SDDDC Farm Development project
2015/16

Differences between and within dairy farming systems

2016-03-01 Alfons Beldman, Co Daatselaar, Shixian Zhai, Junfei Bai, Jelle Zijlstra, Kees de Koning
Contents

- Introduction
- Differences in farm performance between and within different farming systems:
- Intentions and expectations
- Overall conclusions and recommendations
- Appendix: study for Dutch situation

This research was executed within SDDDC and its related program the Dutch Public Private Partnership SDDDC (AF 14247 (TKI Agri & Food), BO-27.04-001-014)
Introduction

- Survey SDDDC dairy farms
  - Developed in cooperation with Dr Junfei Bai (CAU)
  - Conducted by CAU and SDDDC
  - Integral survey
    - Farm structure (herd, land, machinery, staff)
    - Farm management (feeding, manure, use of software)
    - Economics (loans/debts, gross margin)
    - Performance (productivity, environment)
Introduction

- **Survey SDDDC dairy farms**
  - Survey was conducted in July – October 2015 by graduate students from College of Economics & Management (CEM), coordinated by Junfei Bai (CAU) and Liu Kai (SDDDC)
  - Total sample: 126 farms
  - First analysis by Shixian Zhai and Junfei BAI (both CAU), presented on December 7\textsuperscript{th} 2015 at CAU, part of their results is used in this presentation.
  - Dataset is further analysed by Wageningen UR, using the same farm size classes
  - For most graphs and tables data of 90-100 farms could be used; only for feed costs and margin it was around 55
Introduction

- Goal of analyse
  - To get insight in performance of different farm types using performance indicators
    - that fit with regional circumstances
    - and, as a set of indicators, give an integrated picture of the overall performance
  - To get insight in differences in performance within farm types
    - To get insight in room for improvement
Choice of performance indicators

- For the overall picture of performance of a dairy farm indicators are required for:
  - People (e.g. labour circumstances, safety, milk quality, use of antibiotics, animal welfare)
  - Planet (e.g. losses of N and P, greenhouse gas emissions)
  - Profit (e.g. productivity, gross margin, total costs)

- The choice of indicators for this analyse was based on:
  - Critical factors for Chinese dairy production, partly based on the white paper
  - Availability of data.
Choice of performance indicators for Chinese dairy

- **Performance indicators used in this study:**
  - Milk quality (SCC, TBC, milk refusal)
  - Milk yield/cow, cows/labour unit
  - Milk price, feed cost, milk-feed margin, labour costs

Information was collected on ration of the animals, but it appeared to be insufficient to be able to calculate N and P efficiency indicators.
Respondents in the survey according to number of dairy cattle on the farm

- Respondents from provinces Hebei, Tianjin and Beijing

(Note: nr of dairy cattle is total number including young stock)
Farm management: kg milk per cow

- Mark in box is average
- 25-75% in yellow boxes
- 2.5-97.5% between the whiskers

- Larger scale farms show higher milk yield
- Differences with farm types big: much overlap between groups
Farm management: number of young stock per 10 dairy cows

- No clear differences between the size classes
Farm management: number of cows per employee

- On bigger farms more cows per employee
Milk quality: SCC and TBC

- Bigger farms tend to have lower SCC, for TBC no clear pattern
- Smaller farms seem to have more outliers
- Several farms higher then international thresholds for SCC and TBC
- Level SCC Western Europe 100-200000
- Level TBC US and Western Europe < 10000

SCC: *10000 per ml (40 = 400.000 = EU threshold)
TBC: *10000 per ml (10 = 100.000 = international threshold)
Reasons for refusal of milk

- Most refusals because of sensory evaluation, followed by TBC and SCC
- Nearly all farms have refusals: no effect of farm size
Milk price and feed costs in RMB/kg milk

- Bigger farms tend to have higher milk price
- Feed costs tend to rise from 2nd to last farm type
- Feed costs: large variation within farm types: room for improvement!
• Bigger farms tend to have lightly higher margin milk over feed
• Smallest scale has smallest margin
• Variation within each farm type is high: room for improvement
Labour costs and depreciation

- Bigger farms tend to have lower labour costs.
- Compared to feed costs, labour costs are limited (feed costs 5-6 times labour costs)
- Depreciation are minor costs, no clear differences between the groups

Depreciation includes (% of investment): feeding and milking equipment (8%), milking hall, barn (5%), ventilation, power equipment (6.7%), manure related equipment (10%)
• The appropriate milk price is about 4.5 RMB. This return is needed to cover the costs.

