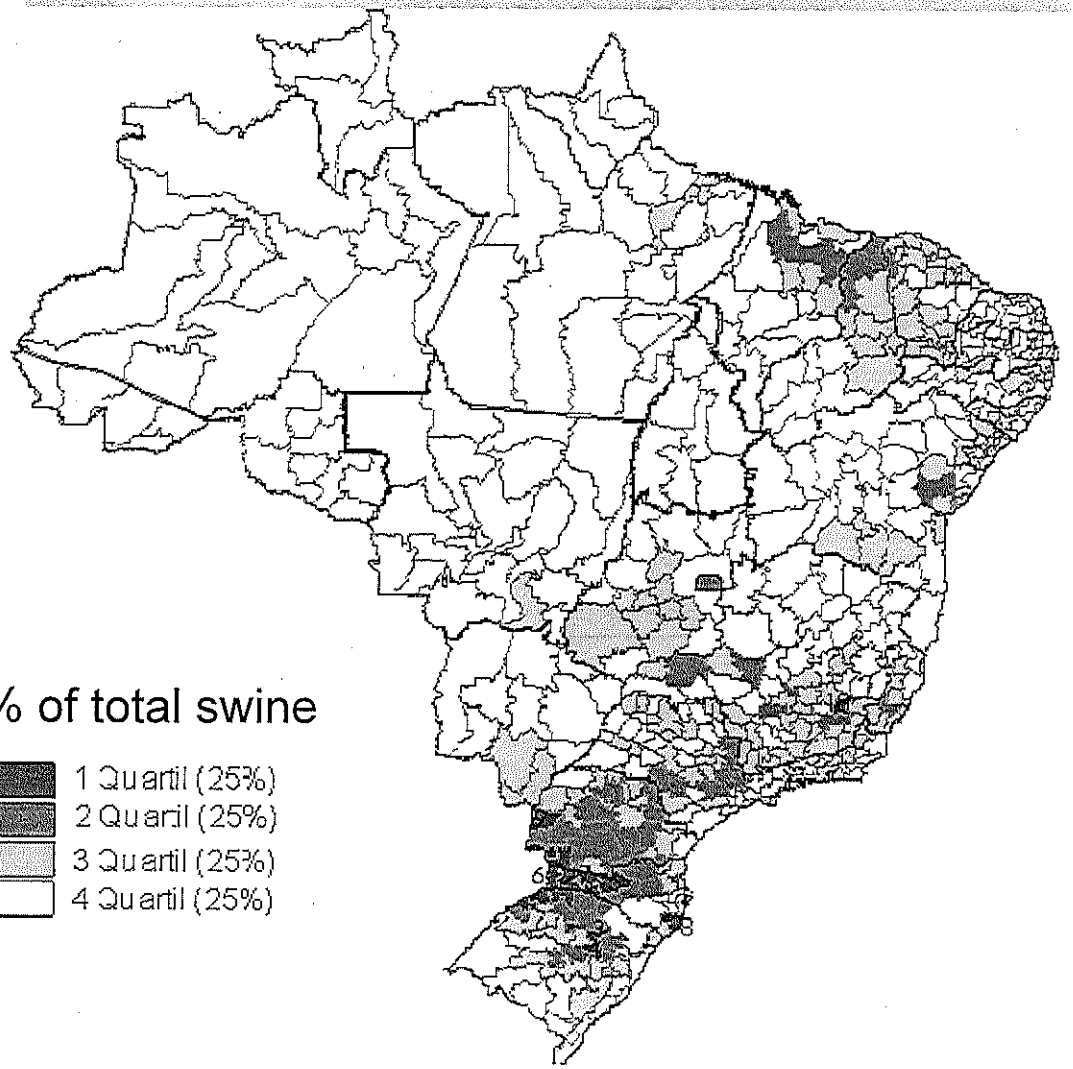


Bovine density (heads/ha)

The highest densities of cattle are not coincident with the highest densities of swine production

