

Estimating the value of good biosecurity in pig fattening

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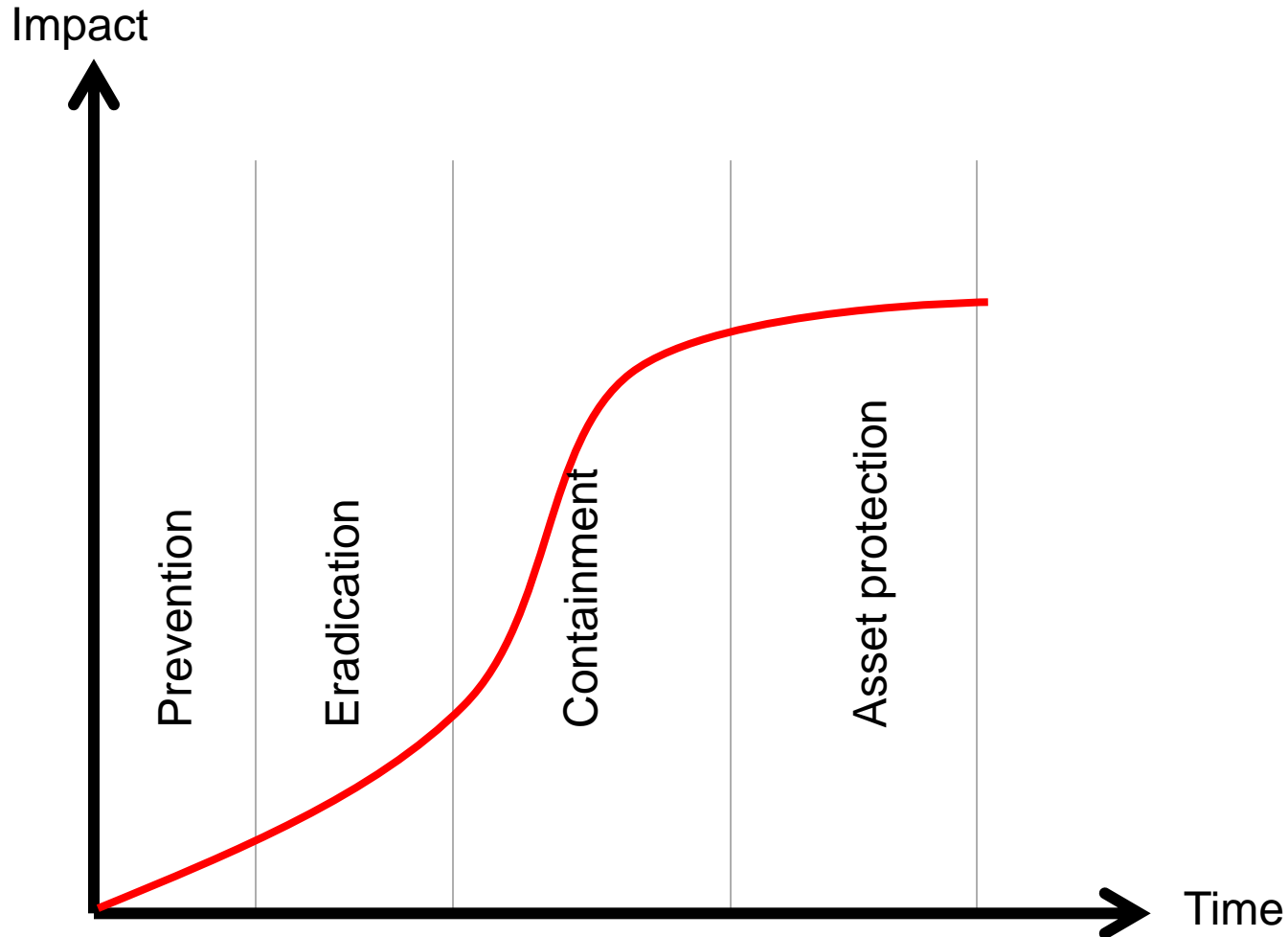
NJF NJF seminar 500: Sustainable and competitive animal production



