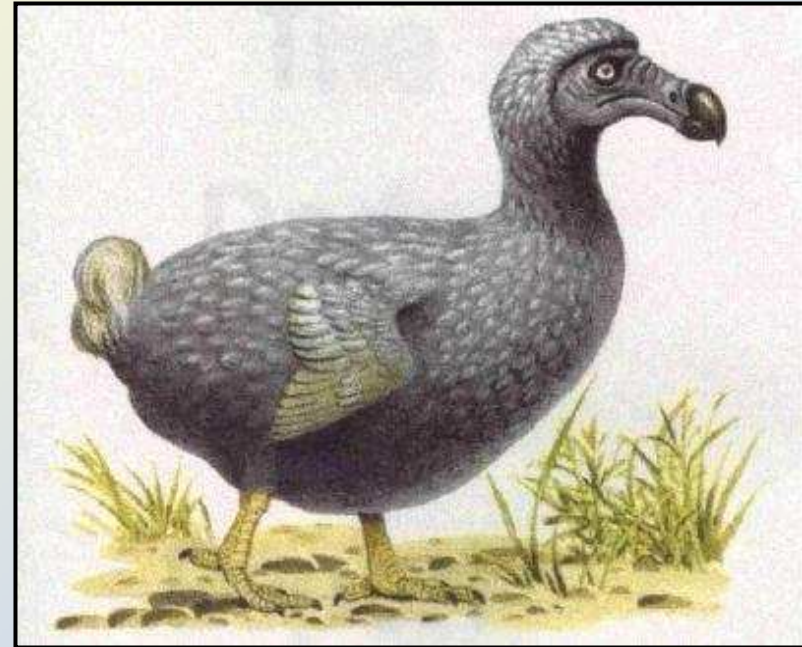


**Precision Livestock Farming
for Animal Health, Welfare
and Production**

**Christopher Wathes
The Royal Veterinary College
University of London**



Precision Livestock Farming

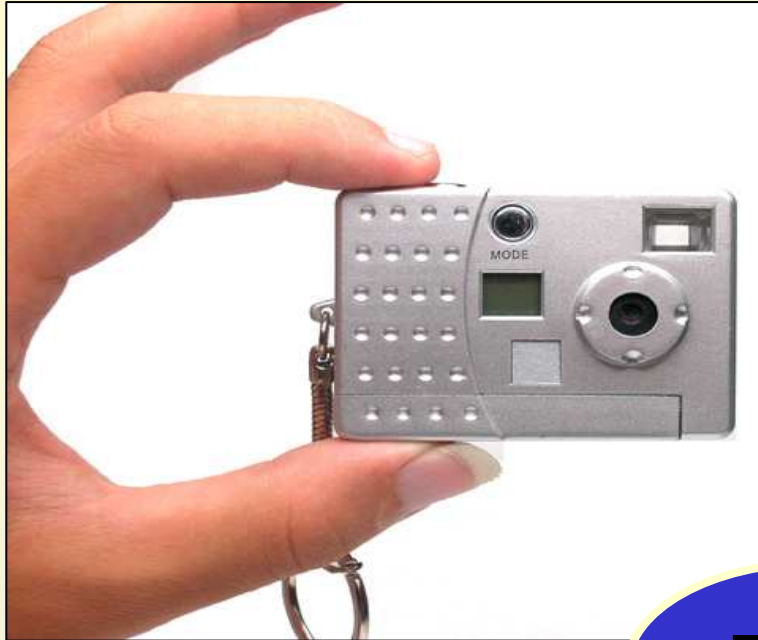
*The application of the principles and techniques of
process engineering to livestock farming to monitor,
model and manage animal production*

Farmer's view

Sustainable livestock production requires tight product specification to be met profitably by skilled stockmen with minimal environmental impact and a high standard of health and welfare