• The gap between the appropriate milk price and the realized milk price 0-1 RMB per.
Interim summary (1)

- Majority of surveyed dairy farms 300-1000 dairy cattle
- Milk yield per cow somewhat higher on larger farms
- Milk quality: more negative outliers on group of smallest farms. Not much difference between other groups.
- Milk quality big issue:
  - Nearly every farm has one or more refusals of milk
  - Main reasons sensory evaluation, SCC and TBC
  - SCC and TBC quite often above international thresholds
- Milk price nearly 4 RMB/kg (€0.50-€0.55; $0.60-$0.65)
  - About 4.5 RMB/kg milk considered as appropriate (to cover the calculated costs)
- Larger farms have higher milk price, but also somewhat higher feed costs
Interim summary (2)

- Ratio milk price /feed costs about 1.5: feed major costs. This means margin is heavily influenced by variation in feed costs and cannot be controlled by the management. (Ratio milk/feed in Netherlands 3.5)
- Margin is lower in the group of smallest farms, not much difference between the other groups
- Tendency of less labour/kg milk on bigger farms, no/small differences other costs
- Differences within farm types are big for almost all indicators, this suggest there is room for improvement on many farms
- Calculated margin is rather low and does not include all costs. Taking into account the volatility of feed costs this means the systems are quite vulnerable.
- Addition of indicators like total costs, longevity and N- and P-efficiency could give a more balanced view of the overall performance
Intentions and expectations

- The survey also included questions related to plans for investment and need and availability for loans.
Realized loans for recent investments and daily expenses classified into sources

- Farms between 300 and 1000 heads are the main borrowers
- Banks are the main lenders
- Considerable number of loans from other sources
Investment desire and share of required loan that can be obtained (according to the farmer)

- Quite a number of farms needs loans for daily expenses.
- Especially smallest and biggest farms expect not to obtain the required size of loans.
Assumed lender(s) for new loans and foreseen action in case of insufficient loans

- Other sources for loans in total as often as banks
- Alternative strategy if insufficient loans are available: status quo.
Main problems to be solved according to the farmers

• Low milk price is most often ranked as no 1 problem
• Independent testing within the chain is in second place
• Downturn consumer market in third place

![Graph showing ranking of problems to be solved] (Milk price is low, No third party testing, The downturn in the consumer market, Higher feed costs, Forced sale behavior of milk enterprises, Manure treatment, Difficult to control the quality of silage and difficulty in collecting silage)
Intentions and expectations: summary

- Banks are main lenders, but also considerable number of other sources available
- Quite a number of farms need loans for daily expenses
- Top 3 of main problems to be solved according to the farmers
  - Low milk price
  - Independent test of milk quality
  - Downturn of consumer market.
Overall conclusions and recommendations

- Some differences between farm types: the group with smallest farms tends to have more outliers with milk quality, a lower milk price and lower margins. Differences between other groups rather small.

- The differences within groups are much bigger than the differences between groups. This shows that there is room for improvement.

- All farm types are vulnerable for volatile feed costs: feed costs are a high percentage of total costs and margins are relatively low.

- A large share of the farmers with smallest and largest scale farms expect that they cannot get the required/desired loans.

- With some additions this survey could give a balanced picture of the overall integral (triple P) performance of the different farm types. For the Chinese circumstances total costs, N and P efficiency and longevity should probably be added.
Overall conclusions and recommendations

- The large differences within farm types show that there is room for improvement for many farms. Tools to achieve this improvement are:
  - Use of benchmark tools to compare results of a specific farm with a peer group of farms with a similar farm structure
  - Exchange of best practices between farms e.g. by e-tools or in discussion groups
  - Suggestion is to use results of this survey to discuss in a workshop with e.g. dairy economists and/or farm managers if and how this type of information could be used.