Introduction

- As indicated previously, maintaining high level of biosecurity is considered as a key intervention to reduce production diseases
- Little is known about the value of good biosecurity
 - Internal vs. external biosecurity
- Biosecurity is a preventive measure: The costs of measures are incurred before potential benefits are observed
 - This implies that incentives to adopt higher biosecurity may change if the risk or disease changes
- The aim of this presentation is to analyse the rationale of internal biosecurity in a fattening pig farm.

Biosecurity is essential at all stages of disease risk management



Improvements in biosecurity of a pig farm



Costs

- Extra labour input needed
- Extra materials
- Effects on farm operations



Benefits

- Lower veterinary and medication costs
- Improved yield
- Reduced variation in pigs?
- Better quality of products



Methods

- A stochastic dynamic optimisation model which optimises pig delivery pattern under a given biosecurity policy and per compartment
- The model can estimate economic benefits and costs of good hygiene at the farm level
- A mechanistic model describes the growth of pigs in a batch
- Taking into account possible adjustments in management decisions under different biosecurity policies is essential because changes in disease risk and output may influence decisions such as the timing of slaughter

Data

- A hygienic challenge experiment by INRA with two housing policies
 1. Dirty housing: an uncleaned room, reduced ventilation
 2. Clean housing: room cleaned before pigs arrive and daily during the experiment
- Data provided by the experiment
 - Growth and feed intake information
 - Carcass weight and quality
 - Clinical signs and treatments for each week
 - Lesions observed at slaughter
- Market prices and other relevant parameters obtained from other sources

In the experiment, pigs with poor hygiene had lower production efficiency

	Carcass weight kg	Average daily gain kg/d	Feed conversion ratio kg/kg
Period 1 (challenge)			
Clean	43.53	0.74	2.52
Dirty	38.69	0.57	3.77
Difference	-11 %	-23 %	50 %
Period 1 (recovery)			
Clean	83.65	0.93	3.08
Dirty	75.64	0.91	2.99
Difference	-10 %	-2 %	-3 %

How do the two policies compare when **changes** in labour and other input use and adjustments to slaughter timing are taken into account?

Objective function

- The value of pig space unit at a given time (t) and state

Vector of slaughter dates

State vector

Discount rate

$$V(\mathbf{x}_t) = \max_{\mathbf{u}_t} \sum_{t=1}^T (R(\mathbf{x}_t, \mathbf{u}_t) + \beta V(\mathbf{x}_{t+1}))$$