Consumer's view

..... food must be safe, tasty and cheap



Light



Activity

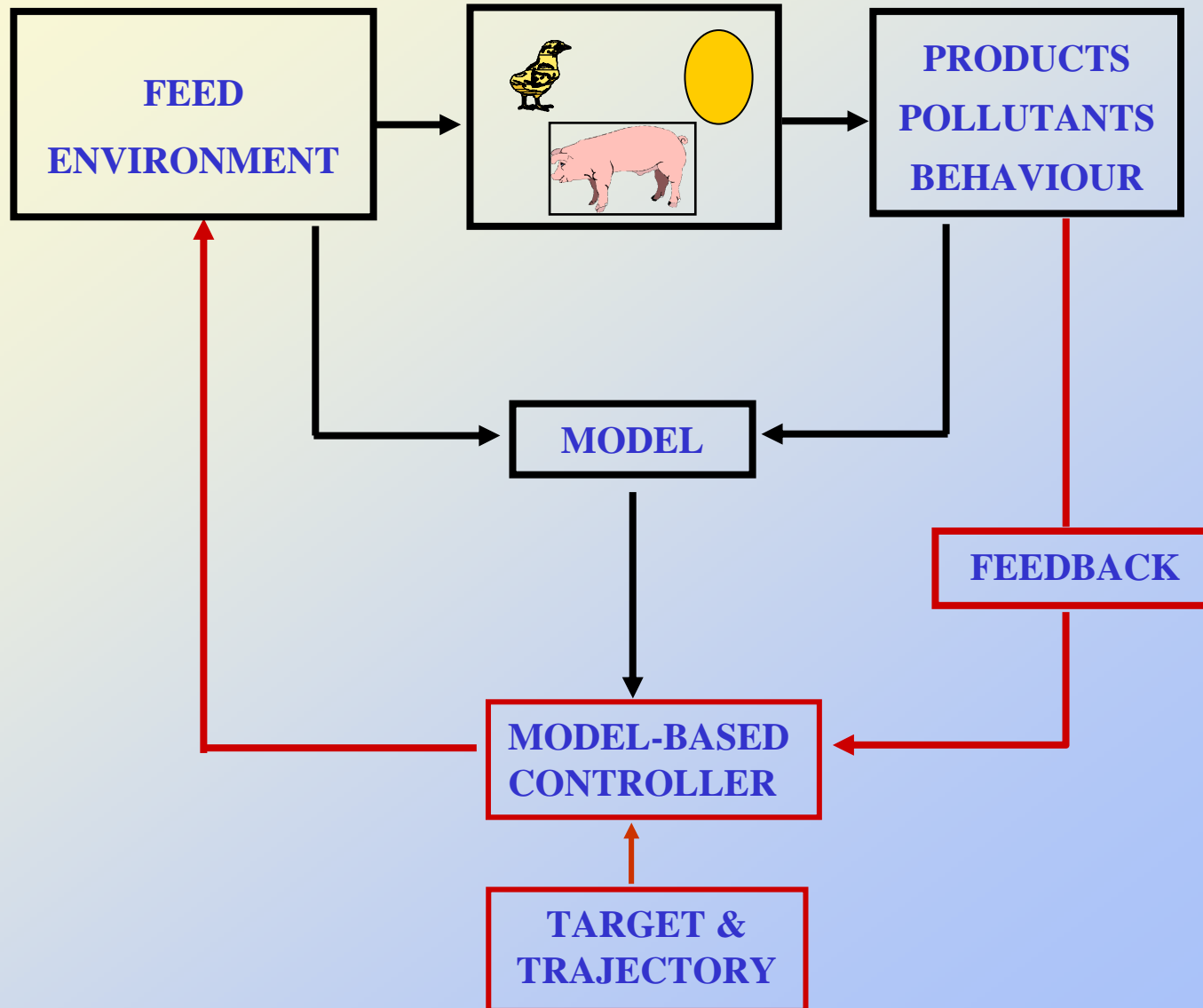
Model

$$y(k) = \frac{B(z^{-1})}{A(z^{-1})} u(k - d)$$