- In order to assess integral performance (triple P) of different types of dairy farms a structured and continuous data collection is needed:
  - Stratified sample of farms spread over different regions
  - Choice of right triple P indicators and aligned integral data collection
  - Continuous data collection (yearly or bi-yearly) to be able to analyse trends
Appendix: similar type of analyse based on Dutch data
SDDDC Farm Development project 2015

Differences: between and within dairy farming systems in the Netherlands

2015-12-07, Alfons Beldman & Co Daatselaar
Contents

- Introduction
- Differences in farm performance between and within different farming systems:
  - Survey China
  - Dutch case: comparing two farming systems
  - Risk profile: dependencies and resilience
- Value of integrated and continuous data collection
- Benchmarking
- Concluding remarks
Introduction

- Survey SDDDC dairy farms
  - Developed in cooperation with Dr Junfei Bai (CAU)
  - Conducted by CAU and SDDDC
  - Integral survey
    - Farm structure (herd, land, machinery, staff)
    - Farm management (feeding, manure, use of software)
    - Economics (loans/debts, gross margin)
    - Performance (productivity, environment)
  - Data has been collected in 2015, will be analysed in 2016
Comparing two farming systems: Dutch Case
Comparing two farming systems: Dutch Case

Dairy farm

- On farm feed production (grass, maize)
- Milk production dairy cows and young stock
Comparing two farming systems: Dutch Case

Dairy farm

On farm feed production (grass, maize)

Milk production
Dairy cows and Young stock

Manure

Feed

Feed companies

Import

By products food industry

Crops

Feed

Arable farms

Feed

Manure

Fertilizer
Comparing two Dutch farm types: classification

- ‘Medium size extensive’
  - 60-100 cows
  - 1.3-1.7 cows per ha

- ‘Big intensive’
  - 120-250 cows
  - 2.2-4 cows per ha

- Recognizable farm types for the Netherlands
  - It is expected that these types will continue in future
Farm structure: characterizing features

- No of cows: 100% = 315
- Cows/ha: 100% = 4
- 25-75% in the boxes
- 10-90% between the whiskers
- Mark in box is average

<table>
<thead>
<tr>
<th>Average</th>
<th>Med ext</th>
<th>Big int</th>
</tr>
</thead>
<tbody>
<tr>
<td>No cows</td>
<td>82</td>
<td>173</td>
</tr>
<tr>
<td>Cows/ha</td>
<td>1.5</td>
<td>2.8</td>
</tr>
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</table>

Farm structure for 2 groups of Dutch dairy farms
## Farm structure of Dutch dairy farms

<table>
<thead>
<tr>
<th></th>
<th>Dutch average</th>
<th>Medium size extensive</th>
<th>Big intensive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dairy cows</td>
<td>93</td>
<td>82</td>
<td>173</td>
</tr>
<tr>
<td>Fodder crops (ha)</td>
<td>50.2</td>
<td>53.3</td>
<td>62.8</td>
</tr>
<tr>
<td>Dairy cows/ha fodder crops</td>
<td>1.85</td>
<td>1.55</td>
<td>2.83</td>
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<tr>
<td>Kg milk/ha fodder crops</td>
<td>14800</td>
<td>12483</td>
<td>24999</td>
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<tr>
<td>Automatic milking system</td>
<td>23%</td>
<td>38%</td>
<td>42%</td>
</tr>
</tbody>
</table>
Farm structure of Dutch dairy farms

Farm structure for 2 groups of Dutch dairy farms

<table>
<thead>
<tr>
<th>md sz ext</th>
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<th>big int</th>
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<tr>
<td>0-315</td>
<td>0-135</td>
<td>0-4</td>
<td>0-35000</td>
<td>0-100</td>
<td>Share AMS</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>no of cows</td>
<td>no of ha</td>
<td>cows/ha</td>
<td>kg milk/ha</td>
<td>Share AMS</td>
<td></td>
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</table>
## Farm management on Dutch dairy farms

<table>
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<th>Dutch average</th>
<th>Medium size extensive</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Milk per cow (kg)</td>
<td>8000</td>
<td>8049</td>
<td>8845</td>
</tr>
<tr>
<td>Young stock/10 cows (no)</td>
<td>7.3</td>
<td>7.3</td>
<td>7.2</td>
</tr>
<tr>
<td>Grazing (hours/year by cows)</td>
<td>1333</td>
<td>1782</td>
<td>579</td>
</tr>
<tr>
<td>Feed efficiency (kg milk per kg feed)</td>
<td>1.23</td>
<td>1.24</td>
<td>1.24</td>
</tr>
</tbody>
</table>
Farm management on Dutch dairy farms