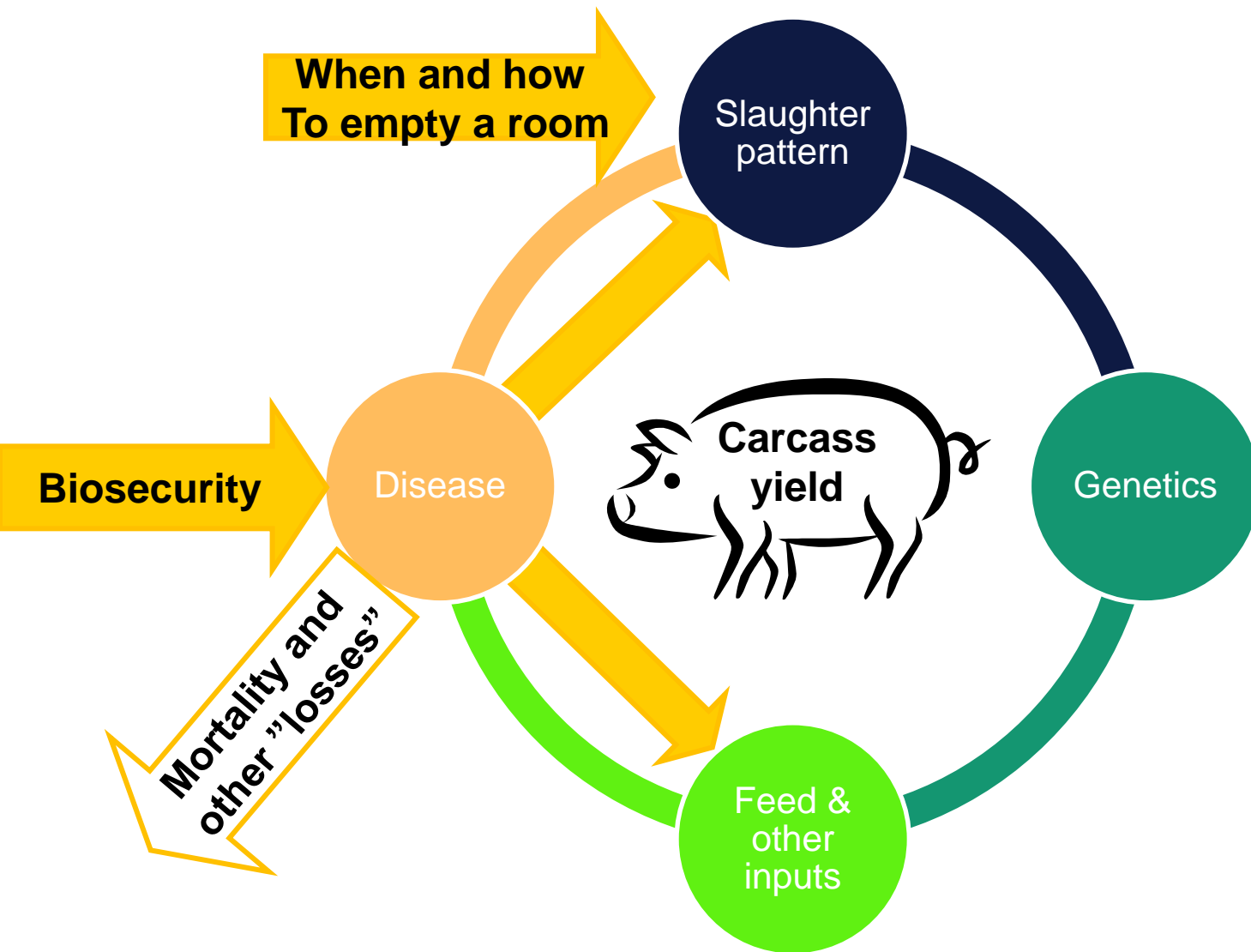
Subject to: $\mathbf{x}_{t+1} = g(\mathbf{x}_t, \mathbf{u}_t) + \varepsilon$