PLF



Control of livestock processes





MODEL

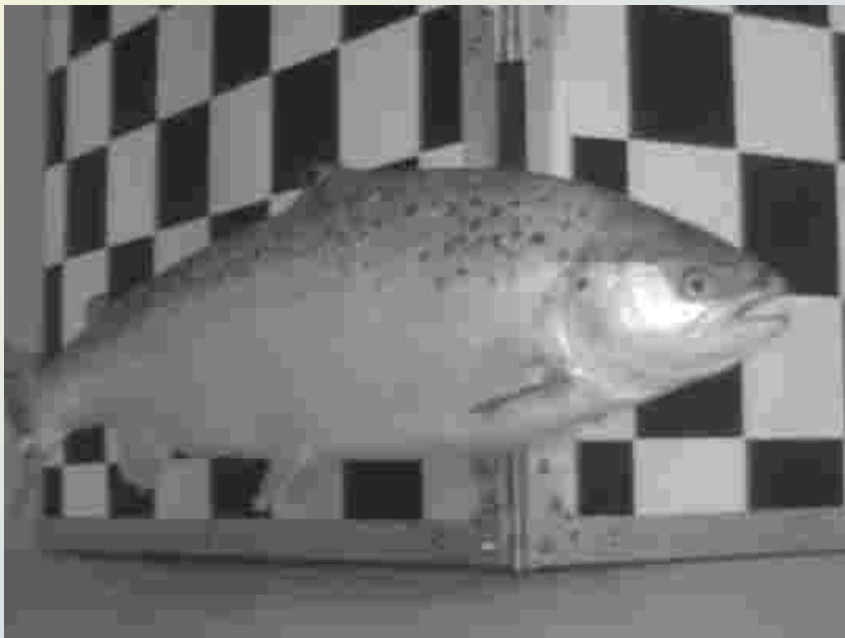
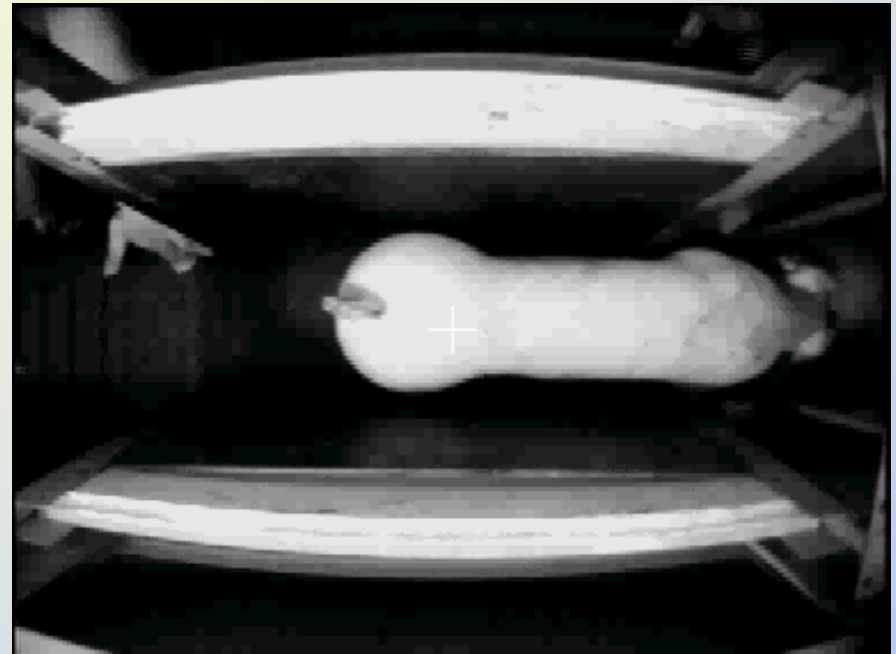
FEEDBACK