Farm management for 2 groups of Dutch dairy farms

- **md sz ext**
  - 0-10000 kg milk/cow
- **big int**
  - 0-10 kg milk/cow

- **md sz ext**
  - 0-10 no young stock/10 cows
- **big int**
  - 0-10 no young stock/10 cows

- **md sz ext**
  - 0-4000 hours grazing/year
- **big int**
  - 0-4000 hours grazing/year

- **md sz ext**
  - 0-1.4 kg milk/kg feed
- **big int**
  - 0-1.4 kg milk/kg feed
Sustainability on Dutch dairy farms: planet

<table>
<thead>
<tr>
<th></th>
<th>Dutch average</th>
<th>Medium size extensive</th>
<th>Big intensive</th>
</tr>
</thead>
<tbody>
<tr>
<td>% home grown feed in ration</td>
<td>60</td>
<td>68</td>
<td>49</td>
</tr>
<tr>
<td>Nitrogen soil surplus (kg/ha)</td>
<td>182</td>
<td>168</td>
<td>176</td>
</tr>
<tr>
<td>N-efficiency cattle</td>
<td>24</td>
<td>22</td>
<td>25</td>
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<tr>
<td>P-excretion (g/kg milk)</td>
<td>3.0</td>
<td>3.7</td>
<td>2.6</td>
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<tr>
<td>Energy usage (MJ/kg milk)</td>
<td>0.80</td>
<td>0.78</td>
<td>0.79</td>
</tr>
<tr>
<td>Carbon footprint (kg CO2/kg milk)</td>
<td>1.29</td>
<td>1.37</td>
<td>1.14</td>
</tr>
</tbody>
</table>
Sustainability on Dutch dairy farms: planet

Some PLANET issues for two groups of Dutch dairy farms

<table>
<thead>
<tr>
<th></th>
<th>md ex</th>
<th>big</th>
</tr>
</thead>
<tbody>
<tr>
<td>% home grown feed in ration</td>
<td>0-106</td>
<td></td>
</tr>
<tr>
<td>Nitrogen soil surplus kg/ha</td>
<td>0-37600</td>
<td></td>
</tr>
<tr>
<td>N-efficiency cattle</td>
<td>0-37</td>
<td></td>
</tr>
<tr>
<td>P-excretion g/kg milk</td>
<td>0-5</td>
<td></td>
</tr>
<tr>
<td>primary energy in MJ/kg milk</td>
<td>0-1</td>
<td></td>
</tr>
<tr>
<td>kg CO2/kg milk</td>
<td>0-2</td>
<td></td>
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</tbody>
</table>
## Sustainability on Dutch dairy farms: people

<table>
<thead>
<tr>
<th></th>
<th>Dutch average</th>
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</tr>
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<tbody>
<tr>
<td>Grazing (hours/year by cows)</td>
<td>1333</td>
<td>1782</td>
<td>579</td>
</tr>
<tr>
<td>Nature management (share of farms)</td>
<td>36%</td>
<td>57%</td>
<td>16%</td>
</tr>
<tr>
<td>Use of antibiotics (ADD)</td>
<td>2.9</td>
<td>2.7</td>
<td>3.5</td>
</tr>
<tr>
<td>Somatic cell count</td>
<td>199</td>
<td>217</td>
<td>208</td>
</tr>
<tr>
<td>Longevity (years)</td>
<td>5.6</td>
<td>5.7</td>
<td>5.2</td>
</tr>
</tbody>
</table>
Sustainability on Dutch dairy farms: people

Some PEOPLE issues for two groups of Dutch dairy farms

- hours grazing by cows/year
- share nature management
- antibiotics ADD
- somatic cell count
- longevity in years
## Sustainability on Dutch dairy farms: profit

