The pig/pork production system as a Complex Adaptive System

CAS-thinking x Innovation strategy

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Outline of this contribution

- Helping the NW-European pork sector to enter the future is complicated
- We (Wageningen UR) are trying to add a systems approach to the multi-actor-innovation approach
  - Complex Adaptive Systems
  - Best illustrated with Agent Based Modelling
- Here: focus on the pigs/pork system
  - Multi-level project: animal – farm – sector – society
- Put research efforts into a real life context
  - Research as an instrument for
    - Guiding an evolutionary development
    - Enhance sustainable development
Why a systems approach?
Animal production systems are complex!
Understanding is needed

- Understanding what is happening at chain / sector / society level is useful**

- A certain set of glasses helps in good sight offers a conceptual view

Developments are multilevel & multifactorial and required views are multidisciplinary

→ Conceptual systems approach useful

** Adviser & Horizon2020!
Complex Systems Thinking

- Animal production systems combine biological complexity with human complexity, and function in a complicated (complex) context.

Challenge for science to model the development

? Instruments to guide processes?
! Suit animal production into the local context

A Complex Adaptive Systems approach seems to provide a good framework.
What makes systems ‘Complex Adaptive Systems’?

- Open: in interaction with their environment
- Components that are linked through interactions
- Positive and negative feedbacks
- Non-linear behaviour, nested and multilevel
- Variety of components and interactions between components
- Emergence
- Various orientations (attractors)
- Adaptive

(cas-criteria, adapted from Kauffman and from Bregt)

Co-evolution, emergence and self-organisation
Agent Based Modelling
a tool connected to CAS
Agent Based Modelling makes life easier

Examples
- Birds in a swarm
- Termites hill
- Traffic jam
- Crowd behaviour

http://www.fhwa.dot.gov/advanced_research/pubs/11036/
http://www.ldc.upenn.edu/myl/abm/
Views on innovation
View on innovation

- Guided process OR evolutionary development
- Interventions? Planning versus stimulating?, Help?

IF CAS THEN “create an adequate environment” BETTER THAN “perform interventions”.

Relevant for policy makers
CASE: The World Pork System

- Commodity (exchangeable)
- Many (~diverse) actors on the ends of the chain

-> market price to marginal cost = lowest cost performance

➔ Operational excellence
➔ Harmonisation

➔ ~ locked in
Key ambitions/ questions - overall

- Analyse whether pork sector behaves as a Complex Adaptive System
- Answer to the question: Why does a (seemingly inert) commodity system change: emergence, forces
- What is the role of the ‘Innovation arena’ in the change

→ Understand
→ Explain
→ Advise

CAS-criteria (Kauffman?)

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Influences on the pork chain

DEMAND:
- Market development

SUPPLY:
- Technical development

ENVIRONMENT:
- Societal development
  - Animal welfare, environmental issues, ...
  - Competing claims (labour, area, support)
  - ...

Conceptual view on developments in the pork chain

DEMAND:
- Market development

SUPPLY:
- Technical development

ENVIRONMENT:
- Societal development
  - Animal welfare, environmental issues
  - Competing claims (labour, area, support)

representatives

sector

FARM
Conceptual view on developments in the pork chain

**DEMAND:**
- Market development

**SUPPLY:**
- Technical development

**ENVIRONMENT:**
- Societal development
  - Animal welfare, environmental issues
  - Competing claims (labour, area, support)
ResPork: a multi-level approach to the innovation process in the pork system
ambition

- Apply CAS-view to the pork sector
  - evaluate whether pork system behaves as a CAS
- Model the systems behaviour
  - Multi level: Animals, Farmers, Representants
- Connect CAS to Innovation theory
- Analyse/ judge / evaluate strategies
  - For the actor groups involved
    - In our specific context
      - Polder NL Joint / collective / construction
Experiences so far

- **CAS-thinking**
  - sharper conceptual view (why, how, who)

- **Agent based modelling**
  - Deal with the multi and many-actors situation
  - Technical and human factors combined
  - brings forward multi-actor-crowd processes

- **Take a humble analyst-position in the sector-development**
  - (complex, multi-actor, multifactor, adaptive)
  - Planned behaviour in a non-steerable environment
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Complex Adaptive Systems approach:

a valuable addition to our systems toolkit

Thank you
Helping the NW-European pork sector to enter the future is complicated

- Difficult market position, difficult societal position

Change needed, but Locked in (commodity system!)

Various factor and drivers

Innovation theory (evolution model vs design model, niche management vs multi-actor processes (Dutch polder model)

Integrality Balance interests,
4 phases

1. Identify major changes (emergence of systems changes) develop time line [2012+]
2. Choose changes that are not obvious (not elsewhere, opposite trend etc.) group housing and castration as cases
3. Describe & analyse the change(s) in their context: nature of the change, influencing factors
4. Model the development (time, influences, appearance)
Conceptual development: combine innovation theory with CAS-thinking

- Rotmans, Geels, Grin
‘Transition cannot be organised, but it can be influenced’

‘innovations need a bedding’

- Principal approach (frame, paradigm)
- Design approach (Grin, RIO)
- Evolutionary approach (Rotmans)
- Niche management approach (Geels, Schot)

-> Intervention tools?

-> role of public policy tools
Geels et al

Landscape developments

New ST-regime influences landscape

Socio-technical regime

ST-regime is 'dynamically stable'. On different dimensions there are ongoing processes.

New configuration breaks through, taking advantage of 'windows of opportunity for novelties'. Adjustments occur in ST-r

Technological niches

Elements are gradually linked together, and stabilise into a new ST-configuration, which is not (yet) dominant. Internal momentum increases.

Articulation processes with novelties on multiple dimensions (Technology, user preferences, policies). Via co-construction, elements are gradually linked together.

Macroniveau (landschap)

Mesoniveau (regimes)

Microniveau (niches)
Grin et al.

1. System & actor analysis
   - Key challenges
   - System analysis
   - Future visions

2. Structured design
   - Key Functions
   - Morph. Function Diagram
   - Gen. of Solutions
   - Design Concepts
   - Detailed proposals

3. Anticipating niche & structural change
   - Key actors & needs
   - Briefs of requirements
   - Networks & ownership
   - Identif. of institutional barriers
   - Prop. & interventions for change
   - Pilots & trials in niche

(External effects)