Lewis Hamilton

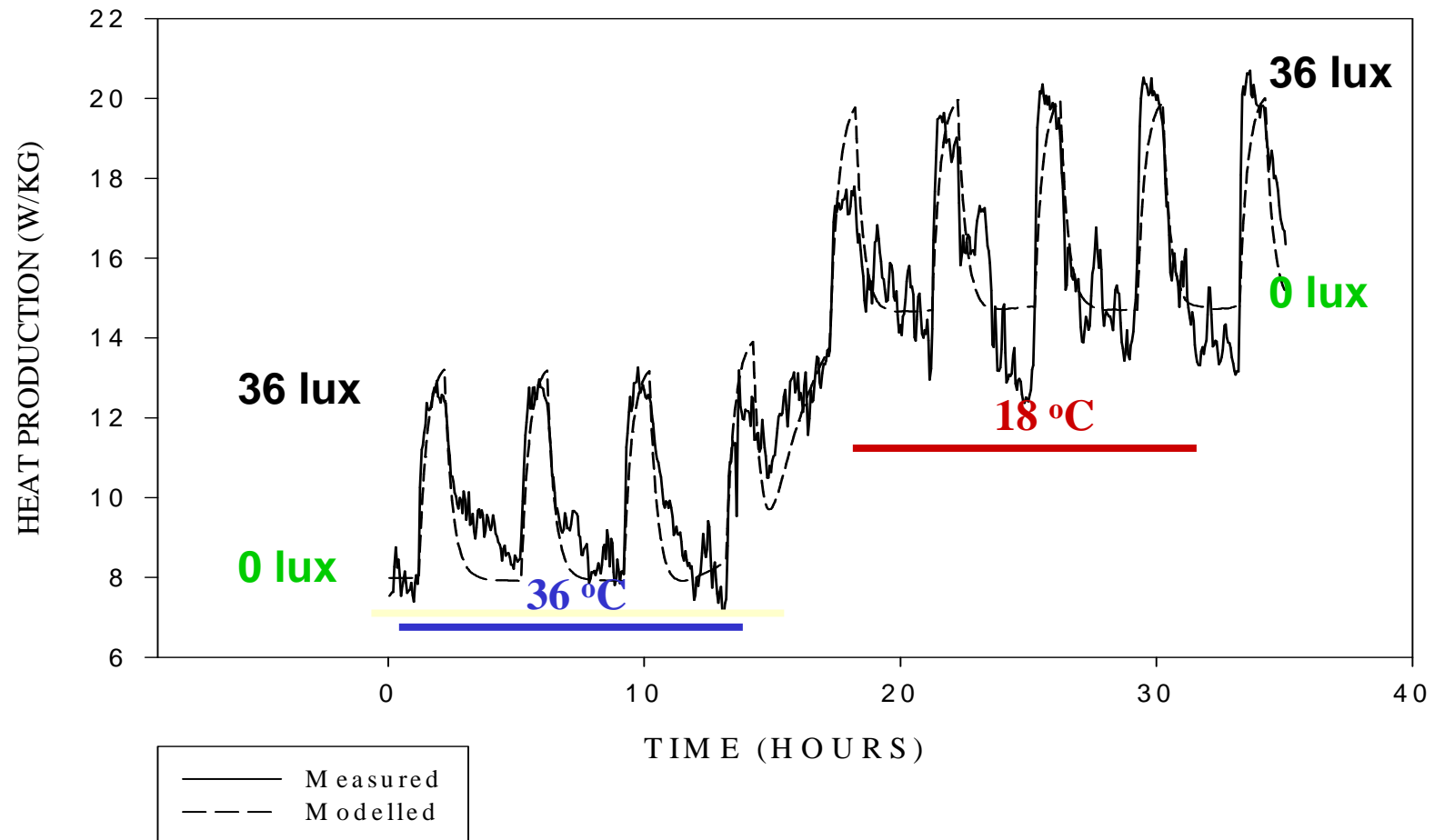
Where's the chequered flag?





Heat production of broilers following step changes in temperature (36 to 18 °C) and light intensity (0 – 36 lux)

Aerts et al, IFAC-CAEA workshop, 1998



Targets and Trajectories



Applications of PLF in broiler farming

<u>Input</u>	<u>Process</u>	<u>Output</u>
Feed quantity	Growth	Weight
Light intensity	Behaviour	Activity and rest
Absolute humidity	Ammonia emission	Litter water activity

Lessons from The Pioneers of PLF

FLOCKMAN™

- Monitoring feed intake and bird weight
- Novel diet blending
- Environmental management
- Control of food supply

Aerts and Be...

- Platform...
- Platform...
- Platform...
- Platform...

Silsoe PL...