Source: IBGE 2003



Framework for the Risk Assessment

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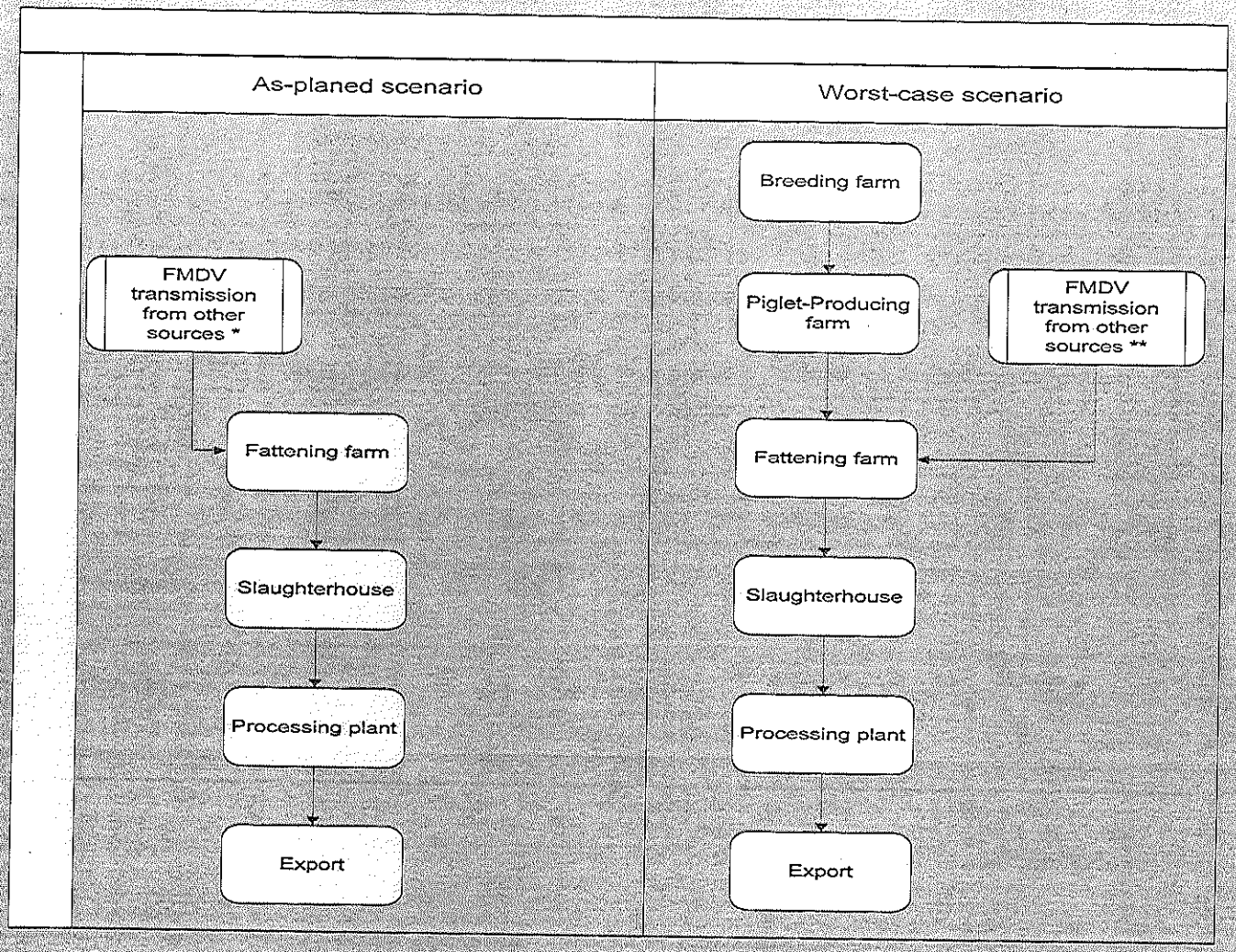

(*) Field evidence suggests that FMD transmission from other sources is the only likely route of infection of a fattening farm in the as-planned scenario. Vertical spread down the swine production chain is considered sufficiently small to be negligible in the analysis.

(**) In the worst-case scenario, the probability of FMD spread down the swine production chain is taken into account, based on possible flaws in biosecurity and surveillance procedures. Also, the probability of transmission from other sources is set at a higher level, as a result of a hypothetical reinfection of the free zone.

"As-planned scenario"

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Should reflect the level of risk of exporting FMD via swine products if everything in the swine production chains goes according to plans, given histories and epidemiology of FMD in the swine exporting areas in Brazil.

Some key issues:

1. All exports would come from the FMD free zone with vaccination (although pigs are not vaccinated)
2. The probability of virus circulation would be low and was derived from surveys carried out to demonstrate freedom from infection
3. Biosecurity levels along the swine production chain would be as estimated from real data, reflecting current procedures.

"Worst-case scenario"

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It aimed at capturing flaws in the swine production chains that would result in more damaging situations.