<table>
<thead>
<tr>
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<th>Dutch average</th>
<th>Medium size extensive</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Labour productivity (kg milk/hour)</td>
<td>206</td>
<td>172</td>
<td>295</td>
</tr>
<tr>
<td>Modernity</td>
<td>37</td>
<td>30</td>
<td>46</td>
</tr>
<tr>
<td>Farm income (€/unpaid labour unit)</td>
<td>47262</td>
<td>46235</td>
<td>58181</td>
</tr>
<tr>
<td>Long term debts (€/kg milk)</td>
<td>1.17</td>
<td>1.11</td>
<td>1.42</td>
</tr>
<tr>
<td>Cost price of milk (€/100 kg milk)</td>
<td>50.48</td>
<td>49.66</td>
<td>46.56</td>
</tr>
<tr>
<td>Paid costs (€/100 kg milk)</td>
<td>26.84</td>
<td>26.23</td>
<td>26.70</td>
</tr>
</tbody>
</table>
Sustainability on Dutch dairy farms: profit

Some PROFIT issues for two groups of Dutch dairy farms

| md ex | big |
|-------|
| 0-500 | 0-100 |
| kg milk/hour | 0-200000 |
| labour | € farm income/unpaid labour unit |
| 0-3 | 0-65 |
| € long term debts/kg milk | cost price of milk €/100 kg milk |
| 0-40 | paid costs €/100 kg milk |
Two farm types: planet/people/profit

- % home grown feed
- Nitrogen surplus in kg/ha
- N-efficiency cattle
- P-excretion in g/kg milk
- Primary energy MJ/kg milk
- kg CO2/kg milk
- hours grazing by cows/year
- Antibiotics ADD
- Somatic Cell Count
- Longevity in years
- Kg milk/hour labour
- Modernity
- Farm income/unpaid LU
- Long term debts/kg milk
- Cost price of milk
- Paid costs/kg milk
Med. sized extensive: planet/people/profit

<table>
<thead>
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<tbody>
<tr>
<td><strong>Profit</strong></td>
</tr>
<tr>
<td>Paid costs/kg milk: 21-33</td>
</tr>
<tr>
<td>Cost price of milk: 41-58</td>
</tr>
<tr>
<td>Long term debts/kg milk: 0.6-2.2</td>
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<td>Farm income/unpaid LU: 0-120000</td>
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<td>Modernity: 0-100</td>
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<tr>
<td>Kg milk/hour labour: 100-300</td>
</tr>
<tr>
<td><strong>People</strong></td>
</tr>
<tr>
<td>Longevity in years: 5-7</td>
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<td>Somatic Cell Count: 100-300</td>
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<td>Antibiotics ADD: 1-5</td>
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<td>hours grazing by cows/year: 0-3000</td>
</tr>
<tr>
<td><strong>Planet</strong></td>
</tr>
<tr>
<td>kg CO2/kg milk: 1-1.5</td>
</tr>
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<td>Primary energy MJ/kg milk: 0.5-1</td>
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<td>P-excretion in g/kg milk: 2-3</td>
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<td>Nitrogen surplus in kg/ha: 120-260</td>
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<td>% home grown feed: 35-75</td>
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LEI WAGENINGEN UR
Big intensive: planet/people/profit

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**People**
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- Somatic Cell Count: 100-300
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**Planet**
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Two farm types: planet/people/profit

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- MdS ext unfavourable
- MdS ext favourable
- Big int unfavourable
- Big int favourable
Variable costs and gross margin
Revenues and variable costs per 100 kg milk for Dutch dairy farms

- Euro per 100 kg milk
- Revenues excl subsidies
- Variable costs
- Dutch average
- Medium sized extensive
- Big intensive
- other field costs
- fertilizer
- other cattle costs
- animal health
- other feed
- roughage
- other revenues
- turnover cattle
- milk
- gross margin

Revenues and variable costs
Fixed paid costs and depreciation

Fixed costs excluding unpaid labour and unpaid capital

Euro per 100 kg milk

- paid interest
- paid labour
- machinery
- contract work
- buildings
- land
- quota
- other costs
- energy

Dutch average | Medium sized extensive | Big intensive
Resilience issues for two dairy farm types

Some resilience issues for two groups of Dutch dairy farms

<table>
<thead>
<tr>
<th></th>
<th>md ex</th>
<th>big</th>
</tr>
</thead>
<tbody>
<tr>
<td>% home grown feed in ration</td>
<td>0-106</td>
<td></td>
</tr>
<tr>
<td>€ long term debts/kg milk</td>
<td>0-5</td>
<td></td>
</tr>
<tr>
<td>paid costs €/100 kg milk</td>
<td>0-40</td>
<td></td>
</tr>
</tbody>
</table>
Comparing two farming systems: Dutch Case