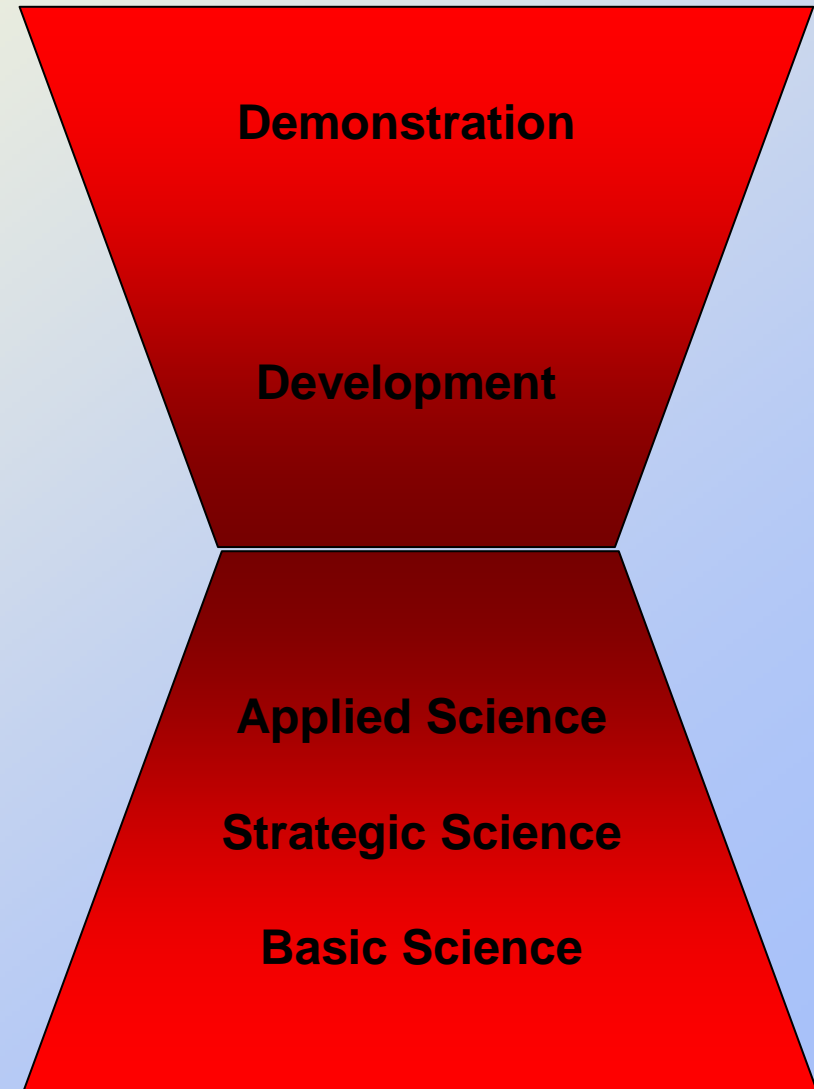
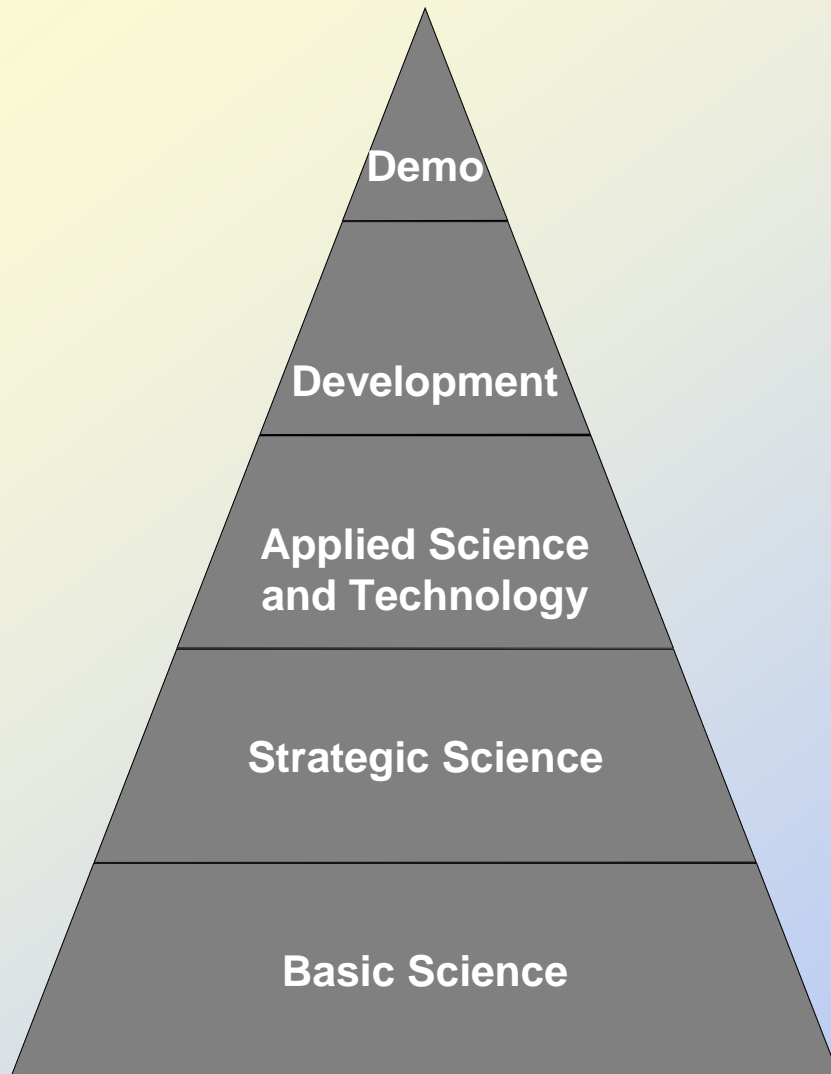
- Video...
- M...
- and...
- Cont...