\mathbf{x}_t and $V(\mathbf{x}_T)$ are given

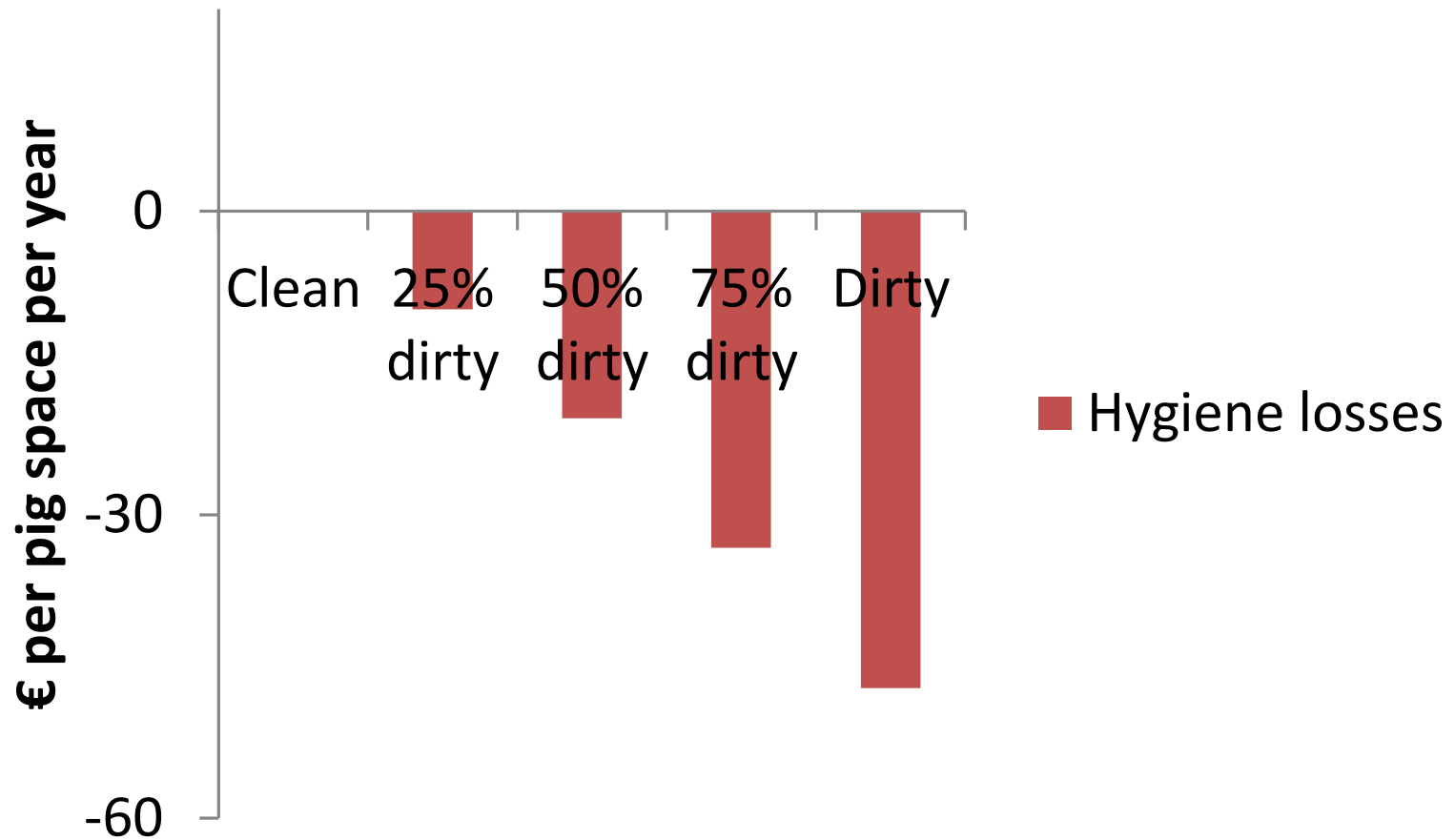
One-period returns
(market value of carcasses,
Piglet, feed, biosecurity)

Change in the state variable due to decisions,
stochastic events and current state of nature