- Goal is to make similar comparison for Chinese situation
- What is the main objective:
  - Comparing systems within same region?
  - Comparing regions?
  - Assessing variation within a farming system to come up with a program for improvement?
Value of integrated and continuous data collection

- Dutch case based on Farm Accountancy Data Network (FADN)
- About 70 years old. Original purpose: base for the calculation of cost of production for the purpose of price policy
- LEI one of the founders of the FADN for the whole European Union (currently 28 countries).
Dutch Farm Accountancy Data Network

- Sample of 1500 agricultural and horticultural holdings
  - Representative for all “commercial” farms
  - Data available on individual level

- Yearly data of the 1500 farms
  - Financial: income, prices, balance sheet, costs, subsidies
  - Technical: kg/ha, milk production/cow, no of pigs
  - Environmental: nutrients/manure, energy/climate etc.
  - Animal health
  - Organic farming
  - Nature management
  - Non agricultural activities (Agro-tourism etc.)
  - Innovation, risk management, cooperation in the chain, etc.
Design principles of the FADN

- No setup of data collection system for each policy objective but use same infrastructure to achieve synergy
  - Cheaper
  - Better quality
  - Reduction of administrative costs
  - Consistency

- Conditions for the system
  - Flexibility
  - Customer and future oriented
Value of integrated and continuous data collection

- Provides continuous monitoring on different indicators
- Can be used to estimate effect of changing circumstances e.g. different pricing, different policy etc.
- Can be used for comparing farming systems in an integrated way as in this presentation
- Can be used to provide individual farms with a benchmark
Nitrogen use and surplus

Dairy farms

kg/ha

Year: 1991 - 2013

N-applied artificial fertilizer
N-applied animal and other organic manure
N-surplus

Source: LEI Wageningen UR, Landelijk Meetnet effecten Mestbeleid
Benchmarking for individual farms

- Individual comparative report
- Important that performance of the farm is compared with the right peers

<table>
<thead>
<tr>
<th></th>
<th>Company X</th>
<th>Mirror group</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Output</strong></td>
<td>56.29</td>
<td>47.43</td>
<td>-15 0 15</td>
</tr>
<tr>
<td><strong>Variable costs</strong></td>
<td>8.87</td>
<td>11.1</td>
<td>-15 0 15</td>
</tr>
<tr>
<td><strong>Gross margin</strong></td>
<td>47.42</td>
<td>36.33</td>
<td>-15 0 15</td>
</tr>
<tr>
<td><strong>Fixed costs</strong></td>
<td>62.76</td>
<td>49.93</td>
<td>-15 0 15</td>
</tr>
<tr>
<td><strong>Rate of return</strong></td>
<td>79</td>
<td>78</td>
<td>-15 0 15</td>
</tr>
<tr>
<td><strong>Labor income</strong></td>
<td>14.63</td>
<td>10.02</td>
<td>-15 0 15</td>
</tr>
<tr>
<td><strong>Milk production / man</strong></td>
<td>193800</td>
<td>244098</td>
<td>-75000 0 75000</td>
</tr>
<tr>
<td><strong>Turnover / man</strong></td>
<td>109000</td>
<td>117480</td>
<td>-75000 0 75000</td>
</tr>
</tbody>
</table>
Benchmarking for individual farms

- Tool to assess strong and weak points
- Starting point of PDCA cycle: plan, do, check, adjust/act
Concluding remarks

- The presentation is based on the Dutch situation comparing two Dutch farming systems for performance indicators that fit with local circumstances.
- Differences within Dutch farming systems are (for many indicators) bigger than differences between farming systems.
- The choice for the ‘best’ farming system also depends on the choice of performance indicator(s), what are the key indicators for China?
- Beware not to just look at performance, but also at resilience or risk
- Differences in farming system are much bigger in China, how big will the differences be within a system?
- A benchmark is considered as an important tool to support management on a dairy farm, could this work in China and how should it look like (e.g. choice of peers)?
Thank you for your attention.

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