Common lessons

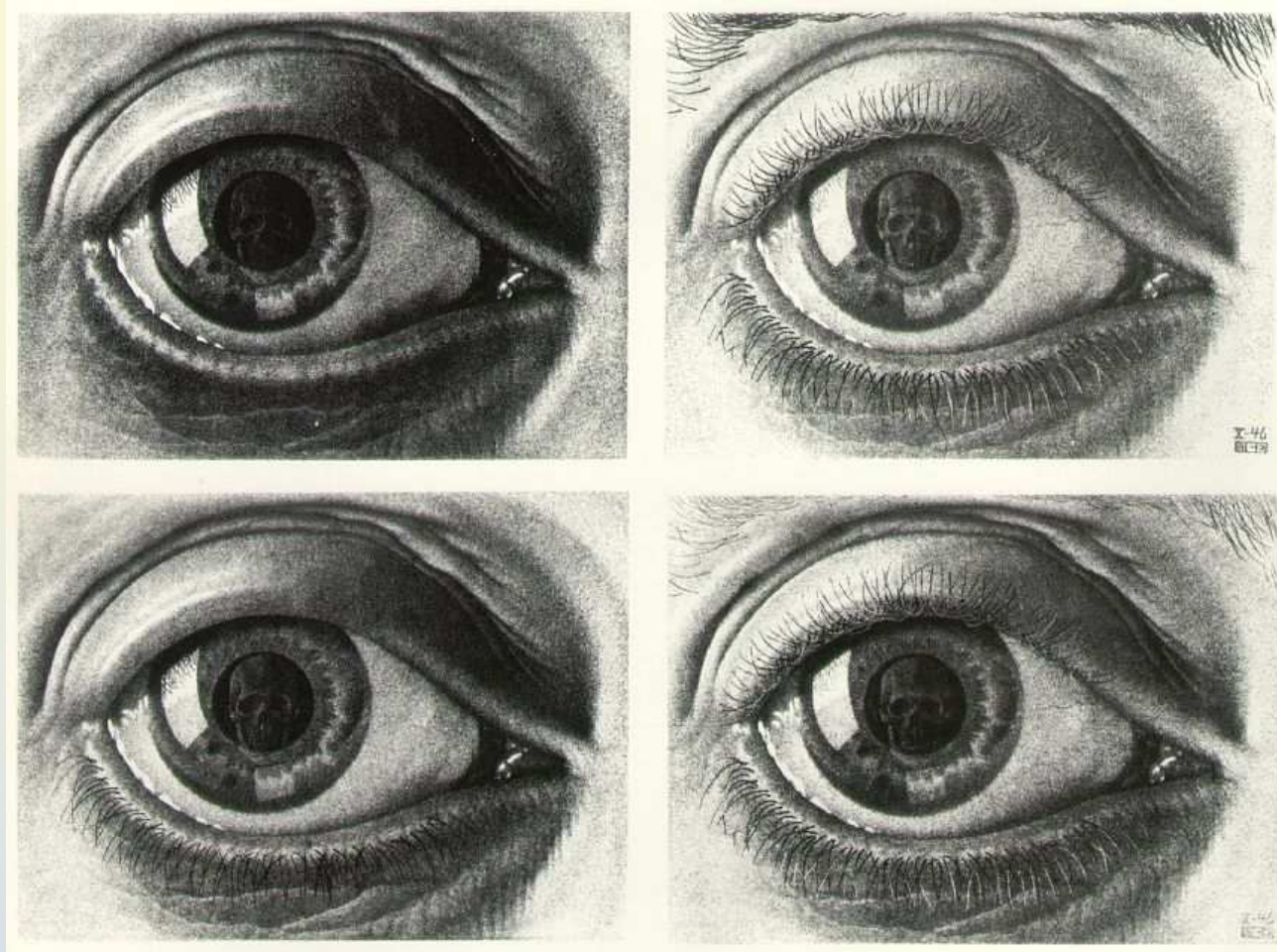
- Growth – First application
- Poor commercial success
- Insufficient development
- Software too sophisticated