1. It simulates a situation where FMD would have been reintroduced in the free zone

2. Uses parameters derived from data of the FMD outbreaks in Rio Grande do Sul in 2000 (virus O) and 2001 (virus A). By using real data, the worst-case scenario is taking into account the capacity of herders and the veterinary administration to react to new outbreaks. In other words, it is attempting at answering the question: "what would be the likelihood of exporting FMDV in swine products, while the free zone is experiencing a reintroduction of FMDV?".

3. It also assumed that there could be flaws in biosecurity measures and surveillance procedures along the swine production chain

On both scenarios

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- The epidemiological unit is the herd, or group of pigs, throughout the scenario tree
  - e.g. probability of failure to detect at least one sick animal if the herd is infected
- Probabilities of detection are based on clinical examination of a fully naïve population
- Where data were missing, worst-case assumptions were applied
- The unit of 100 tons of swine products was used for the calculations

Computer model simulation

- Simulations were run in Excel® with @Risk for Excel® add-on to simplify uses of probability distributions.

- 10,000 iterations were executed for each simulation.

Parameters used in the model

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- ***N: Number of herds required for the production of 100 tons of meat***
- ***P1: Probability of Breeding Farms (BF) having FMD***
- ***P2: Probability of FMD transmission from BF to Piglet producing Farms (PF)*** (i.e. detection failure – herd level)
- ***P3: Probability of FMD transmission from PF to Fattening Farms (FF)*** (detection failure – herd level)
- ***P4: Probability of the presence of FMDV in the pork exporting regions*** (1-the confidence level of the sero-survey, considering the threshold prevalence)
- ***P5: Probability of pigs in FF having contact with cattle*** (the % of fattening farms where cattle operations are also in place)
- ***P6: Probability of FMD transmission from cattle to pigs*** (the attack rate of pigs in cattle holdings that experienced FMD outbreaks in 2000 and 2001)
- ***P7: Probability of FF having FMD***
- ***P8: Probability of FMD infected FF being selected for slaughter***
- ***P9: Probability of failure to detect FMD during ante-mortem inspection*** (herd level)
- ***P10: Probability of failure to detect FMD during slaughter*** (herd level)

- It is important to stress that all parameters used in the model are risk management variables and, therefore, can be improved

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Parameter	Value					
	As-planned scenario			Worst-case scenario		
	Minimum	Most-likely	Maximum	Minimum	Most-likely	Maximum
1132/N	35	500	6800	35	500	6800
P_1	N/A	N/A	N/A	0	0.00417	0.02083
P_2	N/A	N/A	N/A	0	0.1	0.2
P_3	0	0.05	0.1	0	0.1	0.2
P_5	0.05	0.1	0.2	0.05	0.1	0.2
P_9	0	0.05	0.1	0	0.1	0.2
P_{10}	0	0.005	0.01	0	0.01	0.02
P_4	95% confidence that the prevalence is below 1% with the mode at 0.0014					0.014
P_6			0.1288			1
P_8			$1-(1-P_7)^N$			$1-(1-P_7)^N$

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Summary statistics from the stochastic simulation for the as-planned scenario

Summary Statistics

Statistic	Value
Minimum	0.00017×10^{-9}
Maximum	1904.25×10^{-9}
Mean	24.0882×10^{-9}
Std Dev	62.3886×10^{-9}
Variance	0.000004×10^{-9}
Median	8.44636×10^{-9}
Mode	33.0578×10^{-9}
5%	0.66899×10^{-9}
25%	3.08553×10^{-9}
75%	$21.653o \times 10^{-9}$
95%	90.2606×10^{-9}