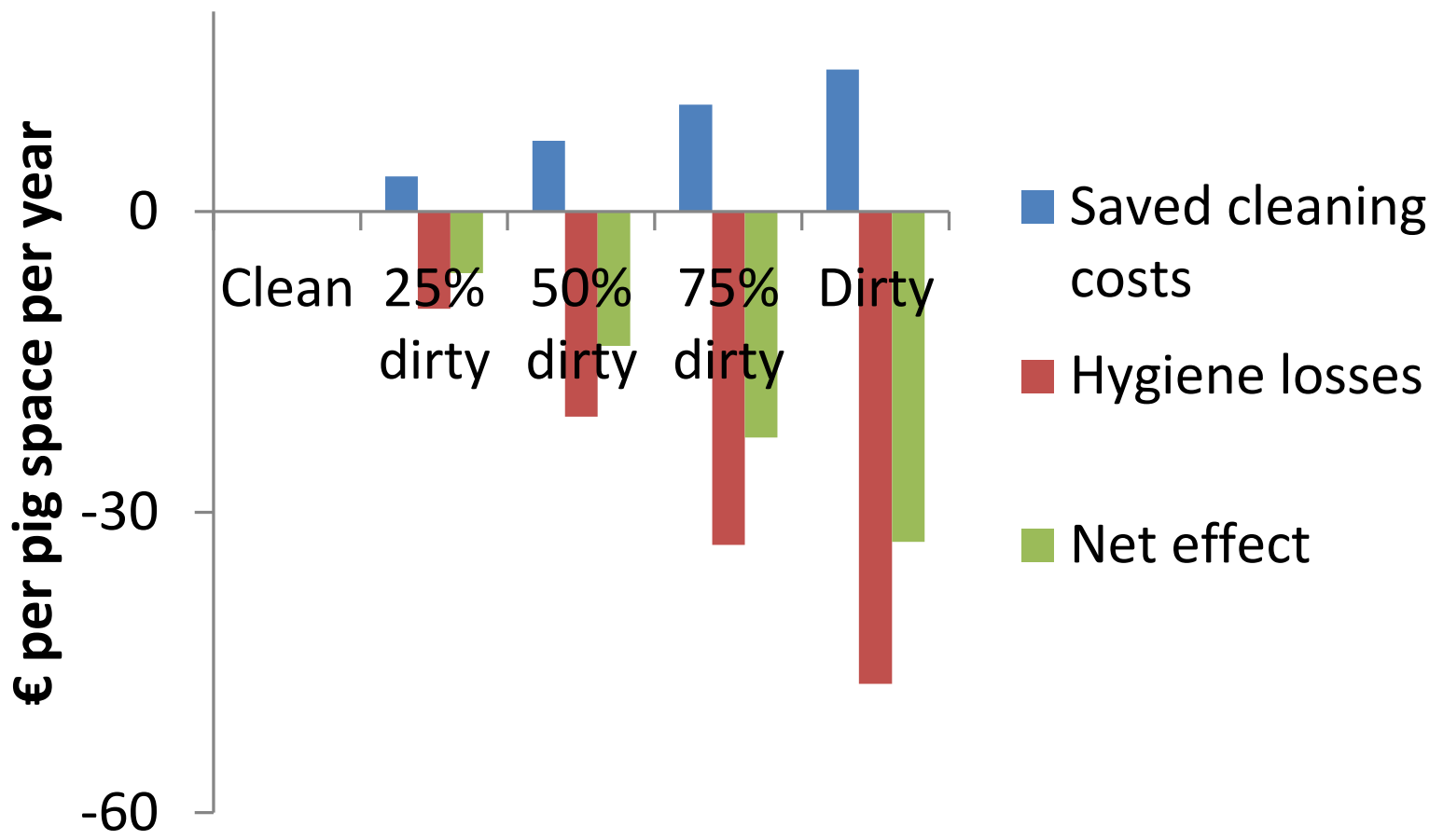
The amount of output depends on several factors



Preliminary results



Preliminary results



Preliminary results

- Good hygiene improves return on pig fattening and interacts with other management choices of the farm although some of the benefits are offset by the costs of maintaining the good sanitary conditions
- Reducing the level of biosecurity reduces labour costs whereas losses due poor hygiene and performance increase

- Productivity effects
 - Fewer batches produced per year
 - Variation in batch weights increase and lighter pigs will be slaughtered a lower weight
 - Variation can be decreased by adjusting slaughter patterns
 - As a consequence of optimisation which takes into account the rise of disease risk and increased variation in pigs, it may be optimal for the farm to operate using all in all out practice

Discussion

- The results suggest that following good hygienic practices is economically beneficial to the farm
- The costs and benefit of biosecurity vary by the type of measure and farm
 - Economic incentives to adopt a measure depend on farm-specific factors and the level of risk faced
 - The total costs of adopting a measure can quite high if the measure is repeated daily

Thank you for your attention

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