Too far, too soon?

Linear approach or Egg-timer?



The Electronic Stockman



“Monitoring and control in livestock production is relatively undeveloped compared to most industries” Frost *et al.*, 1997

SMART Workshop 2006

Sensors for Livestock



**Sponsors:
Fancom, Petersime
and De Laval**

Cattle

Rumen pH & Blood & Milk fat

Temperature: rumen + vulva

Lameness & Location

Calving behaviour

Pigs

Vocalisations & Activity

Farrowing behaviour

Growth & Body composition

Poultry

Birds: Liveweight

Eggs: Temperature + albumen

+ Ph + Nitric oxide release

**You can't fatten a pig
by weighing it**

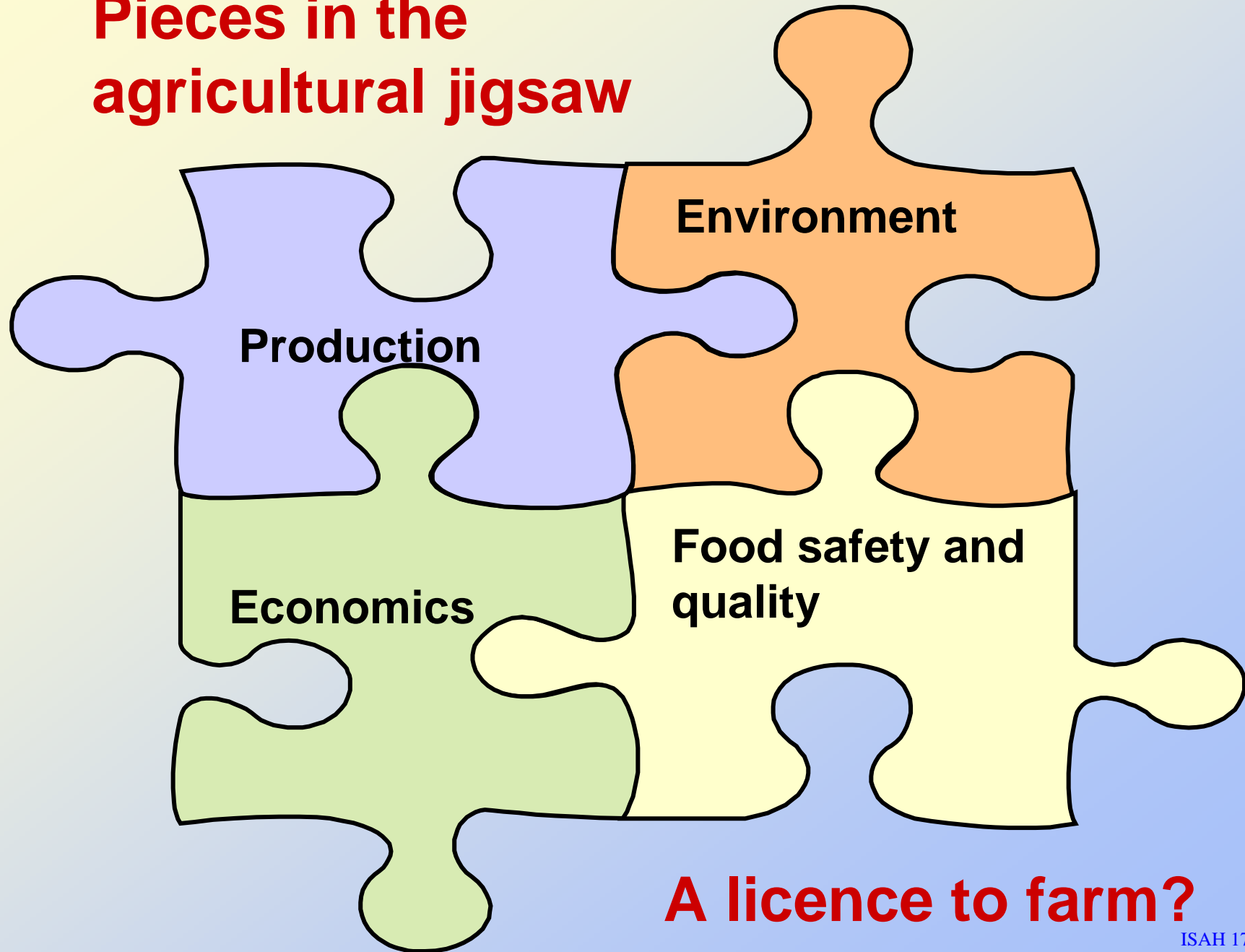


