Participatory modelling for strategy design on dairy farms

Option 1
Option 2
Option 3
Option 4
Option 5
Option 6
Option 7
Decision levels

Strategic

Tactical

Operational
Knowledge is necessary to take the best decision

Labour
- Technical performances
- Capital/land
- Prices
- Ambition

Consumer

Cost price
- Environment (oa CC)
- Regulations
- Technological progress
- Family
PROBLEM context

• Why operational research (OR) methods can’t help decision making at farm level?
• OR models (ex. LP) are mathematical formalisation of the economic decision problem;
• This is, optimizing something (a criterion) subject to constraints (production factors, other criteria, technological relationships)
PROBLEM analysis

• For some processes: OR optimisation = OK

• For other applications, ex. culling decisions based on stochastic dynamic programming, OR use in practice is already more problematic

• Process versus organisational optimisation: farmer as decision maker has multiple objectives and constraints

• Strategy design versus operations management

• Not “the optimum”, but a range of plausible solutions is interesting

• But also attitude towards solutions “that come from a machine”

• Do we really need stand-alone one-fits-all quantitative tools?

• Or is it workable?
Learning by doing: 4 cases

- RQ: how to organize a process and tool development to make it work
- Action research, mutual learning
- Close involvement of stakeholders, while we carefully watch not to confound the stakeholders stakes with our RQ
- Cases:
  - Scale enlargement in the post-quota era: AR with advisors
  - Communication between modellers at various levels with typical farms
  - Home-grown proteins in LI dairy farming
  - Soy bean breeding in moderate climate zones
Some lessons learnt

• It works! But difficult
• Very situation specific (farm, location, contexte, theme)
• Need for high involvement of those who are familiar with the situation
• Too early to come to conclusions, but, already a framework of four principles
4 attention fields – principles – actions - paradoxes

• Whole-farm modeling, integrative, holistic approach to link all relevant processes and links. Paradoxe complexity -simplicity

• Decision support systeem, normative, need to integrate strategic and operational levels.

• Stakeholder involvement, participatory, need to compile knowledge for inspiration. Paradoxe generality- specificity

• Typical farms, communicative, reflect own decision context to benchmarks
Whole-farm modelling

• For **academic** reasons: model the system as comprehensive as possible to gain extra insights
• For **practical** reasons: we cannot experiment (that much) with the system, so simulation to cope with it
• For **decision support**
  – E.g. grazing strategies, crop mix- feed ration, culling decisions
  – Policy level: trade and food security
  – Farm: continuum from operational to strategic decisions
• Paradoxe: comprehensiveness versus simplicity
A farm model for dairy farms

Inputs

Animals

Outputs

Constraints

• Ration
• Manure
• …

Land

Outputs

Cash flow

Investment

Investment options
Decision-support systeem

- The strategic – operational challenge
- DSS= system of models
- Decision support tool linked to OR: sensitivity analysis, shadow price analysis
- Paradoxe: normative teachery versus normative explorative ≠ dual solution
  more important than the primal one
Optimal scale under changing milk and concentrate prices

Price concentrates (euro/100 kg)

Milk price (euro/100 l)

110 Dairy cows

140 Dairy cows

190 Dairy cows

230 Dairy cows
Optimal scale under changing milk and concentrate prices
Possible output

Why does the model make a certain investment choice?

Example: within which limits of the milk price and the concentrate price stays the optimal investment choice optimal?
Stakeholder involvement

• Who cares? Many!
• Farmer, advisors, partners, family, veterinarians, technology providers, agronomists, farm economists, modellers, ...
• Who helps in knowledge compilation and inspiration? Same!
• Paradoxes: specificity versus generality
Different actors have knowledge at different levels and in different disciplines.

- Farmer
- Researcher
- Adviser

- Technical
  - Farm management
  - Modelling
- Policy
- Technical - Commercial banks
- Farm management
Typical farms

• Typical farm:
  – not necessarily a peer or a benchmark, but similarity helps
  – recognizable characteristics from a group of farmers (or individual farm, BUT confidentiality)

• Aim:
  – making ideas and inspiration tangible
  – to show mechanism of optimisation, importance of processes and links
  – Communicatio between modellers

• Paradoxes: recognizable pocket size example versus similarity to specific complexity
Identifying typical farms

Facilitator for constant information flow between different modelling levels in the project

- Models are not aligned
- Have a different data need

Can we link the results of the different modelling levels using typical farms?
Researchers’ inspiration: 4 principles drives RQ in the cases

<table>
<thead>
<tr>
<th>Conceptual framework</th>
<th>Knowledge compilation: what is the influence of the different methods used?</th>
</tr>
</thead>
</table>
| WFM & features       | - Do the different features hold?  
                        - Are they comprehensive?  
                        - Can they be combined or are they contradictory? |
| DSS & features       | - Is there a ranking of importance?  
                        - How are they met?  
                        - Are they application specific? |
| Participatory & features |                                                                 |
| Typical farms & features |                                                                 |

Problem statement
- Decision environment of dairy farms is complex (changing policies, margins, ...)
- The different actors in AKIS have knowledge available but the knowledge compilation can improve

Knowledge exchange (practical RQ)

<table>
<thead>
<tr>
<th>Scale enlargement</th>
<th>Is it necessary to have a complex model?</th>
<th>Combination with existing tool</th>
<th>Was this a successful process? Why?</th>
<th>From actual farms to typical farms Farm specificity</th>
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<tbody>
<tr>
<td>Soya</td>
<td>Ration and nitrogen balance</td>
<td>Linear top down approach of providing information?</td>
<td>Providing information to other disciplines</td>
<td>Farm specificity vs generalizing information</td>
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<tr>
<td>SOLID</td>
<td>Can we use typical farms in WFM</td>
<td>Linear top down approach of providing information?</td>
<td>Opportunities and threats in for designing these typical farms</td>
<td>Are typical farms typical?</td>
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