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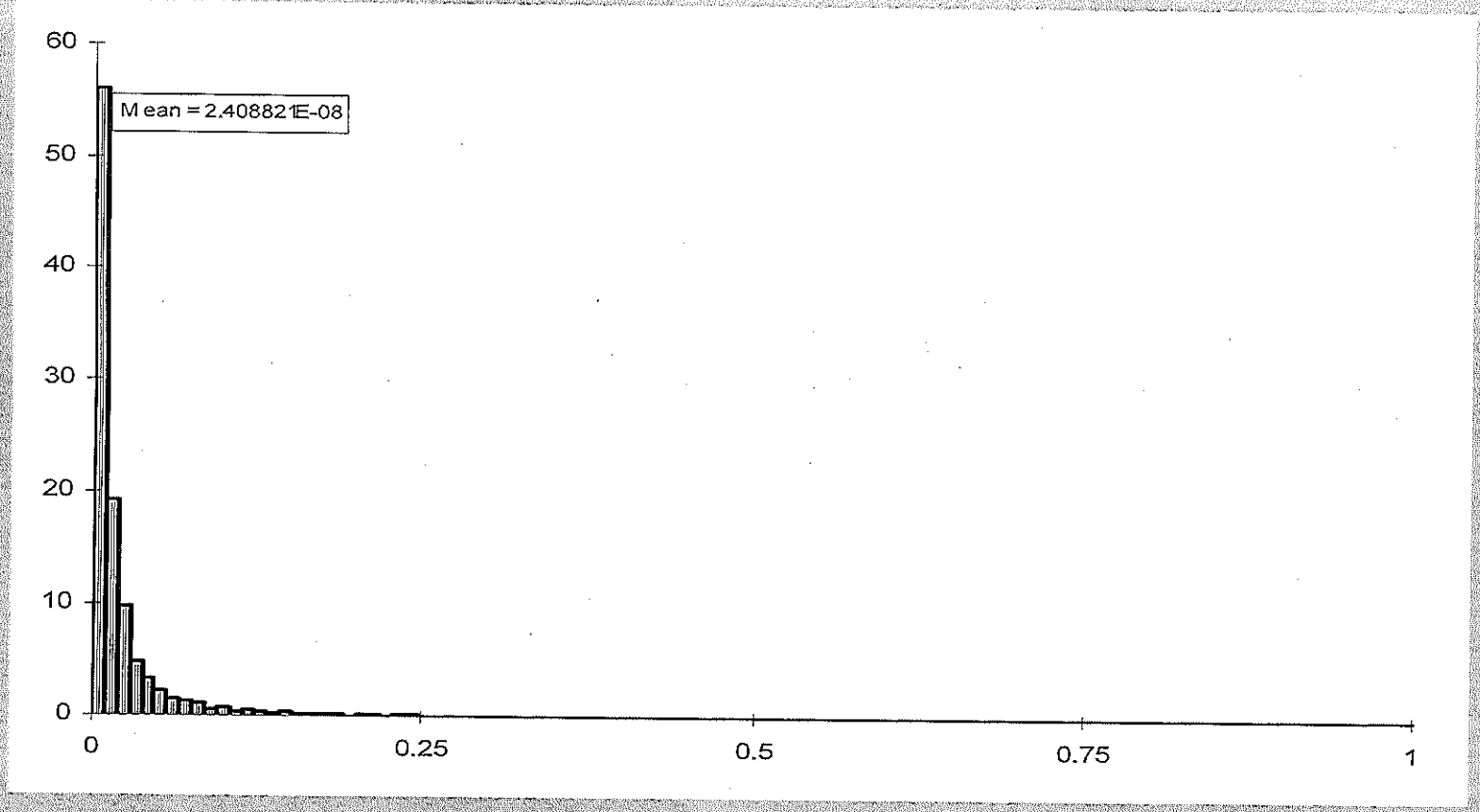
PDF for the probability that any batch of swine meat is contaminated with FMD in the as-planned scenario



Values in 10^{-6}

Summary statistics from the stochastic simulation for the worst-case scenario

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Summary Statistics

Statistic	Value
Minimum	21.5798×10^{-9}
Maximum	81336.7×10^{-9}
Mean	2728.36×10^{-9}
Std Dev	4963.37×10^{-9}
Variance	0.02464×10^{-9}
Median	1260.13×10^{-9}
Mode	546.688×10^{-9}
5%	231.433×10^{-9}
25%	635.980×10^{-9}
75%	2708.46×10^{-9}
95%	10009.4×10^{-9}