Reasons why electronic monitoring is uncommon on livestock farms

1. Lack of involvement of manufacturing companies and unclear specifications
2. Lack of proving trials at farm scale with full scale demonstration
3. Unknown market demand by farmers

But.....

Pieces in the agricultural jigsaw



A licence to farm?

Automatic monitoring

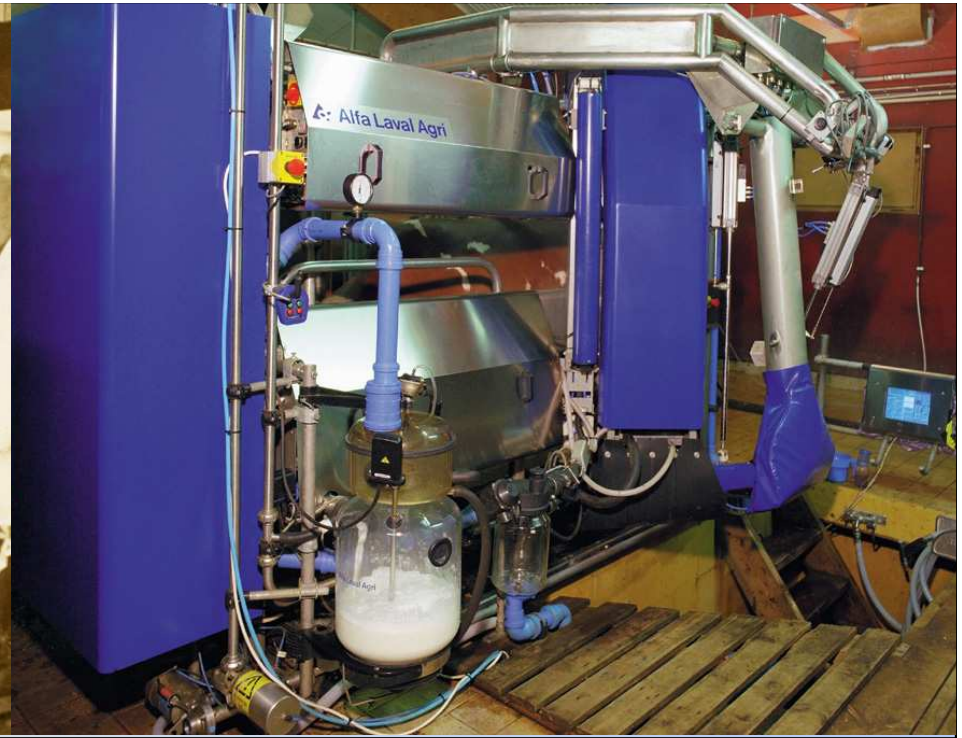
On the farm

- Pollutant emissions
- Zoonoses
- Markers of meat quality

During transport and at the abattoir

- Welfare
- Texture and tenderness





Barriers for PLF to overcome:

Robust, low cost technology

Appropriately applied

Developed and demonstrated