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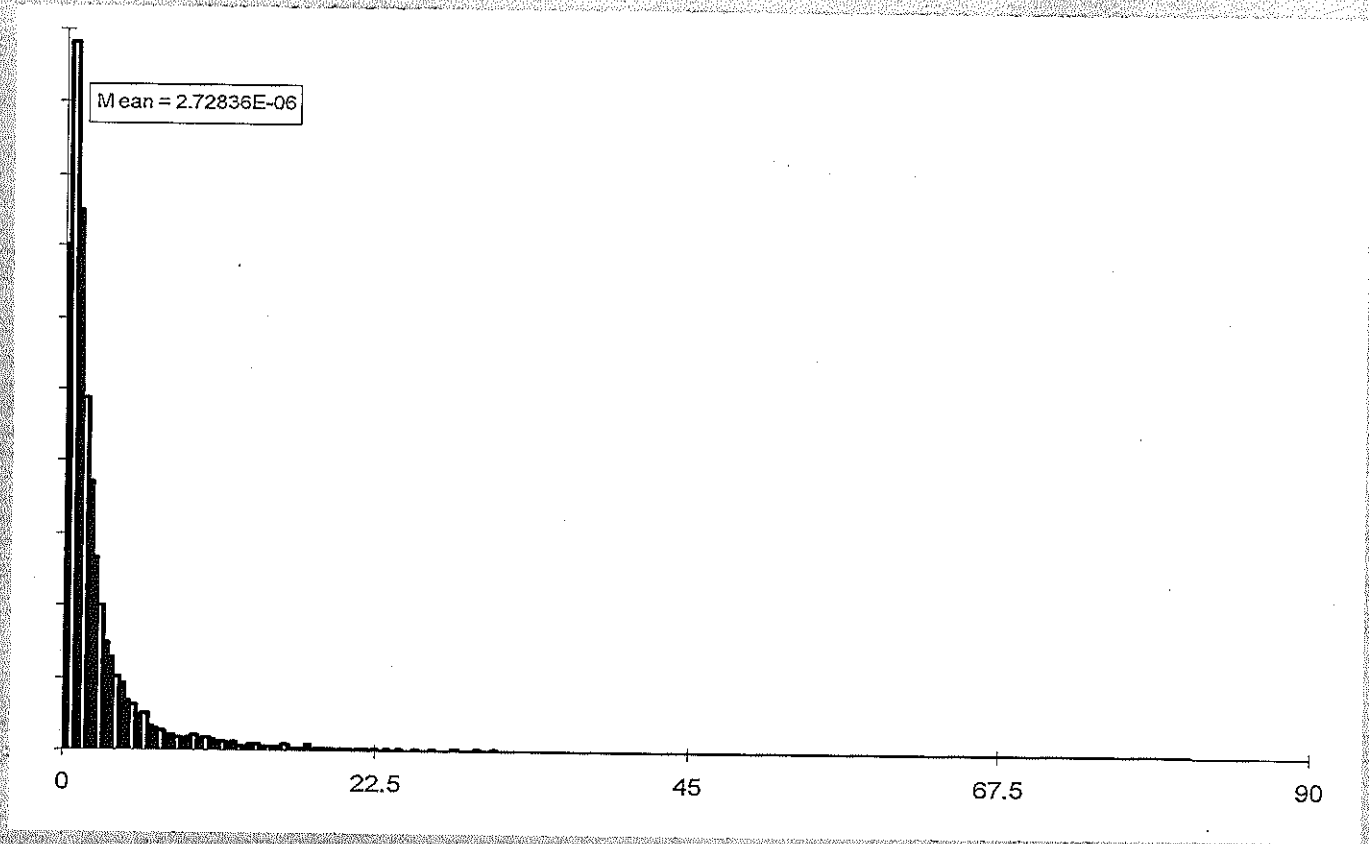
PDF for the probability that any batch of swine meat is contaminated with FMD in the worst-case scenario



Value in 10^{-3}

Results: as-planned scenario

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- The probability density function (PDF) for the risk of FMDV contamination in swine meat in the as-planned scenario shows that there is approximately a 40-fold difference between the first and the third quartiles. A narrow range of the probabilities on the X-axis indicates a greater degree of confidence in the estimates than a wide range.

- On average, an exportation of a 100-ton of swine meat contaminated with FMD will occur in every 1 in 40 million times. Even at 99% confidence, the probability of any batch of swine meat intended for export being contaminated was less than one in ten million batches.

Results: worst-case scenario

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- Even in the worst situation, on average, there would be one contamination out of approximately 360,000 batches (36 million tons) of swine meat for export. At 95% confidence, the probability of contamination is approximately 1 out of 100,000 batches.

- As expected, the worst-case scenario yielded the higher probabilities of adverse occurrences. On average, the risk for the worst-case scenario is 100 times higher than the risk for the as-planned scenario. For example, the mean probability was 2.73×10^{-6} for the worst-case scenario, where it was 0.024×10^{-6} for the as-planned scenario.

Discussion and comments

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- The present work showed that the risk of exporting FMD in swine products from Brazil is negligible
- In fact, there is no evidence that such thing has ever happened
- This reflects both the evolution of the FMD eradication efforts in Brazil and the biosecurity standards and integrated structure of the swine industry
- The model should be updated and refined in 2008. It will continue to serve as a basis for discussing the role of biosecurity procedures, as well as surveillance systems, in providing assurances of the absence of FMDV.

Carlos de Abreu
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